ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FULL STUDY REPORT FOR THE PROPOSED NAIROBI WESTERN BYPASS PROJECT, KIAMBU COUNTY, KENYA

February 2017
In accordance with Environmental Management and Coordination Act (EMCA), Cap 387 and Environmental Management and Coordination (Amendment) Act, 2015

Report prepared by
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CERTIFICATION

<table>
<thead>
<tr>
<th>EIA/EA Firm:</th>
<th>Earthcare Services Limited</th>
</tr>
</thead>
<tbody>
<tr>
<td>Registration Number:</td>
<td>7629</td>
</tr>
<tr>
<td>EIA Experts:</td>
<td>Dr. Wimbo W. Waithira</td>
</tr>
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<td>Signature:</td>
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<td>Date:</td>
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<td>P.O. Box 22433-00100 Nairobi Kenya</td>
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</tr>
</tbody>
</table>

| Project proponent:    | Kenya National Highways Authority |
| Contact Person:       | Eng. Peter M. Mundinia          |
| Designation:          | Director General                |
| Signature:            |                                |
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EXECUTIVE SUMMARY

Introduction
For growing economies, such as Kenya, several enabling factors, environment and resources are central to the success of economic growth and transformation, and the development process at large. These include capital, a well-trained labour force, as well as infrastructure. Particularly, accessible and quality infrastructure plays a key role in shaping an economy and investment decisions, thus is directly affecting a country’s ease of doing business and its attractiveness to foreign investors.

To Kenya – a country that has just achieved the middle income status – the importance of world class infrastructure cannot be overstated. The country’s policy declarations such as Vision 2030 highlight the importance of scaling up the quantity and quality of infrastructure, aiming for interconnectedness through world-class infrastructural facilities and services. Actually, the document sets integrated, cost effective, safe and efficient infrastructure including a network of roads as a necessary foundation and precondition for unlocking the potential of the economy.

It is in this light that the Government of Kenya (GoK) has in the past two decades embarked on a historically most ambitious and revolutionary endeavour in infrastructural development. The Nairobi Bypass project (which includes the Northern, Eastern and Southern Bypasses) as a Vision 2030 flagship project is a hallmark of the country’s expansion and interconnectedness strategy. The three roads are operational and open to traffic.

For the Nairobi Bypass Project to effectively and efficiently serve its revolutionary role in improving road network around the city and the Nairobi Metropolitan Area, Kenya National Highways Authority (KeNHA) – a Kenyan public corporation established under the Kenya Roads Act, 2007, and hereby referred to as the proponent – under the framework of the Nairobi Bypass Project for the improvement and mitigation of the traffic congestion in the main roads around Nairobi, has proposed to undertake the Nairobi Western Bypass Project, to link it with the Southern and Eastern Bypass to complete the ring road around the City of Nairobi. Western Bypass is currently the missing link in this endeavour.

Accordingly, under the Environmental Management and Coordination Act Cap 387 (its 2015 Amendment) and the Environmental (Impact Assessment and Audit) Regulations, 2003, it is compulsory that infrastructural projects such as the Nairobi Western Bypass undergo an Environmental and Social Impact Assessment (ESIA) process, to evaluate existing and potential positive and negative impacts of the project, so as to attune the project to sustainability requirements. In this regard, Earthcare Services Limited (Earthcare/ESL), a specialist environmental consulting firm registered by National Environment Management Authority (NEMA), was contracted by the Kenya National Highway Authority, and its contractor, China Roads and Bridge Corporation (CRBC) to undertake an Environmental and Social Impact Assessment full study and to draft a report. This report details the findings of that study.
Project Justification and Objectives
Evidence exists that Nairobi roads are congested due to high population growth. This is attributed to the fact that Nairobi is the capital of the country, thus drawing in large numbers of population from the rural areas in search of employment. Traffic congestion in Nairobi City is estimated to cost more than Ksh37 billion annually.

A similar situation exists in Kiambu County which hosts the project. Kiambu has experienced an influx of population in the past 2 decades. What was then considered as coffee plantations has since changed due to a construction boom. The County is to a large extent characterised by residential homes as the high number of gated communities, apartments and other forms of housing increases, spurred by what many have referred to as a ‘spill over property boom’ from tremendous growth in Nairobi’s real estate sector, as the economy grew.

The County also hosts a number of major industries, in manufacturing, textiles, food and beverage etc., thus the need for better infrastructure. Specifically, Gitaru road, which currently serves to connect Southern Bypass and the Northern bypass was not designed to a high technical index. This class C road is in average to poor condition, which leads to slow vehicle speed, more fuel consumption and likelihood for occurrence of traffic accidents. Of even more concern is that this road is limited by the impact of non-motorized vehicles and pedestrians, in particular for the sections passing through major town centres such as Ndenderu, Wangige and Kihara.

The project is therefore expected to meet several objectives:

- **Improve the needs of the Nairobi City Bypasses**: There is an urgent demand for the convenient transportation owing to the high population growth along the project route.
- **Effectively ease the traffic pressure in the city centre of Nairobi, and improve transport system**: Currently, due to lack of bypass road and transit channel in Nairobi, large number of transit traffic has to pass through the downtown of Nairobi
- **Reduce the cost of transport and reduce the traffic accidents**: The road has slow vehicle speed thus more fuel consumption.
- **Promote social and economic development of the region and improve the living standard of residents along the project.**

Proposed Project Design
The Western Bypass is proposed as a Class A National Trunk Highway with 4 lanes and median strip. The Design Speed is 80km/h and the width of subgrade is 21m wide. The length of the main alignment of this project is 16.358km, with 17.351 km service roads (excluding ramps). The starting point of the alignment is connected to the end of the Southern Bypass of Nairobi City, intersected with A104, with a full cloverleaf interchange located at the intersection. The road mainly follows along the old alignment towards the northeast. The end of the alignment is located at Ruaka town, connecting the starting point of the Northern Bypass, and a single-trumpet interchange is set at Km14+813, connected with Limuru Road.
Passing several large towns such as Wangige, Ndenderu and Ruaka etc., the road provides convenience for several large population centres along the line, with interchanges set at Km0+855, Km4+851, Km7+865, Km10+000, Km12+600, Km14+813, respectively.

The project proposes to construct major interchanges at Dirt (Kwa Magu), Wangige, Ndenderu, Kihara, Rumingi and Ruaka.

**The Environmental and Social Impact Assessment**

This EIA is undertaken in accordance with the Environmental Management and Coordination Act (EMCA), Cap 387 and the Environmental Management and Coordination (Amendment) Act (EMCA), 2015. It serves several objectives, including:

1. To identify the issues that are likely to be significant (scoping) and thereafter undertakes their assessment in detail.
2. Review the Environmental and Social policies, legislation and regulations relevant to the project.
3. To provide a ground plan for subsequent steps by assessing the baseline environmental and social conditions, as well as the project’s potential social and environmental impacts,
4. Conduct Alternatives Analysis
5. Provide an environmental management plan.
6. Undertake Public consultation

**Methodology**

In undertaking the study, the Consultant employed a participatory approach that entailed a range of research methods:

- Field study where reconnaissance and field visits to the proposed project route were conducted to obtain further data and consult the stakeholders. Additional interviews with Kenya National Highways Authority (KeNHA) and China Road & Bridge Corporation (CRBC) staff provided essential background and baseline information on the proposed project.
- Public engagement which took various forms including interviews with neighbours to the project as well as those most likely to be affected by the project. This was achieved through administration of 221 questionnaires.

Meetings with key stakeholder groups such as:
- the Members of Parliament (MPs) of Kiambu (i.e. Kiambaa, Kabete and Kikuyu) and the Senator;
- County Government of Kiambu, and
- Utility companies as the table below shows.
### Table 0.1: Schedule of Meetings with Key Stakeholders

<table>
<thead>
<tr>
<th>Date</th>
<th>Stakeholder</th>
<th>Time Held</th>
<th>Venue</th>
<th>Number of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>20/12/2016</td>
<td>Senator and Members of Parliament, Kiambu County</td>
<td>8.44am-11.05pm</td>
<td>Radisson Blu Hotel, Nairobi</td>
<td>14</td>
</tr>
<tr>
<td>11/01/2017</td>
<td>Utility Companies and Agencies</td>
<td>9.37am-1.06pm</td>
<td>Sarova Panafric Hotel, Nairobi</td>
<td>33</td>
</tr>
<tr>
<td>12/01/2017</td>
<td>County Government of Kiambu</td>
<td>9.35am-12.56pm</td>
<td>African Institute for Capacity Development Centre, Jomo Kenyatta University of Agriculture and Technology, Kiambu</td>
<td>23</td>
</tr>
</tbody>
</table>

- Public Forums: Two public meetings were held in Wangige and Ndenderu as detailed in Table 0.3 below. The meetings were attended by a variety of actors including Members of Parliament, local residents, business owners, government agencies such as the National Museums of Kenya.

### Table 0.2: Schedule for public forums

<table>
<thead>
<tr>
<th>Date</th>
<th>Venue</th>
<th>Time Held</th>
<th>Location</th>
<th>Number of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>19/01/2017</td>
<td>ACK St. Peter’s Church Wangige</td>
<td>09.51am – 1.34pm</td>
<td>Wangige</td>
<td>250</td>
</tr>
<tr>
<td>19/01/2017</td>
<td>Anglican Church of Kenya – Ndenderu Parish</td>
<td>3pm – 5.35p.m.</td>
<td>Ndenderu</td>
<td>232</td>
</tr>
</tbody>
</table>

- Technical studies such as air and noise quality surveys, and biodiversity assessments

### Study Area

Administratively, the project is located in Kiambu County- a county that covers a total area of 2,543.5 Km². The affected constituencies include Kiambaa and Kabete Sub counties/constituencies.

The site topography of the proposed route varies between flat ground e.g. near Kihara and Wangige, and hilly terrain topography. There are about eight large valleys along the project. Although during the rapid assessment, no wild animal species were encountered along the proposed project location, a low density of livestock species including cattle, donkey, goat, sheep and dogs were encountered.

The project site is mainly dominated by secondary and/or exotic plant species. *Eucalyptus sp*, *Acacia mearnsii*, *Grevillia robusta* and *Casuarina sp* were the most abundant tree species, all exotic. Other exotic plant species encountered during the survey were *Lantana camara*, *Tithonia diversifolia*, *Caesalphinia decapelata*, *Senna didymobotrya*, *Solanum incanum*, *Bougainvillea spectabilis* and *Parthenium hysterophorus*, alongside dozens of crop species.
According to the 2009 Kenya Population and Housing Census, Kiambu County had a population of 1,623,282 persons, distributed between 469,244 households. This was a 1.57 percent increase since the previous census held in 1999. The population density of the County as at 2009 was 638 people per sq. kilometre (km²), and projected to reach 799 per km² in 2017.

A substantial number of the county’s population is relatively young. Individuals of age 34 and below constitute approximately 75 percent of the population. Particularly, a disturbing fact is that those age 19 years and below (i.e. the dependent group) constitutes at least 43 percent of the County’s population.

Majority of the County’s population is urban based. The route also passes through a number of other big towns such as Ndenderu, Ruaka and Wangige which are highly populated.

Almost half (48 percent) of Kiambu’s population have primary level education while 39.9 have secondary education and above. This largely means that at least 12 percent have no basic education. Education levels are important because they affect economic status and employability.

A number of factors influence the livelihood and economic profile of Kiambu County. These include its close proximity to Nairobi, an increasing youthful population and the presence of a wide range of industries. The country ranks high in the number of SMEs. Particularly the presence of Wangige market next to the proposed route means the presence of a substantial number of informal market sellers, including food (fruits and vegetables), assorted retail items, Mpesa shops, auto spares shops, and clothing (mitumba) vendors. Similarly, at other main strategic areas sections of the road are inhabited by various informal fruit and vegetable sellers. Furthermore, the whole proposed route is strewn with all types of businesses ranging from welders, hardware shops selling construction materials, bicycle repair shops, food kiosks, Fruit vendors, saw dust sellers, garages, car washes, animal feed (hay sellers) etc. Several boda boda sheds exist along the road.

Policy, Legal and Institutional Framework
Kenya’s Vision 2030 is the country’s blueprint print planning strategy, while the Second Medium Term Plan (MTP 11) acts as its accompanying implementation plan, for achieving economic, political and social transformation. This recognises the need to scale up quantity and quality infrastructure.

The Constitution of Kenya, 2010 and the National Environment Policy (NEP) underscores the linkages between the environment and natural resources and the local and national economy people’s livelihoods and the provision of environmental services. They both advocate for a balanced development while protecting the environment i.e. sustainable development.

The Environmental Management and Co-ordination Act (EMCA), 1999 and Environment Management and Coordination (Amendment) Act, 2015 provide a legal and institutional framework for the protection and conservation of the environment, environmental impact assessment, environmental auditing and monitoring. This requires construction projects such as Western Bypass to undergo a full EIA study.
EMCA (Environmental Impact Assessment and audit) regulations 2003, among others, reiterate the need for a full EIA study. Other laws contain provisions for the health, safety and welfare of persons employed as well as the general public.

The Constitution, the Land Act and National Land Commission Act provide the legal framework for land acquisition. The laws require prompt, just and fair compensation for land and structures affected.

**Project Alternatives**

A no construction/project alternative would imply that the situation on the current Gitaru road be left in its present state. While this ensures non-interference and preservation of the status environment and social conditions, without the Nairobi Western Bypass project, the ring road around Nairobi will be incomplete. Nairobi metropolitan area will continue to suffer as a result of traffic congestion. This will worsen as future demands grows.

The “No Action Alternative” should not be adopted, as we need to encourage development so long as it is undertaken on a sustainable basis as per the environmental management plan developed in this report.

Comparing various routes, the current location of the Nairobi Western Bypass was chosen due to its ease of connection to the Northern Bypass, the existence of a large RoW, smooth connections and reduction in land acquisition needs. The proposed location is also shorter compared to majority of the alternatives.

**Public Participation**

The aim of this exercise was to disseminate information to interested and affected parties (stakeholders), solicit their views and consult on sensitive issues, in order to add value to the project design considerations. The methods in use included:

- Direct interviews where necessary, to get responses from the proponent, project contractor and project engineers.
- Questionnaire administration, where over 200 open ended questionnaires were administered at strategic locations to collect the views of various stakeholders.
- Consultation meetings that allowed for political leaders, County Government of Kiambu and utility companies to be updated and raise concerns about the project were held.
- Public forum meetings at Wangige and Ndenderu.

In the various platforms, stakeholders raised concerns about the impact of the proposed project including matters of compensation as a result of loss of land and other assets, loss of business due to relocation, traffic congestion during construction, vegetation clearance, disruption of social life setting as well as reduction in aesthetics since construction projects tend to leave open quarries, borrow pits and other open trenches after project completion, and mostly without rehabilitating the areas. However, they also noted that the project had positive impacts particularly noting improved transport convenience, safety and traffic decongestion in the long run, increased employment and trading opportunities, land value appreciation and improved infrastructural developments such as good sewer networks, water connections, internet accessibility, and communication networks, among others, triggered by improved accessibility.
Project Impacts

The proposed Nairobi Western Bypass project is envisaged to generate social and environmental impacts which could be positive or negative, direct or indirect, local, regional, reversible or irreversible and hence the necessity to subject the proposed project to an ESIA process. Most of the positive benefits and negative impacts will take place during construction and operation phases.

The process of determining the various impacts was done through stakeholder participation, discussion with proponent’s technical team, site visits, technical studies (e.g. noise and air quality studies), review of the facility specifications etc. The prediction and analysis of the environmental impacts of the proposed project is also based on:

i. Compliance with the relevant Kenyan legislation and standards on environment, health and safety and the International Labour Organisation etc. guidelines.
ii. Professional judgment.

The assessment criteria of the significant impacts are as shown in the Table 0.4 below:

*Table 0.3: Criteria for Assessing Significant Impacts*

<table>
<thead>
<tr>
<th>Key</th>
<th>Type of impact</th>
<th>Key</th>
<th>Type of impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>++</td>
<td>Major positive impact.</td>
<td>+</td>
<td>Minor positive impact.</td>
</tr>
<tr>
<td>- -</td>
<td>Major negative impact</td>
<td>-</td>
<td>Minor negative impact.</td>
</tr>
<tr>
<td>0</td>
<td>Negligible/zero impact</td>
<td>NC</td>
<td>No change</td>
</tr>
<tr>
<td>Sp</td>
<td>Specific/localized</td>
<td>W</td>
<td>Widespread.</td>
</tr>
<tr>
<td>R</td>
<td>Reversible</td>
<td>Ir</td>
<td>Irreversible.</td>
</tr>
<tr>
<td>Sh</td>
<td>Short term</td>
<td>L</td>
<td>Long term.</td>
</tr>
<tr>
<td>T</td>
<td>Temporary</td>
<td>P</td>
<td>Permanent</td>
</tr>
</tbody>
</table>

On the basis of information gathered, the potential positive and negative environmental impacts are tabulated below.

*Table 0.4: Potential Positive Environmental Impacts*

<table>
<thead>
<tr>
<th>Nature of anticipated positive impact</th>
<th>Pre-Construction</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landfilling</td>
<td>++, Sp, P</td>
<td></td>
</tr>
<tr>
<td>Improved aesthetics</td>
<td></td>
<td>++, Sp, P, L</td>
</tr>
</tbody>
</table>
Table 0.5: Potential Negative Environmental Impacts

<table>
<thead>
<tr>
<th>Nature of anticipated negative impact</th>
<th>Pre-Construction</th>
<th>Construction</th>
<th>Operation</th>
<th>Decommissioning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air quality degradation</td>
<td>NC</td>
<td>--, Sp, Sh, T</td>
<td>-, W</td>
<td>--, Sp, Sh, T</td>
</tr>
<tr>
<td>Noise and excessive vibrations</td>
<td>NC</td>
<td>--, Sh, Sp, T</td>
<td>-, L</td>
<td>--, Sp, Sh, T</td>
</tr>
<tr>
<td>Changes in topography</td>
<td>NC</td>
<td>--, Sp, P, Ir</td>
<td>NC</td>
<td>NC</td>
</tr>
<tr>
<td>Soil erosion and contamination</td>
<td>NC</td>
<td>--, Sh, Sp, T</td>
<td>-</td>
<td>--, Sh, T, Sp</td>
</tr>
<tr>
<td>Changes in land use: loss of agricultural and produce</td>
<td>--, Sp, Ir, L</td>
<td>--</td>
<td></td>
<td>--, Sp</td>
</tr>
<tr>
<td>Increased solid waste generation</td>
<td>NC</td>
<td>--, Sp, Sh</td>
<td>--, Sp</td>
<td>--, Sp, Sh</td>
</tr>
<tr>
<td>Loss of vegetation cover</td>
<td>--, P, Sp, R</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
</tr>
<tr>
<td>Impact on animal species</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
</tr>
<tr>
<td>Introduction of invasive species</td>
<td>NC</td>
<td>NC</td>
<td>--, Sp</td>
<td>NC</td>
</tr>
<tr>
<td>Increase in storm water</td>
<td>--, Sh, Sp</td>
<td>--, L, Sp</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surface and underground water pollution</td>
<td>--, Sh, W</td>
<td>--, Sp</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increase in water demand</td>
<td>--</td>
<td>--, Sh, Sp</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alteration of natural drainage pattern</td>
<td>--, Sh, Sp, R</td>
<td>--, Sp</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Workmen Campsites, bitumen &amp; asphalt plant, crushers, quarries, magazines, borrow pits, borehole and other affiliated/secondary sites which support road construction.</td>
<td>T, Sh, R, Sp,-</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

On the basis of information gathered during both the desktop and field study, the potential positive and negative social impacts of the proposed project are tabulated below.

Table 0.6: Potential Positive Social Impacts

<table>
<thead>
<tr>
<th>Nature of anticipated positive impact</th>
<th>Pre-Construction</th>
<th>Construction</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local revenue generation</td>
<td>++, W</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employment creation</td>
<td>++, Sh, Sp</td>
<td>+, Sp</td>
<td></td>
</tr>
<tr>
<td>Increase incomes and improved livelihoods</td>
<td>++, Sh, Sp</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economic growth</td>
<td>++, L</td>
<td>++, W</td>
<td></td>
</tr>
<tr>
<td>Increase in property value</td>
<td>++</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ease of traffic pressure in the Nairobi city centre</td>
<td>++</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduced transport costs and accidents</td>
<td>++</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 0.7: Potential Negative Social Impacts

<table>
<thead>
<tr>
<th>Nature of impact</th>
<th>Pre-Construction</th>
<th>Construction</th>
<th>Operation</th>
<th>Decommissioning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land acquisition and involuntary resettlement and associated loss of structures</td>
<td>--, Sp, P</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
</tr>
<tr>
<td>Disruption of livelihoods, income and loss of revenue</td>
<td>--, Sp, Sh</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interference with social-cultural and setup of families</td>
<td>--, Sp, Sh</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disruption of utility services</td>
<td>--, Sp, Sh</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender inequality</td>
<td>--, Sh</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Traffic congestion and diversions</td>
<td>--, Sh, Sp</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Changing demographics and related concerns</td>
<td>--, Sh</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety and health outcome(occupational)</td>
<td>--, Sp, Sh</td>
<td></td>
<td>--, Sp, Sh</td>
<td></td>
</tr>
<tr>
<td>Safety and health outcome(Public)</td>
<td>--, Sh, Sh</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increase in traffic, traffic accidents and loss of life</td>
<td></td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Pressure on services</td>
<td>-</td>
<td></td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

Environmental and Social Management and Monitoring Plan (ESMMP)

In terms of mitigating the environmental impacts, the proponent and the contractor will be required to implement comprehensive re-afforestation and landscaping programmes. Similarly, as far as air, water and noise pollution are concerned, they will be required to strictly adhere to the EMCA air quality, water, and noise regulations to prevent pollution. This can be achieved in various ways as the detailed Environmental and Social Management and Monitoring Plan (ESMMP) outlines. The ESMMP is developed to ensure sustainability of the project, from construction through to operation. The plan provides a general outlay of the activities, associated impacts, mitigation action plans and appropriate monitoring indicators. Implementation timeframes and responsibilities are also defined.

The ESMMP also outlines social mitigation measures. The most crucial and urgent is the need for a Comprehensive Resettlement Action Plan (RAP) to mitigate against loss of land & asset loss, involuntary resettlement, disruption of livelihoods, income and loss of revenue. The RAP shall guide in the relocation and compensation of the Project Affected Persons (PAPs) along the project corridor. The County Government of Kiambu is responsible for all traders within the County and therefore should find alternative market places as resettlement sites for the traders to be displaced. Major public facilities such as the Bus Park in Wangige will also be relocated and modernised.

The primary responsibility for the integration of the mitigation measures for the proposed development lies with the project proponent and by extension the contractor during the construction stage, while the proponent takes over the duty upon commissioning of the project. At
Conclusion and Recommendations

This Environmental and Social Impact Assessment report identifies the environmental and social issues that are likely to be significant (scoping) and thereafter undertaken their assessment in detail. In this screening and scoping process it has been determined that the project meets a threshold requirement of a Finding of Significant Impacts (FOSI) under established environmental examination procedures, and as stipulated under EMCA (1999) EIA procedures (2003). However, noting that the project impacts can be mitigated, the study recommends that the project be licensed but with conditions to implement the ESMMP.

A major recommendation measure is the need for a comprehensive Resettlement Action Plan to address the displacement effects of the proposed project. In terms of scope and the level of detail, such a RAP should at the very least include:

- Objectives
- Potential impacts
- Socio-economic studies
- Legal and institutional framework,
- Eligibility, valuation and compensation of losses,
- Resettlement measures and relocation planning
- Community participation
- Grievance redress procedures
- RAP implementation schedule, costs and budgets
- Monitoring and evaluation.

In addition, the proponent - KeNHA and the contractor-China Roads and Bridge Corporation will be required to develop and implement (if these do not exists already) internal environmental and social policies and plans, including setting up of relevant institutional frameworks to oversee their fruition. The contractor - China Roads and Bridge Corporation, will also be required to submit (prior to the start of the project) to the proponent KeNHA stand alone:

- Waste (Solid and Liquid) Management Plan
- Spill Prevention and Response Plan
- Occupational Health and Safety Plan

In addition to the Full EIA study, the Contractor is required to meet the following:

- An annual Environmental Audit
- A Fire audit, risk assessment and safety and health audit has to be conducted for the sites at least once every year.
- Undertake EIA’s for all ancillary sites such as batching plants, quarries, campsites to ensure their specific issues are identified in detail and mitigated.
ACKNOWLEDGEMENT

Earthcare Services Limited wishes to express its gratitude and acknowledges all the respondents who availed information sought by the team. This report could not have been completed without the support accorded by key stakeholders including the local administration, members of the clergy and Members of Parliament and other political leaders who played a key role in mobilising people for public participation, the local residents along the proposed route. Of critical importance was the information availed from the enthusiastic community members, and key informants and stakeholders who took part in the environmental examination process.

We would also like to thank Kenya National Highways Authority (KeNHA) and China Road and Bridge Corporation (CRBC) for availing the necessary documentation for the study, organising initial site visits and answering the numerous requests for information on the proposed study.
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<tbody>
<tr>
<td>ACK</td>
<td>Anglican Church of Kenya</td>
</tr>
<tr>
<td>ADB</td>
<td>African Development Bank</td>
</tr>
<tr>
<td>AICAD</td>
<td>African Institute for Capacity Development</td>
</tr>
<tr>
<td>AWSB</td>
<td>Athi Water Services Board</td>
</tr>
<tr>
<td>CIDP</td>
<td>County Integrated Development Plan</td>
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<tr>
<td>CO2</td>
<td>Carbon dioxide</td>
</tr>
<tr>
<td>CRBC</td>
<td>China Road and Bridge Corporation</td>
</tr>
<tr>
<td>CSP</td>
<td>County Spatial Plan</td>
</tr>
<tr>
<td>CSR</td>
<td>Corporate Social Responsibility</td>
</tr>
<tr>
<td>dB</td>
<td>Decibels</td>
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<td>DOSH</td>
<td>Directorate of Occupational Safety and Health</td>
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<td>Environmental Management and Coordination Act</td>
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<td>Environmentally Sound Design</td>
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<td>Environmental and Social Impact Assessment</td>
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<td>Earthcare Services Limited</td>
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<td>ESMMP</td>
<td>Environmental and Social Management and Monitoring Plan</td>
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<td>ERC</td>
<td>Energy Regulatory Commission</td>
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<tr>
<td>FOSI</td>
<td>Finding of Significant Impact</td>
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<tr>
<td>GOK</td>
<td>Government of Kenya</td>
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<tr>
<td>GSHAP</td>
<td>Global Seismic Hazard Assessment Program</td>
</tr>
<tr>
<td>HIV</td>
<td>Human Immunodeficiency Virus</td>
</tr>
<tr>
<td>HMA</td>
<td>Hot-Mix Asphalt</td>
</tr>
<tr>
<td>ILO</td>
<td>International Labour Organization</td>
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<tr>
<td>ILP</td>
<td>International Lithosphere Program</td>
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<tr>
<td>JUAT</td>
<td>Jomo Kenyatta University of Agriculture and Technology</td>
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<tr>
<td>KDHS</td>
<td>Kenya Demographic and Health Survey</td>
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<tr>
<td>KeNHA</td>
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<td>Kenya Rural Roads Authority</td>
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<td>Kenya Power and Lighting</td>
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<tr>
<td>KURA</td>
<td>Kenya Urban Roads Authority</td>
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<tr>
<td>LPG</td>
<td>Liquefied Petroleum Gas</td>
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</tbody>
</table>
M  Metres
MCA  Member of County Assembly
MMI  Modified Mercalli Intensity
MM  Millimetres
MP  Member of Parliament
MSME  Micro, Small and Medium Establishment
NC  No change
NEMA  National Environment Management Authority
NEP  The National Environment Policy
NLC  National Land Commission
NTSA  National Transport and Safety Authority
OP  Operational Policy
OSH  Occupational Safety and Health
PAPs  Project Affected Persons
PAYE  Pay As You Earn
PM  Particulate Matter
PAPs  Project Affected Persons
PPE  Personal Protective Equipment
PRSP  Poverty Reduction Strategy Paper
PSV  Public Service Vehicle
RAP  Resettlement Action Plan
RoW  Right of Way
S&E  Safety and Health
SGR  Standard Gauge Railway
SID  Society for International Development
TOR  Terms of Reference
TLV  Threshold Limit Values
TMS  Time Meander Search technique
UN/IDNDR  United Nations International Decade for Natural Disaster Reduction
USD  United States Dollar
VOC  Volatile Organic Compounds
WMA  Warm-Mix Asphalt
WRMA  Water Resources Management Authority
WSPs  Water Service Providers
VAT  Value Added Tax
VdB  Vibration Decibels
1. INTRODUCTION

For growing economies, such as Kenya, several enabling factors, environment and resources are central to the success of economic growth and transformation, and the development process at large. These include capital, a well-trained manpower and labour force, as well as technology – factors which also double as necessary inputs into the growth process.

Particularly, infrastructure, often classified as a public good and service is key for economic growth and is essential for production processes. It is vital in reducing production, transport and communication costs, and improving transition efficiency thus improving returns on investment. Developing infrastructure enhances a country's productivity, makes firms more competitive, provides economic incentives to public and private sector participants and has a potential to boost a region's economy. Particularly, accessible and quality infrastructure plays a key role in shaping an entrepreneur’s investment decisions, thus is directly related to a country’s ease of doing business and determines its attractiveness to foreign investors.

Such importance is recognised universally. To Kenya – a country that has just achieved the middle income status – the importance of world class infrastructure cannot be overstated. For instance, as the Kenya Economic Survey 2016 produced by the Kenya National Bureau of Statistics (KNBS) notes, ‘sustainable, shared and equitable growth that would in return lead to job creation’ is not possible without accelerated spending in infrastructure.¹ This is a statement that reiterates policy declarations made in the country’s blueprint and long-term development strategy for achieving economic, political and social transformation. Kenya’s Vision 2030 highlights the importance of scaling up the quantity and quality of infrastructure, aiming for interconnectedness through world-class infrastructural facilities and services. Actually, it sets integrated, cost effective, safe and efficient infrastructure including a network of roads as a necessary foundation and precondition for unlocking the potential of the economy.

It is in this light that the Government of Kenya (GoK) has in the past two decades embarked on a historically most ambitious and revolutionary endeavour in infrastructural development. The government has invested heavily in world class infrastructure, more so roads around Nairobi city and Nairobi Metropolitan area, to tap into the potential of Kenya’s economic growth and to reduce economic loss associated with traffic snarl ups. The Nairobi Bypass project (see Figure 1.1 below) as a Vision 2030 flagship project is the hallmark of the country’s expansion and interconnectedness strategy.

The Nairobi Bypass Project was initially meant to involve the construction of three roads around the city to ease traffic snarl-up within Nairobi. The three roads include:

- Northern Bypass: Financed by GoK and the Chinese Government, the 31 kilometre (km) road is aimed at channelling traffic away from the city Centre. It connects Thika Road to Ruaka area i.e. Limuru road.

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¹ Emphasis added.
Southern Bypass: Financed by GoK and the Chinese Government. The 28.6 km road connects Mombasa Road at Ole Sereni and ends at the intersection with A104 (Nairobi-Nakuru highway) in the town of Kikuyu located south west Nairobi. Starting from the south eastern Nairobi, it links up other major road trunks in Nairobi area including Mombasa road, Outer Ring Road, Langata (C58), Ngong (C60), Dagoretti (C63) and Thogoto (D411).

Eastern Bypass: Financed by GoK and the Chinese Government, the 39km road connects the Busy Mombasa road to Thika Road i.e. Ruiru-Kiambu road near Kamiti prison.

As an important part of the infrastructure vision for Nairobi Metropolitan area, the three bypasses have been completed and opened for public use and traffic. However, the vision to improve the entire Nairobi bypass is only partially achieved. The Southern and Northern Bypasses are connected by C63J1 road (Gitaru road) which currently is a two lane road, and is the only access from the southwest of Nairobi to north Nairobi. This means that Western Bypass is the missing link in the Nairobi Bypass Project, to enable the completion of a ring road of a modern high-grade highway system around Nairobi.

![Figure 1.1: The Nairobi Bypass Project](image.png)

For the Nairobi Bypass Project to effectively and efficiently serve its revolutionary role in improving road network around the city and the Nairobi Metropolitan Area, Kenya National
Highways Authority (KeNHA) – a Kenyan public corporation established under the Kenya Roads Act, 2007, and hereby referred to as the proponent – under the framework of the Nairobi Bypass Project for the improvement and mitigation of the traffic congestion in the main roads around Nairobi, has proposed to undertake the Nairobi Western Bypass Project, to link it with the Southern and Eastern Bypass to form a ring road around the City of Nairobi.

In this regard, the Proponent embarked on a feasibility study to fully demonstrate the necessity, feasibility and environmental suitability of this project, to choose the economic reasonability and operating safety route scheme, determine the appropriate construction scale and reasonable investment scale and provide the essential reference basis for the project administrator (government), investor and the project Contractor. China Road and Bridge Corporation (CRBC) was contracted to undertake the technical works including construction works to Class A construction standards of Kenya. In consultation with the proponent, CRBC has completed the preliminary designs.

The Western Bypass is therefore proposed as a Class A National Trunk Highway with 4 lanes and median strip. The Design Speed is 80km/h and the width of subgrade is 21m wide. The length of the main alignment of this project is 16.358km, with 17.351 km service roads (excluding ramps). The starting point of the main line is connected to the end of the Southern Bypass of Nairobi City, intersected with A104, with a full cloverleaf interchange located at the intersection.2 The road mainly follows along the old alignment towards the northeast. The end of the line is located at Ruaka town, connecting the starting point of the Northern Bypass, and a single-trumpet interchange is set at Km14+813, connected with Limuru Road. Passing several large towns such as Wangige, Ndenderu and Ruaka etc., the road provides convenience for several large population centres along the line, with interchanges set at Km0+855, Km4+851, Km7+865, Km10+000, Km12+600, Km14+813, respectively.

Accordingly, under the Environmental Management and Coordination Act Cap 387 (2015 Amendment) and the Environmental (Impact Assessment and Audit) Regulations, 2003, it is compulsory that infrastructural projects such as the Western Bypass undergo an Environmental and Social Impact Assessment (ESIA) process to evaluate existing and potential positive and negative impacts of the project, so as to attune the project to sustainability requirements. EMCA ensures that proposed developments takes into consideration appropriate measures to mitigate any adverse impacts to the natural and social environment. These measures are stipulated in the Environmental and Social Management and Monitoring Plan (ESMMP). Further, the Constitution of Kenya provides for the right to all Kenyans to a healthy environment achieved through Environmentally Sound Design (ESD), aimed at achieving sustainable development. ESD is necessary to prevent failure of economic or social development projects due to environmental causes, and damage to the environment which imperils future economic and social development.

In this regard, Earthcare Services Limited (Earthcare/ESL), a specialist environmental consulting firm registered by National Environment Management Authority (NEMA), was contracted by the Kenya National Highway Authority, and its contractor, China Roads and Bridge Corporation

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2 The Gitaru interchange will form phase 2 of the project and thus will subjected to a different EIA process.
Nairobi Western Bypass Project
Environmental and Social Impact Assessment Report

(CRBC) to undertake an Environmental and Social Impact Assessment (EIA) full study and to draft a report. This report details the findings of that study.

1.1. Project Justification
Evidence exists that Nairobi roads are congested due to the high population growth. This is attributed to the fact that Nairobi acts as the capital of the country thus drawing in large numbers of population from the rural areas in search of employment and for schools. Particularly, Nairobi’s population has grown through the years. In 2009, the County population was projected to be 1,605, 230 and is expected to rise to 4,253,330 in 2017.

This has a direct effect on the capacity of the roads and resultant impact in terms of economic growth. For instance, according to the International Business Machines Corp’s Commuter Pain survey in 2011, Nairobi’s city’s roads were the world’s fourth-most congested. Speaking during the observance of the World Town Planning Day celebrations in 2009, the then Nairobi metropolitan region, Cabinet minister Mr. Robinson Githae said Kenya’s economy was losing about Kenya Shilling (Ksh) 29 billion annually due to traffic congestion in the Nairobi metropolitan region. Traffic congestion in Nairobi City was estimated to cost Ksh37 billion annually, according to a report by the Nairobi County’s Transport and Urban Decongestion committee. This they attributed to poor planning of the city that did not factor in steady increase in population and vehicular traffic.

The same applies to the Kiambu County which hosts the project. Kiambu has experienced an influx of population in the past 2 decades. What was then considered as coffee plantations – giving a feeling of travelling to some rural villages - have since changed due to a construction boom. The County is to a large extent characterised by residential homes as the high number of gated communities, apartments and other forms of housing increases, spurred by what many have referred to as a ‘spill over property boom’ from tremendous growth in Nairobi’s real estate sector, as the economy grew.

Specifically, Kiambu and Nairobi Counties share a unique relationship. Due to the close proximity, a substantial number of those who work in Nairobi live in Kiambu County. This has led to the development of the ‘Nairobi bedroom’ tag in reference to Kiambu, meaning there is often huge flows of traffic between the two counties at peak hours, both morning and evening, with the end destination being work and home respectively.

The County also hosts a number of major industries, in manufacturing, textiles, food and beverage etc., thus the need for better infrastructure. Specifically, Gitaru road, which currently serves to connect Southern Bypass and the Northern bypass was not designed to a high technical index. This class C road is in average to poor condition, and which leads to slow vehicle speed, more fuel consumption and likelihood for occurrence of traffic accidents. Of even more concern is that these roads are limited by the impact of non-motorized vehicles and pedestrians, in particular for the sections passing through major town centres such as Ndenderu, Wangige and Kihara.

Currently, the traffic from A104 turning to the northern Nairobi is brought together in the urban area of Nairobi, causing traffic congestion in downtown Nairobi. The development of Western Bypass is therefore expected to improve the traffic and road conditions in the ring road of Nairobi,
significantly improve the existing highway capacity and running speed, meaningfully mitigate traffic congestion, accommodate the growing traffic demand, provide a convenient, comfortable, safe transportation environment for the healthy, rapid and coordinated development of the economy, improve the living standard of residents along the project and promote the sustainable development of the regional socio-economy as well.

1.2. Project Objectives
According to the Feasibility report, the Nairobi Western Bypass infrastructure Project mainly aims to:

1. **Improve the needs of the Nairobi City Bypasses.**
Western Bypass project connects with Nairobi Southern, Eastern and Northern Bypasses, which are already open to traffic. Currently, only Nairobi Western Bypass project is to be constructed to improve the entire Nairobi Bypass.

The existing north-south direction road located in the project area of influence is only C63J1 road (Gitaru road) which currently is a 2 lane road and is one of the two access from the southwest of Nairobi to north Nairobi, the other being Limuru road. This access serves as a long distance transit and bypass corridor. The running speed on Gitaru Road is limited by the impact of non-motorized vehicles and pedestrians, in particular for the sections passing through town centres, the driving speed is very low and cannot meet the demand of transit and bypass transportation.

According to statistics from 1995 to 2003, the average annual growth of vehicle numbers in Nairobi City was 6.0%. While from 2000 to 2003, there was a rapid average annual growth up to 21.4%. There is an urgent demand for the convenient transportation owing to the high population growth along the project route.

2. **Effectively ease the traffic pressure in the city centre of Nairobi, and improve transport system.**
The starting point of the proposed project is the end point of the Southern Bypass. The proposed project links with the Kabete Limuru Road (A104) a trunk road, Lower Kabete Road (E422J2), Getathuru road (D378), Ngong Road (E425J1), Limuru road, and D408 in loop type and finally ends at Ruaka town where it connects with the starting point of Northern Bypass. After project completion, the Bypass will provide an important fast track road transit for Nairobi city and help to rapidly alleviate the traffic congestion for the transit vehicles and making it convenient for urban transportation.

Currently, due to lack of bypass road and transit channel in Nairobi, large number of transit traffic has to pass through the downtown of Nairobi. According to the traffic survey undertaken during the feasibility stages, the classification of roads A104, C58, C60 and C63, etc. which have close relationships with this proposed project are A, B, C and D respectively. Due to high traffic volume, the vehicles movement is slow during the peak hours with serious exhaust fumes. The proposed project meets the requirement of the transport master plan and the investment requirements of transport, and its implementation will effectively mitigate the traffic congestion in the city centre of Nairobi and improve transport system of Nairobi city.
3. Reduce the cost of transport and reduce the traffic accidents.
Gitaru road alignment was not designed to a high technical index and the current condition is average. The class E road that is connected with Gitaru road is in average to poor condition, and this leads to slow vehicle speed, more fuel consumption and likelihood for occurrence of traffic accidents. The development of this project will improve road conditions of the region’s road network, significantly improve the existing highway capacity and running speed and provide fast and comfortable traffic environment.

4. Promote social and economic development of the region and improve the living standard of residents along the project.
Nairobi Metropolitan Vision 2030 is part of Kenya Vision 2030. In Nairobi Metropolitan Vision 2030, the south region of Kiambu is incorporated into the planning area and will be the northern metropolis of Nairobi.

Nairobi Metropolitan spatial planning concept was approved by the Ministry of Nairobi Metropolitan Development in March, 2013. According to the planning, the affected area has two second-level regions (Sub-regional Centre), 2 third level regions (Growth Centre), 1 subsidiary second level region (Priority Town). The two sub-regional centres are Kikuyu and Kiambu. The first Priority town is Knowledge-cum-Health city, located in the north of Limuru road and defined as the second level regions and sub-regional centres in that planning. For this reason, the planned Priority town is located in this project zone. Therefore, the implementation of this project has a great significance to promote social and economic development of the region and improve the living environment of residents along the project.

After completion, the project should meet the objectives by improving the needs of the Nairobi City Bypasses by creating a ring road around the city thus opening up movement in and around the City’s CBD.

1.3. EIA Objectives
This EIA is undertaken in accordance with the Environmental Management and Coordination Act (EMCA), Cap 387 and the Environmental Management and Coordination (Amendment) Act (EMCA), 2015. It serves several objectives:

1. To identify the issues that are likely to be significant (scoping) and thereafter undertakes their assessment in detail.
2. Review the Environmental and Social policies, legislation and regulations relevant to the project. Outline the pertinent regulations and standards governing Environmental and Social quality, safety and health, protection of sensitive areas, protection of endangered species, and land use control at the national and local levels; then comply with the EMCA, 1999, EMCA Amendment Act 2015, the Environmental (Impact Assessment and Audit) Regulations, 2003, and other international directives.
3. To provide a ground plan for subsequent steps for the project by making an assessment of:
   - The baseline environmental conditions in the affected areas; Describe study area/geographical boundaries, generate baseline data used to describe the: (i) physical and biological environments, and, (ii) socio-economic and cultural constraints.
The Environmental and Social Characteristics of the Project. Conduct a comprehensive review of the environmental and social characteristics of the Project and the surrounding environment, specifying any information necessary to identify and evaluate Environmental and Social effects of the project:

The relevant national and international laws;

Environmental and Social Screening:
- Environmental Screening: Assess: (1) Physical Environment (geology, topography, and soils); (2) Natural Drainage (surface drainage and flood risk); (3) Climate and Air Quality (water and noise level pollution); and (4) Biological Environment (Forest and vegetation cover, sensitive habitats).
- Social Screening: Gather information on land use, proximity to nearby residences, public health issues, demographics, employment, power and energy, infrastructure (utilities and services), cultural resources, hazardous materials, contaminated soils and aesthetics;

The projects potential social and environmental impacts, and the impact area/zone within which impacts are likely to be effective:
- Assess the likely impacts (nature and scale) of the Project development on the described environment, including direct, indirect and cumulative impacts, and their relative importance to the design of the Project;
- Distinguish between significant positive and negative impacts, reversible or irreversible direct and indirect, long term and immediate impacts as well as avoidable impacts;

Possible mitigation measures:
- Recommend mitigation measures to reduce/minimize predicted adverse impacts and quantify associated costs. Prepare guidelines for avoiding, reducing, or compensating (e.g. restoration, rehabilitation, and/or habitat replacement), as far as possible, adverse impacts due to proposed usage of the site and utilisation of existing Environmental and social attributes for optimum development.

4. The need and potential for monitoring as well as provision of an environmental management plan.

5. Alternatives Analysis
- Conduct a preliminary alternative analysis which considers the “No Project” alternatives and the technical alternatives developed for the Project with respect to Environmental and Social impacts monitoring and mitigation that could be considered at that site or at any other location.

6. Stakeholder/Community Consultation & Public Disclosure
- Undertake preliminary consultation with selected stakeholders, government agencies, and communities that are likely to be affected;
- Identify main stakeholder groups relevant to the Project and describe the scope of the consultation with each group;

A detailed Terms of Reference (TOR) can be found in Appendix A.
1.4. Methodology
In undertaking the study, the Consultant employed a participatory approach that entailed a range of research methods:

1.4.1 Desk Review
This involved desk studies and review of all relevant available documents on the project activities and components from the client. The team also reviewed all the available and relevant national and international legal environmental documents, standards and guidelines. In addition, national and county level (planning) documents (such as Vision 2030, the Second Medium Term Plan, County Integrated Development Plan) relevant to the project area were reviewed. Area maps were similarly reviewed.

1.4.2 Field Study
A major element of the study is primary research - both qualitative and quantitative among relevant stakeholders. The environmental assessment team conducted reconnaissance and field visits to the proposed project route, to obtain further data and consult the stakeholders. This established the nature of the surroundings which included existing infrastructure, economic and social set up of the local communities whose normal daily activities will be and/or are likely to be affected by the project, as well as collecting their views on the proposed project. Similarly, observations entailed documentation on the physical characteristics of the area including the biological environment.

Additional interviews with Kenya National Highways Authority and China Road & Bridge Corporation staff provided essential background and baseline information on the proposed project.

The systematic approach followed comprised of:

- Scoping
  Screening was undertaken in order to identify key environmental issues and their scope of using both local and international standards.

Public consultation using structured questionnaire was conducted by the consultant to determine the acceptance of the proposed project.

The conditions existing in the site area prior to the proposed project were documented to provide a baseline scenario against which possible impacts of the proposed project activities were to be assessed.

- Impact Prediction
  The likely changes in different environmental parameters were analysed against the established baseline information and the impacts described.

- Mitigation Measures
  The mitigation measures were derived for each foreseen environmental impact. Environmental monitoring and management plan, showing the responsible persons and implementation schedule was developed to be followed by the contractor. The proponent is expected to supervise the
implementation to ensure sustainable utilization of natural resources during the construction and decommissioning of the project.

1.4.2.1 Public Consultation

Public engagement took various forms:

- Interviews were carried out with neighbours to the project as well as those most likely to be affected by the project. These groups were requested to fill a questionnaire that inquired on various aspects including the respondent’s views on the positive and negative impacts that they anticipated from the project and suggested mitigation measures. They were also requested to provide information about the area, focusing on aspects such as sensitive ecosystems, provision of various infrastructure facilities and socioeconomic and environmental impacts of the project in the area amongst other issues. In total, 221 questionnaires (as per the stakeholder lists) were administered. Appendix B contains the list of individuals and businesses consulted, while Appendix C contains samples of the questionnaire administered.

- Meetings with key stakeholder groups such as the Members of Parliament (MPs) of Kiambu and the Senator, County Government of Kiambu and utility companies. The Senator Kiambu County (Hon. Kimani Wamatangi) and the MPs of Kiambaa (Hon. Paul Koinange), Kabete (Hon. Ferdinand Waititu) and Kikuyu (Hon. Anthony Kimani Ichung'wa) Constituencies attended the meeting on 20th December 2016. The main utility companies represented on 11th January 2017 included Safaricom, Liquid Telecom, Telecom Kenya, Airtel, Huawei, Kenya Power and Lighting Company, Kenya Electricity Transmission Company, Athi Water and Services Board, Access Kenya among others.

In the case of the County Government, the attendants in the 12th January 2017 meeting included the Deputy Governor H.E Gerald Gakuha Githinji and representatives from the Roads, Transport & Public Works, Trade, Tourism, Industry & Co-operatives, Water, Environment & Natural Resources, Land, Housing & Physical Planning (Survey), County Architect, Tourism, among other departments.

Table 1.1 summarises the rest of the details.
Table 1.1: Schedule of Meetings with Key Stakeholders

<table>
<thead>
<tr>
<th>Date</th>
<th>Stakeholder</th>
<th>Time Held</th>
<th>Venue</th>
<th>Number of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>20/12/2016</td>
<td>Senator and Members of Parliament, Kiambu County</td>
<td>8.46am-11pm</td>
<td>Radisson Blu Hotel, Nairobi</td>
<td>14</td>
</tr>
<tr>
<td>11/01/2017</td>
<td>Utility Companies and Agencies</td>
<td>9.37am-1.06pm</td>
<td>Sarova Panafric Hotel, Nairobi</td>
<td>33</td>
</tr>
<tr>
<td>12/01/2017</td>
<td>County Government of Kiambu</td>
<td>9.35am-12.56pm</td>
<td>African Institute for Capacity Development Centre, Jomo Kenyatta University of Agriculture and Technology, Kiambu</td>
<td>23</td>
</tr>
</tbody>
</table>

- Public Forums: two public meetings were held in Wangige and Ndenderu as detailed in Table 1.2 below. The meetings were attended by a variety of actors including Members of Parliament, local residents, business owners, government agencies such as the National Museums of Kenya.

Table 1.2: Schedule for Public Forums

<table>
<thead>
<tr>
<th>Date</th>
<th>Venue</th>
<th>Time Held</th>
<th>Location</th>
<th>Number of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>19/01/2017</td>
<td>ACK St. Peter’s Church Wangige</td>
<td>09.51am</td>
<td>Wangige</td>
<td>250</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.34pm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19/01/2017</td>
<td>Anglican Church of Kenya – Ndenderu Parish</td>
<td>3pm</td>
<td>Ndenderu</td>
<td>232</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.35p.m.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- During the public forums, the consultant gave their phone and email contacts to members of the public. Following this, those with queries and concerns made several visits to the Consultant’s offices. In addition, phone calls and emails were made by members of the public.

Appendix D contains the minutes of the meetings held with the Political unit, utility companies, County Government of Kiambu as well as Wangige and Ndenderu public forums. Appendix E contains the list of attendants of the various meetings.

Chapter 6 details the public participation process.
1.4.2.2 Biodiversity assessments
A rapid random biodiversity assessment was conducted along the proposed western bypass, where five plot less sampling points were randomly selected adjacent to the existing tarmac road. Dominant vegetation species were recorded by observation in each of the sampling plots. Time Meander Search technique (TMS) was employed to search for direct animal observations, or their signs, tree and shrub species and human activity in each sampling plot. Invasive plant species were also recorded in each of the sampling plots. With 10 minutes of unsuccessful searching for new species, it was assumed that there were no new species and/or human activity in particular plots.

1.4.2.3 Bioclimatic analysis
Bioclimatic data was acquired from Worldclim –Global climate data, where monthly variables of temperature and rainfall were derived to generate biological meaningful variables for the proposed project area. These variables were further analysed for potential ecological impacts pre and post project implementation.

1.4.2.4 Noise and air quality studies
For Ambient Noise Level Assessment, a precision integrating sound level meter type CR 262A S/No. B21122FA, with Omni-directional microphone was used set at a slow response. The instrument was calibrated using Bruel and Kjaer sound level calibrator type 4230 for sound level meter at 94 dB (A) and 1000 Hz. The calibration was used to check the sensitivity of the instrument immediately before and after the measurement period.

Air quality measurements were undertaken using a Drager Tube Flue Gas Analyser. This is a direct reading instrument that has the capacity to measure and display the products of combustion from a domestic or commercial fossil fuelled appliance. It can also measure ambient air quality in rooms or buildings. The measurements are carried out by placing the probe at the general area along the road and directly reading the levels of the parameters on the tube.

For dust concentration measurement, static dust samples (total dust) were taken on Millipore cellulose .08µm membrane filter by placing pre-weighed filters at the site of interest for ten to twenty minutes depending on dust concentration at the site. A close supervision on the sampling instrument is taken to make sure that the sampler is operating as expected.

The inhalable dust particle size which is less than 10µm aerodynamic diameters was captured on filter paper for gravimetric analysis.

The two studies can be found in Appendix K and L.

1.4.3 Data Synthesis
The data collected was used to prepare a comprehensive environmental and social management plan (ESMMP) encompassing the potential impacts, mitigation measures and monitoring indicators which form part of this report.

1.4.4 Reporting
The main output is an EIA project report comprising of executive summary, assessment methodology, project description, study area, legal and institutional framework, anticipated impacts and an Environmental and Social Management and Monitoring Plan (ESMMP).
1.4.5 Team Members
The EIA team members are covered in Table 1.3 below.

Table 1.3: Team Members

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>NEMA expert</th>
<th>EIA/Audit registration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Winnie Wairimu</td>
<td>EIA/EA Lead expert, Lead Sociologist, Team Leader</td>
<td>7629</td>
<td></td>
</tr>
<tr>
<td>John Kuloba</td>
<td>EIA/EA Lead expert</td>
<td>1018</td>
<td></td>
</tr>
<tr>
<td>Hellen Mukuru</td>
<td>Associate Environmental Expert, Occupational Health and Safety Expert</td>
<td>6534</td>
<td></td>
</tr>
<tr>
<td>Augustine Juma</td>
<td>Associate Environmental Expert</td>
<td>8598</td>
<td></td>
</tr>
<tr>
<td>Julie Wanja</td>
<td>Associate Environmental Expert</td>
<td>4059</td>
<td></td>
</tr>
<tr>
<td>George Wairoma</td>
<td>Associate Environmental Expert</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Edmond Waswa</td>
<td>Associate Environmental Expert</td>
<td>8759</td>
<td></td>
</tr>
<tr>
<td>Jesse Wakukha</td>
<td>Assistant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Albert Muriuki</td>
<td>Air and Noise Quality Specialist</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2. PROJECT DESCRIPTION

2.1. Project Location
Administratively, the project is largely located in Kiambaa and Kabete Sub counties/constituencies of Kiambu County. The project borders major institutions such as churches (e.g. Anglican Church of Kenya St Andrew’s Ndenderu, ACK St Peter’s Church Wangige), a host of schools (including Ndenderu Primary School, The Angels Care School, Aloe Vera Preparatory School), Markets (e.g. Wangige market), bus terminals (e.g. Wangige Bus Park), a host of other businesses e.g. Total Petrol Station and residential complexes (e.g. in Ruaka).

2.2. Route Layout
The proposed Nairobi Western Bypass project starts from the end point of Nairobi Southern Bypass and links with trunk roads of the Kabete-Limuru Road (A104), Lower Kabete Road (E422J2), Getathuru road (D378), Ngong Road (E425J1), Limuru road, and D408 in loop type, and terminates at Nairobi Ruaka town where it connects with the starting point of the Northern Bypass. The overall length of the main alignment is 16.358 km, with 17.351 km service roads (excluding ramps).

Figure 2.1: Geographical Location of the Project
The starting point of the main line is connected to the end of the Southern Bypass of Nairobi City, intersected with A104, with a full cloverleaf interchange located at the intersection. The road mainly follows along the old alignment towards the northeast. The end of the road is located at Ruaka town, connecting the starting point of the Northern Bypass, and a single-trumpet interchange is set at Km14+813, connected with Limuru Road. Passing several large towns such as Wangige, Ndenderu and Ruaka etc., the road provides convenience for several large population centres along the line, with interchanges set at Km0+855, Km4+851, Km7+865, Km10+000, Km12+600, Km14+813, respectively.

Figure 2.2: Overall route map of Nairobi Western Bypass

2.3. Technical Standards
According to the guidance and suggestions formed through communication with KeNHA, the alignment layout principle of Nairobi Western Bypass Road Project is to make full use of the existing road through expansion and reconstruction, to minimize land acquisition and reduce the cost of the project. Design standards of alignment and interchange can be justified in positions passing through town area.

Based on the forecast of the traffic volume and the regulations of Kenya Road Design Manual, the Project is proposed to be a Class A National Trunk Highway with 4 lanes and median strip. The Design Speed is 80km/h and the width of subgrade is 21m wide. See Table 2.1 for the major technical parameters.
### Table 2.1: Major Technical Parameters

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terrain Category</td>
<td>-</td>
<td>Flat / Rolling</td>
</tr>
<tr>
<td>Class of Highway</td>
<td>-</td>
<td>Class A National Trunk Highway</td>
</tr>
<tr>
<td>Design Speed</td>
<td>km/h</td>
<td>80</td>
</tr>
<tr>
<td>Design Flood Frequency</td>
<td>year/time</td>
<td>100/1</td>
</tr>
<tr>
<td>Subgrade Width</td>
<td>m</td>
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</tr>
<tr>
<td>Width of Carriageway</td>
<td>m</td>
<td>2 (dual)-2*3.5</td>
</tr>
<tr>
<td>Stopping Sight Distance</td>
<td>m</td>
<td>120</td>
</tr>
<tr>
<td>Minimum Radius of Horizontal Curve</td>
<td>m</td>
<td>350</td>
</tr>
<tr>
<td>Maximum Gradient</td>
<td>%</td>
<td>5</td>
</tr>
<tr>
<td>Design Vehicle Load on Bridges and Culverts</td>
<td>-</td>
<td>BS5400HA Load, 30 units HB Load</td>
</tr>
<tr>
<td>Bridge Width</td>
<td>m</td>
<td>22</td>
</tr>
</tbody>
</table>

**Figure 2.3: Standard Cross section of sub grade**

#### 2.4. General Design Scheme

The length of the main alignment of this project is 16.358 km. The volume of excavation and filling material for both soft and hard material are 1.998 million m³ and 2.738 million m³ respectively; the quantity of the drainage protection is 84,000 m³ and the pavement is 0.4842 million m³.
There are:

- 11 bridges with a total length of 600 m, of which there are 5 medium bridges with the total length of 256 m;
- 6 interchanges, 2 grade separation interchanges with total length of 88m,
- 11 box culverts of length 740.9m, 40 pipe culverts of length 1323.8m: and,
- 5 pedestrian bridges.

There are 20 service roads with the total length of 17.351km, 203 pipe culverts within the service roads with a total length of 1399 m.

2.5. Subgrade and Pavement

2.5.1 Subgrade

2.5.1.1 Regular Subgrade

1) General Principle of Subgrade Design

In principle, the regular subgrade shall be designed taking overall account of such physical conditions as the terrain, relief, hydrographic and meteorological features as well as the geological conditions in the Project Corridor, adopting cost-effective defects-control measures, and putting stress on harmoniously merging with local environment.

2) Cross Section of Subgrade

Dual 4-lane with a 2.0m wide median strip and 2 x 0.5m marginal strips, the width of carriageway is 2 x 3.5 + 2 x 3.5m, with 2.0m paved shoulder, and a total width of road being 21m.

3) Cross Fall of Crown

According to Kenya Road Design Manual, the specific pavement type of the Project Road, local natural conditions and the existing road in the Project Area, the cross fall of crown of carriageway shall be 2.5%, while the paved shoulder slope shall be 4%.

4) Side Slope of Subgrade

According to Kenya Road Design Manual, side slope of the regular filled subgrade shall be arranged as shown in Table 2.2 and Figure 2.4.

*Table 2.2: Ratio of Filled*

<table>
<thead>
<tr>
<th>Serial No.</th>
<th>Filling Depth (hf)</th>
<th>Side Slope Ratio (1:n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>( hf \leq 1m )</td>
<td>( n=4 )</td>
</tr>
<tr>
<td>2</td>
<td>( 1m &lt; hf \leq 3m )</td>
<td>( n=2 )</td>
</tr>
<tr>
<td>3</td>
<td>( hf &gt; 3m )</td>
<td>( n=1.5 )</td>
</tr>
</tbody>
</table>
Regular setting of side slope for the excavated shall be arranged as shown in Table 2.3 and Figure 2.5.

![Sketch of Slope for Filled](image1)

**Figure 2.4: Sketch of Slope for Filled**

![Sketch of side slope for the excavated](image2)

**Figure 2.5: Sketch of side slope for the excavated**

**Table 2.3: Setting of Excavated Side Slope**

<table>
<thead>
<tr>
<th>Classification</th>
<th>Slope Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Soil Slope</strong></td>
<td></td>
</tr>
<tr>
<td>Cohesion less Sands</td>
<td>1:2</td>
</tr>
<tr>
<td>Silty Sands - Silts</td>
<td>1:1</td>
</tr>
<tr>
<td>he&lt;5cm Eluvial Soils (Red Friable Clays)</td>
<td>1:0.67</td>
</tr>
<tr>
<td>he&gt;5cm Eluvial Soils (Red Friable Clays)</td>
<td>1:1</td>
</tr>
<tr>
<td><strong>Rock Slope</strong></td>
<td></td>
</tr>
<tr>
<td>Weathered Rock</td>
<td>1:0.5—1:0.25</td>
</tr>
<tr>
<td>Sound Rock</td>
<td>1:0.33 — 1:0.1</td>
</tr>
</tbody>
</table>

5) Top Soil Stripping and Pre-Fill Compaction
In the Project, 30cm of top soil shall be stripped and the thickness of compaction before filling shall be 15cm.
6) Range of the Right-Of-Way
The line is substantially within the scope of road rights.

7) Earth Borrowing for Subgrade
For environmental considerations, earth of subgrade is mainly collected from the borrow pit along the line.

2.5.1.2 Special Subgrade
Unsuitable soil, mainly black cotton soil and gully soft soil, has been identified during field geological survey. Subgrade therein shall be treated by digging and removing the inferior soil and replacing it with subgrade fillings, embankment backfilling for black cotton soil and rock filling for soft soil.

2.5.1.3 Subgrade Protection
To ensure side slope stability, control erosion and achieve an aesthetic design, all filled and cut side slopes shall be protected. Soil slope with fill height more than 8m shall adopt herringbone framework with turfing, while stable and weathered rock section with cut height more than 8m shall be protected by mortar rubble grid; and stable soil slope with cut or fill height less than or equal to 8m shall use seeding protection by local grass.

2.5.1.4 Subgrade Drainage
A sound subgrade drainage system shall be designed by taking overall consideration of the Road Class, terrain, hydrogeological and meteorological features as well as bridge and culvert layout. Drainage system for the subgrade is composed of draining ditch, side ditch, chute and intercepting drain etc.

Draining ditch is usually built on fill sections of road and side ditch built on cut section, both of which adopt trapezoidal sections. Chute shall be built on the bottom of concave curve of fill section and between conical slopes. Intercepting drain shall be built on top of slope for some sections according to slope ratio and runoff condition of slope surface for cut section, and the distance to top of slope shall be no less than 5m, trapezoidal soil ditch, 0.6m wide at bottom, 1:1 at ratio. Soil platform shall be built and compacted inside the ditch using the cutting soil of the ditch.

Transversal draining shall be used for super-elevation section with median strip.

All drainage system shall be integral and coordinated with local irrigation system and avoid damaging farmland, soil loss and water pollution.

For roads passing through cities and towns, drainage design shall be in coordination with the existing and planned urban drainage system and facilities.

2.5.2 Pavement
2.5.2.1 Design Principle
Pavement on the Project Road has been designed in a comprehensive way, taking overall account of geological, hydrological, meteorological features and soil characteristics, and making full use of local road-building experience.
On the premise of meeting the traffic needs and road function requirements, the pavement design has been carried out in compliance with the principle of proper use of local materials, construction and maintenance convenience as well as fund saving with the pavement structure carefully selected on the basis of advanced road-building technology, cost-effectiveness, safety and reliability considerations, and facilitating mechanized and mass production.

2.5.2.2. Calculation of Pavement

Multi-layered elastic continuum theory under the action of dual round vertical uniformly distributed loads is adopted for asphalt concrete pavement, design deflection value is the design indicator of the overall stiffness of pavement, and then the thickness of pavement structure is calculated, and layer bottom tensile stress is checked for the asphalt concrete surface layer and flexible base materials and bottom level.

1) Traffic Forecast and Axle Load Conversion

a) Results of Traffic Forecast

The project is opened to traffic by the end of 2018. Featured years selected for traffic volume forecasting are 2019, 2020, 2025, 2030 and 2038, respectively. Results of the traffic forecast and the composition of vehicle models are shown in Tables 2.4 and 2.5.

Table 2.4: Results of Traffic Forecast for the Project (Unit: Standard Sedan Vehicles/Day)

<table>
<thead>
<tr>
<th>Year</th>
<th>2021</th>
<th>2025</th>
<th>2030</th>
<th>2035</th>
<th>2041</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starting Point—Wangige</td>
<td>17,677</td>
<td>22,022</td>
<td>26,738</td>
<td>31,631</td>
<td>37,375</td>
</tr>
<tr>
<td>Wangige—Karuri</td>
<td>14,551</td>
<td>18,128</td>
<td>22,009</td>
<td>26,038</td>
<td>30,766</td>
</tr>
<tr>
<td>Karuri—Ndenderu</td>
<td>12,434</td>
<td>15,491</td>
<td>18,808</td>
<td>22,251</td>
<td>26,291</td>
</tr>
<tr>
<td>Ndenderu-Ruaka (End Point)</td>
<td>20,284</td>
<td>25,271</td>
<td>30,682</td>
<td>34,371</td>
<td>38,732</td>
</tr>
<tr>
<td>Mainline Average</td>
<td>16,751</td>
<td>20,869</td>
<td>25,338</td>
<td>29,450</td>
<td>34,284</td>
</tr>
</tbody>
</table>

Table 2.5: Composition of Vehicle Models in Each Featured Years of Future (Absolute Number)

<table>
<thead>
<tr>
<th>Year</th>
<th>Sedan Vehicle</th>
<th>Pickup Truck/JEEP/ Four-Wheel Drive/Van</th>
<th>Small Bus</th>
<th>Medium Bus</th>
<th>Big Bus</th>
<th>Light Truck</th>
<th>Medium Truck</th>
<th>Heavy Goods Truck</th>
<th>Articulated Trucks</th>
<th>Oil Tanker</th>
</tr>
</thead>
<tbody>
<tr>
<td>2021</td>
<td>16.80%</td>
<td>10.76%</td>
<td>8.980%</td>
<td>5.360%</td>
<td>6.280%</td>
<td>4.500%</td>
<td>8.700%</td>
<td>14.66%</td>
<td>16.00%</td>
<td>7.96%</td>
</tr>
<tr>
<td>2025</td>
<td>15.20%</td>
<td>10.20%</td>
<td>8.50%</td>
<td>5.60%</td>
<td>7.00%</td>
<td>4.50%</td>
<td>9.10%</td>
<td>15.30%</td>
<td>16.80%</td>
<td>7.80%</td>
</tr>
<tr>
<td>2030</td>
<td>13.20%</td>
<td>9.50%</td>
<td>7.90%</td>
<td>6.00%</td>
<td>7.90%</td>
<td>4.50%</td>
<td>9.50%</td>
<td>16.00%</td>
<td>17.70%</td>
<td>7.80%</td>
</tr>
<tr>
<td>2035</td>
<td>12.08%</td>
<td>9.13%</td>
<td>7.59%</td>
<td>6.19%</td>
<td>8.34%</td>
<td>4.44%</td>
<td>9.81%</td>
<td>16.44%</td>
<td>18.20%</td>
<td>7.80%</td>
</tr>
<tr>
<td>2041</td>
<td>11.40%</td>
<td>8.90%</td>
<td>7.40%</td>
<td>6.30%</td>
<td>8.60%</td>
<td>4.40%</td>
<td>10.00%</td>
<td>16.70%</td>
<td>18.50%</td>
<td>7.80%</td>
</tr>
</tbody>
</table>
b) Axle Load Conversion and Accumulated Axle Load

Various types of vehicles are treated as equivalent conversion in accordance with the law to achieve the equivalent standard axle load times. Effect of axle load less than 40kN is negligible, so it is not included in the equivalent conversion. By equivalent conversion, traffic axle times are a total of 17.548 million, with the traffic rating of heavy traffic.

2) Scheme of Pavement Structure
   a) Scheme of Newly Built Pavement
      ❖ Carriageway Pavement Structure comprises of:
      1cm Asphalt Surface Dressing (6/10)
      5cm Asphalt Concrete (0-20)
      15cm Dense Bitumen Macadam (0-30)
      17.5cm Cement Stabilized Graded Crushed Stone (Cement Ratio: 2%-4%)
      30cm MDD 100% Subgrade
      Total 68.5cm
      ❖ Pavement Structure of Shoulder comprises of:
      3.5cm Asphalt Concrete (0-14)
      15cm Cement Stabilized Graded Crushed Stone (Cement Ratio: 2%-4%)
      17.5cm Cement Stabilized Graded Crushed Stone (Cement Ratio: 2%-4%)
      30cm MDD 100% Subgrade
      Total 66cm
      ❖ Pavement Structure of Ramp Road comprises of
      1cm Asphalt Surface Dressing (6/10)
      5cm Asphalt Concrete (0-20)
      15cm Dense Bitumen Macadam (0-30)
      17.5cm Cement Stabilized Graded Crushed Stone (Cement Ratio: 2%-4%)
      30cm MDD 100% Subgrade
      Total 68.5 cm

After the checking of deflection value and allowable tensile stress, pavement structure of carriageway meets the regulatory requirements. Therefore the above pavement structure is the recommended scheme of the project, as well as able to make good use of local red friable clays, which is economical and convenient for construction.

b) For the transformation of the old road pavement, there are two categories for pavement treatment:

The first category is to make use of the existing pavement structure as much as possible and new pavement layer is laid on the old road based on the actual situation of the old road. The first class of road rehabilitation can take full advantage of the old road structure layer, and it is convenient for construction, but the standard road levels need to be raised, which affects adjacent buildings and roads and results in the insufficient width of subgrade in some sections.

The second category is to try to maintain the original road elevation, paving the new base and surface layers after removing the old road pavement and base. The second class of road rehabilitation can maintain the elevation of existing pavement with little impact on adjacent
buildings and roads, yet the construction of it is difficult, and the sub-base of the old road is greatly affected by the passing traffic during the construction process.

Combining the situation of the project, two road-widening schemes of old roads are presented in Figure 2.6 and 2.7.

Scheme One is to cut the old pavement, and additionally pave with 17.5 Cement Stabilized Graded Crushed Stone + 15cm Dense Bitumen Macadam + 5cm Asphalt Concrete + 1cm Asphalt Surface Dressing;

Scheme Two is to retain the old pavement, and additionally pave with 12.5 Crushed Stone + 15cm Dense Bitumen Macadam + 5cm Asphalt Concrete + 1cm Asphalt Surface Dressing.

The existing old road in the project was completed in 1971 with thin road surface, only about 6cm thick. It has experienced many times of maintenance and overlay over years. The condition of the existing subgrade and pavements are more complicated. Neighbourhoods and residents along the project on both sides of the road have a certain distance from the old roads, so the original old road heightening or excavations have very little impact on the neighbourhoods. After repeated comparison and considerations, the first class of road treatment program is recommended.

Figure 2.6: Scheme one of Old Road Widening
Figure 2.7: Scheme Two of Old Road Widening

2.6. Bridge and Culvert

2.6.1 Technical Standards:
- Design Vehicle Load: BS 5400 HA Load, 30 units HB Load
- Design Flood Frequency: 1/100 for bridge, 1/50 for culvert
- Bridge Deck Width: The main line bridge in the Project is divided into two sides, the width of a single side is 10.5m, the cross section is 0.5m crash barrier + 9.5m carriageway + 0.5m crash barrier, and the width of median strip is 1.0m; The single side width of interchange ramp bridge is 12m, the cross section is 0.5m crash barrier + 11.0m carriageway + 0.5m crash barrier.
- Pavement Structure of Bridge: 1cm Asphalt Surface Dressing (6-10) + 5cm Asphalt Concrete (0-20), with a PB (I) waterproof layer at the bottom layer.
- Earthquake Protection Standard: Reference to A Catalogue of Felt Earthquakes in Kenya (1892-1969), for the seismic fortification intensity division diagram, the Project is set according to the intensity VII, with ground motion peak acceleration to be 0.10~0.15g.
- Safety Grade of Bridge and Culvert Structure: Grade I.
- Environmental Classification of Bridge and Culvert Structure: Class II.

2.6.2 Bridge Project
There are 11 bridges with a total length of 600 m, of which there are 5 medium bridges with the total length of 256 m; 6 interchanges, 2 grade separation interchanges with total length of 88m, 11 box culverts of length 740.9m, 35 pipe culverts of length 1070.9m and 5 pedestrian bridges.

There are a total of 20 service roads, with 203 pipe culverts of 1399m long.

Steel-concrete composite girder and voided slab have the advantages of simple structure, clear stress, and easy and fast installation method. Fabrication yard can be built at a proper place near the bridge to make voided slabs, which can be lifted with trucks or erected with bridge girder erection machine; steel-concrete composite girder can be assembled and hoisted on site, and the
bridge deck slabs are cast by through vertical shuttering grouting on site. Thus, 25-meter steel-concrete composite girder and 16-meter prefabricated simply-supported PC (pre-stressed concrete) voided slabs are used in all the bridges along the main lines and interlinked lines.

The bridge pier is the technically mature bicylinder-style bridge pier with convenient construction method and clear stress (diameter: 1.2m-1.5m). The bored pile foundation has a diameter of 1.5 meters. The U-shaped abutment is used. The diameter of its bored pile foundation is 1.5 meters.

### 2.6.3 Pedestrian Bridge

To connect people living on both sides of the main lines, 5 pedestrian overpass bridges will be built. The bridges will adopt the pre-stressed concrete structure with the 2.5-meter-wide bridge deck. Single-column pier and pile foundation are set up.

### 2.6.4 Passageway and Culvert

In line with the function, flood discharge capacity, subgrade filling height, geological condition, as well as the local materials and construction conditions, box culvert and pipe culvert are adopted. Box culvert adopts 1-4x4m, 2-4x4m, 1-6x5.8m, 2-6x5.8m, 2-12x7.2m and 1-12x7.2m. Culvert wing wall or retaining wall is adopted for the hole type. 1--900mm and 2--900mm pipe culverts are utilized. 1-9600mm ditch culvert is used.

The establishment of bridges and culvert can be seen from Table 2.6 to Table 2.9.

*Table 2.6: List of Interchanges*

<table>
<thead>
<tr>
<th>S N</th>
<th>Name of Bridge</th>
<th>Central Chainage</th>
<th>Present Crossed Road Class</th>
<th>Angle (°)</th>
<th>No. of Span/Length</th>
<th>Bridge Length (m)</th>
<th>Bridge Width (m)</th>
<th>Type of Structure</th>
<th>Scheme of Interchange</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>EK0+150.27 Medium Bridge</td>
<td>EK0+150.27</td>
<td>Class D</td>
<td>90</td>
<td>2x16</td>
<td>44</td>
<td>12.0</td>
<td>PC Voided Slab</td>
<td>Wangige Interchange</td>
<td>Overcrossing Main Line</td>
</tr>
<tr>
<td>2</td>
<td>AK0+185.253 Medium Bridge</td>
<td>AK0+185.253</td>
<td>Class E</td>
<td>90</td>
<td>2x16</td>
<td>44</td>
<td>12</td>
<td>PC Voided Slab</td>
<td>Kihara Interchange</td>
<td>Overcrossing Main Line</td>
</tr>
<tr>
<td>3</td>
<td>LK0+52.706 medium bridge</td>
<td>LK0+522.706</td>
<td>Class C</td>
<td>86.1</td>
<td>2x25</td>
<td>62</td>
<td>30.93</td>
<td>Steel-concrete composite girder</td>
<td>Ndenderu interchange</td>
<td>Overpass Main line</td>
</tr>
<tr>
<td>4</td>
<td>K10+474.532 medium bridge</td>
<td>K10+474.532</td>
<td>Class C</td>
<td>80.3</td>
<td>2x16</td>
<td>44</td>
<td>14.50</td>
<td>Pre-stressed concrete void slab</td>
<td>Ndenderu interchange</td>
<td>Overpassed by main line</td>
</tr>
</tbody>
</table>
Table 2.7: List of Separated Interchanges

<table>
<thead>
<tr>
<th>Name of Bridge</th>
<th>Central Chainage</th>
<th>Present Crossed Road Class</th>
<th>Angle (°)</th>
<th>No. of Span/Length</th>
<th>Bridge Length (m)</th>
<th>Bridge Width (m)</th>
<th>Type of Structure</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 K3+788 Medium Bridge</td>
<td>K4+788</td>
<td>Class D</td>
<td>90</td>
<td>2X16</td>
<td>44</td>
<td>12</td>
<td>PC Voided Slab</td>
<td>Overcrossing Main Line</td>
</tr>
<tr>
<td>2 K5+790 Medium Bridge</td>
<td>K6+790</td>
<td>Class D</td>
<td>90</td>
<td>2X16</td>
<td>44</td>
<td>12</td>
<td>PC Voided Slab</td>
<td>Overcrossing Main Line</td>
</tr>
</tbody>
</table>

Table 2.8: List of Overpass Bridges

<table>
<thead>
<tr>
<th>Central Chainage</th>
<th>Angle (°)</th>
<th>No. of Span/Span Length</th>
<th>Bridge Width (m)</th>
<th>Type of Structure</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 K2+360</td>
<td>90</td>
<td>4x16</td>
<td>2.50</td>
<td>Pre-stressed concrete voided slab</td>
<td>Overcrossing Main Line</td>
</tr>
<tr>
<td>2 K8+920</td>
<td>90</td>
<td>4x16</td>
<td>2.50</td>
<td>Pre-stressed concrete voided slab</td>
<td>Overcrossing Main Line</td>
</tr>
<tr>
<td>3 K11+410</td>
<td>90</td>
<td>4x16</td>
<td>2.50</td>
<td>Pre-stressed concrete voided slab</td>
<td>Overcrossing Main Line</td>
</tr>
<tr>
<td>4 K13+800</td>
<td>90</td>
<td>4x16</td>
<td>2.50</td>
<td>Pre-stressed concrete voided slab</td>
<td>Overcrossing Main Line</td>
</tr>
</tbody>
</table>
Table 2.9: List of Box Culverts

<table>
<thead>
<tr>
<th>S.N</th>
<th>Central Chainage</th>
<th>Structure Type</th>
<th>Angle (°)</th>
<th>Span number – Span Diameter x Clear Height (m)</th>
<th>Length of Culvert (m)</th>
<th>Inlet and Outlet Type</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Box Culvert</td>
<td></td>
<td></td>
<td></td>
<td>Inlet</td>
<td>Outlet</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Wing Wall</td>
<td>Wing Wall</td>
</tr>
<tr>
<td>1</td>
<td>K0+145</td>
<td>Box Culvert</td>
<td>90</td>
<td>2-6x5.8</td>
<td>32.5</td>
<td>Wing Wall</td>
<td>Wing Wall</td>
</tr>
<tr>
<td>2</td>
<td>K0+855</td>
<td>Box Culvert</td>
<td>90</td>
<td>2-6x5.8</td>
<td>26.5</td>
<td>Wing Wall</td>
<td>Wing Wall</td>
</tr>
<tr>
<td>3</td>
<td>K3+373</td>
<td>Box Culvert</td>
<td>90</td>
<td>2-4x4</td>
<td>73</td>
<td>Wing Wall</td>
<td>Wing Wall</td>
</tr>
<tr>
<td>4</td>
<td>K4+520</td>
<td>Box Culvert</td>
<td>90</td>
<td>2-4x4</td>
<td>99.5</td>
<td>Wing Wall</td>
<td>Wing Wall</td>
</tr>
<tr>
<td>5</td>
<td>K5+220</td>
<td>Box Culvert</td>
<td>90</td>
<td>1-4x4</td>
<td>56</td>
<td>Wing Wall</td>
<td>Wing Wall</td>
</tr>
<tr>
<td>6</td>
<td>K6+600</td>
<td>Box Culvert</td>
<td>35</td>
<td>2-4x4</td>
<td>97.8</td>
<td>Wing Wall</td>
<td>Wing Wall</td>
</tr>
<tr>
<td>7</td>
<td>K7+110</td>
<td>Box Culvert</td>
<td>77</td>
<td>1-4x4</td>
<td>68.8</td>
<td>Wing Wall</td>
<td>Wing Wall</td>
</tr>
<tr>
<td>8</td>
<td>K8+700</td>
<td>Box Culvert</td>
<td>90</td>
<td>2-4x4</td>
<td>80</td>
<td>Wing Wall</td>
<td>Wing Wall</td>
</tr>
<tr>
<td>9</td>
<td>K9+410</td>
<td>Box Culvert</td>
<td>45</td>
<td>2-6x5.8</td>
<td>75.8</td>
<td>Wing Wall</td>
<td>Wing Wall</td>
</tr>
<tr>
<td>10</td>
<td>K9+716.5</td>
<td>Box Culvert</td>
<td>35</td>
<td>2-4x4</td>
<td>109</td>
<td>Wing Wall</td>
<td>Wing Wall</td>
</tr>
<tr>
<td>11</td>
<td>K12+973.718</td>
<td>Box Culvert</td>
<td>90</td>
<td>1-12x7.2</td>
<td>22</td>
<td>Wing Wall</td>
<td>Wing Wall</td>
</tr>
</tbody>
</table>

2.7. Line Intersection
In this project, 6 interchanges will be built; other grade crossings are mainly at the crossings of service roads and local roads.

2.7.1 Interchange

2.7.1.1 Location and Type of Interchange
Interchange is a significant factor that affects the scale of road project and improves the development of local economic. According to local economy, land use condition, road layout, road network plan, traffic forecast and owner requirements, 6 interchanges will be built in the Project. See details in the following table.
Table 2.10: List of interchanges

<table>
<thead>
<tr>
<th>S.N</th>
<th>Name of Interchange</th>
<th>Central Chainage</th>
<th>Type of Interchange</th>
<th>Distance to the Last Interchange (km)</th>
<th>Present Name and Class Road</th>
<th>Crossed Name and Class Road</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dirt</td>
<td>K0+855</td>
<td>Diamond</td>
<td></td>
<td>E42J2, Class E</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Wangige</td>
<td>K4+851</td>
<td>Diamond</td>
<td>4</td>
<td>D378, Class D</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Kihara</td>
<td>K7+865</td>
<td>Diamond</td>
<td>3.01</td>
<td>Kihara-Gacii-Karura Road, Class E</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Ndenderu</td>
<td>K10+000</td>
<td>Clover-leaf</td>
<td>1.14</td>
<td>Limuru Rd, Class C</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Rumingi</td>
<td>K12+600</td>
<td>Simple</td>
<td>2.6</td>
<td>Class E</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Ruaka</td>
<td>K14+813</td>
<td>Single Trumpet</td>
<td>2.81</td>
<td>D408, Class D</td>
<td></td>
</tr>
</tbody>
</table>

2.7.1.2. Design Principle of Interchange
1. In line with the road network condition and long-term plan, making a scientific overall plan of the interchanges and choosing the final interchange plan after considering the terrain condition;
2. Safety principle: interchange is accident-prone area; safety is the main concern in the design;
3. The layout of interchanges shall try to take up less land and remove fewer people;
4. The layout of interchanges shall stay harmony with the environment, possess the proper functions and simple form as well.

2.7.1.3. Cross Section of Ramp Subgrade
The ramp subgrade of one-way single lane is 8m wide, in which the carriageway is 4m wide, the paved shoulder on the left side is 2m wide, and the paved shoulder on the right side is 2m wide.

The ramp subgrade of one-way dual lanes is 11m wide, in which the carriageway is 2mX3.5m, the paved shoulder on the left side is 2m wide, and the paved shoulder on the right side is 2m wide.

The ramp subgrade of two-way dual lanes is 11m wide, in which the carriageway is 2mX3.5m, the paved shoulder on the right side is 2m X 2m.
2.7.1.4. Main Line Interchanges

Figure 2.8 Location of Interchanges

1. Dirt Interchange
   a) Location and Function in Road Network
   Dirt Interchange is located near Dirt. It is connected with E42J2. It is used to serve the vehicles in and neighbouring Dirt.

   Dirt Interchange is 4.45km away from the next Wangige Interchange.

   b) Interchange Type, Ramp Design Speed and Ramp Cross Section
   The crossed E42J2 road of the Interchange is a Class E road. The road mainly undertakes the distribution of neighbouring residence. Thus, in line with its location and the traffic volume, a diamond design is adopted for this Interchange. The design speed of the ramp is 40km/h. One-way single lane ramp cross section is adopted. The subgrade width is 8m.

   c) Terrain, Ground Features and Geological Structure
   Located at the urban area, the scale of Dirt Interchange is limited by land.
d) Interchange Structure
2*5.8m box culvert will be set up at the intersection of the interchange and the crossed road for passing traffic and pedestrian, as well as draining water. At the position of AK0+280 and DK0+020, 1-0.9m-pipe culvert is set up for draining the water in the triangle area of the interchange.

2. Wangige Interchange
a) Location and Function in Road Network
Wangige Interchange is located near Wangige. Wangige Interchange is connected with D378. It is used to serve the vehicles in and neighbouring Wangige.

Wangige Interchange is 4.45km away from the last Dirt Interchange, and 3.01km away from the next Kihara Interchange.

b) Interchange Type, Ramp Design Speed and Ramp Cross Section
The crossed D378 road of the Interchange is a Class D road. The Road D378 mainly undertakes the distribution of neighbouring residence. Thus, in line with its location and the traffic volume, a diamond design is adopted for this Interchange. The design speed of the ramp is 40km/h. One-way single lane ramp cross section is adopted. The subgrade width is 8m.

c) Terrain, Ground Features and Geological Structure
Located at the urban area, the scale of Wangige Interchange is limited by land. As Wangige Interchange crosses the mountain, there is cutting in the middle part and fillings on both sides.
d) Interchange Structure
Undercrossing crossed road is adopted at Wangige Interchange. At the EK0+150.272 position of crossed road, 2X 16m-fabricated PC voided slab will be set up. The bridge deck adopts the gravity U-type abutment, column pier and pile foundation. At the position of AK0+139, CK0+226 and DK0+102, 1-0.9m pipe culvert is set up for draining the water in the triangle area of the Interchange.

3. Kihara Interchange
a) Location and Function in Road Network
Kihara Interchange is located near Kihara. The crossed Kihara-Gacii-Karura Road mainly serves the vehicles in and neighbouring Kihara.

Kihara Interchange is 3.01km away from the last Wangige Interchange, and 1.14km away from the next Ndenderu Interchange.

b) Interchange Type, Ramp Design Speed and Ramp Cross Section
The crossed Kihara-Gacii-Karura Road is a Class E road. It mainly undertakes the traffic of Kihara-Gacii-Karura. Thus, in line with its location and the traffic volume, this Interchange adopts the diamond design. The design speed of the ramp is 40km/h. One-way single lane ramp cross section is adopted. The subgrade width is 8m.

c) Terrain, Ground Features and Geological Structure
Located at the urban area, the scale of Kihara Interchange is limited by land.
Figure 2.11: Kihara Interchange

d) Interchange Structure
Undercrossing the crossed road is adopted at this Interchange. At the EK0+185.253 position of the crossed road, 2X 16m-fabricated PC voided slab will be set up. The bridge deck adopts gravity U-type abutment, column pier and pile foundation.

At the position of AK0+074 and BK0+125, 1-0.9m pipe culvert is set up for draining the water in the triangle area of the Interchange.

4. Ndenderu Interchange

a) Location and Function in Road Network
Ndenderu Interchange is located at the centre of Ndenderu. The main line and the crossed road Limuru Road are intersected at here. This location has good geological conditions. As there are important churches at here, demolition is difficult.

Ndenderu Interchange is 1.14km away from the last Kihara Interchange, and 2.6km away from the next Rumingi Interchange.

b) Interchange Type, Ramp Design Speed and Ramp Cross Section
Ndenderu Interchange is intersected with Limuru Road. The crossed Limuru Road is a Class C road, an important traffic artery in Nairobi with a large traffic volume. Since there are many houses in the intersection area, demolition is difficult. Thus, in line with the location, traffic volume and the land use conditions, a whole cloverleaf interchange is adopted for this Interchange. The design speed of the ramp is 40km/h. One-way single lane ramp cross section is adopted. The subgrade width is 11 m.

c) Terrain, Ground Features and Geological Structure
Located at the urban area, the scale of this Interchange is limited by land.
d) Interchange Structure
This Interchange is overcrossing the main line. At the positions of LK0+522.706, 2 X 25m fabricated PC voided slab will be set up, and at K10+474, 2 X 16m concrete voided will be set up. The bridge deck adopts gravity U-type abutment, column pier and pile foundation.

At the position of AK0+11K AK0+204> DK0+086.5> AK0+215.7> EK0+158> GK0+224 and HK0+168, and LK0+726, 1-0.9m pipe culvert is set up for draining the water in the triangle area of the Interchange.

5. Rumingi Interchange
   a) Location and Function in Road Network
Rumingi Interchange is located near Rumingi. Rumingi Interchange connects with the local roads. It mainly serves the vehicles near Rumingi.

Rumingi Interchange is 2.6km away from the last Ndenderu Interchange, and 2.81km away from the next Ruaka Interchange.

   b) Interchange Type, Ramp Design Speed and Ramp Cross Section
The crossed road of the Interchange is a Class E road. It mainly serves the traffic volume of the surrounding area. Since there are many houses in the intersection area, demolition is difficult. Thus, in line with the location, traffic volume and the land use conditions, a simple interchange is adopted for this Interchange. The design speed of the ramp is 40km/h. One-way single lane ramp cross section is adopted. The subgrade width is 8m.

   c) Terrain, Ground Features and Geological Structure
Located at the urban area, the scale of this Interchange is limited by land.
d) Interchange Structure
It is an overcrossing form. The 1-12m box culvert will be set up at the intersection of the Interchange and the crossed road for passing traffic and pedestrian, as well as draining water.

At the position of AK0+070, 1-0.9m pipe culvert is set up for draining the water in the triangle area of the Interchange.

6. Ruaka Interchange
a) Location and Function in Road Network
Ruaka Interchange is located near Ruaka. Ruaka Interchange connects with the local roads. It mainly serves the vehicles in the urban area and neighbouring Rumingi.

Ruaka Interchange is 2.81km away from the last Rumingi Interchange.

b) Interchange Type, Ramp Design Speed and Ramp Cross Section
The crossed D408 road of the Interchange is a Class D road, an important road for entering and leaving the city. Thus, in line with the location, traffic volume and the land use conditions, a single Trumpet design is adopted for this Interchange. The design speed of the ramp is 40km/h. Two-way dual lanes ramp cross section is adopted for the Interchange Ramp A, with ramp subgrade width of 11m. One-way single lane ramp cross section is adopted for other ramps, with ramp subgrade width of 8m.

c) Terrain, Ground Features and Geological Structure
Located at the urban area, the scale of this Interchange is limited by land.
d) Interchange Structure
Undercrossing main line is adopted at this Interchange. 2X25m steel-concrete composite girder is set at the position of AK0+537.192, the gravity U-type abutment, column pier and pile foundation are adopted.

At the position of AK0+482, BK0+150 and DK0+085, 1-0.9m pipe culvert is set up for draining the water in the triangle area of the Interchange.

2.7.2 Grade Intersection
The grade intersection in the Project is mainly set up in areas between service roads and local roads, as well as in areas between service roads and interchange ramps.

2.8. Traffic Engineering and Line Facilities
1. Relevant Specifications and Standards

2. Road Markings
The purpose of the road markings is to guide the traffic flow, give drivers necessary guidance, warning, restriction or direction, to let road users go their separate ways, and ensure good sight guidance at day and night. Clear boundaries and lines can ensure safe and smooth driving of vehicles.

In order to make the markings have the same clarity at night as that in the day, material with long service life and good reflective effect should be used as the material of road markings. The material of road markings should be characterized in strong bonding with the road, short drying time, good abrasion resistance, durability, slip resistance, etc. Finished markings should have good visual recognisability, equal width and spacing, smooth edges, regular and smooth lines. Also the drainage needs of roads should be considered when deciding the thickness of the coating of markings. The markings shall be reflective thermoplastic paint.
The Setting Principles of Road Markings include:

- Carriageway edge lines: white full line, line width 0.1m.
- Carriageway dividing lines: white dashed line, line width 0.1m. If the design speed is greater than or equal to 65km/h, the carriageway should be of 3-9 dashed line; if not, dashed line 2-6.
- Road central line: yellow dashed line, line width 0.1m. If the design speed is greater than or equal to 65km/h, the carriageway should be of 3-9 dashed line; if not, dashed line 2-6.
- Mark out entrance markings and road guiding arrows on acceleration and deceleration lanes of interchanges and intersections.

3. Traffic Signs
Traffic signs are designed to ensure smooth traffic flow and traffic safety, to provide road users with clear, accurate, timely and adequate information and to meet the visual effect for driving at night. The layout of markings of the whole line should be equal instead of overly concentrating on a local section. The structure and form design of signs should coordinate with the road shape and the surrounding environment to meet the aesthetic and visual demands. The markings of the whole line to be laid out are: exit notice, exit signs, entrance notice, entrance signs, guide signs, speed limit signs, height limit signs, lane merging and branching induction signs, guide signs, sight line induction signs. All signs are in the form of single-pole, double-pole and attachment style.

The structure and layout of traffic signs are designed with principles of clearness and pleasing to the eye as our guide. The structure of all types of signs should be simple, generous and beautiful. The specific dimensions of signs should be in accordance with existing local standards of Kenya. In case of size limitations, the size of fonts can be changed accordingly.

The outer border of traffic signs should be set off with a substrate colour. Specified substrate colours are: yellow warning signs, white propitiatory signs and green guide signs.

Sign boards should be made of aluminium alloy plates, of which the thickness is 2mm for board less than 9m² and 3mm for more than 9m². The tensile strength of aluminium alloy plate should be not less than 289.3Mpa, yield point not less than 241.2Mpa, elongation not less than 4% ~ 10%.

The supporting parts of sign board are steel structure, of which the supporting types are in form of single-pole and double pole.

The base of signs should be of reinforced concrete foundation.

The sign boards and supporting parts are connected with hoop. The supporting parts and the concrete foundation are connected with anchor bolts.

For selection of reflective material of board, take into account the reflective characteristics of various types of reflective film, functions, application field and service life, as well as the clear distinction of the contents of different parts, so as to have good visual recognisability of the traffic information at night. The project uses third level reflective film. The background colour, text and
graphics of sign board adopt reflective stickers and the colour should be in accordance with requirements of "Design manual of road traffic signs and markings "of the Republic of Kenya.

For post type signs on road sides, the distance between the inner edge of sign board and the edge of carriageway should be not less than 0.25m; the clearance height between the lower edge of a cantilever sign board and the road should be not less than 5.5m. Special attention should be paid during transporting and hoisting processes of sign boards, avoiding any interference to sign boards and reflective films.

4. Waveform Guardrail
The main purpose of waveform guard bar is to prevent vehicles in driving from going out of roads and to prevent pedestrians from falling down to outside of roads, so as to minimum damages suffered by vehicles and road users in the event of an accident. Waveform guard bars are generally set on both sides of a roadbed, of which the fill height is greater than or equal to 3 m. Refer to the “Design drawings of waveform guard bars” in this document for specific settings.

Generally posts of guard bars should be hammered into soil with a pile driver. In case of underground communication channels or drainpipes or rock embankment, on-site basic hole digging and cast-in-place concrete foundation could be used. All components of guard bars should be subject to anti-corrosive treatment after machining and forming. All waveform beam steel plates, brackets and steel tube post should be subject to aluminizing treatment. Bolts and other parts should be subject to hot dip galvanizing anti-corrosive treatment.

2.9. Project cost
A rough estimated cost of construction is approximately 17.356 billion Kenya shilling.

2.10. Project Construction activities and inputs
Construction activities relate to preparatory stages of the project,

2.10.1 Pre- construction stage
This involves:
- Design and drawing of architectural plans and designs including establishing coordinates, elevation systems, resurveys and correcting any discrepancies between site and design drawings, review opinions on designs etc. has been ongoing. This includes meeting different stakeholders such as the political unit of Kiambu and has led to some revisions of the designs.
- Survey and detection of underground utility facilities and infrastructure e.g. pipes and lines, including underground optical, electric cables, water pipes, oil and heat pipes, including verification of accurate location and contacting the owner or authority. Utility companies were met on 11th January and joint site visits held to plan for relocation of services. Companies pledged to provide detailed location plans for services and utilities. This is an ongoing activity to ensure minimal disruption of services.
- Application for the various permits and licenses including; the Nairobi City County Development Control Section approvals of the project and Water Resource Management Authority (WRMA) approvals for water abstraction.
• Application for land acquisition for the relevant sections. This will follow the preparation of a Resettlement Action Plan to be implemented by the National Land Commission.
• Application and engagement of the relevant government agencies for use of infrastructural utility reserves.
• Environmental and social impact assessment, public participation process and seeking approvals by NEMA.

2.10.2 Inputs
The project will basically handle input materials of various nature:

a. **Non-hazardous materials:** The store for non-hazardous materials will be accommodated within the site area. Materials to be stored shall include samples for review / testing by consultants and or inspectors.

b. **Hazardous materials:** Hazardous materials shall include paints, oil, grease, vehicle fuel, bitumen etc. The store to keep these materials shall have iron sheet walling and roof and a waterproof concrete floor to contain spills. Storage and handling of all hazardous chemicals shall be in accordance with manufacturer's instructions as outlined on the material safety data sheets.

c. **Bulk construction materials:** The bulk materials to be stored on site include: sand, ballast, stones, cement, quarry chips, steel, timber etc. It is recommended that the project proponent should plan for material to be delivered in manageable quantities in order to avoid any form of deposit, which will impede site activities, induce safety hazards and create a nuisance to the neighbourhood.

Other inputs include:

• **Water:** The project will require significant volumes of water for various activities including spraying dusty sections, concrete-making, optimum compacting of different layers of materials constituting the roadway, cleaning operations in worksite camps. The project has the option of digging boreholes to supplement water needs for both road construction and campsite

• **Labour:** The contractor will hire skilled, semi-skilled and unskilled workers. In terms of numbers to be mobilized, this has not yet been estimated.

2.10.3 Site office
The contractor shall construct temporary site offices to run and manage all activities at different phases. This will also include securing of the utility services such as water, electricity which will be crucial for the construction activities.

2.10.4 Site Management
Clearly visible signage on roads and buildings under construction will be set up. Sufficient and quality diversions will be created as well as protected walkways for pedestrians maintained. Provision and maintenance of access to all properties and project neighbours’ facilities will be mandatory.

Site clearance will include clearance of trees, removal of top soil and removal of existing buildings after land acquisition.
2.10.5 Foreseen Works

- Site clearing and excavation: This will involve excavating for the various unit foundation works, access roads and the landscaping. Structure Excavation will include Pipe Culvert and Drain excavation. The bulk of the excavated material will be carried away from site by the contractor to approved dumpsite(s) in accordance with the EMCA (waste management) regulations, 2006.

- Civil works activities. These range from Landscaping (to include beautification e.g. grass and flowers) to installation of safety and security features (e.g. installation of security lighting, traffic markings), bridge construction, drainage and slope protection, road marking and installation of road furniture, utility service infrastructure set up, earthworks, drainage establishment, pavements structure construction etc.

- Afforestation/Reforestation and Landscaping: After road construction, it is expected that the contractor will rehabilitate and replant trees cut down during site clearance. Grass will also be planted where possible to check on erosion and to green the road.
3. STUDY AREA BASELINE

This section details the study area. Its main focus is on the larger General County as well as areas immediate to the project.

3.1. Geographical Location

Administratively, the project is located in Kiambu County- a county that covers a total area of 2,543.5 Km². The County was first set up in 1925, as Kiambu Native District Council, later changing to Kiambu African Native Council in 1958. It finally gained its official name 'Kiambu' borrowing from resultant screams arising from tribal raids conducted by the Maasai, who often raided the villages for livestock.³

The proposed Western Bypass is in Kiambu County cuts across Kiambaa and Kabete constituencies. The bypass cuts across five wards of the total ten wards in the two constituencies as highlighted in Figure 3.1 below.

³ http://kenya.opencounty.org/about.php?cid=2
The projects passes several large towns such as Wangige, Gitaru, Ndenderu and Ruaka etc. In terms of its immediate neighbours, the project borders a variety of actors and institutions, including churches (e.g. Anglican Church of Kenya St Andrews Ndenderu, ACK St Peter’s Church Wangige), a host of schools (including Ndenderu Primary School, The Angels Care School, Aloe Vera Preparatory School), Markets (e.g. Wangige market), bus terminals (e.g. Wangige Bus Park), a host of other businesses e.g. Total Petrol Station and residential complexes (e.g. in Ruaka).

Figure 3.1: The Proposed Western Bypass in relation to the ten wards of Kabete and Kiambaa Constituencies
3.2. Environmental Baseline

3.2.1 Physical Environment

3.2.1.1 Geology

Apart from a few isolated occurrences of Precambrian and Quaternary rocks, the site area is composed of volcanic rocks that originated in the rift region and flowed eastwards on to a warped and partly dissected, pre-Miocene erosion surface, cutting across the older crystalline rocks. There is also no obvious fault in the site with reference to data of nearby projects.

Earthquake Protection Standard

The Kenyan Seismic Code, issued in 1973 by the Ministry of Works, uses the Modified Mercalli Intensity (MMI) scale to map the seismic hazard of the country. As Figure 3.2 below shows, the map divides the country in four seismic zones: Zone V, VI, VII and VIII-IX, where the Roman numbers are in accordance with the MMI scale. The adopted return period of design earthquakes even though not stated is inferred to be not more than 100 years.

![Figure 3.2: Seismic zoning of Kenya](image)

The project is located in Kiambu, almost bordering Nairobi is in Zone VII. Reference to A Catalogue of Felt Earthquakes in Kenya (1892-1969), for the seismic fortification intensity division diagram, the Project is set according to the intensity VII, with ground motion peak acceleration to be 0.10–0.15g. The geological tectonic conditions within the project site and its environs would be of good stability.

However recently, Worku (2014) highlighted that although the Kenyan code was the pioneering seismic code in Africa, it has not been updated. Given, the county is located well within the Eastern branch of the active seismic region of the EARS which is prone to strong earthquakes, he suggests...
that there is need for updates. He highlights one such initiative as part of the Global Seismic Hazard Assessment Program (GSHAP), launched by the International Lithosphere Program (ILP) and endorsed as a demonstration programme in the framework of the United Nations International Decade for Natural Disaster Reduction (UN/IDNDR). Based on access to the GSHAP base map, he produces a map of the EARS region - the most earthquake-prone region of Africa as shown in Figure 3.3. However, given the location of Kiambu is not within the yellow region (PGAs up to 0.16 g), the map does not show need to worry about the seismicity of Kiambu.

![Seismic Hazard Map of EARS region for a return period of 475 years according to GSHAP](image)

*Figure 3.3: Seismic Hazard Map of EARS region for a return period of 475 years according to GSHAP*

*Source: Worku 2014*

**Site Specific Geology**

The rock in the western Nairobi is mainly volcanic. For the eastern Nairobi, it is mainly the sand metamorphic rocks (such as mica, marble, quartz, gneiss and shale). The rocks of Nairobi area mainly comprise a succession of lavas and pyroclastic of Cainozoic age overlying a foundation of folded Precambrian schists and gneisses of the Mozambique Belt.

The engineering geological condition of study area at the route position is good in general. The main poor geology and special rock soil include the black cotton soil and ravine soft soils.
3.2.1.2. Topography and geomorphology

The project area is characterised as falling largely within the lower highland zone that is mostly found in Limuru and Kabete constituencies and that is characterised by hills, plateaus, and high-elevation plains. The proposed project area lies between 1772-2145 metres above sea level. The soils in the midland zone are dissected and are easily eroded. Other physical features include steep slopes and valleys, which are unsuitable for cultivation. Some parts are also covered by forests.

Figure 3.4: The proposed bypass in relation to elevation in the study area
This largely means that the site topography of the proposed route varies between flat ground e.g. near Kihara and Wangige, and hilly terrain topography, Piedmont (geomorphology) foothills slopes topography and alluvial valley landscape. The route runs through the hilly slopes and toe flat plains, across the valley. The terrain of some site sections is relatively flat but some sections are in scarp, slope and arable land. There are eight large valleys along the project.

Plate 3.3: Hilly Topography and valleys along the proposed route

The project area is located in the lava plains east of a line Ruiru-Nairobi-Ngong which were underlain by a succession of lava flows alternating with lake beds, stream deposits, tuffs and volcanic ash. These plains, comprising mainly the Athi plains and the northern section of the Kapiti plains, extend westwards, rising from 4,900 feet (1,493m) at Athi River, to 6,000 feet (1,829m) in the faulted region near Ngong.

3.2.1.3. Soils and Soil Resources
Kiambu County is covered by three broad categories of soils which are: high level upland soils, plateau soils and volcanic footbridges soils.

The project site (Kiambaa and Kabete Constituencies), is covered by high level up land soils, which are from volcanic rocks, and highly fertile. Their fertility is conducive for livestock keeping
and growth of various cash crops and food crops such as tea, coffee, horticultural products, pyrethrum, vegetables, maize, beans, peas and potatoes.

There is red clay widely distributed along the project route. Considering the environmental protection, the borrow earth of the subgrade is mainly from the borrow pit along the route. The bedrock is mainly in Basalt along the route and part of the region is present in basalt exposure. The stone material can be purchased from the existing quarry or self-served.

Most sections of the proposed western bypass are characterized by exposed red loam soils with steep side banks of a gradient approximately 60° (Plate 3:4). Additionally, some sections of the proposed bypass are characterized by previous soil structural disturbance with evident excavations from previous developments (Plate 3:4).

![Plate 3.4: Evidence of soil structural disturbance from previous human activity along the proposed project location](image)

### Types, Capacity and Uses

The project area is mainly covered with red soil, some sections are have poor geology that is black cotton soil and gully soft soil. The red clay widely distributed along the route can be used as a borrow pit.

#### 3.2.1.4. Water Resources

**Surface Water**

Nairobi River is the main waterway of the Nairobi river basins, running through Nairobi with tributaries. There are a number of parallel rivers flowing eastward. All rivers in the river basin feed into Athi River in the eastern Nairobi and eventually flow into the Indian Ocean. In the main waterway, the Nairobi River flows into north centre of the north city. With reconstruction for the part of the waterway, the tributary are the Ruiru River, Kamiti River (Gathara-ini), Rui Ruaka River, Karura River, Gitathuru River (aka Getathuru), Mathare River, Nairobi River (main channel), Kirichwa river, and Motoine-Ngong River from north to south.

**Water Uses**

There are no large rivers that flow through the project area.
Water Quality

Most streams in the project area are seasonal. Because of pollution, the water obtained from most surface water is of poor quality owing to the chemical nature of the aquifers.

Groundwater

The groundwater type is mainly phreatic water, which was found in the clay layer, and whose permeability is weak. The permeability coefficient is $10^{-7} \sim 10^{-5}$ cm/s, thus indicating a weak pervious layer.

The main sources of recharge for ground water is precipitation and surface runoff infiltration. The main ejectment of groundwater is evaporation and infiltration of rivers.

Groundwater level is affected by rainfall and other factors, thus the seasonal effect is obvious and the annual rate of change is high. During the drilling test for groundwater undertaken in the wet season during the feasibility report stage, the clay layer permeability was found to be weak. The measured groundwater level was also found to be affected by rainfall factors. Special water level observations can be made in further stages.

3.2.1.5. Drainage

The project area is well drained because of the valleys, vertical slopes and red volcanic soils which are porous and allow for infiltration. However, this also means that some of the valleys can hold water. In a few instances, swamps used to grow arrowroots do exists. A good example is the valley next to Kimachia Road. However incidences of flooding are rare.

In the wet season, rainfall water gathers as brooks in some valley places, then flows to the east in general and gathers into Athi River and eventually flows into the Indian Ocean. This is the trend/route for all water and rivers in Nairobi and its environs.

3.2.2 Bioclimatic condition

3.2.2.1 Rainfall

Kiambu County experiences bi-modal type of rainfall. The long rains fall between mid-March to May followed by a cold season usually with drizzles and frost from June to August and the short rains between mid-October to November. The annual rainfall varies with altitude, with higher areas receiving as high as 2,000 mm and lower areas of Thika Town constituency receiving as low as 600 mm. The average rainfall received by the county is 1,200 mm.

Mean annual rainfall in the proposed project site varies between 1011mm and 1344mm. The months of April and November are the wettest, with the month of April receiving a mean annual rainfall of 212mm.

Mean annual precipitation ranges from a low of 1052mm, most experienced towards Gitaru, and a high of approximately 1114mm at Kihara and Ndenderu. Figures 3.5 and 3.6 below shows the spatial range of rainfall condition along the proposed project site.
3.2.2.2 Temperature
The mean temperature in Kiambu county is 26°C with temperatures ranging from 7°C in the upper highlands areas of Limuru and some parts of Gatundu North, Gatundu South, Githunguri and
Kabete constituencies, to 34°C in the lower midland zone found partly in Thika Town constituency (Gatuanyaga), Kikuyu, Limuru and Kabete constituencies (Ndeiya and Karai).

Mean temperature range along the proposed bypass is 8.6°C – 10.6°C during the coolest months and 24.4°C – 27.0°C during the hottest months. Lowest temperatures are experienced in the months of July and August, whereas January to March are the hottest months. Mean diurnal temperature ranges along the proposed project site ranges between 11.2°C and 12.2°C.

The county’s average relative humidity ranges from 54 percent in the dry months and 300 percent in the wet months of March up to August.

Figure 3.7: Temperature condition at the proposed project location
3.2.3 Biological Environment and Terrestrial ecology

3.2.3.1 Wildlife resources

Kiambu County has few wildlife resources since many gazetted forests have been subdivided and allocated to individuals. An example is Kinare forest in Lari Constituency, whose ecosystem constitutes of a dense forest with elephants, hyenas, bush baby, baboons, Colobus monkeys, dik-dik, bush pigs, tree and ground squirrels, porcupines and many species of birds such as weaver, guinea fowls, sparrow among others.

During the rapid assessment, no wild animal species were encountered along the proposed project location. Absence of wild animal species might possibly have been due to competitive displacement by human activity. A low density of livestock species including cattle, donkey, goat, sheep and dogs were encountered.

3.2.3.2 Plant Species

The project site is mainly dominated by secondary and/or exotic plant species. *Eucalyptus sp*, *Acacia mearnsii*, *Grevillia robusta* and *Casuarina sp* were the most abundant tree species, all exotic. Other exotic plant species encountered during the survey were *Lantana camara*, *Tithonia diversifolia*, *Caesalpinia decapetala*, *Senna didymobotrya*, *Solanum incanum*, *Bougainvillea spectabilis* and *Parthenium hysterophorus*, alongside dozens of crop species. It is important to note that *Parthenium hysterophorus*, *Lantana camara*, *Caesalpinia decapetala*, *Acacia mearnsii*, and *Solanum incanum* are highly invasive, especially in disturbed soils. Plate 3:5 displays...
Ceasalpinia sp and Tithonia sp invasion alongside the extant bitumen road on the proposed project site.

Plate 3.5: Ceasalpinia decapelata and Tithonia diversifolia invasion alongside the extant bitumen road on the proposed project site

Though at very low densities, Croton megalocarpus, Croton macrostachyus and Acacia xanthophloea were the few remnants of indigenous vegetation encountered along the project site. These species are indicators of high rainfall potential and high water table. In fact, during reclaimed wetlands (Plate 3:4), were encountered along the proposed project site, a confirmation of the high water table potential of the proposed project site.

Plate 3.6: Reclaimed wetland along the proposed western bypass
3.2.4 Air Quality

The aim of the assessment was to establish the ambient air quality levels, the concentration of the suspended particulate matter (Dust) and the quality of greenhouse gases at the proposed project area. This data can be used to form basis for planning the control measures that would eliminate or minimize air pollution exposure from the proposed construction activities to the human environment. The air quality assessment was carried out by Ecoserv Laboratory on 14th December 2016 from 10.30 am to 1.05 pm.

The concentration of suspended particulate matter (dust) which is captured on the filter is determined by gravimetric method and the measurement results are tabulated in Table 3.1 below.

Table 3.1: Suspended Particulate Matter PM$_{10}$ concentration

<table>
<thead>
<tr>
<th>Location/Site / (Coordinates)</th>
<th>Measured levels (mg/m$^3$)</th>
<th>TLV mg/m$^3$</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gitaru Road at Nairobi – Nakuru Highway Under-Pass to Ruaka End of Northern By Pass</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Gitaru Road at Nairobi/Nakuru Underpass (S 01°13’59.379”, E 036°40’09.995”)</td>
<td>0.12</td>
<td>0.14</td>
<td>Within the limit</td>
</tr>
<tr>
<td>2 Church Road Ngure at PCEA Church (S 01°13’50.441”, E 036°40’29.881”)</td>
<td>0.11</td>
<td>0.14</td>
<td>Within the limit</td>
</tr>
<tr>
<td>3 Njema Filling Station Area (S 01°13’47.3610”, E 036°41’06.794”)</td>
<td>0.12</td>
<td>0.14</td>
<td>Within the limit</td>
</tr>
<tr>
<td>4 1st Revival Pentecostal Church area (S 01°13’33.227”, E 036°41’38.393”)</td>
<td>0.09</td>
<td>0.14</td>
<td>Within the limit</td>
</tr>
<tr>
<td>5 Gitaru Interchange ToTal Petrol station (S 01°13’28.651”, E 036°42’21.758”)</td>
<td>0.11</td>
<td>0.14</td>
<td>Within the limit</td>
</tr>
<tr>
<td>6 Wangige Interchange Wangige Town (S 01°13’11.270”, E 036°42’44.632”)</td>
<td>0.12</td>
<td>0.14</td>
<td>Within the limit</td>
</tr>
<tr>
<td>7 Gitaru/Gikuni Junction (S 01°12’41.119”, E 036°42’36.090”)</td>
<td>0.11</td>
<td>0.14</td>
<td>Within the limit</td>
</tr>
<tr>
<td>8 Gitaru/St Toto Road Junction (S 1°12’10.142”, E 36°43’26.680”)</td>
<td>0.10</td>
<td>0.14</td>
<td>Above the limit</td>
</tr>
<tr>
<td>9 Karura Centre (S 1°11’39.172”, E 36°43’56.522”)</td>
<td>0.11</td>
<td>0.14</td>
<td>Within the limit</td>
</tr>
<tr>
<td>10 Ndenderu Centre (S 1°1139.981”, E 36°44’35.764”)</td>
<td>0.12</td>
<td>0.14</td>
<td>Within the limit</td>
</tr>
</tbody>
</table>
### From the dust measurement results, the dust level at all sections surveyed is within the recommended threshold limit values (TLV). However, some sections of the road were wet with little dust particles.

**Table 3.2: Air Quality Emission Concentration**

<table>
<thead>
<tr>
<th>No.</th>
<th>Location</th>
<th>Carbon Monoxide (CO)</th>
<th>Sulphur Dioxide (SO\textsubscript{2})</th>
<th>Carbon Dioxide (CO\textsubscript{2})</th>
<th>Volatile Organic Compounds (VOC)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Gitaru Road at Nairobi/Nakuru Underpass</td>
<td>Below detectable limit</td>
<td>Nil</td>
<td>1.60</td>
<td>Below detectable limit</td>
<td>Within the limit</td>
</tr>
<tr>
<td></td>
<td>(S 0°13'59.379&quot;, E 036°40'09.995&quot;&quot;)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Church Road Ngure at PCEA Church</td>
<td>Below detectable limit</td>
<td>Nil</td>
<td>1.05</td>
<td>Below detectable limit</td>
<td>Within the limit</td>
</tr>
<tr>
<td></td>
<td>(S 0°13’50.441”, E 036°40’29.881”)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Njema Filling Station Area</td>
<td>Below detectable limit</td>
<td>Nil</td>
<td>1.05</td>
<td>Nil</td>
<td>Within the limit</td>
</tr>
<tr>
<td></td>
<td>(S 0°13’47.3610&quot;, E 036°41’06.794”)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>1st Revival Pentecostal Church area</td>
<td>Below detectable limit</td>
<td>Nil</td>
<td>1.20</td>
<td>Nil</td>
<td>Within the limit</td>
</tr>
<tr>
<td></td>
<td>(S 0°13’33.227”, E 036°41’38.393”)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Gitaru Interchange ToTal Petrol station</td>
<td>Below detectable limit</td>
<td>Nil</td>
<td>1.35</td>
<td>Nil</td>
<td>Within the limit</td>
</tr>
<tr>
<td></td>
<td>(S 0°13’28.651”, E 036°42’21.758”)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Wangige Interchange Wangige Town</td>
<td>Below detectable limit</td>
<td>Nil</td>
<td>1.30</td>
<td>Below detectable limit</td>
<td>Within the limit</td>
</tr>
<tr>
<td></td>
<td>(S 0°13’11.270”, E 036°42’44.632”)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 3.2.5 Noise Quality

A precision integrating sound level meter type CR 262A S/No. B21122FA, with Omni-directional microphone was used set at a slow response. The instrument was calibrated using Bruel and Kjaer sound level calibrator type 4230 for sound level meter at 94 dB (A) and 1000 Hz. The calibration was used to check the sensitivity of the instrument immediately before and after the measurement period.

The meter has current calibration certificate from the manufacturer (A copy of the certificate is appended in the Noise quality report). The meter was set to measure the A-weighted noise level, which varies with the frequency and intensity like the sensitivity of the human ear.
### Table 3.3: Noise Levels Survey at the Proposed Road

<table>
<thead>
<tr>
<th>Position</th>
<th>Ambient Noise Levels</th>
<th>TLV</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gitaru/Limuru Road</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LeqMin</strong></td>
<td><strong>LeqdB(A)</strong></td>
<td><strong>LeqMax</strong></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Gitaru Road at Nairobi/Nakuru Underpass (S 01°13'59.379&quot;, 036°40'09.995&quot;)</td>
<td>54.5</td>
<td>66.4</td>
</tr>
<tr>
<td>2</td>
<td>Church Road Ngure at PCEA Church (S 01°13'50.441&quot;, E036°40'29.881&quot;)</td>
<td>54.2</td>
<td>62.8</td>
</tr>
<tr>
<td>3</td>
<td>Njema Filling Station Area (S01°13’47.3610&quot;, E036°41‘06.794&quot;)</td>
<td>48.2</td>
<td>65.7</td>
</tr>
<tr>
<td>4</td>
<td>1st Revival Pentecostal Church area (S 01°13’33.227&quot;, E036°41’38.393&quot;)</td>
<td>57.3</td>
<td>67.8</td>
</tr>
<tr>
<td>5</td>
<td>Gitaru Interchange Total Petrol station (S 01°13’28.651&quot;, E036°42‘21.758&quot;)</td>
<td>65.7</td>
<td>77.9</td>
</tr>
<tr>
<td>6</td>
<td>Wangige Interchange Wangige Town (S01°13‘11.270&quot;, E036°42’44.632&quot;)</td>
<td>50.3</td>
<td>78.9</td>
</tr>
<tr>
<td>7</td>
<td>Gitaru/Gikuni Junction (S01°12‘41.119&quot;, E036°42’36.090&quot;)</td>
<td>54.5</td>
<td>68.2</td>
</tr>
<tr>
<td>8</td>
<td>Gitaru/St Toto Road Junction (S1°12‘10.142&quot;, E36°43’26.680&quot;)</td>
<td>55.4</td>
<td>60.2</td>
</tr>
<tr>
<td>9</td>
<td>Karura Centre (S1°11’39.172”, E36°43’56.522&quot;)</td>
<td>53.5</td>
<td>69.2</td>
</tr>
<tr>
<td>10</td>
<td>Ndenderu Centre (S1°1139.981”, E 36°44’35.764&quot;)</td>
<td>59.6</td>
<td>71.1</td>
</tr>
<tr>
<td>11</td>
<td>Gitaru Limuru Junction (S1°11’32.160&quot;, E 36°4437.812&quot;)</td>
<td>62.6</td>
<td>72.1</td>
</tr>
<tr>
<td>12</td>
<td>Junction to Rungiri PCEA Church (S1°11’45.402”, E 36°45’09.832”)</td>
<td>65.6</td>
<td>69.8</td>
</tr>
<tr>
<td>13</td>
<td>Junction to Gachie (S1°12‘01.050&quot;, E 36°45’38.187&quot;)</td>
<td>63.5</td>
<td>70.7</td>
</tr>
<tr>
<td>14</td>
<td>Junction at Muhura Drive (S1°12’5010.891”, E 36°4613.116&quot;)</td>
<td>59.6</td>
<td>68.3</td>
</tr>
<tr>
<td>15</td>
<td>End of the proposed Road To be Constructed at Ruaka</td>
<td>62.6</td>
<td>73.1</td>
</tr>
</tbody>
</table>
The current ambient noise emission is from traffic and people walking along the road including birds and animals.

### 3.3. Social Economic Baseline

#### 3.3.1. Demography

According to the 2009 Kenya Population and Housing Census, Kiambu County had a population of 1,623,282 persons, distributed between 469,244 households. The number of men versus women was 873,200 and 892,857 respectively.

The 2009 statistic was a 1.57 percent increase since the previous census held in 1999, as the Figure 3.9 below shows.

*Figure 3.9: Population development of Kiambu*

Further, the population was expected to reach 2,032,464 people by the end of 2017. This can be explained by the county’s population growth rate standing at 2.81 per cent and the proximity to Nairobi city thus resulting in an influx of people who work in the city. However, at 2.7, the fertility rate for women in Kiambu is one of the lowest in the country, ranking second to Kirinyaga (at 2.3), but tying in second place with Nyeri and Nairobi.

*Table 3.4: The main affected constituencies and wards population*

<table>
<thead>
<tr>
<th>Constituency/Ward</th>
<th>Total Pop</th>
<th>Male</th>
<th>Female</th>
<th>0-5</th>
<th>0-14</th>
<th>10-18</th>
<th>15-34</th>
<th>15-64</th>
<th>65+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kiambaa Constituency</td>
<td>144,582</td>
<td>72,173</td>
<td>72,409</td>
<td>22,108</td>
<td>47,329</td>
<td>22,885</td>
<td>61,215</td>
<td>92,843</td>
<td>4,410</td>
</tr>
<tr>
<td>Cianda</td>
<td>15,110</td>
<td>7,530</td>
<td>7,580</td>
<td>2,535</td>
<td>5,654</td>
<td>2,700</td>
<td>5,627</td>
<td>9,014</td>
<td>442</td>
</tr>
<tr>
<td>Karuri</td>
<td>30,379</td>
<td>14,977</td>
<td>15,402</td>
<td>4,354</td>
<td>9,952</td>
<td>5,292</td>
<td>11,971</td>
<td>19,259</td>
<td>1,168</td>
</tr>
<tr>
<td>Ndenderu</td>
<td>35,760</td>
<td>17,491</td>
<td>18,269</td>
<td>5,307</td>
<td>11,237</td>
<td>5,448</td>
<td>15,689</td>
<td>23,400</td>
<td>1,123</td>
</tr>
<tr>
<td>Muchatha</td>
<td>26,519</td>
<td>13,179</td>
<td>13,340</td>
<td>3,941</td>
<td>8,627</td>
<td>4,281</td>
<td>11,022</td>
<td>16,928</td>
<td>964</td>
</tr>
</tbody>
</table>

---


The population density of the County as at 2009 was 638 people per sq. kilometre (km$^2$), and projected to reach 799 per km$^2$ in 2017. However this average figure does not show the variations between different areas. For instance, (and as per 2017 projections), the highest density is found in Kabete Constituency (2,916 persons/km$^2$), which is one of the constituencies affected by this project, while the lowest is recorded in Lari (343 persons/km$^2$). Kiambaa Constituency – another constituency affected by this project has 2,478 persons/km$^2$, ranking second.

A substantial number of the county’s population is relatively young. Individuals of age 34 and below constitute approximately 75 percent of the population as Figure 3.10 below shows. Particularly, a disturbing fact is that those age 19 years and below (i.e. the dependent group) constitutes at least 43 percent of the County’s population. This trend is replicated in the two constituencies affected by the proposed Western Bypass. In Kiambaa and Kabete constituencies, those of 18 years and below constitute approximately half of the population (49 percent).

Defining the Youth Age Group as 15–29 years, The County Integrated Development Plan (CIDP) notes that this constitutes at least 29.1 percent of the total county population. Such statistics poses unique challenges for the County and the economy in general, especially the need to ensure employment opportunities grow at a similar or higher rate.

**Figure 3.10: Kiambu Population Pyramid**

Source: KNBS and SID 2013
Majority of the County’s population is urban based. By the end of 2017, 1,172,453 out of the projected 2,032,464 was expected to live in urban areas. Towns such as Kikuyu which are in close proximity to the proposed project record high numbers of urban dwellers. Kikuyu is unique given its urban dwellers were projected to reach 292,022 by 2017, constituting 25 percent of the County’s total urban population. These again are dynamics attributed to the close proximity of such towns to Nairobi, thus triggering an influx or people who work in the city, as well as proximity to other services such as universities etc.

The route also passes through a number of other big towns such as Ndenderu, Ruaka and Wangige which are highly populated.

3.3.2 Education Level
48 percent of Kiambu’s population have primary level education while 39.9 have secondary education and above. This largely means that at least 12 percent have no basic education. Education levels are important because they affect economic status and employability.

Kiambaa constituency has a higher percentage of people with secondary and higher levels of education (42.6 percent) compared to the county average of 39.9. Kabete Constituency has an even higher figure with 45.6 percent.

The county has 1,225 primary schools, with 47% being public schools. 75 percent of secondary schools are public schools. The County also hosts one public university i.e. Jomo Kenyatta University of Agriculture and Technology and several private ones including St. Pauls University and Mt. Kenya University. This points to the availability of some level of skills that can supply the project. The project could also act as an opportunity for internships and apprenticeships for this young population.

3.3.3 Health Services
Kiambu County has about 364 health facilities, managed by a variety of actors include the government, private entities, and mission/NGOs. Of these only one is a level five hospital, three are level four hospitals and four are level three, with one being located in Kiambaa. Majority are private clinics. The average distance to the health facility is seven kilometres and the facilities are well accessed since the road network is good. Such access to health care could explain the reason why Kiambu ranks first (tying with Kirinyaga) in the proportion of health facility deliveries at 93 percent.

However, the county still faces some challenges in the health sector, with a doctor/population ratio of 1:17,000, and a nurse/population ratio that stands at 1:1,300.

3.3.4 HIV/Aids
There is a significant level of awareness of HIV/AIDS in Kiambu. 100 percent of women age 15-49 as compared to 99.6 percent of men have heard of AIDS. When it comes to Percentage with a comprehensive knowledge about AIDS, these figures go down to 61.7 and 85.3 percent. However more women (86.2 percent) that men (77.4 percent) have undertaken a test in the past.
Still despite a county HIV adult prevalence (overall) rate of 3.8%, the HIV prevalence among women in Kiambu County is higher (5.6%) than that of men (2.0%). Over the years, the women living in the county have been more vulnerable to HIV infection than the men.

3.3.5 Land Use
About 1,878 km² is arable land, while 649.7 km² is non arable and 15.5 km² is under water mass within the county.

In the past decade, congestion in Nairobi’s neighbourhoods has forced the expansion of the city to its outlying areas. Kiambu County has been a major beneficiary of this expansion, due to its close proximity to Nairobi. Therefore what was once characterised as agricultural land, giving a feeling of travelling through a rural village, where major roads such as Gitaru Road were lined with shrubs and coffee plantations and scattered homes, has given way to residential blocks characteristic of Nairobi.

Land fragmentation is another central characteristic of the county. The project area’s zoning is therefore mixed. Part of the land that borders the project can be characterised as agricultural (e.g. sections where growing arrowroots are physically seen), whereas others are commercial (including various businesses e.g. petrol stations, office space, open markets, private schools). Residential land is also evident, with Ruaka and Kikuyu towns hosting a number of prime residential estates that are preferred by the low to middle class due to the presence of security, physical and social infrastructure. The improvement of the Thika Super Highway has also spelt a boom to Kiambu’s property and residential investments over the years.

Plate 3.7: Agricultural use of proposed route

3.3.6 Poverty, Livelihoods and Economic Profile
The poverty gap as a percentage of the poverty line indicates the nature of resources required to eradicate poverty. It gives an indication of how much on average is needed to move each household in an area from their current income to at least the poverty line. This gap in Kiambu County is relatively low at 6 percent. It is actually the third lowest in the country, lower than the Kenyan (as a whole) poverty gap which stands at 12 percent, that of urban areas 8 percent and half that of rural areas at 14 percent. This indicates the county is in a better position that majority counties in the county. It is no wonder then that the county was once ranked as the richest county in Kenya.
Other indicators can be used to show the poverty position of Kiambu, relative to other counties in the country. Using estimated consumption expenditures, Kiambu ranks as one of the top four counties, with the largest proportion of their population spending Ksh7, 200 and above, and similarly with a 0.34 Gini coefficient, as one of the counties with low inequalities (compared with other counties).\(^6\)

However, it is important to note that it is a county that still displays substantial differences within itself in the share of households with high expenditure versus those with low expenditure – differences that cannot be taken for granted.

A number of factors influence the livelihood and economic profile of Kiambu County. These as mentioned earlier include its close proximity to Nairobi, an increasing youthful population, presence of a wide range of industries mostly located in Thika and Ruiru Constituencies and in a varied number of sectors. Particularly, the county hosts a number of manufacturing factories, leather, food and beverage, chemicals, mining, textile and major industrial assembly plants, which have experienced tremendous growth in recent years, providing good commercial opportunities to residents and investors alike.

![Employment Statistics Kiambu County, 2009, Activity Status](image)

**Figure 3.11: Employment Statistics Kiambu County, 2009, Activity Status**

Source: Generated from KNBS Kenya Data Portal\(^7\)

According to the 2009 population census undertaken by the Kenya National Bureau of Statistics (KNBS), approximately 51 percent of the population (above age 5) were employed. 55 percent of these were men. Of the 41 percent that were economically inactive, 58 percent comprised of women. Similarly, when asked about the last 7 days economic activity, 25 percent worked for pay while 22 percent noted they (or their family) owned a business or agricultural holding.\(^8\)

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\(^6\) KNBS and SID 2013a


\(^8\) KNBS 2009, Last 7 Days Economic Activity by County and District
As Figure 3.12 above shows, majority of those employed or working are engaged in wholesale and retail trade. An even more recent Micro, Small and Medium Establishment (MSME) study by the same institution gives a visual picture of the current states of businesses and enterprises in the county. The 2016 study shows that Kiambu ranks fourth in the highest number of licensed MSMEs in the county, following Nairobi, Nakuru and Meru in that order. There are over 92000 MSMEs in the county, where 91 percent are micro establishments and 7.9 percent are small establishments. With 170.8 (thousand), Kiambu ranks number nine in terms of unlicensed MSMEs, attesting to the county’s entrepreneurship potential.

The above statistics to a large extent are replicated along Gitaru road. Particularly the presence of Wangige market next to the proposed route means the presence of a substantial number of informal market sellers, including food (fruits and vegetables), assorted retail items, Mpesa shops, auto spares shops, and clothing (mitumba) vendors. Similarly, at other main strategic areas e.g. the junction of Limuru Road, Banana road and Gitaru road, sections of the road are inhabited by various informal fruit and vegetable sellers. Furthermore, the whole proposed route is strewn with all types of businesses ranging from welders, hardware shops selling construction materials, bicycle repair shops, food kiosks, fruit vendors, saw dust sellers, garages, car washes, animal feed (hay sellers) etc. Several boda boda sheds e.g. at Wangige market exist along the road.

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10 The report adopts Kenya’s official definition, in which MSMEs are defined according to employment size: MSMEs are enterprises having between 1 and 99 employees (GOK, 2005). Micro-enterprises have less than 10 employees; small enterprises have 10–49 employees while medium sized enterprises have between 50 and 99 employees.
Plate 3.8: Sawdust, Vegetable and Fruits and other Retailers along the Proposed Route

Plate 3.9: Car wash and Clothes (Mitumba) sellers along the Proposed Route

Plate 3.10: Charcoal sellers and Garages along the Proposed Route
The bus park at Wangige also employs a number of people as drivers and touts.

Plate 3.11: Wangige Bus Park

3.3.7     Infrastructure and Services

3.3.7.1     Transport and Roads

Overall, Kiambu County has a relatively good road network. This includes 2,033.8 km of bitumen roads, 1,480.2 km under gravel surface and 430.1 km under earth surface.

The project area is fed by a number of high capacity roads. These include the busy A104 (Nairobi Nakuru highway), the Northern Bypass and Limuru roads. Numerous other feeder roads although inadequate and in some areas very poorly maintained exist such as the Ndenderu-Banana link, Wangunyo road, Kihara-Gacii-Karura road, Mwimuto road, Kangora road, Lower Kabete road, and Ngecha-Wangige road.

The existing C63J1 road (Gitaru road) is currently a 2 lane road, and is the only access from the southwest of Nairobi to north Nairobi. This road is in average to poor condition, which leads to slow vehicle speed, more fuel consumption and likelihood for occurrence of traffic accidents. Of even more concern is that the road is limited by the impact of non-motorized vehicles and pedestrians. This is particular for the sections passing through town centres such as Ndenderu and Kihara.

The County has 131 km of railway line and four railway stations in Ruiru, Thika, Kikuyu and Limuru towns. The Kikuyu station is closest to the project area. It is underutilised with passenger trains operating in the morning and evenings only, largely comprising of work traffic.

3.3.7.2     Energy

Due to the fact that the area is well served by Kenya Power and Lighting Company (KPLC) – a fact that can be attributed to its close proximity to Nairobi area and that majority of the County is urbanised), over half (53 percent) of the population uses electricity as their main source of lighting. 26 percent use lanterns while a tin lamp is in use in 19 percent of the households. Less than 1
percent use fuel wood for lighting.\textsuperscript{11} The high use of electricity thus means that there is a high likelihood of temporary disruption of services during relocation and construction of the road.

Plate 3.12: Power lines along the proposed project route

In terms of cooking energy, the main source is biomass related i.e. firewood and charcoal at 61\%, posing great environmental concerns. This is followed by paraffin at 22.5\%. Only 13.4\% of residents in Kiambu County use Liquefied Petroleum Gas (LPG). These trends are more prevalent in women headed households where biomass use is higher than male headed households i.e. 66.4\% compared to 59.8\% pointing to possibilities of higher vulnerability among the women.

The data for the two relevant constituencies is summarised in the Table 3.5.

\textit{Table 3.5: Cooking and Lighting Fuel}

<table>
<thead>
<tr>
<th>Constituency</th>
<th>Electricity</th>
<th>Paraffin</th>
<th>LPG</th>
<th>Biogas</th>
<th>Firewood</th>
<th>Charcoal</th>
<th>Solar</th>
<th>Other</th>
<th>Households</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kiambaa</td>
<td>1.2</td>
<td>26.6</td>
<td>16.8</td>
<td>1.0</td>
<td>201.</td>
<td>33.4</td>
<td>.0</td>
<td>0.9</td>
<td>41,543</td>
</tr>
<tr>
<td>Kabete</td>
<td>1.1</td>
<td>18.8</td>
<td>15.1</td>
<td>0.9</td>
<td>16.8</td>
<td>46.5</td>
<td>0.0</td>
<td>0.7</td>
<td>40,275</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Constituency</th>
<th>Electricity</th>
<th>Pressure lamp</th>
<th>Lantern</th>
<th>Tin lamp</th>
<th>Gas lamp</th>
<th>Fuel wood</th>
<th>Solar</th>
<th>Other</th>
<th>Households</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kiambaa</td>
<td>70.1</td>
<td>0.6</td>
<td>14.5</td>
<td>14.0</td>
<td>0.2</td>
<td>0.1</td>
<td>0.2</td>
<td>0.3</td>
<td>30,984</td>
</tr>
<tr>
<td>Kabete</td>
<td>74.6</td>
<td>0.6</td>
<td>14.6</td>
<td>9.1</td>
<td>0.3</td>
<td>0.1</td>
<td>0.2</td>
<td>0.4</td>
<td>29,836</td>
</tr>
</tbody>
</table>

Source KNBS and SID 2013

\textsuperscript{11} Statistics on Households and Living Conditions of Kenya, 2009 generated from the Kenya Data Portal of KNBS on 30\textsuperscript{th} January 2017.
3.3.7.3 Water and Sanitation

According to a 2013 report by the Kenya National Bureau of Statistics (KNBS) and Society for International Development (SID), majority (75%) of the residents in Kiambu County use improved water sources, which include protected springs and wells, boreholes and piped water. This trend is mirrored in the two constituencies of concern as shown in Figure 3.13 below.

![Figure 3.13: Source of Water](image)

Source: KNBS and SID 2013

Following the Water Act 2002, Athi Water Services Board (AWSB), licensed several Water Service Providers (WSPs) to serve the broader Kiambu Region. Karuri Water and Sewerage Company is the main provider in the project affected area, while Kikuyu Water and Sewerage Company applies to a lesser extent. Most of the areas beyond these companies jurisdiction do not therefore receive piped water, thus relying on alternative sources. This means that only 22.2 percent and 28.5 percent in Kiambaa and Kabete Constituencies respectively are served by piped water. 12.8 percent and 16 percent respectively have access to borehole water in the two constituencies. This represents a very low percentage of population that has access to safe and adequate water at reasonable distances to their homesteads.

Such figures are even more varied if you compare at ward levels. For instance the project passes through Ndenderu, Karuri and Kihara wards. While Karuri has 29.7 percent of its population accessing piped water from a company or if it is just piped into dwelling, Ndenderu records half of this at 11.5 percent while Kihara records just a quarter at 7.1 percent.

Poor sanitation services in the presence of a rapid increase in population poses a great threat to health. 79.98 percent of the population in Kiambu County uses improved sanitation, defined to include connections to main sewer lines, septic tanks, VIP or pit latrines and cess pools. However, only 5.89 percent has a connection to the main sewer. Over half of the population uses pit latrines.

Kiambaa constituency mirrors the picture above with a record 92 percent having access to improved sanitation facilities but a dismal less than one percent having access to the main sewer line. Similarly, Kabete constituency records 84.49 percent and 1.34 percent when it comes to improved and sewer line connections respectively.
3.3.7.4 Housing

As at 2009, 53 percent of houses in Kiambu had stone or block walls, while 25 percent used corrugated iron sheets. Mud houses accounted for 5 percent only. 12 88 percent use corrugated iron sheets with 7 percent using concrete for roofing material. 13 Tiles accounted for only 3%.

In terms of floor material, 75 percent of the houses are cemented while 22.5 percent have earth floors. 14 This largely means that majority houses in the County can be classified at permanent, with a smaller percentages of semi-permanent dwellings. This is the case along the route of the proposed Western Bypass, where most units are permanent. The majority semi-permanent or temporary units are those owned by informal businesses such as road side food sellers, fruit and vegetable sellers and others retail wares. Again, the proximity of the county to the city of Nairobi has seen transformation of large pieces of land into residential houses.

3.3.7.5 Information and Communication:

Kiambu County is well covered by a range of Information and Communication infrastructure, attributed to its close proximity to Nairobi and the presence of industrial and commercial activities. Access to mobile phone service as at the last census in 2008 stood at 73%, compared to 4 percent when it comes to land line telephone service, attributed to the fact that landlines are becoming obsolete and have a high maintenance cost. 15 Internet use access and access to computer services stand at 13 and 5 percent respectively. These statistics largely imply that there will be an impact and disruption of services during relocation of the infrastructure.

During a meeting with telecommunications utility companies held on 11th January 2017, the main utility companies that indicated presence of infrastructure along the road include Liquid Telecom, Telecom Kenya, Access Kenya and Safaricom (and by extension Huawei as its main contactor).

Plate 3.13: Communication facilities along proposed route

12 KNBS 2009, Housing Wall Material by County and District
13 KNBS 2009, Housing Roof Material by County and District
14 KNBS 2009, Housing Floor Material by County and District
15 KNBS 2009, Access to Landline Telephone Service by County and District
3.3.8 Gender and Vulnerability

In terms of gender, the sex ratio of male to female is insignificant at approximately 1:1.02. However, women perform worse in some areas. Education levels have an impact of economic positions and thus economic vulnerability. Examining data from the 2014 Kenya Demographic and Health Survey (KDHS) by Kenya National Bureau of Statistics on highest level of schooling shows women are worse off in most of categories e.g. no schooling, those who have some level of primary education, those with some level of secondary education and even those who have completed secondary. This also applies in literacy levels, pointing to women vulnerability in the county. They only lead men in categories of those who have completed primary and those with post-secondary education.

This indicates the possibility of project displacement having a greater impact on women more so the road side women sellers (e.g. the Market in Wangige) and thus the need for measures to ensure these can be mitigated appropriately.

Although, Kiambu women, when compared with other counties rank better in some areas related to health and reproductive matters e.g. third in the longest the median birth interval and second in Median age at first birth among women age 25-49 years (which has important consequences for the overall level of fertility as well as the health and welfare of the mother and the child), first in the proportion of births assisted by a skilled provider (which indicates accessibility and good access to health services.

3.4. Conditions of existing road

The alignment of the existing road consists of two-lanes with the subgrade width of 8-11m. Most of the sections of the alignment are relatively intact. In some sections, cracks, turtle cracks, pits and other common damages have occurred. The fill slope ratio of the subgrade is 1: 1.5, excavation slope adopted the 1: 0.3 to 1: 0.75 with more hierarchical slope, and the 2m wide platform was set per 3m high. (All images from this section sourced from the feasibility study).

Plate 3.14: Fill Slope and Excavation slope
The asphalt pavement of the main line is almost intact. However, the hard shoulder edge of some sections is slightly damaged.

In terms of drainage, the pavement surface of the whole current alignment adopts an open drainage system. There are no side ditches and drainage ditch in the field section. Drainage ditches are only provided in the town section. Some high fill sections have the roadside water collection strip, and drainage points at provided at regular interval on the pavement. Most sections lack necessary maintenance, especially the urban road ditches are covered with garbage which affects the drainage system.
Trees and grass are planted along the slopes to protect the bare surface with good landscape.

Plate 3.17: Tree planting along the route

The overall condition of the crossing bridge located between the start point of Western Bypass and A104 is in good structural condition. The observation of the main structure shows no obvious damage and thus it can meet normal operational requirements. However, the alignment of the Western Bypass will be widened to four lanes, thus the span and clearance (is only 4.6m at present) of this crossing bridge cannot meet the technical requirements, thus it is supposed to be demolished and reconstructed.

Plate 3.18: Bridge at A104 intersection
Various types of culverts exist but due to the absence of routine maintenance, inlet and outlet of most of the pipe culverts were blocked and discharge capacity was reduced.

*Plate 3.19: Different types of existing culverts*
4. POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

The starting point of the main line is connected to the end of the Southern Bypass of Nairobi City, intersected with A104, with a full cloverleaf interchange located at the intersection. The line mainly follows along the old line towards the northeast. The end of the line is located at Ruaka town, connecting the starting point of the Northern Bypass, and a single-trumpet interchange is set at K14+813, connected with Limuru Road. Passing several large towns such as Wangige, Ndenderu and Ruaka etc., the road provides convenience for several large population centres along the line, with interchanges set at Km0 + 855, Km4 + 851, Km7 + 865, Km10 + 000, Km12 + 600, Km14+ 813, respectively.

According to the guidance and suggestions formed through communication between the proponent and the contractor, the line layout principle of Nairobi Western Bypass Road Project is to make full use of the existing road through expansion and reconstruction, to minimize land acquisition and reduce the cost of the project. Design standards of line and interchange can be justified in positions passing through town area.

This section therefore considers the relevant Government of Kenya (GOK) policies and legislation, and international safeguards, guidelines, policies and conventions that frame a sustainable approach to eco-development, including the approach towards the environmental and social impacts of Western Bypass, and how they should be mitigated. Relevant legislation need to be strictly adhered to for the successful implementation of the project, and throughout the lifetime of the project.

The legislation have been used to inform the development of this ESIA report and to ensure that adequate mitigation measures are put in place to deal with the negative impacts on the project affected persons, and that all project related activities are in conformity with the existing laws, and regulations, and international best practices.

In addition, the proponent - KeNHA and the contractor- China Roads and Bridge Corporation will be required to develop and implement (if these do not exists already) internal environmental and social policies and plans, including setting up of relevant institutional frameworks to oversee their fruition.

4.1 National Policy Framework

4.1.1 Vision 2030 and the Second Medium Term Plan

Kenya’s Vision 2030 is the country’s blueprint planning strategy, while the Second Medium Term Plan (MTP 11) acts as its accompanying implementation plan, for achieving economic, political and social transformation. The aim is to achieve 10 percent average growth per year to ensure a high quality life for all citizens by the year 2030.

In this strategy document, political, economic and social transformation is envisaged to be achieved in various ways with special attention being paid to:
Scaled up quantity and quality infrastructure: Vision 2030 notes that while significant gains in infrastructure development have been realized over the last decade, Kenya’s global competitiveness is still weak. Infrastructure development and improvement fails to keep at par with a growing human and vehicular population. Therefore the strategy sets integrated, cost effective, safe and efficient world-class infrastructure facilities, networks and services as a necessary foundation and precondition for transforming the economy. Western Bypass which will complete the exterior ring road network around Nairobi City and its metropolitan areas thus reducing traffic congestion contributes to the achievement of this vision. Western Bypass as a crucial link in the Nairobi Bypass project will facilitate smooth and faster movement of goods, services and people, in turn giving the economy the boost it requires, and setting the foundation for transformation in support of Vision 2030.

The prudent management of the country’s natural resources and space: Under the social pillar, environmental management is one of the key eight sectors (others are Education and Training; Health; Water and Sanitation; Housing and Urbanisation; Gender, Youth, Sports and Culture), necessary for transformation of the economy. Specifically, the strategy recognises that environmental management is key to other sectors given Kenya’s economy is dependent on natural resources. It therefore proposes promoting environmental conservation to better support the economic pillar’s aspirations as well as improving pollution and waste management, among others.

### 4.1.2 Sessional Paper No. 10 of 2014 on the National Environment Policy 2014

The National Environment Policy (NEP) underscores the linkage between the environment and natural resources and the local and national economy, people’s livelihoods and the provision of environmental services such as watershed protection and carbon sequestration. It therefore promotes an integrated approach towards the planning and sustainable use and management of Kenya’s environment and natural resources so as to ensure better quality of life for Kenya’s present and future generations. Specifically, it reiterates the constitutional right to a clean and healthy environment and imposes on the state the duty to safeguard and enhance the environment. However, it balances this with the right to development but with due consideration for sustainability, resource efficiency and economic, social and environmental needs.

In Chapter Five, it deals with emerging issues that require environmental stewardship. This includes infrastructural development, thus recognising that projects such as Western Bypass have distinct and unique effects on flora and fauna, social and psychological disruption, vegetation clearance, excavation works and spillages during construction. This thus requires that the proposed project undergoes an Environmental and Social Impact Assessment. In addition, public participation in the planning and approval of the proposed project is mandatory.

The proposed project will be undertaken in compliance to this. This ESIA report acts as a first step in fulfilling NEP requirements while chapter 6 details the public participation process and results.

### 4.2 National Legal Framework

#### 4.2.1 The Constitution of Kenya, 2010

The Constitution of Kenya 2010 is the overarching legal framework for matters on environment. It represents a paradigm shift in the history of the promotion, protection and implementation of
environmental rights. This is largely because it explicitly recognizes the environment as part of the country’s heritage, and which must be safeguarded for future generations for sustainable development. In Article 42, it becomes the first constitution in the history of this country to entrench environmental protection in the Bill of Rights, providing the right to a clean and healthy environment.

Article 69 imposes on the State, other obligations including, the duty to:

- Ensure sustainable utilization, management and conservation of the environment and natural resources;
- Eliminate processes and activities that are likely to endanger the environment; and
- Utilize the environment and natural resources for the benefit of the people of Kenya.

Article 69 highlighted above, and article 43 (which provides for economic and social rights) therefore represents a balance between the right to utilise the environment and the duty to protect it and ensuring environmental sustainability.

Article 69 (2) similarly poses a conservation obligation on parties such as companies, associations or other body of persons, whether incorporated or unincorporated, including KeNHA and CRBC. The two are obligated to cooperate with State organs and other persons to protect and conserve the environment during the lifetime of the Western Bypass project.

In addition, the same article, the state is obligated to establish systems to assess and monitor the impacts of projects such as this. The state has actualised this through the Environmental Management and Coordination Act, 1999 and its subsidiary legislation, the Environmental (Impact Assessment and Audit) Regulations, 2003.

4.2.2 Environmental Management and Co-ordination Act, 1999 and Environment Management and Coordination (Amendment) Act, 2015


EMCA, 1999 acts as Kenya’s first framework environmental law towards the sound management and utilisation of natural resources, as well as providing a focal point for the harmonisation of protection of environmental rights. The 1999 Act, and its 2015 Amendment provides a legal and institutional framework for the protection and conservation of the environment (in line with Article 42 of the constitution), as well as providing the necessary mechanism to monitor that, which include environmental impact assessment, environmental auditing and monitoring as prescribed by Article 69 of the Constitution.

Western Bypass project will be undertaken in compliance with Section 58.(1) which requires the project proponent to undertake an EIA study in the prescribed form, giving all relevant information pertaining the project and its impacts before the commencement of the project. This is reiterated in the Second Schedule in EMCA Amendment Act 2015, which highlights that paved roads should be subjected to an EIA study process. Public participation is required as part of the EIA process.
In addition, KeNHA and CRBC will submit the report to NEMA, accompanied by the prescribed fee i.e. 0.1 percent of the project cost.

Section 60 of EMCA gives power to NEMA to require lead agencies to comment on an EIA Report. Considering the nature of the Project, NEMA may require bodies/agencies such as the Kenya Power and Lighting (KPLC) among others to comment on the EIA Report.

Amended Section 59 (1) requires NEMA to publish a brief description of the project, its location, among other details in the Gazette, in at least two newspapers circulating in the area or proposed area of the project and over the radio.

During construction and operation, and in line with Part VII on environmental audit and monitoring, NEMA is mandated to monitor the progress of Western Bypass in conformity to the law and the EIA study report. KeNHA and CRBC are required to submit annual audit reports to NEMA, describing how far the project conforms in operation with the statements made in this EIA report.

4.2.3 EMCA Related Regulations
To provide guidelines on how to actualize EMCA and its amendment, the government has published a host of regulations. These provide specific requirements as related to water, air, waste, biodiversity and noise.

4.2.3.1 Environmental (Impact Assessment and Audit) Regulations, 2003
These were promulgated as Legal Notice 101 on June 13th 2003. They reiterate EMCA on the need for an environmental impact assessment project report before undertaking any new project and outline mandatory requirements in undertaking an ESIA. They also highlight the minimum content of the report, information to be made available, parties to be consulted and the process to be followed in licensing. In particular, they stipulate that only individual experts or a firm of experts authorized by NEMA, which maintains a register of all experts are authorized to carry out the study. KeNHA therefore by engaging Earthcare Services Limited, undertakes this project report in fulfilment of the above requirements. This report conforms to the above requirements.

In addition, after the completion of an environmental impact assessment study report and once the project has commenced, the proponent is required to undertake an environmental audit study. This will be conducted by a qualified and authorized environmental auditor or environmental inspector who shall be an expert or a firm of experts registered with NEMA, and acts as a baseline upon which subsequent environmental control audit studies shall be based. Thereafter, the proponent can undertake annual self-audits or engage an expert.

4.2.3.2 EMCA (Water Quality) Regulations 2006
The Water Quality Regulations (2006) are contained in the Kenya Gazette Supplement No. 68, Legal Notice No. 120 of September 4 2006 and became effective on July 1 2007. These regulations apply to sustainable water use for a variety of purposes. They protect lakes, rivers, streams, springs, wells and other water sources whereby contravening the regulations is an offence that attracts a fine not exceeding five hundred thousand shillings.

Of immediate relevance to the project is Rule 4-6 as well as Rule 24.
• Rule 4 outlaws acts which directly or indirectly, immediate or subsequently cause water pollution.
• Rule 24 prohibits discharge or application of any poison, toxic, noxious or obstructing matter, radioactive wastes, or other pollutants, into water meant for fisheries, wildlife, recreational purposes or any other uses.

Although there are no indication of any streams in the vicinity of the project, storm water from the road (often because it is contaminated by oil or petroleum products) shall be channelled properly to avoid any ground and surface water pollution.

During construction, and to ensure proper effluent treatment, sanitary services for workers should only be provided by licensed providers.

4.2.3.3 EMCA (Waste management) Regulations, 2006

The Waste Management Regulations (2006) are contained in the Kenya Gazette Supplement No. 69, Legal Notice No. 121. These were promulgated on September 4th 2006 and are effective since July 1 2007. They streamline handling, transportation and disposal of various types of waste, with an aim of protecting human health and the environment. The regulations advocate for cleaner production principles, waste reduction, and segregation at source.

Since the project will generate various types of waste, several sections are relevant. The contractor can only engage NEMA licensed waste handlers as required by Rules 7 -11. The waste must be transported by a NEMA licensed transporter and disposed in a waste treatment facility/site that is approved by the authority. Rule 11 provides that operators of a disposal site shall apply the relevant provisions on waste treatment under the local government act and regulations to ensure that such waste does not present any imminent and substantial danger to the public health, the environment and natural resources.

Other relevant sections include:

• Rule 4 (1) prohibits disposal of water in any other place except designated waste receptacles.
• Rule 4(2) and 5 require segregation of hazardous waste and non-hazardous waste, and disposal in facilities provided by the relevant local authority.
• Rule 6 advocates for cleaner production as a mechanism to minimise waste generation which can include conserving both raw materials and energy.

In a nutshell, the contractor and proponent will take the responsibility to ensure that solid waste is properly handled, stored, transported and disposed as per the procedures provided in these regulations. On site, materials that have the potential to be recycled should be considered for reuse or recycling prior to disposal.

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

These were promulgated in May 2009, thus prohibiting any person or activity from making or causing any loud, unreasonable, unnecessary or unusual noise that annoys, disturbs, injures or endangers the comfort, repose, health or safety of others and the environment. In determining whether noise is loud, unreasonable, unnecessary or unusual, factors such as time of the day,
Proximity to residential area, whether the noise is recurrent, intermittent or constant, level and intensity of the noise, electronic or mechanical means etc. may be considered.

Several sections are relevant to construction and road projects:
- In rule 4, the regulation relates noise to vibration effects, which can be harmful to people or the environment. Harmful vibrations are defined as exceeding 0.5 centimetres per second beyond any source property boundary or 30 metres from any moving source.
- Rule 11 requires any person wishing to operate or repair any machinery, motor vehicle, or construction equipment which is likely to emit noise or excessive vibrations to carry out the activity or activities within the relevant levels provided in the First Schedule to these Regulations.
- Rule 14 requires that all motor vehicles operated on site should not produce any loud and unusual sound.
- Rule 14 requires that where construction, demolition, mining or quarrying is to be carried out in an area, the Authority may impose on how the work is to be carried out including the machinery that may be used, and the permitted levels of noise as stipulated in the Second and Third Schedules to these Regulations.

In this case permissible levels applicable to public utility construction should be in line with Table 4.1 below. I and II are most relevant.

**Table 4.1: Second Schedule– Maximum Permissible Noise Levels for Construction Sites**

<table>
<thead>
<tr>
<th>Facility</th>
<th>Day</th>
<th>Night</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. Health facilities, educational institutions. Homes for disabled etc.</td>
<td>60</td>
<td>35</td>
</tr>
<tr>
<td>ii. Residential</td>
<td>60</td>
<td>35</td>
</tr>
<tr>
<td>iii. Areas other than those prescribed in (i) and (ii)</td>
<td>75</td>
<td>65</td>
</tr>
</tbody>
</table>

Time frame: Day: 6.01 a.m. – 6.00 p.m. (Leq, 14h) Night: 6.01 p.m. – 6.00 a.m. (Leq, 14h)

KeNHA and CRBC will ensure compliance to the regulations and where these may be exceeded, necessary measures must be undertaken to bring the noise levels within the set thresholds.

4.2.3.5 **EMCA (Air Quality) Regulations, 2014**
The objective of these regulations is to provide for prevention, control and abatement of air pollution to ensure clean and healthy ambient air. The overall aim is to protect human health and safety.

The general prohibitions, for instance Rule 5, 6, 7 and 8 prohibit any person from causing the emission of air pollutants (such as liquid and gaseous substances) and suspended particulate matter listed under Second Schedule (Priority air pollutants) to exceed the ambient air quality levels as stipulated under the First (Ambient air quality tolerance limits) and Third Schedule (Emission limits for controlled and non-controlled facilities).

The contractor is therefore required to keep particulate, especially dust, within acceptable limits.
4.2.4 The Work Injury Benefits Act (WIBA), 2007
The WIBA Act provides for compensation to employees for work related injuries and diseases contracted in the course of their employment and for connected purposes.

Section 7(a) of the Act, on the obligations of the employer, requires an employer to obtain and maintain an insurance policy with an insurer approved by the State in respect of any liability that the employer may incur under this Act to any of his employees.

Section 10(1) States that an employee who is involved in an accident resulting in the employee’s disablement or death is subject to the provisions of this Act, and entitled to the benefits provided for under this Act. It also states expressly that an employer is liable to pay compensation in accordance with the provisions of this Act to an employee injured while at work.

On First Aid covered in section 45(1), an employer is supposed to provide and maintain such appliances and services for the rendering of first aid to his employees in case of any accident as may be prescribed in any other written law in respect of the trade or business in which the employer is engaged.

4.2.5 Occupational Health and Safety Act No.15 of 2007
The Occupational Safety and Health Act No.15 of 2007 and the Subsidiary Legislation makes provisions for the health, safety and welfare of persons employed. The provision requires that all practical measures possible be taken to protect persons employed from any injury. The provisions of the Act are also relevant to the management (including handling, transportation and disposal) of hazardous and non-hazardous wastes, which may arise at the project site.

It shall be the duty of the proponent and contractor to ensure workers safety is given priority during construction of the road. This should be achieved in several ways:

- As highlighted in Section 6, by undertaking risk assessments and adopting preventive and protective measures.
- The contractor is required to also develop a health and safety policy and bring this to the notice of all employees as per Section 7.
- Formation of Health and Safety committee at the workplace as stipulated in section 9.
- Ensure all dangerous situations and accidents are reported within time and appropriate action taken.
- Similarly, all plants and machinery in use shall be subjected to periodical examinations as provided by law to ensure safety according to Part VII.
- Proper handling, labelling and transportation of chemicals and hazardous wastes such as petroleum, fuels etc. Section 84 requires that material safety data sheets for chemicals and hazardous substances be availed at the workplace.

General welfare issues are dealt with under Part X. These include provision of drinking water, washing facilities, first aid and accommodation for clothing not worn during working hours. The construction site(s) shall be registered as workplace with the directorate of occupational safety and health services under the Ministry of Labour, Social Security and Services as stipulated in Part V. A safety and health audit, fire audit, risk assessment, and safety and health audit has to be
conducted for the site at least once every year. Failure to do so attracts a fine not exceeding five hundred thousand shillings or imprisonment for a term not exceeding six months or both.

The proponent will there undertake the necessary registrations, take all measures to ensure the health, safety and welfare of persons employed, as well as undertake the relevant assessments as outlined above.

In addition, several subsidiary legislation that operationalizes the Act include:

**4.2.5.1 Safety and Health Committee Rules of 2004**

These rules require the proponent and contractor (once they employ a more than twenty persons) to establish a committee to address the health, safety and welfare of workers. The Proponent and by extension the contractor, are required to provide space for meetings for the committee, training of the S&H Committee, appoint a S&H management representative, as well as allowing all staff to attend these meetings with no risk of loss of earnings, opportunities for promotion or advancement. They should also make legislation on occupational safety and health available to the Committee.

The proponent/contractor must also:

- Develop a clearly defined safety and health policy, bring it to the notice of all employees at the workplace, and send a copy of the policy to the director. They are also required to implement and review the policy when need arises.
- Organise annual health and safety audit of all operations related to the project. This can only be undertaken by a registered health and safety advisor who should forward such a report to the Director of Occupational Health and Safety Services.

**4.2.5.2 Noise Prevention and Control Rules, 2005**

These rules have set minimum and maximum noise exposure limits beyond which workers and members of the public should not be exposed to without adequate means of protection. This is set at 90 dB(A) for more than 8 hours within any 24 hours duration and 140 dB(A) peak sound level at any given time.

The rules also have limits for exposure out of workplaces as 55 dB (A) during the day and 45 dB (A) during the night.

The rules have several recommendations on a comprehensive noise control program for workplaces that covers: noise measurement; education and training; engineering noise control; hearing protection; posting of notices in noisy areas; hearing tests; annual programme review.

In addition, this should include a requirement for medical examination of workers who are exposed to noise (and compensation for impairment), regular noise monitoring and measurement, Information and training of workers, proper installation and maintenance of machinery to reduce noise emission, provision of hearing protection, or plant, and posting of notices where allowed levels are exceeded.
The rules have also set the minimum noise levels that should emanate from a facility to public/neighbouring areas by day or by night. The proponent should provide functional earmuffs for those operating the equipment/machineries at the magazine site and keep on renewing their noise and vibration permits from NEMA.

4.2.5.3 **Medical Examination Rules, 2005**

The rules offer a guide on the need and target of workers who have to undergo regular medical examination to identify the symptoms of hazardous exposures on the body. This is with a sole purpose of monitoring exposure for remedial action.

4.2.5.4 **Fire Risk Reduction Rules, 2007**

These rules were promulgated by the Minister for Labour on April 16th 2007 and apply to all workplaces. The rules apply to this sector project in several ways as enumerated below.

Rule 16 requires a Proponent to ensure that electrical equipment is installed in accordance with the respective hazardous area classification system. It is also a requirement that all electrical equipment is inspected after six months by a competent person and the Proponent is required to keep records of such inspections.

Rules 29 – 31 refer to the installation and maintenance of firefighting systems in workplaces. Fire extinguishers are to be mounted at least 60cm above ground while a fire hose reel must be located within a radius of 30m. Fires can arise from electrical fault at the magazine site.

4.2.6 **The Public Health Act CAP 242**

The Act makes provisions for securing and maintaining health. Part IX, section 115, of the Act prohibits any person or institution from causing nuisance or a condition likely to cause injury or which might be dangerous to human health.

In Part IX, section sanitation and housing requirements are set. These include maintaining cleanliness and ensuring facilities used by the project are suitable for human dwelling. This means that the main contractor and the proponent will be required to provide proper sanitary facilities and solid waste handling containers for use by the construction workers on site during construction phases. A licensed solid waste transporter will also be contracted to collect all solid waste from the site for dumping at approved sites and where possible waste for instance from excavation of the road surface can be recycled to the extent possible. As well, section 116 of the Act mandates the relevant departments of the County government of Nairobi to take proceedings at law against any person causing or responsible for the continuance of any nuisance or condition liable to be injurious or dangerous to human health.

4.2.7 **The Penal Code CAP 63**

Chapter XVII on Nuisances and offences against health and convenience strictly prohibits the corruption of water in public springs or reservoirs, and the fouling of the atmosphere, making it noxious to the health of the public, including those living, passing or doing business in the area.
Waste disposal and other project related activities shall be carried out in such a manner as to conform to the provisions of the code. It is the responsibility of the contracted licensed waste handler to ensure that all kinds of wastes are disposed appropriately as per the legal provisions.

4.2.8 The Standards Act Cap 496
This Act promotes the standardization of the specification of commodities, and provides for the standardization of commodities and codes of practice to ensure public health and safety. It establishes the Kenya Bureau of Standards (KEBS) and defines its functions as related to:

- promotion of standardization in industry and commerce; and
- Making arrangements or provision of facilities for the testing and calibration of precision instruments, gauges and scientific apparatus, for the determination of their degree of accuracy by comparison with standards approved by the Minister on the recommendation of the Council, and for the issue of certificates in regard thereto.

This means that the Proponent and contractor have to ensure that all materials and equipment in use during construction as well as operation of the facility adheres to the highest standards and do not pose any human health and safety risk.

4.2.9 HIV and AIDS Prevention and Control Act, No 14 of 2006
The Act which fully commenced on 1st December 2010 provides for measures for the prevention, management and control of HIV and AIDS, protection and promotion of public health and for the appropriate treatment, counselling, support and care of persons infected or at risk of HIV and AIDS infection.

It requires the government (and by extension government agencies) to promote public awareness about the causes, modes of transmission, consequences, means of prevention and control of HIV and AIDS. This can be achieved through a variety of means, including educational and information campaigns that also encourage voluntary testing.

Section 7 specifically requires the government to provide basic information and instruction on HIV and AIDS prevention and control at the workplace. This should apply to all employees of government agencies and as well those of private sectors. The section further requires that such information should cover issues on confidentiality in the workplace and attitudes towards infected employees and workers.

Section 31 deals with matters of discrimination and hereby prohibits any form of discrimination against qualified employees, including at the workplace, on the basis of actual, perceived or suspected HIV status unless the employer can prove to a tribunal that the job requires a particular state of health or medical or clinical condition.

This Act therefore requires the proponent and by extension the contractor to practice fair employment practices, as well as undertake HIV/AIDS training including provision of free testing facilities for the workers on site.
4.2.10  Employment Act CAP 226 and the Employment Act Subsidiary Legislation
The Employment Act defines the fundamental rights of employees, provides the basic conditions of employment of employees and regulates employment of children. The Act prohibits discrimination of any kind and requires promotion of equal opportunity in employment.

Part V and VI define the conditions of employment. For instance, in Part V, Section 32, the proponent and the contractor are required to provide a sufficient supply of wholesome water for employees on site. Some of these conditions are elaborated on in the subsidiary legislations. For instance, the Employment (Medical Treatment) Rules of 1977 require basic medicines such as Aspirin, Quinine (or some other recognized medicine for the treatment of malaria), Epsom salts and a solution of a recognized antiseptic) to be provided in sufficient quantity. Similarly, first aid kits should be available. The Employment (Sanitation) Rules of 1977 require sanitary services to be provided.

PART VII deal with the protection of children.

4.2.11  The County Governments Act 2012
This Act provides for county governments’ powers, functions and responsibilities to deliver services and for connected purposes. It reiterates the role of the county government as to control air and noise pollution, and other public nuisances from activities within their jurisdiction. This is necessary or desirable for the maintenance of the health, safety and well-being of the inhabitants of an area.

In addition, the Act covers matters of planning, placing the responsibility of planning within counties, and the development of various plans as outlined in Section 107 on the county government. This includes the County Integrated Development Plan (CIDP) and the County Spatial Plan (CSP).

Sections 114 and 115 deal with planning for nationally significant projects in a county. These require mandatory public hearing and public participation as well as provision of clear and unambiguous information through clear environmental impact assessment reports – a function to be observed through the public participation process planned under this EIA study.

4.2.12  The Physical Planning Act of 1996 CAP 286
The Act provides for the preparation and implementation of physical development plans, and for connected purposes. In part V, it vests on local authorities the powers for development control and reserving land planned for open spaces and parks, among others.

Section 30 on control of development, requires Kenya National Highways Authority to apply for development permission and approvals to be granted by the local authority under section 33 prior to the start of any developments. This should be done to avoid fines or the development being discontinued.

Any application for development permission for development activities which are likely to have injurious impact on the environment shall be submitted together with an environmental impact assessment report, as stipulated in section 36.
4.2.13 Kenya Road Act, 2007

The Act gives power to road authorities i.e. Kenya Urban Roads Authority (KURA), Kenya Rural Roads Authority (KeRRA) and Kenya National Highways Authority (KeNHA) to maintain, operate, improve and manage roads under their jurisdiction.

Section 3 establishes Kenya National Highways Authority and mandates it in Section 4 to manage, develop, rehabilitate and maintain all national roads. This includes the powers to control national road reserves, prepare road works programmes for all national roads and to advise the Minister responsible for transport on all issues relating to national roads.

Section 27 (1) gives to KeNHA the powers to request the relocation of infrastructural utilities to a location or alignment approved by the Authority, at no cost to the Authority. KeNHA is however required to give reasonable notice of its intention.

4.2.14 Land Tenure and Acquisition Laws

4.2.14.1 Constitution of Kenya 2010

Under Article 62, the Constitution recognizes all rivers, lakes and other water bodies, all land between the high and low water marks, as well as all roads and thoroughfares as public land. This is held and vested in the national government in trust for and benefit of the people of Kenya, and shall be administered on their behalf by the National Land Commission as Article 67 stipulates.

Private land under Article 64 is land held by any person under leasehold or freehold tenure, and any other land declared private land under an Act of Parliament.

The Constitution provides for equitable access to land, security of land rights and means for dispute settlement for community, private and public land. Section 40 protects the right to individual and association property, noting that every person has the right, to acquire and own property (a) of any description; and (b) in any part of Kenya.

There are general sections that deal with for instance issues of justice, land deprivation and security of land rights:

- Article 10(2) (b) upholds human dignity, equity, social justice, inclusiveness, equality, human rights, non-discrimination and protection of the marginalized.
- Article 19(2) recognizes and protects human rights and fundamental freedoms in order to preserve dignity of individuals, communities and to promote social justice.
- Article 21(1) states that it is the duty of the state and every state organ to observe, respect, protect, promote and fulfil the rights and fundamental freedoms of every citizen. In 21(3) all the state organs and public officers have the duty to address the needs of vulnerable groups within society including women, children, and older persons, persons with disabilities, youth, and members of minority groups, marginalized communities and particular ethnic, religious or cultural communities.
- Article 39(3) notes that every citizen has the right to enter, remain in and reside anywhere in Kenya.
- Article 40(1) protects rights to land.

In addition, Chapter 5 part 1 specifically provides guidelines for ownership, use and acquisition of land, both private and public, since these are the two main categories of concern to the project:
Article 40(3) accords the state powers to deprive a person of property of any description in cases where the deprivation is a product of land acquisition. The deprivation is applicable for public purpose or in public interest. However, this can only be carried out in accordance with relevant laws and prompt payment in full or a just compensation to the affected person(s) must be made. In subsection (4) there is provision for compensation to occupants in good faith of land required, even if the occupants may not have title to it. Subsection (6) provides for matters of property that has been unlawfully acquired.

Article 62(1) (c) provides that private land can be transferred to the state by way of sale, reversion or surrender.

Article 66 empowers the state to regulate the use of land to achieve the objective of meeting public interest.

It is therefore expected that KeNHA will follow due process in matters of acquisition of both private and public land.

On matters of grievance redress, Article 60(1) (g) encourages communities to settle land disputes through recognized local community initiatives consistent with the constitution. In addition, Article 162 provides for the establishment of special courts, with the status of the High Court to hear and determine disputes relating to the use and occupation of, and title to land.

In the fourth schedule, the Constitution sets the roles of the county government to include Trade development and regulation, including markets, trade licences (excluding regulation of professions) and fair trading practices.

**4.2.14.2 Land Act, No.6 of 2012**

Similarly, this gives the powers of compulsory acquisition of public, private and community land to the National Land Commission (NLC). KeNHA can acquire private land through conversion of private land to public land by compulsory acquisition as section 107 allows. This is for public purposes such as transportation i.e. for purposes of building roads such as Western Bypass. However, they are required to apply to the NLC for the necessary land acquisition. KeNHA is then required to compensate for land, trees crops and buildings on the basis of the value of the property as determined by a qualified valuer.

The relevant sections governing compulsory acquisition of private land by NLC on behalf of the county and national governments is in Part VIII, Section 107 to 133, where in addition it provides for clear procedures on land acquisition and compensation.

- Section 107 allows the national government, through the Cabinet Secretary, to acquire land for public development when need arises. However, they are required to apply to the NLC for the necessary land acquisition.
- Section 108 gives to the commission or any authority authorized by the NLC, the powers to enter and inspect the land to ascertain whether the land is suitable for the intended purpose.
- The land if need for acquisition is approved has to be geo-referenced and authenticated at both county and national levels according to Section 110.
• Sections 111 - 117 provide for just, full and prompt compensation to all persons whose interests in the land have been determined. Only the Commission can make rules to regulate the assessment of just compensation.

• Section 128 refers to the Environment and Land Court as the institution to which any dispute arising out of any matter provided for under this Act should be referred for determination.

In terms of settlement:

• Section 134 provides for Settlement schemes and programmes to provide shelter and livelihoods to informal settlers (identified through a Sub-County selection committee), including those involuntary displaced by development projects. This section mandates the Commission to implement and administrate such settlement programmes on behalf of the national and county governments, with the settlement being undertaken on public land, and where such is not available the NLC has to buy such land.

On the other hand, and as far as public land is concerned, in section 8, the Commission is charged with the responsibility of managing public land on behalf of the national and county governments. Section 15-16 empowers NLC to reserve public land or body of water for one or more purposes in the public interest and for public purposes. Such reserved land can be vested in a statutory body, public corporation or public entity such as KeNHA for the reserved purpose.

Sections 143–147 recognize the need for a public rights of way (also called a way leave), and gives the NLC the power to create a public rights of way. The Act notes that a right of way can be created for the benefit of public authorities such as KeNHA, to enable them perform their mandate and functions, and also for the benefit of the public. This empowers contractors acting on behalf of KeNHA to execute works and build installations on the way leave. However, the applicant (KeNHA in this case) has to apply to the commission in writing, providing all necessary information. The authority is also required to notify all persons affected, including those occupying in accordance with customary laws, as well as the relevant county government. KeNHA is also required to compensate for land, trees crops and buildings in cases of private land, on the basis of the value of the property as determined by a qualified valuer.

Section 128 refers to the Environment and Land Court as the institution to which any dispute arising out of any matter provided for under this Act should be referred for determination.


The Act provides for the operations, powers, responsibilities and additional functions of the NLC.

In summary, the NLC is responsible for compulsory land acquisition and payment of compensation to project affected persons where private land is concerned. It also mandates NLC to manage public land on behalf of the national and county governments.

KENHA is therefore required to follow the set procedures in acquiring land for the proposed Western Bypass Project.
4.2.14.4 The Land Registration Act, No. 3 of 2012
This Act is relevant in case one wants to revise, consolidate and rationalize the registration of titles to land, to give effect to the principles and objects of devolved government in land registration, and for connected purposes.

4.2.14.5 The Environment and Land Court
The Land and Environment Court is established under the Environment and Land Court Act, 2011 (No. 19 of 2011). It is empowered by law, given the status of the High Court and has the jurisdiction to hear and determine disputes, actions and proceedings concerning acquisition of land as well as matters pertaining to the environment.

4.3 International Environmental and Social Impact Provisions, Conventions, Treaties and Agreements
Kenya is party to a number of international conventions and treaties that will apply to this project and that need to be adhered to while implementing Western Bypass. These include International Labour Organizations Conventions (among others):

- International Worst Forms of Child Labour Convention, 1999 (No. 182) that requires states to eliminate the worst forms of child labour including that related to construction work such as quarrying, sand harvesting etc.
- Convention on Economic, Social and Cultural Rights, 1966 that safeguards labour rights and the right to work, and seeks to ensure just and favourable work conditions.
- Discrimination (Employment and Occupation) Convention, 1958 (No. 111) which seeks to eliminate exclusion from opportunities or treatment in employment or occupation on the basis of race, colour, sex, religion, political opinion, national extraction or social origin.
- Equal Remuneration Convention, 1951 (No. 100) which requires rates of remuneration to be established without discrimination on the basis of gender.
- Minimum Age Convention, 1973 (No. 138) which abolishes child labour
- Workmen's Compensation (Accidents) Convention, 1925 (No. 17) which ensures that workers who suffer personal injury due to work related accidents, or their dependants, shall be compensated.

4.4 National Institutional Framework
4.4.1 Kenya National Highway Authority
The implementation of this EIA and the accompanying ESMMP remains the responsibility of KeNHA, who are to ensure the contractor meets their obligations as far as environmental matters are concerned. Kenya National Highways Authority is the public entity entrusted with Managing, Developing and Maintenance of the National trunk roads as per Roads Act of 2007. The Act spells out its roles as:

- Constructing, upgrading, rehabilitating and maintaining roads under its control;
- Controlling national roads and road reserves and access to roadside developments;
- Implementing road policies in relation to national roads;
Ensuring adherence to the rules and guidelines on axle load control prescribed under the Traffic Act and under any regulations under this Act;

- Ensuring that the quality of road works is in accordance with such standards as may be prescribed the Minister;
- Overseeing the management of traffic and road safety on national roads;
- Collecting and collating all such data related to the use of national roads as may be necessary for efficient forward planning under this Act Monitoring and evaluating the use of national roads; planning the development and maintenance of national roads;
- Advising the Minister on all Issues relating to national roads;
- Preparing the road works programmes for all national roads;
- Liaising and co-ordinating with other road authorities in planning and on operations in respect of roads, and

For the Authority to carry out its mandate effectively, it should be able to

- Carry out assessment of how the road network is currently being utilised
- Project and plan transport needs
- Control how the road facility is being used and ensure compliance with axle loading
- Control access to the road assets and ensure or minimise road encroachments, and grant access to road assets in a coordinated way as road safety is observed.
- Generally, ensure the road asset is protected and preserved

There are other institutions mandated to deal with matters of environment and Land. However in this case, the most relevant is The National Environment and Management Authority (NEMA) and the National Land Commission (NLC).

4.4.2 National Environment and Management Authority
NEMA is established under section 7 of the Environmental Management and Co-Ordination Act, No 8 of 1999 as the principal institution which exercises general supervision and co-ordination over all matters relating to the environment. It is also the principal instrument of Government in the implementation of all policies relating to the environment.

In specifics (and most relevant here) NEMA is charged with the responsibility to:

- Co-ordinate the various environmental management activities being undertaken by the lead agencies and promote the integration of environmental considerations into development policies, plans, programmes and projects with a view to ensuring the proper management and rational utilization of environmental resources on a sustainable yield basis for the improvement of the quality of human life in Kenya;
- Identify projects and programmes or types of projects and programmes, plans and policies for which environmental audit or environmental monitoring must be conducted under this Act;
- Monitor and assess activities, including activities being carried out by relevant lead agencies, in order to ensure that the environment is not degraded by such activities, environment is not degraded by such activities, environmental management objectives are adhered to and adequate early warning on impending environmental emergencies is given;
- Publish and disseminate manuals, codes or guidelines relating to environmental management and prevention or abatement of environmental degradation;

4.4.3 National Land Commission
As far as land acquisition is relevant, the National Land Commission is the institution in charge. Its functions have been outlined under the National Land Commission Act.

4.4.4 Other Relevant Institutions
*Table 4.2: Institutions with an Environment, Health and Safety mandate*

<table>
<thead>
<tr>
<th>Institution</th>
<th>Responsibility</th>
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</thead>
<tbody>
<tr>
<td>Ministry of Transport, Infrastructure, Housing and Urban Development.</td>
<td>Responsible for policy development, as well as development, standardization and maintenance of roads</td>
</tr>
<tr>
<td>The National Environment Council</td>
<td>Established under section 4 of EMCA, it is responsible for policy formulation and directions for purposes of this Act, sets national goals and objectives and determine policies and priorities for the protection of the environment; promotes co-operation among public departments, local authorities, private sector, Non-Governmental Organisations and such other organisations engaged in environmental protection programmes</td>
</tr>
<tr>
<td>National Environment Tribunal</td>
<td>Its principal function is to receive, hear and determine appeals on environmental matters. These mostly arise from decisions of the National Environment Management Authority (NEMA) on issuance, denial or revocation of environmental impact assessment (EIA) licenses, among other decisions.</td>
</tr>
<tr>
<td>Provisional and District Environment Committees</td>
<td>Established under section 9 of EMCA, Provisional and District Environment Committees are responsible for the proper management of the environment within the province or district in respect of which they are appointed.</td>
</tr>
<tr>
<td>Standards and Enforcement Review Committee</td>
<td>Established under section 70 of EMCA, this plays an advisory, research, monitoring and control of water pollution role.</td>
</tr>
<tr>
<td>County Government of Kiambu</td>
<td>Has a role in controlling air and noise pollution, and other public nuisances from activities within their jurisdiction.</td>
</tr>
<tr>
<td>Water Resource Management Authority (WRMA)</td>
<td>Regulates and protects water resources from adverse impacts</td>
</tr>
<tr>
<td></td>
<td>Regulates water infrastructure, use and effluent discharge including abstraction</td>
</tr>
<tr>
<td>Department of Occupational Health and Safety</td>
<td>It oversees provisions of health, safety and welfare of all workers in all workplaces, trains and does awareness on occupational safety and health, investigates occupational accidents at work places, does regular inspection and auditing of workplaces to promote best practices and ensure compliance with safety and health standards as set out in OSHA, 2007 and its subsidiary legislations and undertakes examination and testing of equipment such as hoists and cranes.</td>
</tr>
</tbody>
</table>
5. PROJECT ALTERNATIVES

This section examines alternatives to construction of the proposed development in terms of the site, products, materials, technology and waste management. Also, impacts of each alternative are identified, discussed and compared with those of this development proposal. With such information, reviewers have basis for decision-making.

5.1 No Project Alternative

The no construction/project alternative would imply that the situation on the current Gitaru road is left in its present state. Specifically, Gitaru road, which currently serves to connect Southern Bypass and the Northern bypass was not designed to high technical indexes and the current condition ranges from poor to average. This leads to slow vehicle speed, more fuel consumption and likelihood for occurrence of traffic accidents. Of even more concern is that this road is limited by the impact of non-motorized vehicles and pedestrians, in particular for the sections passing through town centres such as Ndenderu and Kihara. Currently, the traffic from A104 turning to the northern parts of Nairobi is brought together in the urban area of Nairobi, causing traffic congestion in downtown Nairobi.

The no construction option is mostly applicable in situations where the proposed project area is in ecologically sensitive areas and puts endangered species at risk. The land in which the proposed project is to be constructed is in a stable environment. As the ecological assessment also shows, no wild animal species were encountered along the proposed project location, and therefore will not be affected by this development activity. Similarly, as the impact section details, the impacts of the project can be mitigated.

The decision is also not favourable if the stated project objectives of:

1. Improving the needs of the Nairobi City Bypasses.
2. Effectively easing the traffic pressure in the city centre of Nairobi, and improving transport system.
3. Reducing the cost of transport and reduce the traffic accidents.
4. Promoting social and economic development of the region and improve the living standard of residents along the project.

have to be achieved.

While the ‘no project alternative’ may ensure non-interference and preservation of the status environment and social conditions, without the Nairobi Western Bypass project, the ring road around Nairobi will be incomplete. Nairobi metropolitan area will continue to suffer as a result of traffic congestion. This will worsen as future demands (as a factor of population growth and other key considerations) will exceed capacity of the current road, resulting in significant congestion.

The “No Action Alternative” should not be adopted, as we need to encourage development so long as it is undertaken on a sustainable basis as per the Environmental and Social Management and Monitoring Plan (ESMMP) developed in this report.
5.2 Location Alternatives

The current location of the Nairobi Western Bypass was chosen due to its ease of connection to the Northern Bypass, the existence of a large RoW, smooth connections and reduction in land acquisition needs. The proposed location is also shorter compared to majority of the alternatives.

Given the road has to start from Gitaru (where Southern Bypass meets A104/Nairobi-Nakuru highway) and end at Ruaka at the intersection with Northern bypass, with the best possibility being to use existing roads to minimize on land acquisition, several alternatives are available as per the table below:

Table 5.1: Brief Description and analysis of alternative routes

<table>
<thead>
<tr>
<th>Route Description</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Gitaru road - Kanyariri Gitaru road with a connection to Kapenguria road, then lower Kabete, Ngecha, Redhill and ending at Limuru road at the intersection with Northern Bypass.</td>
<td>• Lower Kabete road is wider than other roads in the area but will still require acquisition.</td>
<td>• This route is longer i.e. approximately 25km. • Too quick a turn to Kanyariri Gitaru road which will require large land acquisition for the whole stretch up to Kapenguria, an estimated 7-8 major interchanges.</td>
</tr>
<tr>
<td>2 Gitaru to Lower Kabete, then Ngecha, Redhill and ending at Limuru road at the intersection with Northern Bypass.</td>
<td>• Closer to current route in terms of distances i.e. approximately 21km but still longer than proposed route. • An estimated 4 interchanges so less than envisaged under proposed route.</td>
<td>• This route is longer i.e. approximately 23km • Estimated 7-8 major interchanges. • Need for substantial land acquisition in some sections and at the major interchanges.</td>
</tr>
<tr>
<td>3 Gitaru to Getathuru road, then Ngecha, Redhill and ending at Limuru road at the intersection with Northern Bypass.</td>
<td>• An estimated 4 interchanges, slightly shorter than chosen route. • An estimated 4-5 interchanges so similar to what is envisaged under proposed route.</td>
<td>• Need for substantial land acquisition in majority sections and at the major interchanges</td>
</tr>
<tr>
<td>4 Gitaru to Kirawa then Ngecha road, Redhill and ending at Limuru road at the intersection with Northern Bypass.</td>
<td>• Much shorter at 12kms. • An estimated 4-5 interchanges. • Slightly shorter than other routes but still longer than proposed route.</td>
<td>• This route is longer i.e. approximately 22km. • Need for land acquisition along major sections of the route and at the major interchanges.</td>
</tr>
<tr>
<td>5 Gitaru to Kihara Gachie Karura road, then Redhill moving towards Kagongo Karura road then Limuru road so as to end at the intersection with Northern Bypass.</td>
<td></td>
<td>• Need for substantial land acquisition along some sections of the route and more so along Kihara Gachie Karura road and at the major interchanges.</td>
</tr>
</tbody>
</table>
6. Gitaru road to Kagongo Karura then to Limuru road ending at the intersection with Northern Bypass.

- An estimated 3 interchanges.
- A shorter route at approximately 10km.
- Need for substantial land acquisition along Kagongo Karura road (over 6 km) and at the major interchanges.

**Plate 5.1:** Alternative 1 Gitaru - Kanyariri Gitaru - Kapenguria - Lower Kabete - Ngecha - Redhill - Limuru Road

**Plate 5.2:** Alternative 2 Gitaru - Lower Kabete - Ngecha - Redhill - Limuru Road - Northern Bypass
Plate 5.3: Alternative 3 Gitaru - Getathuru - Ngecha - Redhill - Limuru Road - Northern Bypass

Plate 5.4: Alternative 4 Gitaru - Ngecha - Redhill - Limuru Road - Northern Bypass

Plate 5.5: Alternative 5 Gitaru - Kihara Gachie Karura – Redhill- Kagongo Karura - Limuru Road – Northern Bypass
The above table shows that these routes carry a lot of disadvantages compared to the current route. In addition, any attempts to use any of these routes beats the purpose of having a ring road around Nairobi Metropolitan area, and takes traffic through highly populated areas. Furthermore most of these routes do not provide for a smooth connection of the adjoining roads with sharp turns that may require larger interchanges in a number of places, while any attempts to take the Bypass further south towards Kitisuru not only increases the distance of the route, but significantly raises the cost of land i.e. the land acquisition budget might not be justifiable.

The main advantage with the chosen route is also due to the existing and large RoW which lacks in most of these routes. Thus land acquisition is concentrated in sections where the interchanges will be constructed and more so the Ndenderu and Ruaka Interchanges.

5.3 Road Design Alternatives
In terms of road design, there is an option of undertaking a single carriageway instead of a dual road. However, given the traffic projections presented earlier, and using the experiences of the Eastern bypass, this will not lead to optimization. Rather traffic snarl-ups will be common feature since the improvement of the road will attract influx of residents as happens with infrastructure improvement in Kenya.

Similarly, development of a road below Class A Trunk highway will still necessitate improvements in the near future.

5.4 Alternative Technology and Construction materials
The road construction sector is one of the sectors that contributes to climate change through high levels of greenhouse gas. This is directly, through fossil energy used in construction related activities such as mining, transportation, paving works etc., or and indirectly through the emissions coming from vehicles. Particularly, asphalt production is one of the most energy consuming industries and as a result produces huge quantities of Carbon Dioxide (CO₂). However, alternatives are available to reduce the environmental footprint of the road construction industry, and which can be explored by the proponent and the contractor in the construction of the Nairobi Western Bypass project.
Green Roads and Highways Concept is the concept used to describe a number of environmentally-friendly road construction and maintenance techniques that protect the natural environment and reduce the amount of energy required to produce road construction materials. Such include:

- **The Heat and Cool Method:** Used to crack large rocks or cliff faces as opposed to blasting which can cause deep fractures in rocks leading to landslides. The practice involves building large fires under the rocks to heat them. Then cold water is poured on the hot rock to crack it. This makes the rocks easier to break manually.

- **Recycling:** Recycled concrete, asphalt, brick and basalt spalls sourced from the current road and processing them to meet specification requirements can provide suitable materials for road works applications thus saving on use of natural materials. Excavated asphalt roads or surfaces that will be excavated can be collected as a co-mingled stockpile, processed by crushing, and screened to a graded material for use in new asphalt manufacture. This recycling of materials will significantly contribute towards making prime non-renewable rock resources last longer.

- **Use of Warm-Mix Asphalt (WMA) in place of Hot-Mix Asphalt (HMA):** WMA production temperature typically ranges from 100 to 140 °C, whereas for HMA it ranges between 150 and 170°C. This reduces the level of energy/fuel consumption, thus decreasing the production of greenhouse gases, since WMA is produced at a lower temperature. It also carries additional benefits such as improvement of working conditions by reducing exposure to fuel emissions, fumes, and odours and reduction of paving cost. Other benefits include engineering benefits such as better compaction on the road. In addition, WMA can be hauled for long distances without concerns over temperature drop during mix transportation.

- **Use of ‘Bio-binders’ as materials for sustainable asphalt pavements or what is known as Green Asphalt:** Bio-binders – also known as biopolymer – which come from natural resources, are fully bio degradable, rather cost effective and show good thermal stability. These can be used as additives or direct replacement for petroleum based liquid asphalt (traditionally sourced from crude-oil refining distillation processes). Bio asphalt binders can be produced from domestic non-food resources i.e. can be biomass derived from agricultural residues or food sources such as molasses and coconut waste. They thus renewable have a lower carbon footprint. In Kenya, such roads are being piloted as polymerised bitumen roads constructed from recycled plastic and asphalt and which provide an effective way of dealing with plastic waste while creating employment for groups that collect such waste.

**Other considerations in terms of alternative technology include:**

**Noise reduction along Schools:** Use of low-noise paving material or noise-reducing road surfacing material such as Stone Mastic Asphalt, Friction Course (with polymer modified binder to improve durability) or other similar alternatives can be useful in reducing the impact along schools. Similarly, a noise barrier wall will surround Ndenderu Primary School, and should be considered near other schools. However, the latter poses an aesthetic concern if the material used does not blend in with the environment. Other alternatives could include the planting of bamboo along such facilities.

**Central barriers:** Features along the road should be made of alternative material to discourage vandalism and theft. For instance, central barriers made of metal are often vandalized due to their scrap value. Concrete barriers have lower scrap value due to the limited use of metal or steel.
6. PUBLIC CONSULTATION AND PARTICIPATION

6.1 Introduction
Public consultation and participation is a fundamental principle of the EIA process which contributes to EIA studies and to the successful design, implementation, operation and management of proposed projects. The main objective of stakeholder engagement is to ensure inclusivity of all the parties (stakeholders, PAPs, interested parties) in the decision making and the subsequent roll out of the project. It also strives to ensure acceptability of the proposed project. Stakeholder engagement is purposely meant to create public information disclosure as well as a consultation process that will influence the project. The approach is geared toward enhancing communications between the project proponent (KeNHA) and the public, by actively engaging individuals, organizations and groups who have a stake in the project activities and outcomes.

The aim of this exercise is to also disseminate information to interested and affected parties (stakeholders), solicit their views and consult on sensitive issues, in order to add value to the project design considerations.

This consultative process involved consultations with relevant project-affected persons/groups/businesses and concerned government authorities in documenting their concerns, assessing potential impacts, and exploring avoidance and mitigation options.

The methodology entailed mainly public consultation exercises by use of open ended questionnaires, public meetings and interviews with the concerned stakeholders. Public consultation has been highly useful for gathering environmental and socio economic data, understanding likely impacts, determining community and individual preferences, selecting project alternatives and designing viable and sustainable mitigation and compensation plans.

6.2 Objectives of Public Consultation and Participation
The specific objectives of the consultation process for the Western Bypass were:

1. To provide clear, timely and accurate information about the proposed project to the communities; this was to ensure they understood the proposed route and potentials impacts;
2. To obtain feedback (the main concerns and perceptions) of the population and their representatives regarding the proposed project; this included impacts, alternatives, and opportunities.
3. To obtain opinions and suggestions directly from the affected communities on their preferred mitigation measures; this included ensuring their concerns and priorities were understood and act as input into the decision making process and inform the solutions.
4. To improve project design and, thereby, minimize conflicts and delays in implementation;
5. To reduce conflict through the early identification of contentious issues;
6. To provide an opportunity for the public to influence project design in a positive manner thereby creating a sense of ownership of the project; and
7. To reduce problems of institutional co-ordination especially where different organisations and institutions are affected e.g. through the need for relocation of utilities.
6.3 Project stakeholders
Here we defined project stakeholders as individuals, groups, or organizations, who may affect, be affected by, or perceive itself to be affected by a decision, activity, or outcome resulting from the proposed Nairobi Western Bypass project. Identification and analysis of stakeholders formed the basis for planning and designing of stakeholder engagement activities.

The stakeholders were identified on the basis of:

- Their interest in the project: Found in area to be affected (directly or indirectly), have right of livelihood to the route etc.
- Have mandate over various issues related to the project and general matters that link to the project e.g. County government and planning, allocation of trading spaces, KeNHA and CRBC and technical design issues concerning the project,
- Their power and measure of influence over the project.
- Those that are considered vulnerable within the proposed project area, e.g. women, youth elderly, low income earners, people living with disabilities (e.g. in the Wangige market). This group was identified as special stakeholder groups, their needs and considerations should be prioritized due to vulnerability.

The stakeholders were grouped as either public (including political wing), private or civil society. A database of all individuals, communities, interested parties, organizations and institutions was generated (and continually updated), and the identification of the stakeholders was based on three different levels (local, county, and national).

6.4 Approach to stakeholder engagement
The approach was based on five key principles:

Inform - information dissemination about the proposed road construction and expansion geared towards authenticity, unbiased and timely passage of information to the public and all interested parties. The approach was achieved through public notices, invitation letters, public meetings, print media, announcement, websites and workshops. For instance, utility companies received a synopsis of the project attached to their invitation letters.

Involve - the need to include all stakeholders in decision making through consensus building and forums. This provided a platform to understand and prioritize their concerns.

Consult - a consultation process that solicited stakeholders’ feedback about the project life cycle as well as their inputs on the initial stages of the proposed activities, analysis of impacts and identification of priorities.

Collaborate - to enhance consensus building as collaboration brings the stakeholders together, creating opportunities, sharing agreements/disagreements and understandings

Empower - integrating stakeholders into governance structures, committees and board members of the proposed project. To give them first-hand information on and enhancing opportunities to participate in crucial decision making, this principle is expected to be followed up on later stages of the project.
6.5 Public Information and Consultation Methodology

Public participation was achieved using a variety of information and consultation methods. These were contextualised to the type of stakeholder and complexity of information to be shared or collected. This process was undertaken in close collaboration with the Proponent KeNHA and the contractor CRBC. The consultant largely used existing networks between the Proponent and stakeholders e.g. the political wing (MPs and Kiambu Senator), County Government of Kiambu, utility companies, and leveraged on these for the exercise, while initiating new contacts e.g. through major churches along the proposed route.

Table 6.1: Medium of Communication/Consultation Employed

<table>
<thead>
<tr>
<th>Medium</th>
<th>Description</th>
<th>Objective</th>
<th>Target group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survey/Questionnaires</td>
<td>These included open ended questions on various issues.</td>
<td>To solicit information on impacts and mitigation measures</td>
<td>Affected groups along the route including institutions (such as churches and schools) and a variety of other actors e.g. the traders operating along the road and markets.</td>
</tr>
<tr>
<td>Interviews</td>
<td>Detailed face to face meetings</td>
<td>To solicit information on impacts and mitigation measures</td>
<td>Key institutional actors</td>
</tr>
<tr>
<td>Public consultations and meetings</td>
<td>At minimum 2 public meetings at strategic locations with a preference for churches, chief’s office, social halls.</td>
<td></td>
<td>General Public and Project interested persons, County Government, Political Unit</td>
</tr>
<tr>
<td>Public notices and announcements</td>
<td>Printed notices and posters in strategic locations e.g. church notice boards, markets, Bus parks. Churches were also encouraged to give announcements on the same.</td>
<td>To inform on the project and Public meeting details</td>
<td>General Public and Project interested persons</td>
</tr>
<tr>
<td>Letters</td>
<td>These were one on one letters directed to a variety of actors e.g. County government, public utility companies</td>
<td>These were to inform on the project and the details of the public meeting i.e. aim, venue, location</td>
<td>Public administration, County Government, Institutions (schools, churches)</td>
</tr>
<tr>
<td>Radio announcements</td>
<td>These were adverts aired on radio stations to inform the locals on the proposed development and communicate the meeting venues/dates</td>
<td>To inform the public and project interested persons of the public meetings.</td>
<td>General public and project interested persons</td>
</tr>
</tbody>
</table>
Online and Social Media.
These included Facebook posts.
To create publicity around the public meetings.
General Public and Project interested persons

Email correspondence
This involved sending electronic mails to individuals directly to their email addresses.
To increase information dissemination especially for those who could not be reached via other medium of communication.
Public administration, County government officials, institutions (schools, churches)

Telephone
Making phone calls to individuals especially those who provided the phone contact numbers during scoping exercise. And to remind them of the meetings.
To invite for meetings
Invited Government and private sector actors.

Meetings
Consultation meetings that allowed for specialised groups to be updated and raise concerns about the project.
To inform on the project, establish e.g. which utilities will be affected
Political actors, County Government, Public utility companies

6.5.1 Direct one on one interviews
Direct interviews were used where necessary, to get responses from the proponent, project contractor and project engineers. These ranged from discussions about the proposed project designs, waste management, alternative technology and sites, among other related issues.

Other stakeholders provided background and baseline information on the project.
Key affected institutions were also interviewed to enlighten the experts about the area and any existing issues that should be put into consideration.

6.5.2 Questionnaire administration
Over 200 open ended questionnaires were administered to collect the views of various stakeholders. These were administered at strategic areas including Ruaka, Ndenderu, Karura, Wangige, Gitaru, Hamagu, Kabete, Riverside, Muthure, Ndenderu, King’ero, Ndumbu-Ini, Nyathuna, Rukubi-Muthure, Gitaru Ngure, Mugugo, Kwa Magu, Kanjeru and Joyland.

During the public meetings at Ndenderu and Wangige, the consultants took advantage of large groups of people to administer additional questionnaires. In total, 221 questionnaires (as per the stakeholder lists) were administered.

The questionnaires were used to capture the respondent’s views in terms of the positive and negative impacts that they anticipated from the project and suggested mitigation measures. They were also requested to provide information about the area, focusing on aspects such as sensitive ecosystems, provision of various infrastructure facilities and socioeconomic and environmental
impacts of the project in the area amongst other issues. Appendix B contains the list of individuals and businesses consulted, while Appendix C contains samples of the questionnaire administered. The recommendations from the public consultations are incorporated in the mitigation measures proposed in the report.

6.5.3 Meetings with specialised groups

Consultation meetings that allow for specialised groups to be updated and raise concerns about the project were held. These include:

- A breakfast consultative meeting between KeNHA, the consultant and political leaders from Kiambu County was held on 20th December 2016 at Radisson Blu Hotel in Nairobi. The Senator Kiambu County (Hon. Kimani Wamatangi) and the MPs of Kiambaa (Hon. Paul Koinange), Kabete (Hon. Ferdinand Waititu) and Kikuyu (Hon. Anthony Kimani Ichung'wa) attended the meeting on 20th December 2016. See minutes in Appendix D I and attendance list in Appendix E 1.
- A meeting/workshop with major utility companies was held on 11th January at Panafric Hotel, Nairobi. This targeted major utility companies who were invited through letters and follow ups made via phone calls. The main concern was to identify those whose infrastructure and services will be affected, achieve a more organized framework for placement of structures and common utilities on highway reserves and work towards a more proactive approach to removal and relocation of services and utilities. The main utility companies represented on 11th January 2017 included Safaricom, Liquid Telecom, Telecom Kenya, Airtel, Huawei, Kenya Power and Lighting Company, Kenya Electricity Transmission Company, Athi Water and Services Board, Access Kenya among others. See minutes in Appendix D II and attendance list in Appendix E II.
- A meeting with the County Government of Kiambu was held on 12th January 2017, at the African Institute for Capacity Development (AICAD) located at Jomo Kenyatta University of Agriculture and Technology (JKUAT), Juja. The attendants included the Deputy Governor H.E Gerald Gakuha Githinji and representatives from the Roads, Transport & Public Works, Trade, Tourism, Industry & Co-operatives, Water, Environment & Natural Resources, Land, Housing & Physical Planning (Survey), County Architect, Tourism, among other departments. The main aim was to inform the County about the proposed project and to solicit their views. This consultation process was expected to influence the project, devise ways to minimize disruption to the public and kick-start a long term engagement process that would ensure enhanced communication and collaboration between the project proponent (KeNHA) and the County. See minutes in Appendix D III and attendance list in Appendix E III.

Table 6.2 summarises the rest of the details.
Table 6.2: Actual details of Meetings with Key Stakeholders

<table>
<thead>
<tr>
<th>Date</th>
<th>Stakeholder</th>
<th>Time Held</th>
<th>Venue</th>
<th>Number of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>20/12/2016</td>
<td>Senator and Members of Parliament, Kiambu County</td>
<td>8.44am-11.05pm</td>
<td>Radisson Blu Hotel, Nairobi</td>
<td>14</td>
</tr>
<tr>
<td>11/01/2017</td>
<td>Utility Companies and Agencies</td>
<td>9.37am-1.06pm</td>
<td>Sarova Panafric Hotel, Nairobi</td>
<td>33</td>
</tr>
<tr>
<td>12/01/2017</td>
<td>County Government of Kiambu</td>
<td>9.35am-12.56pm</td>
<td>African Institute for Capacity Development Centre, Jomo Kenyatta University of Agriculture and Technology, Kiambu</td>
<td>23</td>
</tr>
</tbody>
</table>

6.5.4 Public Forums

These were two public gatherings open to interested and/or affected stakeholders. Initially, invitations letters were sent to major stakeholders such as government and private sectors actors, public notices were set up and a newspaper advert was put up in the Daily Nation of Wednesday December 14th 2016. These were invitations for two meetings to be held on 16th December 2016 at Anglican Church of Kenya – Ndenderu Parish and ACK St. Peter’s Church Wangige (See Appendix F for initial newspaper advert). However, given the close proximity of the proposed dates to the holiday season, and the need for more engagement with more key stakeholders before the public meeting, the proponent, the consultant and contractor agreed to postpone the meeting to 19th January 2017. Cancellation notices were put up in this regard.

After consultation with the political unit, the county government and utility companies, the public consultation meeting forums for the members of the general public were rescheduled for 19th January 2017 as follows;

Table 6.3: Schedule for Public Forums

<table>
<thead>
<tr>
<th>Date</th>
<th>Venue</th>
<th>Time</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>19/01/2017</td>
<td>ACK St. Peter’s Church Wangige</td>
<td>10am – 12pm</td>
<td>Wangige</td>
</tr>
<tr>
<td>19/01/2017</td>
<td>Anglican Church of Kenya – Ndenderu Parish</td>
<td>2pm. – 4pm.</td>
<td>Ndenderu</td>
</tr>
</tbody>
</table>

Invitation letters were sent to relevant stakeholders (See Appendix G for copy of the invitation letter and Appendix H for a list of stakeholders that received a letter), a newspaper advert was put on The Standard of Monday January 16 2017 (in English as Figure 6:1 shows) and radio announcements run on Kameme FM as Table 6.4 shows.
Table 6.4: Schedule of Kameme FM classified Western Bypass announcement

<table>
<thead>
<tr>
<th>Date</th>
<th>Time classified run</th>
</tr>
</thead>
<tbody>
<tr>
<td>16th January 2017</td>
<td>11.10 am 13.10 pm 15.10 pm</td>
</tr>
<tr>
<td>17th January 2017</td>
<td>11.10 am 13.10 pm 15.10 pm</td>
</tr>
</tbody>
</table>

The audio for the classifieds run in Kikuyu language is appended as Appendix J.
Over 300 public notices were also set up in strategic areas. These were also delivered to churches along the route and the clergy men agreed to make public announcements on Sunday. For instance, some reported having heard the announcement on January 15th Sunday 2017. Appendix I contains a copy of the public notice.

The meeting took place as shown in Table 6.5 below

<table>
<thead>
<tr>
<th>Date</th>
<th>Venue</th>
<th>Time Held</th>
<th>Location</th>
<th>Number of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>19/01/2017</td>
<td>ACK St. Peter’s Church Wangige</td>
<td>09.51am – 1.34pm</td>
<td>Wangige</td>
<td>250</td>
</tr>
<tr>
<td>19/01/2017</td>
<td>Anglican Church of Kenya – Ndenderu Parish</td>
<td>3pm – 5.35p.m.</td>
<td>Ndenderu</td>
<td>232</td>
</tr>
</tbody>
</table>

Given that the stakeholders varied in age and literacy levels, both meetings in Ndenderu and Wangige meetings were held in a mixture of English, Kiswahili and Kikuyu languages. There was a deliberate and conscious decision by Earthcare services to have master of ceremony who could speak Kikuyu. Similarly, the presentation by ESL was made by a native Kikuyu speaker. This proved useful since at some point, some members of the public would request a repeat of sections of the presentations or discussions in the local language.

Plate 6.2: Members of the public arrive and register for the Wangige Public Forum
Plate 6.3: Members of the public discuss the route diagrams and pictorials during the Wangige forum

Plate 6.4: A participant raising his concerns and participants raise their hands to speak in the Wangige Forum
Plate 6.5: Participants during public forum meeting in Wangige

Plate 6.6: Participants arrive and register for the Ndenderu Forum, a participant raises his concerns in the same meeting
6.5.5  Phone calls, Emails, Letters and Office Visits

During the public forums, Dr. Wairimu of Earthcare had displayed the company email address and personal mobile phone number and asked whoever still had concerns to visit the office or call her. Following this, there were a number of phone calls and visits to Earthcare Services Limited.

In addition, some residents sent emails while one Member of Parliament sent a letter to KeNHA with a number of concerns to be addressed.
6.6 Documentation of Stakeholder engagement and Issues raised

In order to measure success and build efforts for future activities, there was need to capture the various engagements. Minutes of major meetings as indicate above were done. The summary of issues highlighted are indicated below.

6.6.1 Political unit meeting issues

During the breakfast consultative meeting between KeNHA and political leaders from Kiambu County at Radisson Blu Hotel, Nairobi concerning the proposed Nairobi Western Bypass, the following issues and points were highlighted for consideration:

- Storm water at the project start at Gitaru is a major concern. The storm water from Sigona area causes a lot of property damage (house and crops). The leaders suggested that the design should take into consideration the development of a channel to direct the storm water to the natural drainage around Gitaru. The design of the proposed Nairobi Western Bypass should also take into consideration the design of the yet to start James Gichuru-Rironi Road. Storm water from Nairobi-Nakuru road shouldn’t find its way to the proposed Western bypass.
- *Boda boda* riders were highlighted as major users of the road who might be impacted by the proposed road upgrading. Therefore their interests should be put into consideration. Provisions to be made such that they can use both the main road (bypass and Service lanes).
- Dispensary at Ndenderu: There is a dispensary along Limuru Road at Ndenderu centre which may be affected by the slip road of the proposed interchange at Ndenderu. The leaders stressed the need to check on whether it will be impacted.
- Noise barrier at Ndenderu School: - In addition to installing the structural noise barrier at the Ndenderu interchange to minimize noise effect at the school, the leaders proposed the planting of bamboo trees along the school to also act as biological noise barrier.
- The leaders suggested that it would be important to realign the road so that public institutions such as churches and schools are avoided because if they are to be affected, to avoid a lot of opposition from the community.
- Several link roads along the traverse need to consider for upgrade since they could serve as important connecters to the bypass/ other major road and also to settlement and major centres such as at Kanjeru area, Kagongo and Kirangari area among others.
- The leaders expressed the need to incorporate adequate interchanges at the crossing points between the bypass and minor access road such as in Kahunco area and Lower Kabete road among others.
- The leaders suggested the Ruaka interchange should incorporate certain design consideration so that there is seamless connectivity of traffic along Banana-Raini Road and between Banana-Raini Road and Limuru Road and also between the Western Bypass and the Northern By pass. The link road at Ruaka along Limuru Road should strive to reduce the perennial traffic jams common in the area.
6.6.2 Utility Companies meetings deliberations

During this meeting, the following was agreed that:

- All utility companies will provide required information to enable planning by KeNHA
- All participants agreed to a recommendation for common service ducts which depends on information to be provided by companies.
- There was need for a joint meeting to brainstorm on other merging issues. This was scheduled for the 2nd week of February. Each utility company was requested to nominate someone as the liaison person for the purposes of the meeting.
- Project ground breaking was scheduled for October. All companies were required to plan and budget for relocation of utility infrastructure.
- Joint site visits were set for 20th January for KPLC, 24th for telecommunications companies and 26th for water companies.
- KeNHA would share contacts details for all regional managers and contact persons for the various regions
- KeNHA would share list of roads planned for improvement or construction, the presentation, layout of acquisition plans for Western bypass, construction limits and road reserves for Western bypass

6.6.3 Public Questionnaire Administration concerns

The main issues and concerns raised are summarized in the table below. The majority of the route residents acknowledged that they were aware of the proposed development project of Western Bypass. In addition to this, they pledged their support for the full implementation/construction of the project acknowledging that the project will indeed have numerous positive impacts. They also noted negative social, economic and environmental impacts which will be mitigated through the stipulated mitigation measures available in this Environmental and Social Impact Assessment (ESIA) study report and its corresponding Environmental and Social Management and Monitoring Plan. Sample Questionnaires filled by the public are contained in Appendix C.

Table 6.6: Summary of key issues raised on Western Bypass (Questionnaire Analysis)

<table>
<thead>
<tr>
<th>Key Negative Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Utility services disruption</strong>: Most people interviewed were concerned about the interruption of utility services like electricity, water supply, drainage system, water pipes, and fibre optic cables along the route during the road construction. They called for prior relocation of the services before the commencement of the construction works to avoid any inconveniences.</td>
</tr>
<tr>
<td><strong>Road accidents</strong>: Majority of the area residents feared that the construction of the bypass will result in increased road accident occurrence hence requested for proper road use and safety awareness creation.</td>
</tr>
<tr>
<td><strong>Impact on wetland (river)</strong>: One area resident pointed out the river near Ndenderu, opposite Angel Care School as a sensitive ecosystem which needed protection against pollution as it is adjacent to the road.</td>
</tr>
<tr>
<td><strong>Loss of businesses</strong>: Most business owners along the route complained that they might end up losing their businesses due to expected demolitions, and business relocations to new areas. They requested for early notifications before the start of the project activities.</td>
</tr>
</tbody>
</table>
**Loss of jobs:** Small business operators in the areas complained that the construction and operation of the road might leave them without places to sell their items which will drive them out of the business for good.

**Air pollution:** Most people cited vehicular exhaust fumes from construction vehicles, machineries and equipment’s; dust from construction works (excavation) as the main sources of atmospheric pollutants.

**Traffic congestion:** Many residents predicted the heavy traffic jams during construction by construction vehicles, machineries and equipment; and by vehicles during operation of the road. They proposed that there be diversions and faster construction works.

**Dust pollution:** This was expected to originate from the quarries, excavation works, during road levelling, borrow pits. This, residents complained will pollute the air and as such suggested that tarpaulins be used and water be sprinkled in dust emitting areas.

**Noise pollution:** This is expected to originate from construction equipment, machineries, vehicles and material excavation works. People suggested that regular servicing and maintenance should be carried out to minimise on the problem.

**Loss of property:** Demolition of houses, homesteads, business premises, churches, hospitals on the route will result in the loss of property to the people to which they suggested proper compensation be ensured and prior notification be communicated before works commencement.

**Impact on Sensitive Ecosystems:** Many residents pointed out that Rivers Gataara, Gitathure, and Kiawanjira will be polluted due to construction works, while Gitaru water project, Karura, all community water sources risked being demolished despite their important roles in the area of water provision.

**Waste management:** This was key as most residents feared that waste materials will be irresponsibly handled and disposed resulting in environmental pollution and degradation, bad odour, and poor environmental aesthetics.

**Soil erosion:** Most people brought to attention the expected soil erosion occurrence due to the expected excavation works weakening soil structure leading to loss of soil and degradation of environment.

**Insecurity:** Most people were concerned with the security of the area especially when there will be an influx of people working on the project with differing social backgrounds. This, they expected to result in theft cases among other social societal problems.

**Demolitions:** The owners of buildings like churches, hotels, hospitals, housing properties, petrol stations to be brought down requested for early notification and proper compensation as they will be losing their life investments.

**Prostitution:** Residents noted that the arrival of other people in the area with different societal backgrounds will result in anti-social behaviours like prostitution that will result in spread of HIV/AIDS among residents.

**Wangige market:** There were concerns that upon the demolition of the market place; most businesses will close down while others will make losses. As such, they requested for its proper relocation.

**Deforestation:** Residents noted that forest patches along the route will be cleared and trees felled. They thus called for proper environmental conservation and protection.

**Excess ground vibrations:** This is expected from heavy machineries, vehicles and equipment; during excavations and quarrying, and can result in cracking of houses. To this, the residents suggested that caution prevails during such processes.

**Trees and vegetation clearance:** That trees and vegetation will be cleared, the residents advised that vegetation and trees in areas not affected by the proposed road route should not be cleared but preserved for aesthetic purposes.
**Environmental degradation:** People pointed out many quarries; borrow pits and other open trenches around the area after project completion and vegetation clearance as the main environmental degradation cases expected. To this, they suggested proper decommissioning process of the same.

**Cracking of houses:** Most area residents complained of the expected housing cracking due to excavation, quarrying and construction works’ excess vibrations in the area which they said will damage their houses.

**Social life setting disruption:** Some residents complained that the influx of ‘strangers’ in the area with differing social backgrounds will interrupt their normal social life settings.

### Key Positive Impacts.

**Development growth:** Most people were confident that the construction of the road will promote the area development through easy access and opening it up to many people.

**Accessibility:** Most people feel that the construction will ease the means of accessing most areas in terms of saved time and convenience associated with it.

**Employment opportunities:** The construction of the road will offer area residents many employment opportunities in various categories like through the provision of skilled, semi-skilled and manual labour. This will earn them income and improve their standards of living/livelihood.

**Improved transport convenience:** This, the residents have attributed to the expected reduced time of travel to such places and the reduced traffic congestion upon the completion of the road.

**Business growth:** The construction and operation of the road is expected by the people to result in business growth and rise of many more businesses along the route important for economic growth.

**Economic growth:** A boost in trading activities, easier and faster transportation and exchange of goods and services is expected to result into the economic growth of the areas along the proposed route.

**Appreciation of land values:** Land prices are expected to rise upon the completion of the road due to the high demand associated by the areas’ easy accessibility from anywhere within Nairobi town.

**Traffic decongestion:** The project is expected by most residents to be the answer to the traffic jams in Nairobi. Therefore, it is expected to improve the convenience and the time taken for people travelling to different areas in such places.

**Improved housing:** Most people feel that the standards of housing properties in the area will shoot up due to high demand for investment in the area by local, international and private investors.

**Improved road lighting:** With the expected installation of street lights and flood lights along the road during its operation, most residents are optimistic that the initiative will improve lighting in the area especially in areas that are not secure at nightfall.

**Boosting of property values:** Property values along the entire route are expected to rise due to expected increase in demand as a result of the area’s improved accessibility. Properties like land, housing, among others are to be affected.

**Infrastructural development:** Most people believe that the construction of the road will attract other infrastructural developments to the area in terms of good sewer networks, water connections, internet accessibility, and communication networks, among others.
Increased trading activities: The expected improvement in terms of convenience and area accessibility that makes it easy for goods and services to reach markets at low costs and faster for exchange. Also, growth and rise of new market centres along the route is expected.

Improved transport network: The bypass will connect with several other small access and link roads within the area and form a major road network that will be vital for transport activities in the entire area.

Improved road safety: Upon completion, the new road is expected to come with proper signage, guard rails, street lights among other measures that will ensure for the road safety. Awareness creation on road safety is also expected to be conducted to enlighten people of the same.

Small business growth: Food kiosks, hawkers among other small business operators expect to cash in on the services of providing food to the construction workers. This will enable them earn a living and improve their livelihood standards.

6.6.4 Public Forum Issues raised

Table 6.7: Public Forum Concerns on the proposed project

<table>
<thead>
<tr>
<th>Wangige Public Forum</th>
</tr>
</thead>
</table>
| **Road design:** The people wanted to know whether KeNHA will construct a ground level pedestrian footbridge, whether it will consider sewer line, or if it will consider putting up many footpaths for property owners to access their properties.  
To this, KeNHA promised that it will consider and integrate them into the detailed road design. Mr. Waititu on the other hand suggested that they form a committee to follow up on the detailed issues raised. |
| **Accessibility:** The residents wanted to know whether there will be an access road linking it to Nairobi Southern Bypass to which they were told that all the roads will be interconnected. On how to join the Bypass, KeNHA explained that there will be designated exits and points to allow change of direction. And lastly, on considering to construct an access road from Rungiri to Gitaru, KeNHA promised the residents that they will construct access roads and pedestrian footbridges where necessary and usable. |
| **Safety and Health:** To avert accident occurrence at interchanges, KeNHA noted that that footbridges will be erected; roads marked clearly and designed factoring in safety measures. On use of footpaths by the elderly and physically challenged persons, KeNHA acknowledged that the designs had put that into consideration through gradient moderation. Restriction of boda boda operators from using the footbridges was deemed impossible given their design nature but depended solely on safety measures enforcement by the relevant authorities. |
| **Drainage:** To solve drainage problems at the footbridge opposite Mlango Wa Soko, KeNHA promised that the footbridge will be redesigned to address current issues. The residents also wanted to know of the design that will be incorporated for River Gatara flowing across the road. This, KeNHA shared with the residents that a box culvert or other necessary design will be used to cater for the capacity of the flow. |
| **Resettlement, relocation and land acquisition:** Concerning lands with existing court cases, it was agreed that the National Land Commission and the courts deals with such matters. About compensation to Project Affected Persons, KeNHA assured residents that the process will be fair and just. On issues of communally owned family lands, and pegging of the road map resulting in loss of tenants, KeNHA advised that the Resettlement Action Plan will be used to address the issues in collaboration with the National Land Commission in light of the policies like the Community Land Act. It was recommended again that the boda boda sheds at Wangige market be relocated after a proper RAP has been developed. |
**Noise:** The residents requested that noise barriers be installed at Ndenderu Primary School; church and school in Kingeero; and other schools also. KeNHA promised to consider all their comments and suggestions emphasizing that the design was still at preliminary stages.

**Environmental aesthetics and visual intrusion:** KeNHA was urged by the residents to ensure that the road design is environmentally friendly, be inspired by local settings (blend with the local environmental settings), and does not cause visual intrusions.

**Employment:** On employment bureaus extorting people of money and recruiting based on tribalism, KeNHA advised that the whole process will be overseen by the County Government. Gender concerns touching on women were to be addressed through the ESIA report and the RAP. To ensure for fair, just, and non-discriminatory job awarding, key qualifications and skills will be regarded, just as required in the country’s constitution.

**Ndenderu Public Forum**

**Road Design:** Concerning the erection of footbridges and permanent barriers at Ruaka, KeNHA, agreed that they will put them at specific areas identified during a survey they had conducted earlier on. About duct intervals, and whether they will be in kilometres or not, KeNHA assured them that the specifications will be provided by the service providers. The gradient of the road and the interchanges will allow for safe climbing by the trucks hence presence of climbing lanes. Residents also wanted to know whether service lanes will be one or two way, but, KeNHA assured them that this will be determined by the project cost and necessity, and as such was expected to vary from place to place.

**Accessibility:** In response to the question that construction of bypasses has always resulted in economic loss in small towns and locking such towns from access, KeNHA, assured them that there will be no interruption with the existing market centres; however, the small towns will be served by the service lanes or roads like the ones in Kikuyu. Asked on lighting system in underpasses to enhance security, KeNHA gave the assurance that all underpasses will be sufficiently lit.

**Drainage:** About tunnel causing water backflow on a river in Karura, causing damage to properties and farms, KeNHA, responded that hydrological studies had been carried out in the area during feasibility studies to determine the kind of bridges and tunnels suitable for the area to solve the problem.

**Safety:** Given the residents observation that between Gitaru and Ruaka, there were no footbridges, KeNHA clarified the information emphasizing that the whole stretch has five footbridges including those for the physically challenged fitted with ramp access. On safety of the motor cyclists and non-motorists given their vulnerability in terms of road use, KeNHA assured them that there are provisions for them in the road design e.g. footpaths for pedestrians, main road and service lanes for motorcyclists. Concerning vandalism, KeNHA said that they were doing research on a material for use that won’t have any scrap value to replace the existing vandalized materials and also conducting of road patrols to deter the vandalisms.

**Noise Abatement:** KeNHA assured the residents that in terms of noise management in institutions and schools during road construction, it will hold meetings with key stakeholders and affected institutions to look for possible mitigation measures and implement them, plus constructing noise barriers in such areas as Ndenderu Primary School.

**Employment and CSR:** On minimum wage to employees, KeNHA advised the people that the minimum wage is determined by the Labour Laws hence the contractor has no mandate of paying above or below the average amount required. Whether or not the contractor will introduce some corporate social responsibility projects during project implementation, KeNHA reminded the residents that Community Social Responsibility (CSR) is not compulsory but rather a voluntary undertaking by the contractor.

**Environment:** On measures put in place by NEMA to ensure that storm drains are solely for run-offs only and not sewerage drainage system that will pollute River Ruaka, it was agreed that all shall adhere to laws and regulations governing the use of natural resources and waste management as stipulated in EMCA Act of 1999 and Amendment,
2015 In regards to the contractor leaving open borrow pits, KeNHA assured the public that adequate mitigation measures would be put in place to rehabilitate the same. The authority also assured the residents that where possible they would tap into solar lighting system to ensure cleaner and better energy use on the road.

**Land acquisition and compensation:** Where trees will be felled by the project contractor, National Land Commission will help in valuation process for compensation. The contractor will also put in place a re-vegetation programme to ensure that tree replacements are undertaken along the road. On acquisition of remaining remnant lands after the purchase of larger parts, KeNHA advised that it is not an easy job given the responsibility it comes with including court cases where they have in the past been enjoined, or cases of previous land owners and resettling on the same parcel after the NLC acquires the land on their behalf (KeNHA).

### 6.6.5 Issues raised through Phone calls, Emails, Letters and Office Visits

**Table 6.8: Concerns raised through Phone calls, Emails, Letters and Office visits**

**Noise Abatement:** On whether noise barriers would be considered for churches in addition to schools, the consultant explained that at the moment, the designs only consider Ndenderu primary school as the school will be surrounded by the road, while other facilities are not surrounded. The consultant noted that considerations in putting up such structures also include the number of people affected e.g. churches hold large groups but for very short periods as compared to the school.

**Road Design:** There was concern that Kabete road which terminates at King'eero T junction is a major artery from Nairobi. There was thus need for an elaborate interchange to decongest Wangige especially during the morning and evening rush hours.

Similarly, there was concern if the design would accommodate private future development plans and if these would be factored in the designs of the road if provided. It was noted that future developments can only be considered if they affect matters of the public e.g. a public school, county government plans but not private plans or else the construction costs escalate to unacceptable levels.

In the Ndenderu area, people straddle the road to collect feed for animals and the proposed developments will most likely affect many. The consultant explained that there will be several footbridges along the route and walkways on the underpasses. The citing of these facilities are informed by population.

Given that the designs have taken into consideration children and attempted to protect them from noise, adults needed to be protected too, from diesel fumes. Noise control is possible to a certain extent and the project has given priority to school children. Measures to reduce fumes are often targeted at the vehicles producing such to ensure cleaner and efficient fuel burning, use of low sulphur diesel as well as ensuring vehicles are routinely maintained and serviced. Enforcing such is the work of the Energy regulatory Commission and NTSA.

**Scheduling of construction:** The need to prioritise Gitaru interchange due to the fairly high number of fatalities was raised, to which the consultant noted that Gitaru interchange was scheduled as phase two and thus not covered in this EIA.

On whether there was a tentative programme so the affected can prepare mentally, the consultant noted that a RAP would be undertaken and then NLC would deal with matters of land acquisition. As explained in the public meeting, the proponent had given indications of starting construction in October 2017 if all goes as planned.

**Separation of families and impact on livelihood:** A concern raised on the design proposed for Ndenderu interchange was that it would affect many who had lived for years in the area. This would lead to separation of families while the remnant land would not support agricultural livelihoods which many have practised for years. The RAP was expected to deal comprehensively with such issues including matters of compensation, livelihood,
and social impacts of displacement as well as how to treat residual land that would not be of economic value to the owners.

<table>
<thead>
<tr>
<th>Land Acquisition and affected structures:</th>
<th>Some raised concerns that they lived next to the road and needed to know if their structures or land was affected. Others requested to see the maps showing which properties were affected.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compensation matters:</td>
<td>Where some buildings have ongoing court cases, some wanted to know who would be compensated. The consultant noted such cases have to be resolved before any compensation. Others were concerned as tenants and wanted to know if they would be compensated to which the consultant noted the RAP would recommend how to treat tenants, both commercial and residential.</td>
</tr>
<tr>
<td></td>
<td>Some of the trees along the Ndenderu – Ruaka road were planted by some elderly men and women and also using the Kiambaa Constituency Development Fund (CDF) and there was concern if the individuals would be compensated and if there would be a donation of tree and bamboo seedlings to the CDF for replanting trees in the area.</td>
</tr>
</tbody>
</table>
7. ENVIRONMENTAL IMPACTS

7.1 Introduction

ESIA is a tool used to guide environmentally sustainable decisions. It helps to identify, predict and quantify where possible the magnitude of impacts, evaluate and assess the importance of the identified changes and formulate plans to monitor and mitigate the actual changes. Prediction of impacts technically characterizes the causes and effects of impacts, and their secondary and synergistic consequences to the environment and the local community.

This chapter focusses on the potential positive and negative environmental impacts that are likely to occur as a result of the proposed construction of the Nairobi Western Bypass, and their relative significance. These were identified according to the proposed project phases namely

- Pre- construction (planning, design, preparation),
- Construction,
- Decommissioning
- Post-construction (operation and maintenance phase), and

The proposed Nairobi Western Bypass project is envisaged to generate social and environmental impacts which could be positive or negative, direct or indirect, local, regional, reversible or irreversible and hence the necessity to subject the proposed project to an ESIA process. Most of the positive benefits and negative impacts will take place during construction and operation phases.

The process of determining the various impacts was done through stakeholder participation, discussion with proponent’s technical team, site visits, technical studies (e.g. noise and air quality studies), review of the facility specifications etc. The prediction and analysis of the environmental impacts of the proposed project is also based on:

iii. Compliance with the relevant Kenyan legislation and standards on environment, health and safety and the World Bank Safeguards as well as World Bank’s Environment, Health and Safety guidelines.

iv. Professional judgment.

In addition, it is worth noting that all prediction techniques of environmental impacts, by their nature, involve some degree of uncertainty. The assessment criteria of the significant impacts are as shown in the Table 7.1 below:
Table 7.1: Criteria for Assessing Significant Impacts

<table>
<thead>
<tr>
<th>Key</th>
<th>Type of impact</th>
<th>Key</th>
<th>Type of impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>++</td>
<td>Major positive impact.</td>
<td>+</td>
<td>Minor positive impact.</td>
</tr>
<tr>
<td>- -</td>
<td>Major negative impact</td>
<td>-</td>
<td>Minor negative impact.</td>
</tr>
<tr>
<td>0</td>
<td>Negligible/zero impact</td>
<td>NC</td>
<td>No change</td>
</tr>
<tr>
<td>Sp</td>
<td>Specific/localized</td>
<td>W</td>
<td>Widespread.</td>
</tr>
<tr>
<td>R</td>
<td>Reversible</td>
<td>Ir</td>
<td>Irreversible.</td>
</tr>
<tr>
<td>Sh</td>
<td>Short term</td>
<td>L</td>
<td>Long term.</td>
</tr>
<tr>
<td>T</td>
<td>Temporary</td>
<td>P</td>
<td>Permanent</td>
</tr>
</tbody>
</table>

On the basis of information gathered, the potential positive and negative environmental impacts are tabulated below.

Table 7.2: Potential Positive Environmental Impacts

<table>
<thead>
<tr>
<th>Nature of anticipated positive impact</th>
<th>Pre-Construction</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landfilling</td>
<td>++, Sp, P</td>
<td></td>
</tr>
<tr>
<td>Improved aesthetics</td>
<td></td>
<td>++, Sp, P, L</td>
</tr>
</tbody>
</table>

Table 7.3: Potential Negative Environmental Impacts

<table>
<thead>
<tr>
<th>Nature of anticipated negative impact</th>
<th>Pre-Construction</th>
<th>Construction</th>
<th>Operation</th>
<th>Decommissioning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air quality degradation</td>
<td>NC</td>
<td>--, Sp, Sh, T</td>
<td>-. W</td>
<td>--, Sp, Sh, T</td>
</tr>
<tr>
<td>Noise and excessive vibrations</td>
<td>NC</td>
<td>-. Sh, Sp, T</td>
<td>-. L</td>
<td>-. Sp, Sh, T</td>
</tr>
<tr>
<td>Changes in topography</td>
<td>NC</td>
<td>-.Sp, P, Ir</td>
<td>NC</td>
<td>NC</td>
</tr>
<tr>
<td>Soil erosion and contamination</td>
<td>NC</td>
<td>--,Sp, Sh, T</td>
<td>-</td>
<td>-.Sh, T, Sp</td>
</tr>
<tr>
<td>Changes in land use: loss of agricultural and produce</td>
<td>--,Sp, Ir ,L</td>
<td>-.Sp</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increased solid waste generation</td>
<td>NC</td>
<td>--, Sp, Sh</td>
<td>-.Sp</td>
<td>--, Sp, Sh</td>
</tr>
<tr>
<td>Loss of vegetation cover</td>
<td>-. P, Sp, R</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
</tr>
<tr>
<td>Impact on animal species</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
</tr>
<tr>
<td>Introduction of invasive species</td>
<td>NC</td>
<td>NC</td>
<td>-. Sp</td>
<td></td>
</tr>
<tr>
<td>Increase in storm water</td>
<td></td>
<td>--, Sh, Sp</td>
<td>-. L, Sp</td>
<td></td>
</tr>
<tr>
<td>Surface and underground water pollution</td>
<td></td>
<td>--, Sh, W</td>
<td>-.Sp</td>
<td></td>
</tr>
<tr>
<td>Increase in water demand</td>
<td>-.Sh, Sp</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alteration of natural drainage pattern</td>
<td></td>
<td>--, Sh, Sp, R</td>
<td>-.Sp</td>
<td></td>
</tr>
</tbody>
</table>
7.2 Positive environmental impacts

7.2.1 Landfilling
The overburden and materials cleaned from the existing corridor during excavation and earth moving need to be recycled or disposed of safely. Some land owners may request to have the soil deposited on their land for landscaping and reclamation. On the other hand, the spoils could be dumped into quarries, wastelands and/or used for landfill sites. Such an activity should however be done in a coordinated manner and with relevant approvals from the local authorities.

7.2.2 Improved aesthetics
The project proposes common service ducts for utilities such as electricity and fibre networks. As the minutes in Appendix D II show, the proponent has initiated engagement with utility companies to make this a reality. This will mean better organised and more eye appealing setting up of utility infrastructure as opposed to the current situation. Such provisions will generally improve the aesthetics of the area especially

7.3 Negative environmental impacts

7.3.1 Air quality degradation

7.3.1.1 Construction Phase
During construction air quality may be degraded for short periods due to:

- The exhaust emissions from the operation of heavy construction machinery epically during land clearing and site preparation;
- Fugitive emissions from brick, concrete, and asphalt plants;
- The dust generated from the haulage of materials, exposed soils and material stockpiles;
- Cutting and filling of hill slopes;
- Emission by hazardous wastes stored on site for example oils and solvents
- Material loading and unloading; and,
- Blasting activities.

Temporary diversion areas in most cases are often not tarmacked based on practices from major road construction projects in the country, often causing a lot of inconvenience to the public.

Although the impacts are considered temporary and in most cases confined to construction areas and its most immediate environs – which in this case will act as the impact zone -, the emissions will vary from day to day, depending on activities, specific operations and weather conditions. Some e.g. dust are expected to increase during dry periods, during specific activities such as land clearing if extra care is not taken to mitigate such. Also environmental factors such as wind can exacerbate the dust conditions in some cases i.e. through wind erosion. Vehicle and equipment based pollution will largely depend on factors such as engine power, type of fuel used, equipment
capacity, maintenance etc. Better vehicular and machine engine performance and maintenance reduces emissions.

The most significant components will be CO$_2$ and NO$_X$ emissions due to combustion of diesel from vehicles, crushers, Asphalt mixing plant and Concrete batching plant. Therefore, careful consideration in citing the location of these facilities is of utmost importance.

In addition, utmost care should be taken along the entire corridor as there are sensitive receptors settlements along the existing road. Emphasis will be placed on urban locations e.g. Wangige, Ruaka, Gitaru, Ndenderu and sections with learning institutions e.g. Ndenderu Primary School, near health centres or clinics, and where there are large groups of people so that harmful impacts can be minimized.

And although this is indicated as air related concern, mainly workers and the general public, vegetation and soil will be most affected.

### 7.3.1.2 Operation and Maintenance Phase

Once the Nairobi Western Bypass road is open and operational, there will be substantial increase in traffic flows. This is expected to give rise to air quality impacts at adjacent developments due to increase of diesel and petrol engine vehicle fumes. In addition, impacts will depend on factors such as characteristics such as fuel combustion (sulphur content of diesel, fuel, lead, etc.), engine and vehicle maintenance and vehicle age. Particularly, use of high sulphur diesel, fuel adulteration and low vehicle maintenance are major concerns in Kenya. Vehicular exhausts will therefore be the major source of NOx and SOx.

This impact is rated as a minor negative impact with widespread effect as NOx and SOx travel beyond the local atmosphere.

No mitigation measures will be expected from the proponent and contractor during operational phase of the project. Rather it is the responsibility of the Energy Regulatory Commission (ERC), National Transport and Safety Authority (NTSA) and National Environment Management Authority to oversee emissions control, and for NTSA to check on road unworthy vehicles.

### 7.3.1.3 Decommissioning Phase

Active earth work areas, stockpiles and loads of soil being transported or during demolition of temporary facilities can be a major cause of dust emissions.

### 7.3.2 Noise and excessive vibrations

#### 7.3.2.1 Decommissioning Phase

Active earth work areas, stockpiles and loads of soil being transported or during demolition of temporary facilities can be a major cause of dust emissions.

#### 7.3.2.2 Construction Phase

During the construction period, temporary noise and vibration will be generated from the;

- a. Mobilization of heavy construction machinery;
b. Accelerations/ decelerations/ gear changes – though the extent of impact will depend on the level of congestion and smoothness of the road surface;
c. Excavation work for foundations and grading;
d. Breaking and removal of existing bitumen road and pavement
e. Construction of structures and other facilities;

These construction activities are expected to produce noise levels in the range of 80-110 dB (A) at a distance of about 5 m from the source.

For instance, if one assumes the expected noise level impacts during the two key phases of work, as Removal of the vegetation and top soil; and excavation, using a JCB plant 1 and 2, a tipper and dump and tipper lorry, the combined noise produced by all the equipment will be at the rate of 88dB (A). This noise level is above the target noise level of 84 dB (A) NEMA. To meet the expected target level, noise mitigation must be carried out.

Noise levels above are expected to occur intermittently and residences, schools, health clinics, and other noise sensitive areas within 100 m the roadways will be affected temporarily during construction. The number of persons potentially affected and the duration of these effects cannot be estimated based on available information.

Nuisances from noise is a function of external factors too, such as weather phenomena e.g. speed and direction of the wind and degree of absorption of the acoustic waves into the soils, phenomenon called “soil effect”, air absorption (which depends on the pressure, temperature, relative humidity) etc.,

Vibration levels will be a function of several considerations and factors. First is the source strength, often referring to strength and type of construction equipment and methods. Second is the distance between the equipment causing the vibrations and neighbouring structures. Third is the characteristics of the transmitting medium, and fourth is the neighbouring building type as well as its age. In terms of structural impact on neighbouring structures, vibration levels have to be greater than a certain Level of Vibration Decibels (VdB) to affect the structures or cause inconvenience to neighbours. Therefore potential risks are not envisaged for this aspect.

Still, these extremely high sound levels e.g. noise present real risk to the health of workers on-site, and the neighbours to the project. Specifically, there is concern where high receptors exists as a number of schools exist along the proposed project route. Although, noise impacts are an unavoidable consequence of construction that should be mitigated, timely scheduling of construction activities, proper maintenance of construction machineries, use of personnel protective equipment’s etc. will minimize these impacts.

7.3.2.3 Operation Phase
The current low traffic flows along the project road is expected to increase because of improved economic activities associated with better access. The larger numbers of vehicles will be an additional source of noise and gaseous emissions. This is minor negative impact since there is an existing carriage way, meaning the receptors are adapted to traffic related noise. This however does not apply to high receptor areas such as school. Particularly, of major concern is Ndenderu
Primary school which will be surrounded by roads and thus need to ensure proper ambience for the continued uninterrupted learning and concentration of the pupils.

According to the noise survey, and with an assumption that the main source of noise is the traffic travelling along the road, the traffic noise level is 72dB (A) and people passing the noise level is 54dB (A). The combination of these noise levels will be 72dB (A) and will be within the ambient noise levels set by Kenya Government for traffic along the highway. To meet the target noise level, there should be no sensitive building within 200 meters from the centre of the road.

7.3.2.4 Decommissioning Phase
Temporary noise disturbance is expected during demolition of secondary facilities related to the project e.g. offices. This will be temporary and of minor concern in terms of impact.

7.3.3 Changes on topography, appearance and aesthetics
7.3.3.1 Construction Phase
Construction activities of the project road will bring about changes in the appearance of the project site. There will be loss in aesthetic beauty of the project area mainly due to the earthwork. Cutting of sloppy sides will result in scarring of landscape. Improper disposal of solid wastes which originates from excavations, demolishing existing pavements and tarmac/buildings, abandonment of litter/construction materials on site, plastic container/bags and use of polythene sheets for curing may cause poor aesthetics along the proposed corridor. Excavation activities at extraction sites (where construction materials are derived) will result in topographical changes, where more often than not, large gaping holes and gullies are left in the ground.

During construction, the stock piled material and garbage in the project site may affect the city general appearance of the surrounding, but this will be cleared after the project is completed.

7.3.3.2 Operation Phase
During operation phase the topography will remain the same as it is determined by design of the road during construction however general appearance of the bypass roadside is likely to be affected by landscaping and the maintenance level of the vegetation (grass, trees etc.) used for landscaping. It can be both a minor positive or negative impact depending on the degree of care.

7.3.4 Soils erosion and contamination
7.3.4.1 Construction Phase
Soil erosion is caused by exposure of soil surfaces to rain and wind during site clearing, earth moving, and excavation activities. The mobilization and transport of soil particles may, in turn, result in sedimentation of surface drainage networks, which may result in impacts to the quality of natural water systems and ultimately the biological systems that use these waters.

The project proposes to widen the road, thus exposing larger surfaces to the elements of weather such as wind furring the dry season and run off during rainy weather. Particularly, given the terrain and geological conditions of the area, where this extension happens on valleys and hilly areas of the region, soil erosion can have cumulative effect such as significant land instabilities, destabilisation of embankments, turbidity and siltation of water bodies, drainage problems, etc.
Similarly, utilisation of productive top soil present e.g. in quarry areas for road construction can lead to loss of top soil.

Soil (especially top soil) contamination may also occur due to exposure to hazardous materials such as hydrocarbons, bituminous waste and other heavy metals in the disturbed areas or improper disposal of construction wastes. Location of plant sites for hot mix plants, borrow pits, quarry areas etc. are equally important, while improper disposal of construction waste (which could be contaminated by oils etc.), domestic waste, human waste (from portable toilets that are common in construction sites) may result in contamination and loss of productive land.

This is considered a negative minor impact in the absence of mitigation measures. The impacts are expected to be short term lasting only during construction phase. 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.

7.3.4.2 Operation Phase
Oil spillage and mixing with water may find its way in lands adjacent to the road, contaminating land. This is likely where drainage trenches are directed to the road environs, as is often common.

Immediately after the construction works are complete, there will be plenty of scope for erosion due to the left over materials and exposed soil. Heavy rain will aggravate the rate of erosion on embankments in the interchanges e.g. Ndenderu, Ruaka and Ruminig. However, this will reduce after re-vegetation and landscaping.

7.3.4.3 Decommissioning Phase
Demolition of temporary facilities and leakages e.g. oil spills during the process can be a source of land pollution.

7.3.5 Change in land use: loss of agricultural land and produce
7.3.5.1 Pre-Construction Phase
During pre-construction stage, project planning and preparation will include acquisition of land for the project. This will lead to conversion and loss of agricultural land. The areas which will be mostly affected include sections where interchanges are proposed e.g. Ndenderu interchange which currently are in use for small scale agriculture.

7.3.5.2 Operation Phase
The development of the road and other associated infrastructure will possibly trigger the conversion of more agricultural land in the environs, to commercial and residential purposes, given parts of Kiambu County can still be classified as rural areas. This may result in loss of productive land and agricultural produce.

7.3.6 Increased solid waste
7.3.6.1 Construction phase
Road construction sites can generate non-hazardous and hazardous wastes. Non-hazardous wastes will include excess fill materials from grading and excavation activities, rock and soil materials, concrete spills etc. Campsites and facilities set up to provide services to construction workers
wastes e.g. food will generate large sums of solid waste. Hazardous solid waste in this stage includes leftover paint, waste oil, and other petroleum-based fluids and petroleum-contaminated solids (e.g. oil filters, cans, wrappings) associated with garages and filling stations. Others include contaminated soils and sanitation waste which could potentially be encountered on-site. Both types of wastes could cause several issues of concern including obstructing drainage systems, foul smell and nuisance to the public, as well as accidents in cases where such materials in large quantities e.g. sand obstructs traffic.

Hazardous wastes including waste oil and petroleum-contaminated solids can result in soil and water contamination due to the presence of petroleum hydrocarbons. Such wrappings can also be ingested by animals causing harm given the field visits showed domestic animals roaming along sections of the road.

Similarly bitumen and asphalt and mostly bituminous mixtures containing coal tar should be disposed of properly to avoid contamination of soil.

7.3.6.2 Decommissioning Phase
Demolition of facilities will generate waste such as metal, wood, leftover oil. Leftover construction materials and debris will need to be cleared from sites.

7.3.6.3 Operation Phase
Usually as in the case in all other roads, dumping along the road and in the culverts and storm drains is a common occurrence. It results to poor aesthetics and blockage of storm drains. The dumping of such waste is from resident`s pedestrians, customers and shop owners with premises along the road. Such solid wastes includes non-biodegradable items such as plastic bottles, cans and nylon papers.

Routine maintenance of roads generates wastes in form of surfacing material, animal carcases, sludge and sediment from drainage systems, litter, metal (from barriers) etc. In cases where such materials are disposed off near the road, they can be washed back into the drainage systems, blocking and causing havoc during rainy seasons.

7.3.7 Loss of vegetation cover
7.3.7.1 Pre-construction Phase
The project area being mainly agricultural is dominated by a lot of vegetation cover. Along the proposed bypass, there are different types of vegetation ranging from grass cover to full grown trees e.g. *Grevillia robusta*, African flame trees, Mango trees, Nandi flame trees, pine trees, Jacaranda trees among others which will need to be cut and uprooted to pave way for the road. In some areas, e.g. near Kihara, a small patch of a man made forest can be found along the road. The loss of vegetative cover will mostly be minor negative impact but with a permanent effect. This contractor however can remedy this through landscaping with trees and grass cover in bare sections to provide soil cover.

7.3.7.2 Construction Phase
Road construction activities, transportation activities and other earthwork will also lead to accumulation of dust on the vegetation in the environs. This can lead to deterioration of vegetative
health, affecting the ecology and aesthetics. This is envisaged to be a short-term impact as dust generation is expected only during construction phase. And with frequent sprinkling of water on dust generation areas, the dust deposition problem on vegetation can be minimised.

Emissions e.g. exhaust gases, smoke etc. as a result of poorly serviced vehicles can settle on vegetation, causing interference with plant processes such as photosynthesis. However, such would only be a cumulative effect that results from large amounts of exhaust over considerably long periods of time.

### 7.3.8 Impact on Animal species

There are no notable wild animals save for insects and birds as there is an existing road in the area and development activities along the road. However, being an agricultural area, a number of domestic animals was witnessed along the road e.g. cows and goats. The impact on animals was considered insignificant during screening.

### 7.3.9 Introduction of invasive species

#### 7.3.9.1 Operation Phase

During re-vegetation and landscaping, utmost care and technical expertise is of paramount importance to avoid introduction of invasive species and weeds in the area.

### 7.3.10 Increase in storm water

The existing road is two lanes. The expansion of the road to a two lane dual carriageway (and in some sections service roads) will more than double the amount of impermeable surface area along the route. This will increase the amount of superficial water runoff. High storm water flow rates can lead to flooding.

### 7.3.11 Surface and underground water pollution

#### 7.3.11.1 Construction Phase

Physical hydrology in the project areas is not expected to be significantly affected considering the road is following the existing alignment and that there are no permanent surface water bodies along it. However, it is possible that from construction activities, water degradation occurs as a result of soil sedimentation, suspended solids, hydrocarbon residuals deposited on land, and accidental spills. Specific concern is that such residuals and spills can find their way into water bodies and result into the death of aquatic life in addition to contaminating the water. This is a major negative impact with widespread effects as storm water flows to streams, streams flow across boundaries eventually joining the rivers and other large water bodies. It has long term effects on the water bodies’ biodiversity. Also surface water regimes may be altered because of flow diversions and changes in water intake.

Construction activities will include the generation of large amounts of sanitary wastewater. Spills from portable sanitary units as is common in construction sites, and where waste water is not disposed properly, can have significant impacts on the environment including leaching into the soil potentially contaminating groundwater or nearby sources of water.

#### 7.3.11.2 Operation Phase

Mixing of oil contaminated waste water (from vehicle spills) and storm water runoff is not expected to be a major concern, unless in cases of accidental oil spills as happens with oil
transporting tankers. However, given that the road is a bypass, and thus will be in frequent use by trailers and trucks, there is need to consider the likelihood of occurrence of such events.

7.3.12 Increased water Demand
Roads require substantial amounts of water during construction. Abstraction of water from piped water supply (public water supply), nearby rivers and community sources such as boreholes, shallow wells will likely be an issue of contention. This can raise conflicts between the road contractor and local communities living close to the water source if water source is not sufficient for use by the two groups. This is envisaged to be a minor impact which can be dealt with by the contractor finding alternatives and seeking consent.

7.3.13 Alteration of natural drainage pattern
7.3.13.1 Construction Phase
During construction, the natural drainage system may be affected during excavation and construction activities leading to waterlogging and stagnation of storm water in some areas.

7.3.13.2 Operation Phase
Although the road currently exists, major improvements and introduction of features such as culverts will impact on the drainage pattern in the area. As the general topography of the area is hilly in some areas, with valleys existing, the road alignment in such areas and where overpasses and interchanges are involved will also result in localised changes in drainage patterns. This can result in stagnant waters down the hill or at the start of the interchanges. There could also be cases of drainage of water from the roads into people’s lands causing waterlogging.

7.3.14 Workmen Campsites, bitumen & asphalt plant, crushers, quarries, magazines, borrow pits, borehole and other Affiliated/secondary sites which support road construction.
7.3.14.1 Construction Phase and Operation Phase
These are affiliated facilities which support the road construction. They have varied positive and negative impacts. For example, workman campsites provide accommodation and office for staff and storage areas for construction vehicles and equipment. However, there are environmental impacts associated. For example (i) domestic wastes (sewage and garbage) running into water sources and land would pose health risks. (ii) Construction materials holding and preparation sites with waste oils, bitumen residuals, machine parts, etc. that could infiltrate into water sources, land and air. Effects are mainly people’s health and physical environmental degradation, (iii) Uncontrolled disposal of office wastes could also be a nuisance to the local inhabitants and the environment, (iv) Material sites (gravel, hard stones, sand and water) have risks to people’s safety, environmental pollution and degradation among other undesirable occurrences. Other impacts are social impacts such as increase in crime and prevalence of sexually transmitted diseases with the project affected communities.

The location for setting up the ancillary facilities for the proposed Nairobi Western Bypass had not been identified at the time of the assignment. More so such affiliated facilities tend to have varied impacts, and a detailed environmental impact assessment needs to be undertaken for each to identify such impact and propose mitigation measures.
8. SOCIAL IMPACTS

The development of the Nairobi Western Bypass will result in both positive and negative environmental and social impacts on the project site even though the project is generally beneficial to both the directly affected community and the government. This chapter is therefore meant to outline and weight these impacts, and suggest ways to avoid these impacts or significantly mitigate the unavoidable negative impacts.

8.1 Assessment of Anticipated Significant Impacts

The anticipated impacts of the proposed project on the environmental elements are both positive and negative. The assessment criteria of the significant impacts are as shown in the Table 8.1 below:

Table 8.1: Criteria for Assessing Significant Impacts

<table>
<thead>
<tr>
<th>Key</th>
<th>Type of impact</th>
<th>Key</th>
<th>Type of impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>++</td>
<td>Major positive impact.</td>
<td>+</td>
<td>Minor positive impact.</td>
</tr>
<tr>
<td>- -</td>
<td>Major negative impact</td>
<td>-</td>
<td>Minor negative impact.</td>
</tr>
<tr>
<td>0</td>
<td>Negligible/zero impact</td>
<td>NC</td>
<td>No change</td>
</tr>
<tr>
<td>Sp</td>
<td>Specific/localized</td>
<td>W</td>
<td>Widespread.</td>
</tr>
<tr>
<td>R</td>
<td>Reversible</td>
<td>Ir</td>
<td>Irreversible.</td>
</tr>
<tr>
<td>Sh</td>
<td>Short term</td>
<td>L</td>
<td>Long term.</td>
</tr>
<tr>
<td>T</td>
<td>Temporary</td>
<td>P</td>
<td>Permanent</td>
</tr>
</tbody>
</table>

On the basis of information gathered during both the desktop and field study, the potential positive and negative social impacts of the proposed project are tabulated below.

Table 8.2: Potential Positive Social Impacts

<table>
<thead>
<tr>
<th>Nature of anticipated positive impact</th>
<th>Pre-Construction</th>
<th>Construction</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local revenue generation</td>
<td>++,W</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employment creation</td>
<td>++,Sh, Sp</td>
<td>+,Sp</td>
<td></td>
</tr>
<tr>
<td>Increase incomes and improved livelihoods</td>
<td>++,Sh, Sp</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economic growth</td>
<td>++, L</td>
<td>++,W</td>
<td></td>
</tr>
<tr>
<td>Increase in property value</td>
<td>++</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ease of traffic pressure in the Nairobi city centre</td>
<td>++</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduced transport costs and accidents</td>
<td></td>
<td></td>
<td>++</td>
</tr>
</tbody>
</table>
Table 8.3: Potential Negative Social Impacts

<table>
<thead>
<tr>
<th>Nature of anticipated Negative impact</th>
<th>Pre-Construction</th>
<th>Construction</th>
<th>Operation</th>
<th>Decommissioning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land acquisition and involuntary resettlement and associated loss of structures</td>
<td>--, Sp, P</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
</tr>
<tr>
<td>Disruption of livelihoods, income and loss of revenue</td>
<td>--, Sp, Sh</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interference with social-cultural and setup of families</td>
<td>--, Sp, Sh</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disruption of utility services</td>
<td>--, Sp, Sh</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender inequality</td>
<td>-</td>
<td>Sh</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Traffic congestion and diversions</td>
<td>--, Sh, Sp</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Changing demographics and related concerns</td>
<td>-</td>
<td>Sh</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety and health outcome (occupational)</td>
<td>--, Sp, Sh</td>
<td>-</td>
<td>Sp, Sh</td>
<td></td>
</tr>
<tr>
<td>Safety and health outcome (Public)</td>
<td>--, Sh, Sh</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increase in traffic, traffic accidents and loss of life</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure on services</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 8.2 Positive Impacts

#### 8.2.1 Local revenue generation

**8.2.1.1 Pre-construction Phase**

County and Central government (agencies) will benefit from the payment of rates and fees e.g. through required approvals and registration.

The tax revenue base will also increase through Pay as You Earn (PAYE) deductions, Value Added Tax (VAT) and withholding taxes on goods and/or services rendered on site. More so the consumption of materials, oil, fuel and others will attract taxes including VAT which will be payable to the government hence increasing government revenue.

#### 8.2.2 Employment Creation

**8.2.2.1 Construction Phase**

One of the positive impacts during the project’s construction phase will be the availability of employment opportunities to casual, permanent etc. workers, and several other specialized workers. Employment opportunities are of benefit both economically and in a social sense. In the economic, apart from casual labour, semi-skilled and unskilled labour, formal employees e.g. drivers, supervisors, security personnel, machine operators, flagmen, engineers and foremen, among others are expected to obtain gainful employment during the period of construction estimated to be more than a year. Recruitment of such skills can be undertaken in consultation with the County Government of Kiambu. During the meeting on 12th January 2017, the County indicated the availability of skills surveys which can be of useful to the recruiters. Employment
bureaus may also be an option through which locals can register their interest in job opportunities created by the proposed project.

In addition, induced employment will result from improved business and trade during construction. For instance, businesses that provide services such as catering, cleaning services will hire workers to serve the new project and its employees.

The contractor should recruit construction workers locally regardless of gender. Discrimination on the basis of gender is outlawed.

Wherever possible, local people from the neighbouring areas should be considered for job opportunities matching their level of skills. Where possible, training and capacity building for willing and available youth can be an enhancement measure to enable the youth take advantage of the merging job opportunities, especially those that do not require very technical skills and which can be learnt in a short period. Adequate occupational safety and health principles and standards should be provided to ensure the work environment is conducive.

8.2.2 Operation Phase
During the operation stage, improvement in the industrial and commercial prospects in the area due to improved infrastructure will lead to an improvement in the economic situation thus helping the locals to obtain better employment opportunities.

8.2.3 Increased local incomes and improved livelihoods
8.2.3.1 Construction Phase
Informal businesses will benefit from the works. This is major positive impact, where those who provide services to the workers on site e.g. catering businesses will experience an upsurge in business. Similarly, the local community may get extra income from renting spaces for campsites, borrow pits, dumping sites, lease of ground for yards and temporary passage to pick materials.

8.2.3.2 Operation Phase
Increased labour mobility will result in people seeking better opportunities in as well as out of the county.

8.2.4 Economic growth
8.2.4.1 Construction Phase
Overall, the proposed project as part of the Nairobi Bypass Project plays a key role in the realisation of Vision 2030’s hopes for world class infrastructure for the transformation of the Kenyan economy. Through the use of locally available materials during the construction phase e.g. cement, steel metals and others; the project will contribute towards growth of the country’s economy by contributing to the gross domestic product.

8.2.4.2 Operation Phase
Infrastructure will improve the investment prospects of Kiambu County, spurring the already growing economy. Existing market centres are expected to grow with new businesses likely to emerge along the road corridor. Improved access and reduced travel time and cost due to the completion of the ring road will be a major stimuli to economic growth not only in Kiambu but also Nairobi and its metropolitan areas.
8.2.5 Increase in property value

8.2.5.1 Pre-construction and Construction Phase

Given the experiences of other road projects in the city e.g. Mombasa road and Thika Super highway, and their impact on adjacent land, land and property along the proposed Nairobi Western Bypass will experience a substantial rise in value due to a major infrastructural upgrade. Furthermore, given the proximity of the area to Nairobi, and the expected change in land use, property will generate higher returns for owners e.g. through development of more office space and high residential structures.

8.2.6 Ease of traffic pressure in the Nairobi City Centre

8.2.6.1 Operation Phase

The project will effectively ease the traffic pressure in the city centre of Nairobi, and improve transport system. Already the Northern, Southern and Eastern Bypasses are complete. The proposed Western bypass is critical to complete the exterior ring road around Nairobi City which shall divert the huge traffic volumes that get into or pass through Nairobi via the Nairobi Mombasa Highway, Nairobi- Isiolo Moyale Highway and the great North Highway roads resulting in serious traffic congestion in the city centre.

8.2.7 Reduced transport costs and Accidents

8.2.7.1 Operation Phase

The implementation of this project will reduce the cost of transport and reduce the traffic accidents. Gitaru road alignment was not designed to a high technical index. Right now, this is classified as a class E road with sections varying from average to poor condition. This leads to slow vehicle speed, more fuel consumption and likelihood for occurrence of traffic accidents. Furthermore, the current road is devoid of safety features such as central barriers and foot bridges. The development of this project will improve road conditions of the region’s road network, significantly improving the existing highway capacity and running speed, and provide fast and comfortable traffic environment but with significantly enhanced security and safety features such as lighting, walkways on both sides of service road, 0.5m width of foot path on both sides of underpasses, footbridges strategically located at Kwa Mbao stage, near Munyaka dispensary/Munyaka road, near Furaha/KAG Ndenderu, near Mirai court/Mifereji, Ndenderu interchange and other Pedestrian facilities.

Effective and enhanced connectivity will result in cost savings in fuel consumption and relatively less travel time due to proposed improvements

8.3 Negative Social Impact

8.3.1 Land acquisition and involuntary resettlement, and associated loss of structures

8.3.1.1 Preconstruction Phase

There are many structures along the existing alignment. A substantial number have been noted to encroach on the right of way, thus the residential and commercial structures shall be demolished in order to pave way for the construction of Nairobi Western Bypass. These are mainly temporary structures made of iron sheet and/or plastic roof and wall. In a number of cases, these encroachments in violation of the Traffic Act include permanent buildings.
Apart from such encroachments, the project’s Right of Way (RoW) although largely sufficient along the alignment, is not sufficient to accommodate the design scheme in some sections, e.g. where service roads are required. All major interchanges i.e. Ndenderu and Ruaka (refer back to Figures 2.12 and 2.14) require substantial amounts of land to effect. Table 8.4 provides preliminary estimates of the required land to show in total 111.64 hectares are required.

Table 8.4: Preliminary estimates for land acquisition

<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>Unit</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Land acquisition</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Main line (excluding interchange)</td>
<td>hectare</td>
<td>64.01</td>
</tr>
<tr>
<td></td>
<td>Interchange along main alignment</td>
<td>hectare</td>
<td>47.63</td>
</tr>
<tr>
<td>2</td>
<td>Buildings Relocation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Main line (excluding interchange)</td>
<td>m2</td>
<td>19,833</td>
</tr>
<tr>
<td></td>
<td>Interchange along main alignment</td>
<td>m2</td>
<td>37,220</td>
</tr>
</tbody>
</table>

This will cause loss of land and structures. Land required includes private land used for agricultural purposes, commercial (business), residential purposes, as well as public land. Similarly, structures are:

- Private: Involving residential buildings that range from temporary structures made of mabati to stone wall storeyed buildings, commercial structures such as petrol stations, private kindergartens etc. The proposed route was optimised after a meeting with the political unit to avoid affecting (structures) owned by major public schools and churches
- Public: These relate to essential services such as police posts and sanitary facilities such as the public toilet at Wangige market.

Roadside trees and bushes will also be cleared for the construction of the road. Ancillary sites such as borrow areas, quarry areas, contractor’s camps etc. will require land acquisition or leasing.

This will require a Resettlement Action Plan prepared in accordance with international standards which will then be implemented by the National Land Commission, with key emphasis on a safeguards approach and with the aim of livelihood improvement. Its scope and content has to follow due detailed requirements including objectives, potential impacts, socio-economic studies, legal and institutional framework, eligibility, valuation and compensation of losses, resettlement measures, relocation planning, community participation, grievance redress procedures, implementation schedule, costs and budgets, and monitoring and evaluation.
8.3.2 Disruption of Livelihoods, Income and Loss of Revenue Streams

8.3.2.1 Preconstruction Phase

The proposed land acquisition and involuntary resettlement will bear dire consequences for people and their livelihoods. Livelihood losses have been identified for:

- Traders who own businesses along the reserve corridor who will move to alternative sites. Majority are informal businesses such as carwash, garages, fruit and food vendors, motorbike repair sheds, second hand clothes sellers, construction materials sellers, car garage, kiosks, hair salons, barber shops, shoe repairers, fruits and vegetables sellers, among others. Loss of income and employment will be largely experienced by business owners and their employees. Majority of the businesses along the corridor generate their sales mostly from the employees in the shops, stalls and temporary sheds. The closure or relocation of businesses will therefore lead to loss of income for a substantial number of people.

- Matatu owners and workers who operate from Wangige Bus terminal, although temporarily. Boda boda owners and operators due to loss the recently constructed sheds e.g. at Wangige market.

- Land owners who generate income from their land either through commercial basis (e.g. rental income), agricultural production etc.

Similarly, a RAP will be needed to mitigate against these displacement effects.

8.3.3 Interference with social-cultural life and set up of families

8.3.3.1 Preconstruction Phase

During the public participation process, residents expressed fear of dispersal of families due to land acquisition and involuntary resettlement. This is largely because most family members received their land through subdivision and inheritance thus live in close proximity to each other.

The social life of residential tenants will be affected. This is largely because most will have to find alternative housing.

It is also possible that some cultural structures e.g. graves will be relocated, given parts of the area was rural.

8.3.4 Disruption of utility services

8.3.4.1 Preconstruction and Construction Phase

The construction activities will cause disruption of utility services such as electricity supply, water supply and sewage discharge therefore inconveniencing the community at large. During the meeting with utility companies held on 11th January at Sarova Panafric hotel, the Table below was generated, indicating affected companies and utilities.
Table 8.5: Preliminary List of Utility Relocation

<table>
<thead>
<tr>
<th>Utility Company</th>
<th>Description of nature of utilities and Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kenya Power and Lighting Company</td>
<td>• Overhead cables, Whole stretch of the road</td>
</tr>
<tr>
<td>Liquid Telecom</td>
<td>• 4km of fibre (underground) cable from Ndenderu to Ruaka found on the right side of the road coming from Ruaka towards Rumini, Gitaru interchange</td>
</tr>
<tr>
<td>Telecom</td>
<td>• Gitaru interchange, lower Kabete junction to Ndenderu, and at Ruaka interchange</td>
</tr>
<tr>
<td>Access Kenya</td>
<td>• 500m at Ruaka interchange</td>
</tr>
</tbody>
</table>
| Safaricom                           | • Whole stretch (at Wangige, Lower Kabete, road to Gachie, Ndenderu, Ruaka, Mwimuto, Gachie)  
                                      | • Small gap in the built up area in Ruaka     |
| Karuri Water                        | • 0.06km, 2 inch Upvc service pipeline crossing Gitaru-Ndenderu road at Karura market Centre  
                                      | • 0.06km, 2 inch Upvc service pipeline crossing Gitaru-Ndenderu road at Ndenderu market Centre  
                                      | • 0.6 km, 2 inch Upvc service pipelines running along the road reserve on both left and right sides of Gitaru-Ndenderu road. This pipelines are near Ndenderu and Karura market Centres  
                                      | • 3km, 3 inch Upvc service pipelines running along the road reserve on both left and right sides of Ndenderu-Ruaka road  
                                      | • 1km, 1.5 inch Upvc service pipeline running along the road reserve on both left and right sides of Ndenderu-Ruaka road |

Electricity supply disruption is of utmost concern as most power lines are within the road reserve and will require relocation as shown by Table 8.6.

Table 8.6: Preliminary List of Electricity Facilities Relocation

<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>Unit</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Main line (excluding interchange)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pole</td>
<td>No</td>
<td>224</td>
</tr>
<tr>
<td></td>
<td>Wire</td>
<td>meter</td>
<td>6,812</td>
</tr>
<tr>
<td>2</td>
<td>Interchange along main alignment</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pole</td>
<td>Un.</td>
<td>198</td>
</tr>
<tr>
<td></td>
<td>Wire</td>
<td>meter</td>
<td>9642</td>
</tr>
</tbody>
</table>

Most of these companies will also experience losses due to costs incurred in the process of relocation of the utilities.
8.3.5 Gender inequality

8.3.5.1 Construction Phase

During construction, benefits to local people can be maximized if the contractor recruits construction workers locally regardless of gender. He/she should also not discriminate in the employment of women. There is need to promote gender equality in all aspects of economic development. Women’s roles in road infrastructure construction are mainly confined to supply of unskilled labour and vending of foodstuffs to the construction workers.

The ratio of discrimination cases between genders by the project is not known. However many construction sites often employ women, not only as caterers in the camps, but also as unskilled construction workers during construction. In such cases, discrimination of salary between genders may result.

8.3.6 Traffic congestion and diversions

8.3.6.1 Construction Phase

Traffic may experience minor delays when diverted around active construction areas, but will be more severely hampered at the locations where temporary road closures are necessary.

Such hazard points should have proper signs indicating the nature of the problem envisaged. Additionally temporary road closures and diversions which should be strictly coordinated so that motorists can take safe, practical and short diversion routes. The effectiveness of the traffic control measures should be monitored during construction and adjustments made as necessary.

8.3.7 Changing demographics and related concerns

8.3.7.1 Construction Phase

The project will trigger an influx of persons into the area. This will include Chinese and Kenyan nationalities of different background and cultural orientation. This can trigger tensions and conflicts as people compete for jobs and other resources, lead to an increase in sexually transmitted diseases, prostitution, substance abuse, increase in crime and insecurity e.g. vandalism

Theft and other criminal activities might be sparked off as a result of overgrown bushes, weeds, grass and trees along the road, as these areas provide good hiding points for criminals and people with ill motives.

8.3.8 Health and Safety Outcomes (occupational)

8.3.8.1 Construction Phase

During construction, there will be over 300 workers working on the proposed project. The occupational health and safety concerns likely to arise include; accidents related to:

- Physical hazards – this can be from operating machinery and moving vehicles, working at heights, exposure to weather elements, noise, work in confined spaces, trenching, contact with overhead power lines, falls from machinery or structures, and risk of falling objects
- Industrial hygiene hazards - may be principally associated with exposures to dust during construction and paving activities; exhaust emissions from heavy equipment and motor
vehicles and handling of chemicals without use of proper personal protective equipment or studying material safety data sheets.

- **Noise** – workers may be potentially exposed to extremely high levels of noise from heavy equipment operation and from working in proximity to vehicular traffic. As most of these noise sources cannot be prevented, control measures should include the use of personal hearing protection by exposed personnel and implementation of work rotation programs to reduce cumulative exposure.

- **Fire outbreaks**

Without adequate controls, there will be potential adverse impacts on workers arising from inconsistent management of occupational health.

### 8.3.9 Safety and health outcomes (public)

#### 8.3.9.1 Construction and Operation Phase

Besides construction-related impacts, the public may be exposed to a number of safety and health risks including:

- Increase in the number of accidents in the area during construction. Construction sites along the project roads are usually dangerous with large scale excavated land, debris, heavy machineries, cut trees (waiting for transportation). This can be exacerbated by poor signage.

- Increase in safety risk for children especially since the route has a number of schools and kindergartens e.g. Aloe Vera preparatory school, Highbridge academy, Ndenderu Primary School. Particularly, peak hours in the morning and evening pose the highest risk to children.

- Increased health related e.g. Respiratory diseases to residents of the area due to the expected upsurge of vehicles and increased emissions.

- Operation of the contractor’s campsite may also contribute to spread of communicable diseases such as HIV/AIDS.

### 8.3.10 Increase in traffic, traffic accidents and loss of life

#### 8.3.10.1 Operation Phase

Some sections of the bypass are in highly populated areas or adjoin markets and small centres. This will necessitate the need of the residents to cross the bypass road regularly in order to access services such as schools, religious centres and hospitals. Therefore there is a risk of road accidents involving motorists and pedestrians who are crossing. Often, where designated crossings are perceived as far, pedestrians will create shortcuts for instance through vandalising central barriers. This could be a major cause of accidents.

Creation of illegal U-turn, links and access roads by motorists for general convenience poses a major risk on all road users. A road where crossings are not designated or marked, can also result in accidents.

A factor of consideration is induced traffic i.e. the new added traffic volume owning to the completion and opening of the proposed project to traffic as well as accompanying developments in real estate in the area as a result of the road, as experiences from Mombasa road and Thika...
superhighway have shown. Induced traffic means that the predicted congestion benefits of a new road can often be quickly eroded.

8.3.11 Pressure on services

8.3.11.1 Construction and Operation Phase

Related to the increase in induced traffic, there is a possibility of pressure on resources e.g. sewerage systems, waters services, solid waste management systems, feeder roads if such services are not improved in line with the increasing population in an area. Infrastructure development can accelerate the rate of urban population growth putting larger pressure on County Government and other infrastructure.
9. MITIGATION / ENHANCEMENT MEASURES FOR THE NEGATIVE ENVIRONMENTAL AND SOCIAL IMPACTS

This chapter highlights the necessary mitigation measures that will be adopted to prevent or minimize significant negative environmental and social impacts of the proposed project during its construction, operation and decommissioning phases. The chapter groups most of the impacts identified in Chapters 7 and 8 into broader themes. However, the Environmental and Social Management and Monitoring Plan (ESMMP) in Chapter 10 details these mitigation measures to ensure sustainability of the project, from construction through to operation.

9.1 Social Enhancement Measures

Largely in terms of social enhancement measures, KeNHA i.e. the proponent, the County Government of Kiambu and the contractor should build on the established relationship to institute a working arrangement that will ensure the local population benefits to the maximum extent possible from the proposed project. During the meeting with the County Government of Kiambu, they noted the presence of a skills survey. In addition, employment bureaus can be established for registration of interested locals, with priority accorded to those neighbouring and affected by the project, with extension to the larger county where relevant skills are missing in the environs.

Gender equality is key to ensure women access equal job opportunities as their male counterparts.

Capacity building should be undertaken to ensure the local community takes advantage of the available employment opportunities provided by the project.

The contractor should also prioritise local and Kenyan service providers for aspects related to e.g. waste management. Such can also include prioritisation of youth, women groups and people with disability in matters of landscaping and tree planting during rehabilitation of the route after construction of the road.

In addition, using labour-based construction methods generates massive local employment opportunities which can be explored.

Where possible, social enhancement can include Corporate Social Responsibility endeavours within the area, undertaken by the proponent and/or the contractor.

9.2 Environmental Impacts

9.2.1 Air quality degradation mitigation measures

Air quality degradation shall be mitigated by adhering to the provisions of EMCA (Air Quality) Regulations, 2014. In addition to the measures in the ESMMP, the consultant has undertaken an air quality baseline survey that establishes the baseline conditions to benchmark against during construction and operation. The contractor is required to maintain and service all construction vehicles and machinery periodically to ensure efficiency in fuel combustion thus reducing exhaust emissions and water construction sites, transportation routes, diversions and materials handling.

16 Local does not mean ethnic in this report and should not be construed as so.
sites on dry and windy days, especially if near sensitive receptors, such as the areas occupied by the major shopping centres, residential clusters and institutions such as schools and churches.

9.2.2 **Noise and excessive vibrations mitigation measures**
The proponent shall ensure compliance with the permissible environmental noise standards stipulated in Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009 and occupational noise limits provided by Occupational Safety and Health Act (Noise prevention and Control) rules, 2005 as well as other provisions relevant to the construction activities. A baseline noise levels survey has been undertaken by the consultant and which will form the benchmark against which the contractor shall work to ensure permissible levels of noise are not exceeded.

9.2.3 **Changes on topography, appearance and aesthetics**
The proponent shall ensure that all construction wastes are disposed as per EMCA (Waste Management) Regulations, 2006. In addition, cut slopes should be vegetated immediately after construction activities to prevent soil erosion and improve appearance.

9.2.4 **Soil erosion and contamination**
The construction sites should be stabilized through installation and maintenance of erosion controls so that they remain effective during rainy seasons. Side drains shall be lined with concrete or stone pitched in order to avoid erosion. Re-vegetation of disturbed areas progressively as each section of works is completed is paramount as this will also stabilize the soils.

9.2.5 **Increased Solid Wastes**
The 3R Waste Management Approach, i.e. Reduce, Reuse and Recycle shall be implemented, whereby waste shall be segregated at source so as to determine recyclables especially at the campsite. All waste including hazardous waste should be handled by companies licensed by NEMA. The proponent / contractor should also re-use excess fill materials where possible e.g. to improve earth roads in the neighbourhoods.

9.2.6 **Loss of vegetation cover**
Right-of-way clearing should be limited to the areas required for construction and tree planting along the road should be undertaken as per permit conditions issued by the Kiambu County - Department of Water, Environment & Natural Resources.

Incorporation of landscaping and reforestation in road projects is key in restoration of the environment. It also serves as a beautification exercise that aims at improving the aesthetics and the microclimate of roads. The contractor is thus required to implement a comprehensive re-forestation/afforestation/re-vegetation and landscaping programme. This can be achieved in various ways including donations of suitable tree seedlings to the neighbourhood, the Constituency Development Fund and/or subcontracting the tree and grass planting exercise along the road. Particularly, the contractor is required to restore the biological environment along the current to a better state than currently exists.

9.2.7 **Water pollution**
The proponent shall adhere to the EMCA (Water Quality) Regulations 2006 to prevent water pollution. This shall be through implementation of erosion and sediment control measures such as
silt fences, use of oil/grease interceptors at the campsite to filter oil before waste water is discharged into the septic/soak pits, and designing storm water drains such that they are separated from storage areas containing dangerous goods or hazardous waste where spills are possible so as to prevent disposal in the storm waterway. Also, hazardous substances spills should be dealt with as soon as they occur through removal of all the affected soil promptly and dumping this in clearly labelled containers with lids for disposal later as hazardous wastes in accordance with EMCA (Waste Management) Regulations, 2006.

9.2.8 Increased water demand
The road construction activities may increase water demand thus the proponent should seek a permit to drill a borehole and abstract water from the Water Resources Management Authority (WRMA) and NEMA as well.

9.2.9 Alteration of natural drainage system
The existing natural drainage systems should be improved by use of culverts designed to overcome waterlogging. During operation phase, the natural flow system during heavy rains should be monitored and improvements made where necessary.

9.2.10 Workmen Campsites, bitumen & asphalt plant, crushers, quarries, magazines, borrow pits, borehole and other Affiliated/secondary sites which support road construction
Each of these affiliated facilities has unique environmental impacts and therefore the proponent should undertake an Environmental Impact Assessment for each of these and submit a copy to the National Environmental Management Authority for the purpose of Licensing.

9.2.11 Other Environmental mitigation measures
The contractor- China Roads and Bridge Corporation, will also be required to submit to the proponent KeNHA stand alone:

- Waste (Solid and Liquid) Management Plan
- Spill Prevention and Response Plan

In addition environmental monitoring of the road after construction, and for a period not less than one year is essential to check on a number of key areas that are subject to cause environmental concerns. The scope of the monitoring and maintenance related work should include (but not limited) to:

- Dust management and debris removal requirements and performance
- Ditch and watercourse performance
- Drainage and floodplain appliance performance
- Roadside vegetation performance including weed abatement, grass control and performance, moss on hard surfaces, hedge/tree removal
- Highway risks and vandalism
- Visual impairment and signage
- Road furniture performance
9.3 Social Impacts

9.3.1 Land & asset loss, involuntary resettlement, Disruption of livelihoods, income and loss of revenue

A major mitigation measure is the need for a comprehensive Resettlement Action Plan to address the displacement effects of the proposed project i.e. to guide in the relocation and compensation of the Project Affected Persons (PAPs) along the corridor; In terms of scope and the level of detail, such a RAP should at the very least include:

- Objectives
- Potential impacts
- Socio-economic studies
- Legal and institutional framework,
- Eligibility, valuation and compensation of losses,
- Resettlement measures and relocation planning
- Community participation
- Grievance redress procedures
- RAP implementation schedule, costs and budgets
- Monitoring and evaluation.

Other measures include:
- Compensation according to RAP;
- Restoration of livelihoods as guided by RAP;
- The County Government of Kiambu should find alternative market places as resettlement sites for the traders to be displaced.

9.3.2 Disruption of utility services

The January 12 2017 meeting with utility companies should act as the start of more proactive and meaningful engagement to ensure a more organized framework for placement of structures and common utilities on highway reserves and proactive approach to removal and relocation of services and utilities is attained. This will lead to environmentally friendly and socially acceptable strategies e.g. the proposed common service ducts as well as to minimize disruptions to consumers through well planned and coordination of relocation of the relevant services.

In addition, during the process of relocation, the responsible authority should communicate, giving considerable notice, of any intended disruption of the services to enable the people to prepare for alternatives and pollution incidences should be immediately reported to NEMA - Kiambu County.

9.3.3 Gender inequality

Efforts should be put in place to ensure that both men and women take part in project preparation and implementation. Distribution of jobs during construction shall be guided by the national policy of at least 30% to be women employed. In addition, the proponent & contractor shall be obliged to develop a code of conduct to ensure no abuse takes place at the working areas. Appropriate facilities including rest places and ablution facilities should be provided for both women and men.
9.3.4 Traffic congestion and diversions
The proposed project will cause temporary traffic congestion and diversions especially during construction phase. Appendix M contains proposals for traffic management including priority construction of service roads and diversions so as not to interfere with traffic flow as the existing road is already a busy road, as well as improvement of some feeder roads which can be used as diversions.

The proponent and contractor shall update these into a comprehensive traffic management plan which will guide on how to manage traffic during construction. Information and warning signs about diversions shall be deployed at strategic locations during construction to provide accurate and timely information to motorists, and enable them to make rational decisions on routing choices. Temporary manual traffic control shall also be used when construction occurs at signalized intersections on adjacent arterials or roadways.

In addition, the proponent is advised to consider an additional interchange at Kingeero given this was a recurring concern in all the meetings.

9.3.5 Safety and health outcome
Main is the development of a comprehensive Occupational, Health and Safety Plan.

The proponent should ensure adherence to the occupational health and safety rules and regulations stipulated in Occupational Health and Safety Act, 2007. In this regard, the proponent in conjunction with the contractor shall develop a comprehensive Occupational, Health and Safety Plan as a first step into ensuring Occupational Health and Safety. In addition to that, Personal protective equipment (PPE) of recommended quality shall be provided for all employees and replaced when need be. There shall be adoption of safe equipment and machinery use methods, training programs, undertaking of regular internal and annual statutory Occupational Safety and Health audits, installation of barriers to deter pedestrian access to the roadway except at designated crossing points, designating passage ways for road users, use of protective barriers to shield workers from traffic vehicles, designating a Safety Environment and Health Officer to enforce the safety and health management plan and to monitor implementation among other mitigations in the next chapter.

9.3.6 Increase in traffic, traffic accidents and loss of life
Clear signage and speed bumps shall be erected where large numbers of pedestrians are expected to be crossing the road e.g. at shopping centres, churches, schools. A central barrier has been proposed by the contractor to prohibit people from crossing the road at undesignated areas. For pedestrian safety, measures proposed in the road designs include:

- Walkways on both sides of service roads
- 0.5m width of foot path on both sides of underpasses
- Footbridges strategically located at:
  - Kwa Mbao stage,
  - Near Munyaka dispensary/Munyaka road,
  - Near Furaha/KAG Ndenderu,
  - Near Mirai court/Mifereji, and
  - Ndenderu interchange
In addition, given the high number of schools and churches along the proposed route, the proponent and contractor are advised to take measures to enhance safety for children.

Overgrown trees, grass and ornamental shrubs shall be pruned regularly to eliminate hiding spots and to enhance security of road users.

### 9.3.7 Pressure on services

Related to the increase in induced traffic, there is a possibility of pressure on resources e.g. sewerage systems, waters services, solid waste management systems, feeder roads if such services are not improved in line with the increasing population in an area. It is recommended that the County Government of Kiambu plans accordingly for the provision of these essential services.

### 9.3.8 Other Social Mitigation measures

The contractor will be required to submit an Occupational Health and Safety Plan to the proponent before commencement of work.

The Contractor shall be required to register the construction site(s) as workplace with the Directorate of Occupational Safety and Health (DOSH) services under the Ministry of Labour, Social Security and Services.

In addition to the Full EIA study, the Contractor is required to meet the following:

- An annual Environmental Audit
- A Fire audit, risk assessment and safety and health audit has to be conducted for the sites at least once every year.
10. ENVIRONMENTAL AND SOCIAL MANAGEMENT AND MONITORING PLAN (ESMMP)

Most of the impacts often have to be addressed in the proactive design of the project and other mitigations can only be guaranteed through active and responsible management committed to the propositions of the Environmental and Social Management and Monitoring Plan (ESMMP).

An Environmental and Social Management and Monitoring Plan (ESMMP) outline is developed to ensure sustainability of the project, from construction through to operation. The plan provides a general outlay of the activities, associated impacts, mitigation action plans and appropriate monitoring indicators. Implementation timeframes and responsibilities are also defined. The primary responsibility for the integration of the mitigation measures for the proposed development lies with the project proponent and by extension the contractor during the construction stage, while the proponent takes over the duty upon commissioning of the project. At every stage, the objective should be to ensure that the specified mitigation measures are implemented.

Environmental monitoring on the other hand is an essential component for the entire project lifespan. This describes the processes and activities that need to take place to characterize and monitor the quality of the environment. Annual Environmental Audits throughout the lifespan of the project and other checks by the authority (NEMA), lead agencies, communities and interested parties, where and when need arises, are critical towards the full implementation of a monitoring plan. These forms of monitoring are undertaken to establish if the project implementation has complied or is in compliant with the set environmental management standards as articulated in the EMCA, CAP 387, the EMCA amendment 2015, and its attendant Environmental (Impact Assessment and Audit) Regulations, 2003.

The Social element relates to, and covers health and safety issues, for workers on site, neighbours and the general public. Thus the ESMMP becomes a broader and holistic aspect of protecting the worker, the workplace, the tools / equipment, neighbours and the general public and the biotic environment. It is an essential tool in determining the EIA study. As far as health and safety is concerned, the objective of the ESMMP is to develop rules that will regulate environmentally instigated diseases and occupational safety measures during construction and the operation phases of the proposed project by:

- Avoidance of injuries;
- Provision of safe and healthy working environment for workers comfort so as to enhance maximum output;
- Control of losses and damages to plants, machines, equipment and other products;

It is the primary responsibility of the proponent (and later the contractor) to promote a safe and healthy environment at the workplace and within the neighbourhood in which the proposed project will be constructed by implementing effective systems to prevent insecurity, occupational diseases
and ill-health, and to prevent damage to property. This ESMMP should be used as a tool and a checklist by the contracted engineers in planning and modification of the project.

Table 10.1 below summarizes the ESMMP for the proposed Nairobi Western Bypass Project. It describes parameters that can be monitored, suggests how monitoring should be done, and indicates the actors responsible for monitoring and estimated costs. In addition, the project should endeavour to ensure that the site manager or engineer is accessible in case of complains by the neighbours. This should act as the designated person to handle complains and resolve them as fast as possible to avoid inconveniences to the project neighbours, seeking to establish and maintain good relations.
10.1 Environmental Impacts management and Monitoring plan matrix

Table 10.1: Environmental Management and Monitoring Plan

<table>
<thead>
<tr>
<th>No.</th>
<th>Nature of Negative environmental Impacts</th>
<th>Mitigation Measures</th>
<th>Monitoring Requirements</th>
<th>Responsibility and time frame</th>
<th>Performance Indicators/targets to achieve</th>
<th>Cost per year (KES)</th>
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</table>
| (i) | Air quality degradation (From dust and particulate matter -Exhaust emissions from construction machinery) | • Undertake air quality baseline survey so as to establish baseline conditions to benchmark against during construction.  
• Construction sites, transportation routes, diversions and materials handling sites to be water-sprayed on dry and windy days, especially if near sensitive receptors, such as the areas occupied by the major shopping centres, residential clusters and institutions such as schools and churches;  
• Trucks to be covered with clean impervious sheeting during haulage of friable and loose construction materials to ensure that dusty materials does not leak from the vehicles;  
• Dust generating project activities sites will be cordoned off with dust trappers to minimise dust migration to nearby facilities by wind e.g. excavation works  
• Travel speeds of construction vehicles especially through business centres and institution areas will be controlled by use of signage, speed bumps and driver awareness programs. The maximum speed limit shall be 50km/hr;  
• Construction equipment will be maintained in good operating condition to reduce exhaust emissions;  
• Construction work should be undertaken by an experienced and duly registered contractor with a | • Dust level within the route  
• Public complaints from affected communities  
• Air quality monitoring audits at the construction sites  
• Register of PPE provided to persons exposed to dust  
• Speed limits signage and enforcement policy  
• Maintenance logs of construction machinery with an aim to reduce fugitive emissions associated with machine inefficiency  
• Screening of dusty sections  
• Status of vegetation whether covered with dust or not  
• Evidence of implementation of the  
• Grievance handling mechanism | CRBC / RE (Preconstruction, construction & decommissioning phase) | • Minimal complaints from neighbouring community  
• Nil visible particulate matter in the air  
• Plant leaves without excess dust cover | 1,200,000.00 |
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</table>
|     | Verifiable sense of environmental awareness and responsibility  
  • The location and operation of asphalt batch plants to be sited as far as possible from sensitive receptors.  
  • Staff working in dust generating activities e.g. site preparation, excavation, concrete mixing, stone dressing should be provided with appropriate dust masks.  
  • Wet crushing of aggregate to curtail or reduce dust emission.  
  • Maintain and service all construction vehicles periodically to ensure efficiency in fuel combustion thus reducing exhaust emissions | | | | | | |
| (ii) | Noise and Excessive Vibrations  
  (Noise and excessive vibrations from construction machinery and activities) | Maintain construction equipment properly as most noise originates from equipment. For example replacement of worn, loose or unbalanced machine parts that cause vibration, keeping machines well lubricated to reduce friction and adjusting belts valves and tightening bolts  
  • Damp noisy parts and equipment by installing sound absorbing materials or vibration isolation system’s  
  • Be careful when selecting equipment to avoid use of old or damaged machinery with high level of noise emissions that would have a negative impact in the environment. | Noise survey in accordance with Noise prevention and control rules, 2005  
  • Replacement of ear protectors  
  • Hearing conservation programme implementation  
  • Noise and excessive vibration complaints register | CRBC&RE (Preconstruction, construction & decommissioning phase) | Hearing Conservation programs  
  • Evidence of implementation of the  
  • Grievance handling mechanism | 1,200,000.00  
  Some mitigation measures e.g. signage prohibiting hooting near sensitive receptors to be included in BoQ |
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|     |                                        | • Maximize the offset distance between noisy equipment and residential and institutional receptors  
    |                                        | • Ensure compliance with the permissible environmental noise standards stipulated in Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009 and occupational noise limits provided by Occupational Safety and Health Act (Noise prevention and Control) rules, 2005 as well as other provisions relevant to the construction activities.  
    |                                        | • Ensure formation of community liaison avenues to deal with the residents’ concerns and seeking resolutions of the same at an early stage in an amicable manner.  
    |                                        | • Undertake baseline noise levels in sections with sensitive receptors such as residential, institutions and trading centres. These shall form the benchmark against which the contractor shall work not to exceed by 5 decibels.  
    |                                        | • Schedule regular inspection and spot checks for all noise generating equipment.  
<pre><code>|                                        | • If the EIA license permits night construction, then the contractor shall regulate night time uses of certain noisy machines, such as concrete vibrators and pile drivers. Such machines should be used during the day. |
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<td></td>
<td>Limit the times of construction to daylight hours (8am-5pm) in the vicinity of sensitive receptors. Further to minimize noise impacts near sensitive receptors (particularly schools), operation of excavator and other heavy machineries should be carried out mostly during off-hours eg.3.30 pm to 7 pm and on holidays (Saturday and Sundays).</td>
<td>CRBC/RE (Throughout the construction &amp; operation phase)</td>
<td>Proper waste management</td>
<td>Vegetated slopes</td>
<td>Included in BoQ for construction</td>
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<td></td>
<td>Undertake follow up noise monitoring during the construction phase.</td>
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<td></td>
<td>Put up signage to prohibit hooting at areas where there are institutions and religious establishments.</td>
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<td>(iii)</td>
<td>Changes on topography and landscape (Loss in aesthetic beauty of the project area mainly due to the earthwork. -Scarring of landscape. -Improper disposal of solid wastes causing poor aesthetics along the proposed</td>
<td>Ensure all construction wastes are disposed as per EMCA(Waste Management) Regulations, 2006 Cut slopes should be vegetated immediately after construction activities to prevent soil erosion and improve appearance.</td>
<td>Contracts with licensed waste handler and transporter Development and implementation of integrated solid waste management system. The contractor should prepare and submit this to the proponent before works begin. Vegetation schedule of cut slope areas</td>
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<td>No.</td>
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<td>(iv)</td>
<td>Land degradation</td>
<td>Avoid wherever possible clearing areas of highly erodible soils and steep slopes which are prone to water and wind erosion;</td>
<td>Vegetation of slopes</td>
<td>CRBC &amp; RE (construction period)</td>
<td>Stable soils in disturbed areas</td>
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<td></td>
<td>Exposure of soil surfaces to rain and wind during site clearing, earth moving, and excavation activities</td>
<td>Vegetate and mulch progressively as each section of works is completed. The interval between clearing and vegetation should be kept to an absolute minimum;</td>
<td>Maintenance of soil erosion devices</td>
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<td>Absence of contaminated soils by spills</td>
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<td>Coordinate work schedules, if more than one contractor is working on a site, so that there are no delays in construction activities resulting in disturbed land remaining un-stabilized.</td>
<td>Adequate spill management equipment</td>
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<td>Program construction activities so that the area of exposed soil is minimized during times of the year when the potential for erosion is high, for example during rainy season;</td>
<td>Annual audits to monitor and analyse soil samples from the spill affected area in comparison to the baseline conditions</td>
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<td>Stabilize the site and install and maintain erosion controls so that they remain effective during any pause in construction. This is particularly important if a project stops during the wetter months;</td>
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<td>Reducing or preventing off-site sediment transport through use of settlement ponds, silt fences, and water treatment, and modifying or suspending activities during extreme rainfall to the extent practical;</td>
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<td>Side drains to be lined with concrete or stone pitched; and</td>
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<td>Embank slopes to avoid erosion.</td>
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| (v) | Increased Solid Wastes (Non-hazardous solid waste generated at construction sites includes excess fill materials from grading and excavation activities, scrap wood and metals, and small concrete spills. Other non-hazardous solid wastes include campsite wastes and construction workers wastes e.g. From foods, and drinks packaging). | - Waste from road construction shall be disposed in designated waste receptacles only;  
- Waste generators to ensure that waste is transported by a company which is licensed to transport and dispose of waste in designated waste facilities;  
- Use the 3R Waste Management Approach, i.e. Reduce, Reuse and Recycle whereby waste shall be segregated – plastics, glass, tins, papers, wood, metals etc. (later to be re-used or recycled);  
- Licensed solid waste handlers to collect the solid waste at regular intervals.  
- Engage a hazardous waste handler to collect hazardous wastes.  
- Licensed private artisan groups (Jua Kali) to provide avenue for reuse of old and disposable items hence reducing the volume of the garbage at the site during the whole project cycle;  
- Re use excess fill materials where possible e.g. to improve earth roads in the neighbourhoods;  
- Keep records of waste volumes/masses and types collected by the contracted entity.  
- Education and training for employees to help ensure that proper waste reduction, sorting, and disposal procedures are followed. | - Site plan showing waste receptacles and design  
- Solid waste collection schedules  
- Waste segregation points  
- Adequate waste receptacles  
- No burning of solid waste  
- documented particular care when handling hazardous waste | CRBC /RE (Preconstruction, construction, operation & decommissioning phases)) | - Copies of contractual agreements with licensed waste handlers  
- Adequate waste receptacles  
- Waste management plan in place | 3,000,000.00 |
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<th>No.</th>
<th>Nature of Negative environmental Impacts</th>
<th>Mitigation Measures</th>
<th>Monitoring Requirements</th>
<th>Responsibility and time frame</th>
<th>Performance Indicators/targets to achieve</th>
<th>Cost per year (KES)</th>
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</table>
| (vi)| Loss of vegetation cover | • Right-of-way clearing should be limited to the areas required for construction.  
• Tree plantation along the road shall be undertaken as per permit conditions issued by the Kiambu County-Department of Forests and Agriculture.  
• The species shall be suitable for local climate  
• Proper care shall be taken to increase survival rate of saplings like regular watering, pruning, provision of tree guards, manure for better nourishment, etc. including timely replacement of perished saplings. | • Selective vegetation removal  
• Landscaping with vegetation  
• Maintenance program of saplings | CRBC and Resident Engineer (RE) (Pre-construction, operation phase) | • Greenery along the entire route | Should be included in the (Bill of Quantities (BoQ)) |
| (vii)| Water pollution (from hazardous substances, soil erosion, solid wastes) | • Implementation of erosion and sediment control measures such as silt fences.  
• Cover open stockpiles of construction materials with tarpaulin or similar fabric during rainy season.  
• Grit traps to be incorporated as part of the drainage system.  
• Removal of soil vegetative cover should be kept at minimum and should only be carried out with absolute necessity.  
• Installation of oil/grease interceptors at the service yard bridge before waste water is discharged into the septic/soak pits at the campsite.  
• Proper maintenance of the oil waste water treatment plant to ensure maximum efficiency;  
• Waste water discharged from the oil waste water treatment station into the sewer line/soak pit should comply with the standards set out in the fifth schedule of the EMCA (Water Quality) Regulations, 2006. | • Silt fences maintenance  
• Grit traps efficiency and regular cleaning schedule  
• Tarpaulins placed over stockpiles to prevent migration of grit to water bodies  
• Spill management plans  
• Condition of landscaping | CRBC& RE (construction & operation period) | • Zero or minimal siltation in nearby water bodies | 2,800,000.00 Other works to be included in BoQ e.g. storm water drainage |
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<tr>
<td></td>
<td>• Separate storm water drainage and sewerage systems.</td>
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<td>CRBC &amp; RE (Construction phase)</td>
<td>• EIA license for boreholes if any</td>
<td>400,000</td>
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<td>• Storm water drains should be well separated from storage areas containing dangerous goods or hazardous waste where spills are possible so as to prevent disposal in the storm waterway.</td>
<td>• Assessment of water demand and impact on local supplies</td>
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<td>• WRMA permits to drill borehole, abstract surface water, underground water and to drill a borehole from WRMA</td>
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<td></td>
<td>• Absorbent materials such as saw dust should be available at maintenance and repair areas and at storage areas, in order to clean up small spills from leaks or due to repairs.</td>
<td>• Conduct EIA for proposed boreholes and obtain License from NEMA</td>
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<td></td>
<td>• Water use audits</td>
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<td></td>
<td>• It is advised that hazardous substances spills be dealt with as soon as they occur through removal of all the affected soil promptly and dumping this in clearly labelled containers with lids for disposal later as hazardous wastes in accordance with EMCA(Waste Management) Regulations, 2006.</td>
<td>• Seek permits to abstract surface water, underground water and to drill a borehole from WRMA</td>
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<td>(viii)</td>
<td><strong>Increased water demand and possible water related conflicts (due to road construction activities which require large quantities of water)</strong></td>
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<td>• Seek acceptance for water abstraction from the local community to avoid possible conflicts</td>
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<td>• Depending on the water quantity, the contractor shall sink a borehole to supplement water needs for both road construction and campsite.</td>
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<td></td>
<td>• Seek permit to drill and water abstraction from Water Resources Management Authority (WRMA) and NEMA as well.</td>
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<td>• Monitor water use and keep records.</td>
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<td></td>
<td>• Conduct regular audits of water systems to identify and rectify any possible water leakages.</td>
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| (viv) | Alteration of natural drainage system | • Improve the existing natural drainage systems.  
• Culverts should be designed to overcome waterlogging problem in the area.  
• Monitor the natural flow system during heavy rains and make improvements where necessary.  
• Clear blocked drainage channels.  | • Monitor drainage systems | CRBC & RE (Construction phase) | • Functional drainage system  
• Unobstructed drainage  
• Incidences of flooding | 500,000  
Majority of works to be included in BoQ |
| (viv) | Workmen Campsites, bitumen & asphalt plant, crushers, quarries, magazines, borrow pits, borehole and other Affiliated/sec ondary sites which support road construction | • Undertake Environmental Impact Assessment for each affiliated site and submit a copy to the National Environmental Management Authority for the purpose of Licensing.  
• Wet Crushing to reduce dust.  
• Adhere to blasting regulations.  
• Develop rehabilitation plans for all ancillary sites and facilities  
• Motor vehicles plying the route to comply with the provisions of EMCA (Air Quality) Regulations, 2014; standards provided by the codes of practice for the inspection of motor vehicles in Kenya  
• Planting vegetation (trees) along the verges to reduce the spatial range of air emissions especially particulates.  
• Put up signage to prohibit hooting at areas where there are institutions and religious establishments.  
• Provide adequate secondary containment for fuel storage tanks and for the temporary storage of other fluids such as lubricating oils and hydraulic fluids; Concreting the base and bunding of fuel storage/generators is key.  
• Use impervious surfaces for refuelling areas and other fluid transfer areas;  | • Annual audits in accordance with EMCA (Environmental Impact Assessment and Audit regulations, 2003.  
• Air quality monitoring  
• Adequate signage | CRBC  | • Annual and self-environmental audits  
• Minimal public complains | 5,000,000 |
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<th>Performance Indicators/targets to achieve</th>
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|     | - Train road construction workers on the correct transfer and handling of fuels and chemicals and the response to spills;  
      - Storage sites for hazardous substances e.g. petroleum products to be secured and signs to be posted which include hazard warnings, who to contact in case of a release (spill), access restrictions and under whose authority the access is restricted will be posted.  
      - If stored outside, containers to be labelled and products stored in weather-proof containers on spill containment pallets and under a weather-proof tarp, the contractor/spill response coordinator will monitor periodically for leaks, and check to ensure that labels are still present and legible.  
      - Once the exact areas where soil disturbance are identified subsurface investigations of the areas to be disturbed should be conducted. The investigations should involve the collection of subsurface soil and groundwater samples for laboratory analysis.  
      - All applicable national laws, regulations and standards for the safe use, handling, storage and disposal of hazardous substances and waste to be followed. | | | | | |
## 10.2 Social Impacts Management and Monitoring Plan

Table 10.2: Environmental Management and Monitoring Plan

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<th>No.</th>
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<th>Cost per year (KES)</th>
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<tr>
<td>(i)</td>
<td>Land &amp; asset loss</td>
<td>• Conduct a Resettlement Action Plan (RAP) to guide in the relocation and compensation of the Project Affected Persons (PAPs) along the corridor; • Compensation according to RAP; • Restoration of livelihoods as guided by RAP;</td>
<td>• All Project Affected Persons (PAPs) are relocated and compensated • RAP is undertaken in accordance with relevant national and international regulations and implemented by the National Land Commission (NLC), KeNHA, County Government of Kiambu and other actors identified in RAP.</td>
<td>National Lands Commission (NLC), KeNHA, County Government of Kiambu and other actors identified in RAP.</td>
<td>As outlined in RAP</td>
<td>As per RAP</td>
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<td></td>
<td>(Along the proposed road. Both legally placed persons and encroachers)</td>
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<td>NLC, KeNHA, County Government of Kiambu</td>
<td>As outlined in RAP</td>
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<td></td>
<td>Disruption of livelihoods, income and loss of revenue</td>
<td>• Relocation of PAPs with the objective of livelihood restoration; • The County Government of Kiambu should find alternative market places as resettlement sites for the traders to be displaced</td>
<td>Implementation of RAP</td>
<td>Contractor, Engineer in charge, Water and Sewerage Company, Kenya Power and Lighting Company</td>
<td>• Notices • Relocated utility services • Number and nature of complaints by public</td>
<td>To be determined by the responsible Authority</td>
</tr>
<tr>
<td>(ii)</td>
<td>Disruption of utility services (such as electricity, water supply, sewage drains causing inconveniences)</td>
<td>• Necessary planning and coordination with concerned authorities in charge of utilities; • The responsible authority should communicate, giving considerable notice, of any intended disruption of the services to enable the people to prepare for alternatives;</td>
<td>Relocation of utilities before commencement of works</td>
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| (iii) | Gender Inequality (Mainly because construction jobs favours Males over Females. There are skilled females who can take part) | - Expose and involve women in construction and maintenance activities in an effort to transfer required skills to them;  
- Give equal employment opportunities for both men and women and encourage women to apply for jobs where they have sufficient skills;  
- Involve women groups in activities that they are good at such as landscaping and bush clearing; and  
- Enhance gender sensitivity and reduce gender discrimination in construction activities | Both Genders representation in employment of both skilled and unskilled tasks | CRBC (Construction phase) | Employment slots for women | No cost |
| (iv) | Traffic Congestion and Diversions (minor delays when traffic is diverted around active construction areas, when roads are temporarily closed) | - Develop a comprehensive traffic management plan.  
- Information and warning signs about diversions should be deployed at strategic locations during construction to provide accurate and timely information to motorists, and enable them to make rational decisions on routing choices;  
- Construction activities that might substantially disrupt traffic e.g. delivery of materials should not be | Implement Traffic management plan  
Informative and visible signage at diversions and road closure points | CRBC (Construction phase) | Well flowing traffic | 1,000,000.00  
Most works to be included in BoQ |
<table>
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<tr>
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<th>Nature of Negative Social Impacts</th>
<th>Mitigation Measures</th>
<th>Monitoring Requirements</th>
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<th>Performance Indicators/Targets to Achieve</th>
<th>Cost per Year (KES)</th>
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<td></td>
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<td>performed during peak travel periods to the maximum extent practicable;</td>
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<td>CRBC RE (Construction phase)</td>
<td>10,000,000</td>
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<td>(v)</td>
<td>Safety and health outcomes</td>
<td>• Access to all businesses and residences in the neighbourhood should be maintained.</td>
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<td>• Lost work day cases</td>
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<td>(Range from physical hazards from exposure to machines, falls, cuts; industrial hygiene hazards as a result of exposure to dusts, vibrations, noise and hazardous substances)</td>
<td>• Appropriate warning signs should be used to provide notice of road hazards and other pertinent information to motorists and the general public;</td>
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<td>• Occupational accidents register</td>
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<td>• Signage and barricades should be used as part of the typical construction traffic controls.</td>
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<td>• Valid copies of statutory requirements under OSHA,2007</td>
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<td>• Temporary manual traffic control should be used when construction occurs at signalized intersections on adjacent arterials or roadways; and</td>
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<td>• It is recommended that to further mitigate the negative impacts due to traffic, the contractor is expected to adhere to Kiambu County government traffic by-laws and Kenya traffic laws.</td>
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<td>marking of work site hazards and training in recognition of hazard symbols and accident investigation and prevention initiatives; and development of and training in site emergency response plans; • Installation of barriers to deter pedestrian access to the roadway except at designated crossing points; • Designating passage ways for road users; • Undertake regular internal and annual statutory Occupational Safety and Health audits • Establishment of work zones to separate workers on foot from traffic and equipment. • Routing of traffic to alternative roads when possible • Closure of lanes and diversion of traffic to the remaining lanes if the road is wide • use of protective barriers to shield workers from traffic vehicles • Regulation of traffic flow by warning lights, avoiding the use of flaggers if possible • Design of the work space to eliminate or decrease blind spots • Reduction of maximum vehicle speeds in work zones; • Initiate toolbox talks before commencement of each day’s work on issues of safety.</td>
<td>• Use of Safe work procedures and emergency response plans testing • Regular trainings on safety and health and HIV/AIDS • Scheduled maintenance of firefighting appliances • Log of PPE provided and replacements made • Rating of PPE</td>
<td>• Certificates of training • Adequate information systems</td>
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<td>• Training of workers in safety issues related to their activities, such as the hazards of working on foot around equipment and vehicles; and safe practices for work at night and in other low-visibility conditions, including use of high-visibility safety apparel and proper illumination for the work space (while controlling glare so as not to blind workers and passing motorists); • The area around which elevated work is taking place should be barricaded to prevent unauthorized access; • Hoisting and lifting equipment should be rated and properly maintained, and operators trained in their use. Elevating platforms should be maintained and operated according to established safety procedures including use of fall protection measures (e.g. railings); equipment movement protocols (e.g. movement only when the lift is in a retracted position); and installation of locks to avoid unauthorized use by untrained individuals; • Ladders should be used according to pre-established safety procedures for proper placement, climbing, standing, as well as the use of extensions; • To reduce noise, the use of personal hearing protection by exposed personnel and implementation of work rotation programs to reduce cumulative exposure. • Falls prevention:</td>
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<td>• Implementation of a fall protection program that includes training in climbing techniques and use of fall protection measures; inspection, maintenance, and replacement of fall protection equipment; and rescue of fall-arrested workers, among others;</td>
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<td>• Establishment of a fall protection system should be appropriate for the structure and necessary movements, including ascent, descent, and moving from point to point;</td>
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<td>• Installation of fixtures on bridge components to facilitate the use of fall protection systems;</td>
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<td>• Maintenance of work vehicles and machinery to minimize air emissions;</td>
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<td>• Reduction of engine idling time in construction sites;</td>
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<td>• Use of extenders or other means to direct diesel exhaust away from the operator;</td>
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<td>• Provision of adequate ventilation in tunnels or other areas with limited natural air circulation;</td>
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<td>• Designate a Safety Environment and Health Officer to develop safety and health management plan and to monitor implementation. This should be developed before the project starts.</td>
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<td>• Provide condom dispensers and locate them in prominent areas within the contractor’s campsite such as in the worker toilets and changing rooms.</td>
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<td>(vii)</td>
<td>Informal settlement encroachment - Invasion of the way leave area by unknown people for settlement limits</td>
<td>• Intensify awareness on HIV/AIDS by use of billboards and free VCT services within the campsite accessible to members of the public</td>
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<td></td>
<td>KeNHA Monthly (operation phase)</td>
<td>No Encroachments To be determined in due course.</td>
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<tr>
<td>(viii)</td>
<td>Security threats due to overgrown road side vegetation on the road reserve where criminals can hide and commit crimes e.g. carjacking</td>
<td>• Demolition of illegal settlements</td>
<td>• Erection of road markers posts including demarcation of the road reserve to minimise encroachment</td>
<td>KeNHA Monthly (operation phase)</td>
<td>No overgrown vegetation on the road reserve.</td>
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<td>(ix)</td>
<td>Creation of illegal U-turn, links and access roads by motorists</td>
<td>• Prune trees regularly, clear overgrown grass and ornamental shrubs to eliminate hiding spots and to enhance security of road users using the road.</td>
<td>Pruning and trimming of vegetation schedules</td>
<td>KeNHA (operation phase)</td>
<td>Weekly Road use monitoring Weekly and monthly report on road uses</td>
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<td>(x)</td>
<td>Solid wastes dumping along the road and in the culverts and storm drains</td>
<td>• The road will be a highway so people should not be allowed to set up along the road.</td>
<td>Weekly solid waste collection along the road</td>
<td>KeNHA&amp; NEMA/ Local Authority (operation phase)</td>
<td>Informative Signage Availability of Waste bins</td>
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<td>Nature of Negative social Impacts</td>
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|     |                                  | Sensitization through signage against irresponsible disposal of solid waste by pedestrians and road users  
|     |                                  | Dry vegetation wastes (dry slashed grass, weeds and trees) should be collected and disposed at the required disposal sites  
|     |                                  | Weekly collection of litter along the corridor  
|     |                                  | Engage Authorities in charge of solid waste management such as NEMA & the Local government environment department to prohibit such acts and to cause remediation by the persons responsible | | | |
| (xi) | Damage to signage and road guard rails | Repairing the damaged guard rails  
|     |                                  | Installing new road signage where vandalism has occurred | Regular checking  
|     |                                  | Inspecting the guard rails and road signage | KeNHA (operation phase) | Intact Signage and guard rails | 500,000 |
| (xii) | Traffic accidents related to road crossing | Erect signage and speed bumps where there are expected large numbers of pedestrian crossing | Signage | KeNHA (operation phase) | Signage | 200,000 |
| (xiii) | Blocking of Storm water drainage channels | Keep channels clear at all times by regular inspection and ensuring there are no solid wastes in the drains  
|     |                                  | Clear overgrown vegetation that may encroach the storm drains | Regular cleaning  
|     |                                  | Public sensitization | KeNHA (operation phase) | Open drainage channels | 200,000 |
| (xiv) | Damage to signage and road guard rails | Repairing the damaged guard rails  
|     |                                  | Installing new road signage where vandalism has occurred | Regular checking  
|     |                                  | Inspecting the guard rails and road signage | KeNHA (operation phase) | Intact Signage and guard rails | 500,000 |
11. CONCLUSION AND RECOMMENDATIONS

The Government of Kenya (GoK) has in the past two decades embarked on a historically most ambitious and revolutionary endeavour in infrastructural development. It has invested heavily in world class infrastructure, more so roads around Nairobi city and Nairobi Metropolitan area, to tap into the potential of Kenya’s economic growth and to reduce economic loss associated with traffic snarl ups. In this light, the proposed Nairobi Western Bypass project is expected to decongest the existing road and contribute to the economic development of the area.

The project is planned as a Class A National Trunk Highway with 4 lanes and median strip. The Design Speed is 80km/h and the width of subgrade is 21m wide. The length of the main alignment of this project is 16.358km, with 17.351 km service roads (excluding ramps).

The study established that administratively, the project is located in Kiambu County, and cuts across Kiambaa and Kabete constituencies. The bypass cuts across five wards of the total ten wards in the two constituencies.

This Environmental and Social Impact Assessment report has identified the environmental and social issues that are likely to be significant (scoping) and thereafter undertaken their assessment in detail. It has also reviewed the Environmental and Social policies, legislation and regulations relevant to the project, outlining the pertinent regulations and standards governing Environmental and Social quality, safety and health, protection of sensitive areas, protection of endangered species, and land use control at the national and local levels. As a key component of the full study, several key studies and tests were done including noise and air quality.

Since the project route provides the optimal route, the consideration of alternatives recommended that the “No Action Alternative” should not be adopted, as we need to encourage development so long as it is undertaken on a sustainable basis as per the environmental management plan developed in this report.

In this screening and scoping process it has been determined that the project meets a threshold requirement of a Finding of Significant Impacts (FOSI) under established environmental examination procedures, and as stipulated under EMCA (1999) EIA procedures (2003). This environmental examination process has identified the significant positive environmental and social impacts including local revenue generation, increase in property value, improved area aesthetics, ease in congestion once the bypass is operational, and employment creation where skilled, semi and unskilled workers will be able to get jobs.

Similarly, the study found out the project bears significant negative environmental impacts including air quality degradation, noise and excessive vibrations caused by construction activities, changes in land use, loss of vegetation cover as well as increased in water demand. The project also has high social impacts due to the fact that the proponent has to acquire land for construction. This mostly applies to the proposed interchange areas. The result of such acquisition will be loss of land, structures and disruption of livelihoods. It was also established that there will be significant
disruption of utility services during relocation. The proposed project also poses safety and health risks to not only workers on site but also the general public.

The consultant also undertook comprehensive public participation, engaging various groups of stakeholders, ranging from the political unit of Kiambu, The County Government of Kiambu, utility companies and the general public. The aim of this exercise is to also disseminate information to interested and affected parties (stakeholders), solicit their views and consult on sensitive issues, in order to add value to the project design considerations. This consultative process, mainly actualised through meetings and public forums, documented the stakeholders concerns, possible impacts raised and explored avoidance and mitigation options.

In response to the impacts identified by the consultant and the general public (during public participation), the consultant has proposed measures for enhancing the positive impacts as well as those to mitigate the negative factors. A detailed Environmental and Social Management and Monitoring Plan (ESMMP) outline was developed to ensure sustainability of the project, from construction through to operation. The plan provides a general outlay of the activities, associated impacts, mitigation action plans and appropriate monitoring indicators. Implementation timeframes and responsibilities are also defined.

In project implementation the proponent KeNHA and by extension the contractor will take full responsibility of ensuring the ESSMP is implemented as required.

### 11.1 Recommendations

A major recommendation measure is the need for a comprehensive Resettlement Action Plan to address the displacement effects of the proposed project. In terms of scope and the level of detail, such a RAP should at the very least include:

- Objectives
- Potential impacts
- Socio-economic studies
- Legal and institutional framework,
- Eligibility, valuation and compensation of losses,
- Resettlement measures and relocation planning
- Community participation
- Grievance redress procedures
- RAP implementation schedule, costs and budgets
- Monitoring and evaluation.

In addition, the proponent - KeNHA and the contractor- China Roads and Bridge Corporation will be required to develop and implement (if these do not exists already) internal environmental and social policies and plans, including setting up of relevant institutional frameworks to oversee their fruition.

The contractor- China Roads and Bridge Corporation, will also be required to submit to the proponent KeNHA stand alone:
• Waste (Solid and Liquid) Management Plan
• Spill Prevention and Response Plan
• Occupational Health and Safety Plan

The Contractor shall be required to apply for the following registrations and licenses (among others):

• The construction site(s) shall be registered as workplace with the directorate of occupational safety and health services under the Ministry of Labour, Social Security and Services.
• Water effluent discharge license

In addition to the Full EIA study, the Contractor is required to meet the following:

• An annual Environmental Audit
• A Fire audit, risk assessment and safety and health audit has to be conducted for the sites at least once every year.
• Undertake EIA’s for all ancillary sites such as batching plants, quarries, campsites to ensure their specific issues are identified in detail and mitigated.

Environmental monitoring of the road after construction, and for a period not less than one year is essential to check on a number of key areas that are subject to cause environmental concerns. The scope of the monitoring and maintenance related work should include (but not limited) to:

• Dust management and debris removal requirements and performance
• Ditch and watercourse performance
• Drainage and floodplain appliance performance
• Roadside vegetation performance including weed abatement, grass control and performance, moss on hard surfaces, hedge/tree removal (i.e. those that (or are likely to obstruct traffic)
• Highway risks and vandalism
• Visual impairment and signage
• Road furniture performance
REFERENCES

China Road and Bridge Corporation (2016). *Preliminary Design of Nairobi Western Bypass Project, Kenya. Design Drawings (Volume One).* Nairobi, CRBC.


APPENDICES

Appendix A – Terms of Reference
The following are the specific Terms of Reference for the proposed study as developed by the lead expert in conjunction with the project proponent:

1. Develop the terms of reference for the proposed ESIA study and submit them to NEMA for approval prior to commencement of the ESIA study as per the provisions of the Environmental (Impact Assessment and Audit) regulations, 2003, and the Environmental Impacts Assessment Guidelines and Administrative Procedures of 2002,
2. Carry out assessment and description of location/site, objectives, scope, nature of the proposed project;
3. Carry out analysis of the proposed project activities during the proposed project cycle; construction, operation, decommissioning phases;
4. Establish the suitability of the proposed project in the proposed location;
5. Review and establish all relevant baseline information as will be required by NEMA (Physical, Biological and Social Cultural and economic) and identify any information gaps;
6. Description and analysis of policy legal and institutional framework including but not limited to Kenyan policies, laws, regulation and guidelines; international best practices related to the proposed project, which have a bearing on the proposed project and will also serve as benchmarks for monitoring and evaluation, and future environmental monitoring;
7. Do an in-depth description of the proposed project and associated works together with the requirements for carrying out the works;
8. Analyse the efficacy of the designs, technology, procedures and processes to be used, in the implementation of the works;
9. Carry out Consultation and Public Participation (CPP): Identify key stakeholders and affected persons; hold a public meeting and provide /collect written evidence i.e. minutes;
10. Identify and analyse proposed project alternatives including but not limited to: scale and extent; project site alternatives, no project alternatives, design alternatives, material alternatives and technologies alternatives;
11. Identify, predict and carry out in-depth analysis all actual potential and significant impacts on biosphere, lithosphere, atmosphere, hydrosphere and social and community settings; the direct, indirect, cumulative, irreversible, short-term and long-term effects anticipated to be generated by the proposed project, both positive and negative throughout the project cycle;
12. Recommend sufficient mitigation measures for all the potential negative impacts identified and analysed in 11(eleven) above;
13. Analyse materials to be used in the construction and implementation of the project, and wastes to be generated proposing alternative/appropriate options/technologies;
14. Analyse occupational health and safety issues associated with the proposed project;
15. Develop an Environmental and Social Management and Monitoring Plan proposing the measures for eliminating, minimizing or mitigating adverse impacts on the environment, including the cost, timeframe, monitoring aspects, indicators and responsibility to implement the measures;
16. Prepare a comprehensive ESIA study report in accordance with EMCA Cap 387
17. Submit a draft ESIA Study report to the client for review;
18. Incorporate comments into the ESIA study report after review by client into a final EIA study report;
19. Submit 7 (seven) hard copies and one soft copy of the ESIA study report to NEMA for the purposes of seeking a NEMA license that will approve the proposed project;
20. Submit to the client One copy of NEMA referenced ESIA study report one soft copy of the ESIA study report and acknowledgment letter from NEMA;
21. Earthcare Services Limited to follow up processing and issuance of the ESIA License for the proposed project from NEMA and Submit the Original ESIA license to CRCB and a copy to KeNHA upon issuance.
Appendix B – List of those who filled a Questionnaire
Appendix C – Sample Questionnaires filled by the public
Appendix D – Public Participation Minutes

I. Political Unit

PROCEEDINGS OF THE CONSULTATIVE MEETING FOR THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT ON THE PROPOSED NAIROBI WESTERN BYPASS PROJECT, HELD ON 20TH DECEMBER 2016, AT RADISSON BLU HOTEL, NAIROBI

KIAMBU COUNTY MEMBERS OF PARLIAMENT CONSULTATIVE MEETING

ATTENDEES: See Appendix E I

Agenda

1. Introduction
2. Road project design concept, technical standards and proposed major interchanges presentation
3. Environmental and social concerns and proposed mitigation measures
4. Plenary – Question and Answer
5. Closing remarks

1. Introduction and opening Remarks

The meeting started at 8.44am. Self-introductions then followed.
KeNHA Director General Eng. Peter M. Mundinia (after welcoming the MPs) noted that this was the first public participation meeting on the proposed project. The aim was to inform the MPs on the proposed project and to seek their concerns as well as support for the project. He noted that the leaders had mandate from their constituents thus it made sense to consult them and it was expected that they would represent the views of their electorate.

Engineer Omer noted that there were a number of other public meetings planned including one with utility companies as well as public forums.

2. Road project design concept, technical standards and proposed major interchanges presentation

Engineer Omer presented on the proposed project. He highlighted KeNHA’s mandate as the public entity entrusted with Managing, Developing and Maintenance of the National trunk roads as per Roads Act of 2007.

His presentation highlighted several key issues:
a) Western bypass is the missing link in the Nairobi Bypass project. KeNHA and the utility companies for planning purposes.
b) Western bypass starts from end of Southern Bypass, intersects A8 (A104), and ends at Ruaka town at junction with Northern Bypass. It passes several busy towns: Gitaru, Wangige, Ndenderu and Ruaka etc. Length of main alignment is 16.358 km with 17.351 km service roads (excluding ramps)
c) Significance of Nairobi Western Bypass of the bypass includes:
   - Contribution to Vision 2030 ‘World class infrastructure’
   - Nairobi will be completely ringed by a modern high-capacity highway system
   - Effective reduction of traffic pressure in Nairobi city greatly.
   - Reduction of transport cost and decrease traffic accidents significantly

Eng. Omer showed the overall Route Map of Nairobi Western Bypass Project. Using pictures and diagrams he highlighted the central features of the bypass which includes:

- Western Bypass will be a Class A National Trunk Highway
- It will entail 4 lanes each 3.5m
- A projected speed of 80km/h
- Interchanges at Gitaru, Dirt (Magu stage), Wangige, Kihara, Ndenderu, Rumingi and Ruaka

3. Environmental and social concerns and proposed mitigation measures

Dr. Winnie Wairimu from Earthcare Services highlighted environmental and social concerns as. Highlighting that the project had avoided affecting (structures) owned by major schools and churches, she noted some positive social benefits including:

a) Social enhancement
   - Bus stops and parks (improving the condition of bus terminal at Wangige)
   - Walkways on both sides of service road
   - 0.5m width of foot path on both sides of underpasses
   - Footbridges and other Pedestrian facilities

b) Availability of employment opportunities

c) Increase in local incomes e.g. from informal businesses spurred

d) Increase in property value

e) Ease in traffic congestion

f) Reduced transport costs and accidents

g) Local revenue generation

Some highlighted negative social concerns and their mitigation measures are shown in table below:

<table>
<thead>
<tr>
<th>Impact</th>
<th>Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss of land and structures</td>
<td>Resettlement Action Plan, Adequate compensation</td>
</tr>
<tr>
<td>Disruption of livelihoods and Income</td>
<td>RAP, adequate compensation</td>
</tr>
<tr>
<td>Loss of Public spaces</td>
<td>RAP, Relocation of markets, bus stops etc.</td>
</tr>
<tr>
<td>Safety and Health Risks (public)</td>
<td>Construction of bridges, pedestrian/median and central barriers</td>
</tr>
</tbody>
</table>
She then highlighted the preliminary List on Land Acquisition & Utility Relocation noting the project would require at least 64.01 hectare Main line (excluding interchange) and 47.63 hectare for the Interchange along main alignment, and relocation of at least 224 electricity poles.

4. Plenary – Question and Answers

The following issues and points were highlighted for consideration:

i. Storm water at the project start at Gitaru is a major concern. The storm water from Sigona area causes a lot of property damage (house and crops). The leaders suggested that the design should take into consideration the development of a channel to direct the storm water to the natural drainage around Gitaru. The design of the proposed Nairobi Western Bypass should also take into consideration the design of the yet to start James Gichuru-Rironi Road. Storm water from Nairobi-Nakuru road shouldn’t find its way to the proposed Western bypass.

ii. Bodaboda riders were highlighted as major users of the road who might be impacted by the proposed road upgrading. Therefore their interests should be put into consideration. Provisions to be made such that they can use both the main road (bypass and Service lanes).

iii. Dispensary at Ndenderu: There is a dispensary along Limuru Road at Ndenderu centre which may be affected by the slip rod of the proposed interchange at Ndenderu. The leaders stressed the need to check on whether it will be impacted.

iv. Noise barrier at Ndenderu School: - In addition to installing the structural noise barrier at the Ndenderu interchange to minimize noise effect at the school, the leaders proposed the planting of bamboo trees along the school to also act as biological noise barrier.

v. The leaders mentioned if possible it would be important to realign the road so that public institutions such as churches and schools are avoided because if they are to be affected, then it may raise a lot of opposition from the community.

vi. Several link roads along the traverse need to consider for upgrade since they could serve as important connecters to the bypass/ other major road and also to settlement and major centres such as at Kanjeru area Kagongo and Kirangari area among others.
vii. The leaders expressed to incorporate adequate interchanges at the crossing points between the bypass and minor access road such as in Kahungo area and Lower Kabete road among others.

viii. The leaders suggested the Ruaka interchange should incorporate certain design consideration so that there is seamless connectivity of traffic along Banana-Raini Road and between Banana-Raini Road and Limuru Road and also between the Western Bypass and the Northern By pass. The link road at Ruaka along Limuru Road should strive to reduce the perennial traffic jams common in the area.

ix. The leaders emphasized and thanked KeNHA for organizing the consultation meeting involving the political class (MPs, Senator and County –MCA’s) so that they can fully understand the nitty-gritty of the project design so that they can disseminate the same information to their constituent. This consultation ensures that the projects get a buy in from the local community.

x. As a follow up to today’s meeting the leaders stressed the need for a prior meeting where the Bypass designs which will have incorporated the suggestions and recommendations raised today is presented to them for internalization before the planned 19th January 2017 public consultation meeting. The meeting will be important in ensuring that they encourage the community to fully support the proposed project.

Additional Issues

xi. The leaders stressed the need to address the storm water issue facing the Southern bypass at Kikuyu

xii. Further the leaders called for an immediate resolution to the missing links along the Southern Bypass which has cut off some people

5. Closing remarks
The leaders requested KeNHA to consider a second meeting once all designs were finalised. The meeting ended at 11.05am.

Minutes prepared by: Dr. Winnie Wairimu
Earthcare Services Limited

Date 23rd February 2017
II. Utility Companies

PROCEEDINGS OF THE CONSULTATIVE MEETING FOR THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT ON THE PROPOSED NAIROBI WESTERN BYPASS PROJECT, HELD ON 11TH JANUARY 2017, AT SAROVA PANAFRIC HOTEL, NAIROBI

PUBLIC UTILITIES SERVICE PROVIDERS CONSULTATIVE FORUM

ATTENDEES: See Appendix E II.

Agenda

1. Introduction
2. Opening Remarks
3. Road project design concept, technical standards and proposed major interchanges presentation
4. Environmental and social concerns and proposed mitigation measures
5. Plenary – Question and Answer
6. Closing remarks

1. Introduction
The meeting started at 9.37am with a prayer from Engineer Kato of Kenya National Highway Authority (KeNHA), after a request by the chair of the meeting i.e. Mr. Walter Nyatwanga. All participants followed with self-introductions.
The chair requested members to ensure they register their names and contact details for future engagement and communication.
The chair noted that KeNHA was keen to engage all stakeholders from the onset of the project including planning. The main aim was to create awareness as well as to ensure minimal disruption to the public.

2. Opening remarks
Engineer Samuel Omer of KeNHA thanked the participants for attending, noting that this was not KeNHA’s first time to engage the relevant companies. However, the past interaction was on individual company basis and mainly during approvals. He noted the current engagement was proactive on KeNHA’s side to devise means for management of utilities and more so relocation. The Western Bypass case will be a more concerted effort in collaboration.

He highlighted KeNHA’s mandate as the public entity entrusted with Managing, Developing and Maintenance of the National trunk roads as per Roads Act of 2007.

3. Road project design concept, technical standards and proposed major interchanges presentation
His presentation highlighted several key issues:
d) KeNHA’s mandate as per the 2007 Road act which prohibits any company from setting up utilities on roads manage by KeNHA without prior approval form the authority. This however triggered several questions and sentiments such as:

- Prior to the 2007 Act, some utility companies had infrastructure on the road. The new law thus was seen as problematic by some due to the existence of prior infrastructure on some roads. It was clarified that any new law supersedes existing laws. A committee has also been set up to sort issues between KeNHA and Kenya Power and Lighting Ltd (KPLC) concerning such issues.
- Even when KeNHA pays for relocation, some companies delay in the same. The representative from Kenya Electricity Transmission Company noted that they give the legal notice as required to avoid cases of utility companies who did not relocate within time. This was clarified as 60 days as per the Road Act.
- The cost of use of common ducts managed by KeNHA was noted as high e.g. along Thika Road. KeNHA’s response was this was fair given the cost of each company undertaking own ducts and is determined by law. Furthermore factors such as the extra lanes on the highway e.g. Thika contribute to the costs.
- Participants suggested common ducts for all new roads and KeNHA noted this was the main purpose for the meeting. Eng. Omer noted that they would require companies to indicate the space required to ensure design took capacity into consideration. A participant asked if in the new ducts all providers will be subjected to same rates/costs and if there exists a possibility to reduce costs. The response noted that there are ongoing discussions with the parliamentary committee to revise the relevant regulation which includes costs of such services.
- It was noted that Companies pay both KeNHA and the county governments during set up of such services. KeNHA noted they have already embarked on discussions with Nairobi County government on such matters, discussions expected to involve other counties too, and the proposed regulation is also expected to address such issues.
- One participant noted that Western Bypass should be used as example of how to do common infrastructure ducts if well implemented.
- The need for a master plan for infrastructure (that includes County plans) was highlighted as well overdue.
- A participant noted that the regulator Communications Authority of Kenya should have been represented in the meeting.
- E.g. Omer noted that planning departments within utility companies should be proactive to engage KeNHA too.
- Some representatives noted difficulty in undertaking routine utility maintenance because some roads are in use. KeNHA requested they contact the regional, manager and liaise with him to undertake necessary procedures e.g. notice and closure of the road.

e) The proposed design of the road includes common service ducts.

f) There is need for companies to provide Detailed Location Plans for Services and Utilities And Facility Master Plans to KeNHA.
Western bypass is the missing link in the Nairobi Bypass project. KeNHA and the utility companies for planning purposes.

Western bypass starts from end of Southern Bypass, intersects A8 (A104), and ends at Ruaka town at junction with Northern Bypass. It passes several busy towns: Gitaru, Wangige, Ndenderu and Ruaka etc. Length of main alignment is 16.358 km with 17.351 km service roads (excluding ramps).

Significance of Nairobi Western Bypass of the bypass includes:
- Contribution to Vision 2030 ‘World class infrastructure’
- Nairobi will be completely ringed by a modern high-capacity highway system
- Effective reduction of traffic pressure in Nairobi city greatly.
- Reduction of transport cost and decrease traffic accidents significantly

Eng. Omer also showed the overall Route Map of Nairobi Western Bypass Project. Using pictures and diagrams he highlighted the central features of the bypass which includes:

- Western Bypass will be a Class A National Trunk Highway
- It will entail 4 lanes each 3.5m
- A projected speed of 80km/h
- Interchanges at Gitaru, Dirt (Magu stage), Wangige, Kihara, Ndenderu, Rumingi and Ruaka

**4. Environmental and Social Concerns and proposed mitigation measures**

Dr. Winnie Wairimu from Earthcare Services highlighted that the main environmental concerns as:

- Need for an Environmentally Friendly design: project has provisions for service ducts to avoid eyesore criss-cross of power and telecom lines for instance, damage to roads and vegetation during setting up of new lines etc.

- Socially Acceptable Strategies to ensure minimal disruption to consumers include setting up of mechanisms for engagement to ensure a quick and smooth relocation of the services

- Collaborative and smooth engagement in the course of project implementation

The participants did a round of explaining which existing facilities will be affected as per the table below.

<table>
<thead>
<tr>
<th>Utility Company</th>
<th>Description of nature of utilities and Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kenya Power and Lighting Company</td>
<td>• Overhead cables, Whole stretch of the road</td>
</tr>
<tr>
<td>Liquid Telecom</td>
<td>• 4km of fibre (underground) cable from Ndenderu to Ruaka found on the right side of the road coming from Ruaka towards Rumingi, Gitaru interchange</td>
</tr>
<tr>
<td>Telecom</td>
<td>• Gitaru interchange, lower Kabete junction to Ndenderu, and at Ruaka interchange</td>
</tr>
<tr>
<td>Access Kenya</td>
<td>• 500m at Ruaka interchange</td>
</tr>
<tr>
<td>Safaricom</td>
<td>• Whole stretch (at Wangige, Lower Kabete, road to Gachie, Ndenderu, Ruaka, Mwimuto, Gachie)</td>
</tr>
<tr>
<td></td>
<td>• Small gap in the built up area in Ruaka</td>
</tr>
</tbody>
</table>
5. Plenary – Question and Answer

The main questions asked:

a) Where will the utilities be relocated to? KeNHA will plan with each party on where to relocate. Joint site visits will be undertaken as per the schedule below:
   - KPLC: 20th January 2017
   - Telecom companies: 24th January 2017
   - Water: 26th January 2017

b) Cases where relocation is undertaken but the contractor damages the infrastructure, due to change in road designs, who will be responsible for cost implications? The joint meetings and collaboration is to ensure such issues do not occur and are minimized.

c) CAN KeNHA undertake temporal relocation of the facilities? KeNHA will attempt to accommodate but such issues will be engaged on at with relevant companies including timelines.

d) There was need to have the contractor in the meeting. The contractor is represented here including the design team.

e) How can cases where developers claim that utility companies are encroaching on private land yet its public land? Before any utility company goes to the field they need a supervisor from KeNHA to avoid encroaching on private land. KeNHA offices have details on the extent of the road reserves.

f) Often when private developers are undertaking culverts, interference with utility infrastructure is common: all access to roads is subject to approval requirements and conditions are set for such access including responsibility for third parties. Cases of vandalism should be reported to KeNHA. It’s the responsibility of the utility company to ensure their Contractors stick to the conditions given by KeNHA.

g) Where emergency repair is concerned e.g. on weekends, do these need to go through the lengthy approval processes and paperwork: If the concerned company contacts the regional manager or the person assigned for supervision during connections, these should be able to approve minimal works e.g. a temporary reconnection. The Monday that follows, approvals should be sought for the more detailed work. The revised policy and regulations will also address such issues. Contractors on site are also allowed to undertake quick and uncomplicated reconnection so concerned parties should liaise with them for site level damages. KeNHA will refresh the contact details for regional managers who are often available to deal with emergencies too.

h) The participants requested to be involved or consulted in the development of the emergency sections of the policy.

i) Often putting up utility infrastructure involves double payments to KeNHA and counties governments.
To clarify a number of the issues raised Engineer Kato from KeNHA highlighted a few issues:

- All set up of utility infrastructure requires approval from the director general.
- KeNHA has embraced GIS technology and are creating a database as per data also provided by utility companies.
- For applications for setting up utility on KeNHA managed roads, the requirements include an application, Geo referenced drawings in hard and soft copies in UTM coordinates formats preferably in auto card. Including cordials of important nodes. Once KeNHA receives the application, they may advice on any amendments.
- Supervision of the set-up is key
- Some challenges KeNHA meets includes non-compliance especially with the requirement for supervision, location, interference with existing utility, delays in relocation.
- The way forward includes compliance and continued sensitization, sharing of ducts to avoid trending, forward planning.

On asset protection, KeNHA highlighted

- It’s important to have approval
- Conform to conditions with letter of approval and it’s conditions
- Companies to ensure they have paid and receive a receipt acknowledging this
- A supervisor has to be allocated for each assignment. KeNHA has health and safety standards for people working on their own roads.
- There is need to ensure approvals documents are available on site
- KeNHA checks to ensure right quality infrastructure is set up

6. Closing remarks

The chair summarized the main points from the meeting as

- All utility companies will provide required information to enable planning by KeNHA
- All participants agreed to a recommendation for common service ducts which depends on information to be provided by companies.
- New for a joint meeting to brainstorm on other merging issues in the 2nd week of February. Each utility company was requested to nominate someone as the liaison person for this.
- Project ground breaking is in October so all companies are required to plan and budget for relocation.
- Joint site visits will be on 20th for KPLC, 24th for telecommunications companies and 26th for water.
- KeNHA will share contacts details for all regional managers and contact persons for the various regions
- KeNHA will share list of roads planned for improvement or construction, the presentation, layout of acquisition plans for Western bypass, construction limits and road reserves for Western bypass
There been no other business the meeting ended at 13.06pm

<table>
<thead>
<tr>
<th>Minutes prepared by:</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Winnie Wairimu</td>
<td>23rd February 2017</td>
</tr>
<tr>
<td>Earthcare Services Limited</td>
<td></td>
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</tbody>
</table>
III. County Government of Kiambu

PROCEEDINGS OF THE CONSULTATIVE MEETING FOR THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT ON THE PROPOSED NAIROBI WESTERN BYPASS PROJECT, HELD ON 12TH JANUARY 2017, AT AICAD SAROVA PANAFRIC HOTEL, NAIROBI

KIAMBU COUNTY GOVERNMENT CONSULTATIVE FORUM

ATTENDEES: See Appendix E III.

Agenda

1. Introduction
2. Opening Remarks
3. Road project design concept, technical standards and proposed major interchanges presentation
4. Environmental and social concerns and proposed mitigation measures
5. Plenary – Question and Answer
6. Closing remarks

1. Introduction
The meeting started at 9.351am with a prayer from Lucy Wainaina of KeNHA, after a request by the chair of the meeting i.e. Mr Walter Nyatwanga. All participants followed with self-introductions.

2. Opening remarks
Engineer Samuel Omer of KeNHA thanked the participants for attending. He then thanked the Kiambu County Government for their support for the Nairobi Bypass project. He noted the attendance by the Deputy Governor H.E Gerald Gakuha Githinji as a stamp of approval of the positive relationship between the county and KeNHA.
Eng. Omer noted that KeNHA had plans to develop the difficult parts of the northern and Eastern Bypass by dualling both roads, to ensure the ring road around Nairobi to serves its maximum potential. However he noted that Western Bypass was the priority given its poor state.
Eng. Omer informed the participants that KeNHA and the Consultant Earthcare Services met the political representatives of the county including MPs and the senator in December to brief them about the proposed project. He noted they had also pledged their support for the smooth implementation of the project. He included that the previous day there was a meeting with utility companies to ensure smooth relocation of services and minimal interruptions to the public.
He highlighted the County government was a very important stakeholder given that the road passed solely through Kiambu County and the county government had been given the mandate by the people to represent their interests.
As mandated by EMCA and EIA regulations he noted the public meetings will be held on 19th January. He thus requested the county government to send representatives to the meeting.
3. Opening remarks by the Deputy Governor

The deputy Governor noted that that Kenya is recording exponential growth and that requires word class infrastructure to spur more growth, making the improvement of the same a key concern for the country. He noted KeNHA has undertaken a number of projects in this line in the recent past with an aim to improve connections and spur more growth.

He expressed concern that Kenyans often settle and set up business where new roads come up noting many centres of development have emerged with the coming up of e.g. Eastern Bypass, some encroaching. He recognized that KeNHA has authority and control, which requires collaboration with the County to avoid environments that do not support the intent of many of the new roads e.g. occupation of road reserves. He noted that there needs to be a mechanism to control encroachment even at design stage. Prohibiting of areas with no access roads from being built up should be protected by law and enforced through development control.

The deputy governor noted that the county supports small and medium enterprises e.g. through giving credit of 10000 without collateral and which is easily accessed through application on via the phone. However the places where people trade from should be controlled. He noted that T junctions are often centres of accidents thus need for proper signage and enforcement of traffic rules.

Similarly a road is a work of art i.e. beauty is key. Using an example of Thika road where the central reserves are too high thus soil is washed into the road, he noted designs should help enhance beauty and cleanliness.

He refuted the common saying that Kiambu is the bedroom of Nairobi noting that the County is promoting the development of the county and as a county of preference for work, living and growth e.g. of businesses. This he noted can reduce the environmental footprint as opposed to cases where people travel out of the county for work.

In summary he noted that his key concerns was to ensure aesthetics, environmental protection, design sustainability and adequate compensation for property owners are accorded utmost importance.

4. Road project design concept, technical standards and proposed major interchanges presentation

Engineer Omer presented on the proposed project. He highlighted KeNHA’s mandate as the public entity entrusted with Managing, Developing and Maintenance of the National trunk roads as per Roads Act of 2007.

His presentation highlighted several key issues:

j) Western bypass is the missing link in the Nairobi Bypass project. KeNHA and the utility companies for planning purposes.

k) Western bypass starts from end of Southern Bypass, intersects A8 (A104), and ends at Ruaka town at junction with Northern Bypass. It passes several busy towns: Gitaru,
Wangige, Ndenderu and Ruaka etc. Length of main alignment is 16.358 km with 17.351 km service roads (excluding ramps)

1) Significance of Nairobi Western Bypass of the bypass includes:
   - Contribution to Vision 2030 ‘World class infrastructure’
   - Nairobi will be completely ringed by a modern high-capacity highway system
   - Effective reduction of traffic pressure in Nairobi city greatly.
   - Reduction of transport cost and decrease traffic accidents significantly

Eng. Omer showed the overall Route Map of Nairobi Western Bypass Project. Using pictures and diagrams he highlighted the central features of the bypass which includes:

   - Western Bypass will be a Class A National Trunk Highway
   - It will entail 4 lanes each 3.5m
   - A projected speed of 80km/h
   - Interchanges at Gitaru, Dirt (Magu stage), Wangige, Kihara, Ndenderu, Rumingi and Ruaka

5. Environmental and Social Concerns and proposed mitigation measures

Dr. Winnie Wairimu from Earthcare Services highlighted environmental and social concerns as. Highlighting that the project had avoided affecting (structures) owned by major schools and churches, she noted some positive social benefits including:

k) Social enhancement
   - Bus stops and parks (improving the condition of bus terminal at Wangige)
   - Walkways on both sides of service road
   - 0.5m width of foot path on both sides of underpasses
   - Footbridges (Kwa Mbaao stage, near Munyaka dispensary/Munyaka road, near Furaha/KAG Ndenderu, Near Mirai court/Mifereji, Ndenderu interchange) and other Pedestrian facilities

l) Availability of employment opportunities
m) Increase in Local incomes e.g. from informal businesses spurred
n) Increase in property value
o) Ease in traffic congestion
p) Reduced transport costs and accidents
q) Local revenue generation

Some highlighted negative social concerns and their mitigation measures are shown in table below:

<table>
<thead>
<tr>
<th>Impact</th>
<th>Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss of land and structures</td>
<td>Resettlement Action Plan, Adequate compensation</td>
</tr>
<tr>
<td>Disruption of livelihoods and</td>
<td>RAP, adequate compensation</td>
</tr>
<tr>
<td>Income</td>
<td></td>
</tr>
</tbody>
</table>
Loss of Public spaces | RAP, Relocation of markets, bus stops etc.
---|---
Safety and Health Risks (public) | Construction of bridges, pedestrian/median and central barriers
Safety and Health Risks (workers) | Proper PPE use, first aid and emergency response facilities/kits, Health and Safety training, basic first aid
Disruption of utility services | Service ducts for utilities and services, Relocation
Traffic congestion and diversions | Proper signage, paved deviations
Inaccessibility of property | Improve accessibility to highway

She then highlighted the preliminary List on Land Acquisition & Utility Relocation noting the project would require at least 64.01 hectare Main line (excluding interchange) and 47.63 hectare for the Interchange along main alignment, and relocation of at least 224 electricity poles.

Using some pictures she showed examples of proposed noise barrier around the school in Ndenderu, the central barrier, footbridges etc.

Some environmental concerns presented include:

<table>
<thead>
<tr>
<th>Impact</th>
<th>Proposed Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noise Pollution</td>
<td>Noise barrier (school), noise quality study undertaken</td>
</tr>
<tr>
<td>Vegetation clearance</td>
<td>Re landscape</td>
</tr>
<tr>
<td>Generation of solid waste</td>
<td>Engage licensed waste handler</td>
</tr>
<tr>
<td>Airborne Emissions</td>
<td>Water sprays, speed control, air quality study undertaken</td>
</tr>
<tr>
<td>Soil erosion and contamination</td>
<td>Re-vegetation of embankments,</td>
</tr>
<tr>
<td>Impact on natural drainage</td>
<td>Natural drainage to be enhanced, incorporate grits, soil erosion control devices</td>
</tr>
</tbody>
</table>

She ended her presentation by highlighting that 2 Public Participation meetings/forums will be held on 19th January in:
Eng. Omer then emphasized a number of points:

- The noise barrier will be useful around Ndenderu school
- Given the possibility that roads often convert low density areas into a high density areas, it’s important for the county to plan for other amenities as required including refurbishing county roads in the area to improve accessibility and connectivity.
- Local knowledge is important and can improve the project and its sustainability thus more engagement with the county is important.
- He hoped that Western Bypass will set an example on how to undertake road projects especially on engaging stakeholders.
- KeNHA expected host communities to participate e.g. in employment and noted KeNHA was open to coordinate with County on the way forward. He noted labour bureaus can be used for local to register.

6. Plenary – Question and Answer

The main questions and concerns raised:

j) By Deputy Governor:
   - On local content: On labour bureaus, he noted the county has a list of available skills which can be used.
   - On southern bypass, water collects at Dagoretti market and this should be resolved.

k) By other participants:
   - The county had constructed boda sheds, will these be relocated: KeNHA will facilitate connectivity between such places using access roads for instance but will not set up these structures.
   - Will resting areas for traveller be provided? These are best provided by the private sector. KeNHA can only ensure access and connectivity.
   - How will water services be affected? Kiambu water was invited for the utility meetings, they however directed the consultant to Karuri water who despite confirming attendance did not send a representative. Both Karuri and Kikuyu have been invited for a meeting and joint site visit on 26th to discuss relocation of the essential service.
   - Will KeNHA facilitate the relocation of traders along the road reserve? A RAP will be undertaken to determine how such will be dealt with.
   - Can the design incorporate measures to absorb and reduce emissions because of the houses that are found along the route? Unfortunately, most measures are directed to the cars to ensure cleaner and more efficient processes e.g. use of low sulphur diesel, and normally not the design of the road. The relevant authority then needs to ensure cars that do not e.g. subscribe to regular testing and are considered road unworthy are penalized and banned from the road. However sensitization of the public can be undertaken using bill boards.
There are often too many markets and encroachments by traders along such new roads who at times block drainage. There is need for KeNHA to ensure removal of such as soon as they occur.

Will bus stops that shelter residents from the rain be provided? Properly engineered bus tops will be provided.

Will people walk on the highways? Walkways will be provided along the service roads as well as on underpasses and 5 footbridges strategically located.

Will KeNHA do speed bumps on the road (as Thika road)? The case of Thika is a matter of lack of land planning function along the road. Proposer coordination in terms of land use is required to avoid such design failures.

Will street lighting be done? Yes, along the whole road.

Who controls where petrol stations come up since these are next to buildings. There is a relevant authority for that.

How will the common service ducts be managed? There are planned meetings with utility companies and KeNHA will consult them.

Cases where roads are tolled, how do you manage those who move long and short distances? The tolling policy recognizes these differences and often those moving 5km and below are exempted.

7. Closing remarks
The chair summarized the main points from the meeting as

- Encroachment of roads is a key issue and needs to be managed.
- KeNHA and the county will work on the issue of labour bureaus to provide a conducive environment for the contractor.
- All things working properly, the project will commence in October.
- There is concern about the drainage on Southern Bypass and this will be looked at since the contractor’s contract provides for 1 year clause within which defects should be corrected.
- Linear parking might be provided but other facilities e.g. restrooms are best left to the private sector or the county.
- Boda sheds cannot be allowed on the main line…perhaps next to service roads.
- There is continuing engagement with utility companies to ensure smooth relocation of services and minimal interruptions to the public.
- KeNHA and the consultant extends an invitation to the county for the meetings on 19th January.

Final Remarks form the County:

- The county looks forward to the commencement of the project as it will transform the area and spur development and growth.
- The county held a meeting and invited all national government agencies so as to forge a working relationship. KeNHA was supposed to provide a contact and liaison person for Kiambu County to ensure easier working and fast track of issues of concern e.g. with projects such as southern bypass.
- The county highly welcomes the consideration for locals in the project construction.
• The country is grateful for this engagement and hopes it continues in the same manner till project completion and even during its operation.
• The county hopes that the issues raised will be incorporated into the design. Social concerns should be taken as key.

There been no other business the meeting ended at 12.56pm

Minutes prepared by:                      Date

Dr. Winnie Wairimu                          23rd February 2017
Earthcare Services Limited
IV. Wangige Public Forum

PROCEEDINGS OF THE PUBLIC CONSULTATIVE MEETING FOR THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT ON THE PROPOSED NAIROBI WESTERN BYPASS PROJECT, HELD ON 19TH JANUARY 2017, AT ACK ST. PETERS CHURCH WANGIGE, KIAMBU COUNTY

ATTENDEES: See Appendix E IV.

Agenda
1. Welcoming Stakeholders
2. Opening Remarks
3. Road project design concept, technical standards and proposed major interchanges presentation
4. Environmental and social concerns and proposed mitigation measures
5. Plenary – Question and Answer
6. Closing remarks

1. Welcoming Stakeholders
The meeting started at 9.51am with a prayer from one member of the public, after a request by the chair of the meeting i.e. Mr Anthony Kihara from Earthcare Services Limited. Honourable Ferdinand Waititu, the Member of Parliament for Kabete Constituency was called upon to welcome all stakeholders.

2. Opening remarks from Hon. Ferdinand Waititu- M.P, Kabete Constituency
Hon. Waititu welcomed Kenya National Highways Authority (KeNHA) who were constructing the road from Gitaru to Ruaka. He welcomed the residents and thanked them for turning up in large numbers.

He added that the meeting was an important forum, and residents should utilize the forum to speak about the issues of relocation and compensation. He noted that such a forum was not conducted during the construction of the Southern bypass especially at Kikuyu where there are serious social problems related to access and crossings of the road. He urged the residents to ask and speak about issues of compensation and relocation on the forum.

He emphasized that the proposed major road (The Nairobi Western Bypass) was going to affect the lives of all residents. Lastly, he informed the residents that such forums are the final stages of proposed projects such as the proposed road, and after the forum, road construction will commence.

3. Opening remarks by Dr. Winnie Wairimu- Lead Environmental Expert-Earthcare Services Limited
Dr. Winnie Wairimu welcomed the attendants to the meeting. She informed the attendants about the National Environment Management Authority (NEMA) - that NEMA oversees environmental issues in Kenya. To do so, NEMA registers and licenses Environmental Experts and Environmental Consultancy firms such as Earthcare Services Limited to undertake environmental studies and assessment reports for projects for decision making by NEMA.
She highlighted laws such as the Constitution 2010, (Environmental Management and Coordination Act Cap 387(EMCA) and the EMCA (Environmental Impact Assessment and Audit) Regulations of 2003 which call for public participation in major development projects and more so projects that are likely to result in impacts on the public.

In summary she highlighted:

I. The background of NEMA which is established under the Environmental Management and Coordination Act (EMCA cap. 387) as the principal instrument of government in the implementation of policies relating to the environment, particularly licensing of projects and assessment of their impacts. The audience were enlightened that EMCA provides an institutional framework and procedures for management of the environment concerns including provisions for conflict resolutions.

II. The Environmental Impact Assessment process and what it entails- she further explained that an EIA process and examination of Environmental and social concerns is one of the compulsory requirements in initiating a project of the magnitude of the Western Bypass. Other considerations (in detail and following due process) will include matters of land acquisition which is of interest to most of the attendees.

III. Relevant policies and laws governing environment issues such as noise, pollution, waste management etc.

IV. Highlights on Consultation and Public Participation- she explained to the audience that holding public meeting and engagement of stakeholders is one of the processes entailed in an Environmental and Social Impact Assessment where PAP’s, stakeholders, locals and the interested parties are given a chance to express their objective views on environmental and social issues that might impact on their surrounding and such views are put into considerations and a list mitigations measures to counteract such impacts are given to the project proponent to implement during project implementation process.

V. Use of questionnaires as a tool for engaging locals and stakeholders- she explained the structure of the questionnaires as well as the reasons as to why environmental experts normally administer questionnaires.

She explained that the consultants inform the stakeholders of both positive and negative social and environmental concerns and looks into/discusses the pertinent issues and solutions raised during such meetings which need attention and provides enhancement/mitigation measures in accordance with environmental laws and best practices.

She asked the attendees to give their opinion on social and environmental issues and their suggestions on how to deal with the issues. She also informed the meeting that there were questionnaires available and as they came into the meeting some had received. These she requested them to fill where possible and whoever needed help in filling these could request any of the assistants in yellow reflector jackets for assistance.

Further she added that the outcome of the whole process will be an Environmental and Social Impact Assessment study report which will be submitted to NEMA. A copy of the document will be a public document accessible from NEMA website, and whose summary will be advertised in the newspapers inviting members of the public to comment.
She then welcomed the proponent’s representative, Mr. Walter B. Nyatwanga- Manager, Environment & Social Interests, to give some remarks and introduce his team.

4. Opening Remarks by Mr. Walter B. Nyatwanga- Manager, Environment & Social Interests –KeNHA

Mr Nyatwanga thanked the participants for attending and introduced KeNHA team members among them being:

<table>
<thead>
<tr>
<th>Name</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. Mr. Njue Njiru</td>
<td>Land Valuer</td>
</tr>
<tr>
<td>ii. Mr. Eliud Munene</td>
<td>Surveyor</td>
</tr>
<tr>
<td>iii. Anthony Mugo</td>
<td>Civil Engineer</td>
</tr>
<tr>
<td>iv. Eng. George Kato</td>
<td>Engineer</td>
</tr>
<tr>
<td>v. Ms Lucy Wainaina</td>
<td>Sociologist</td>
</tr>
<tr>
<td>vi. Rebecca Mutunga</td>
<td>Communication (Feedback and Concerns)</td>
</tr>
<tr>
<td>vii. Mr. Otiago</td>
<td>Communication (Feedback and Concerns)</td>
</tr>
</tbody>
</table>

He informed the attendants that the team above represented KeNHA and the Acting Director General, Engineer Samuel Omer who was in Naivasha to attend a meeting. He had however sent his apologies.

He highlighted KeNHA’s mandate as the public entity entrusted with Managing, Developing and Maintenance of the National trunk roads as per Roads Act of 2007. Additionally, he informed the residents that KeNHA has many ongoing and upcoming projects such as James Gichuru- Rironi road, Rironi- Mau Summit dualling, Nairobi Eastern and Nairobi Northern Bypasses expansion and Ndenderu- Banana- Kanunga roads among others

He noted that the Nairobi Western Bypass was the missing link of the Nairobi Bypass Project to complete the ring around Nairobi.

He informed the attendants of various meetings that KeNHA has had on the proposed Nairobi Western Bypass with other teams and stakeholders being:

I. Meeting with the Senator and Members of Parliament for Kiambu County held at Radisson Blu Hotel on 20th December 2016.

II. Meeting with Utilities companies to plan the way forward on relocation of services and utilities held on 11/1/2017 at Sarova Panafric Hotel.

III. Technical officers and Deputy Governor’s meeting from Kiambu County where technical details were shown and the team gave opinions. Held at AICAD Centre, Jomo Kenyatta University of Agriculture and Technology on 12/1/2017.

Mr. Walter ended by mentioning that the road was expected to commence in October, 2017 if all goes as planned. He welcomed Engineer George Kato to give a non-technical brief presentation on the design of the road.
5. Road project design concept, technical standards and proposed major interchanges presentation

Engineer George Kato’s presentation highlighted several key issues;

m) Western bypass is the missing link in the Nairobi Bypass project.
n) Western bypass starts from end of Southern Bypass, intersects A8 (A104), and ends at Ruaka town at junction with Northern Bypass. It passes several busy towns: Gitaru, Wangige, Ndenderu and Ruaka etc. Length of main alignment is 16.358 km

o) Significance of Nairobi Western Bypass of the bypass includes:
   - Contribution to Vision 2030 World class infrastructure’
   - Nairobi will be completely ringed by a modern high-capacity highway system
   - Effective reduction of traffic pressure in Nairobi city greatly.
   - Reduction of transport cost and decrease traffic accidents significantly

Eng. Kato showed the overall Route Map of Nairobi Western Bypass Project. Using pictures and diagrams he highlighted the central features of the bypass which includes:

- Western Bypass will be a Class A National Trunk Highway
- It will entail 4 lanes each 3.5m
- A projected speed of 80km/h
- Major Interchanges at Gitaru, Dirt (Magu stage), Wangige, Karura, Ndenderu, Rumingi and Ruaka.

He however noted Gitaru Interchange will form the second phase of the project.

On land acquisition and utility allocation, he explained that the main land excluding interchange will require 64 hectares piece of land while the interchange along main alignment will need 47.63 hectares. Other relocation shall include buildings and electric facilities. He reiterated that this was just a preliminary list on land acquisition and relocation and that the final list shall be established in the approved final design of the project.

6. Environmental and Social Concerns and proposed mitigation measures presentation

Dr. Winnie Wairimu from Earthcare Services Limited explained she is overseeing environmental and social issues related to the road that will affect the stakeholders. She emphasized that this EMCA 1999 (and its amendment 2015) was the main agenda of the meeting.

She noted some positive social benefits of the proposed project including:

r) Social enhancement
   - Bus stops and parks (improving the condition of bus terminal at Wangige)
   - Walkways on both sides of service road
   - 0.5m width of foot path on both sides of underpasses
   - Footbridges (Kwa Mbao stage, near Munyaka dispensary/Munyaka road, near Furaha/KAG Ndenderu, Near Mirai court/Mifereji, Ndenderu interchange) and other Pedestrian facilities

s) Availability of employment opportunities

t) Increase in Local incomes e.g. from informal businesses spurred

u) Increase in property value

v) Ease in traffic congestion
w) Reduced transport costs and accidents
x) Local revenue generation

She highlighted that the project design which has avoided affecting (structures) owned by major schools and churches.

Some highlighted negative social and environmental concerns and their mitigation measures are shown in table below:

<table>
<thead>
<tr>
<th>Impact</th>
<th>Phase</th>
<th>Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss of land and Structures as a result of compulsory relocation</td>
<td>Planning</td>
<td>There will be a Resettlement Action Plan. She explained that developing this is a comprehensive process. The process of Land acquisition is governed by laws e.g. the Constitution 2010, The Land Act and the National Land Commission Act.</td>
</tr>
<tr>
<td>Loss of public spaces</td>
<td>Construction/Operation</td>
<td>Others will be gained and modernized, the markets and bus stops e.g. Wangige bus terminal for instance will be modernized and relocated</td>
</tr>
<tr>
<td>Disruption of livelihood and income</td>
<td>Construction</td>
<td>Resettlement Action Plan and Adequate compensation would shield the residents from loss of their income.</td>
</tr>
<tr>
<td>Inaccessibility to the property</td>
<td>Operation &amp; Construction</td>
<td>All properties will have access as per the road design. However, this access is controlled through location of access roads and where these access roads can meet the main road to ensure smooth traffic.</td>
</tr>
<tr>
<td>Safety and Health Risks (public)</td>
<td>Operation &amp; Construction</td>
<td>Construction of bridges, underpasses pedestrian/median and a central barrier to prevent people from jumping from one side of the road to the other and resulting in accidents.</td>
</tr>
<tr>
<td>Safety and Health risks (workers)</td>
<td>Operation &amp; Construction</td>
<td>Provision of appropriate PPEs, emergency response plans, availability of First Aid Kits and first aiders as well as trained Health and Safety officers.</td>
</tr>
<tr>
<td>Disruption of utilities and services</td>
<td>Construction &amp; Planning</td>
<td>In consultation with Utility companies, the project shall have provisions for service ducts to avoid eyesore criss cross of power and telecom lines for instance, damage to roads and vegetation during setting up of new lines etc. Utility companies and contractors will employ socially acceptable strategies to ensure minimal disruption to consumers include setting up of mechanisms for engagement to ensure a quick and smooth relocation of the services.</td>
</tr>
<tr>
<td>Noise</td>
<td>Construction &amp; Operation</td>
<td>The proponent to comply with permissible noise standard, erection of Noise barriers i.e. near institutions e.g. at Ndenderu Primary School</td>
</tr>
<tr>
<td>Traffic Management</td>
<td>Construction</td>
<td>Priority construction of service roads and diversions so as not to interfere with traffic flow as the existing road is already a busy road. Improvement of some feeder roads which can be used as diversions,</td>
</tr>
<tr>
<td>Inaccessibility of property</td>
<td>Construction</td>
<td>Improve accessibility of highways and service roads</td>
</tr>
<tr>
<td>Airborne emissions(dust mainly)</td>
<td>Construction</td>
<td>The proponent to ensure Speed control, spray water to suppress dust, cover loads of friable materials on transit.</td>
</tr>
</tbody>
</table>
Impact on natural drainage | Operation | Natural drainage to be enhanced, incorporate grits, soil erosion control devices, design incorporates flood frequency, drainage protection (84km) i.e. drains, ditches, chute and catch drain. Soil erosion control devices have been factored in the design.

Soil erosion and contamination | Construction | Re-vegetation of embankments

Vegetation clearance | Construction | The proponent to ensure re-landscaping and re-vegetation where appropriate.

Solid waste generation | Construction | The proponent to engage the services of a licensed waste handler, recyclable materials to be segregated from the waste generated, reusable materials to be sorted.

Increased water use and demand | Construction | Borehole to supplement water needs for both road construction and campsite. The proponent to seek Water Resource Management Authority approvals of the borehole drilling.

Effluent/wastewater management | Construction | The proponent to provide Portable toilets for the workers. Thorough and routine inspection/monitoring of drainage system.

Using some pictures she showed examples of some of the proposed mitigation measures e.g. proposed noise barrier around the school in Ndenderu, the central barrier, footbridges etc. She also highlighted that some of the mitigation measures are a result of the meeting with the Kiambu political unit in December e.g. the additional fifth footbridge and the improvement of some feeder roads which will also be in use as diversions.

7. Plenary – Question and Answer

At this point, Hon. Ferdinand Waititu and other members of the Kiambu County Assembly (quoting the designs that had been shown to them in the previous meeting in December) and some participants requested that KeNHA to show detailed design i.e. Service roads, underpasses, flyover and drainage for Gitaru, Kanjeru, Muthire Shopping Centre, Kwa Mbao, Greenbelt Junction, Wangige, Riverside, Karingari, Kibiku, Karura, Mukui and Karura Gaitu. In short the entire road, metre by metre to the public. (At some point, The Hon went to his car and came with designs he explained he had received through parliament). A section of the political unit demanded that the public be informed parcel by parcel if their land was affected.

Mr. Nyatwanga explained that first these detailed designs were not available at the meeting. He explained the presentation was a non-technical design presentation therefore and that detailed design runs on a protected software that was not available here. KeNHA superimposed some major sections to show basically a representative design of the route and the major developments e.g. at interchange points and crossing points. Moreover, the designs were still at preliminary stage thus it’s not possible to show detailed design for the entire road. Informing (in detail) whose land will be affected will await the preparation of what is called a red line which was not available at the meeting. Secondly, such an endeavour would require a day or 2 to accomplish given this was a 17km road.
Similarly, Dr Wairimu reiterated Mr. Nyatwanga’s sentiments. She also noted informing the persons whose land is affected has to follow due process i.e. the preparation of a Resettlement Action Plan and then engagement by the National Land Commission as required by law. At this point she went on to explain what an EIA process was and her mandate in holding the meeting…the things that could be discussed too in such a meeting which could not include parcel by parcel discussion of land matters. She highlighted that land matters are sensitive matters that need to be addressed in accordance to the law. Furthermore land matters are private (unless where public and community land is involved) and thus cannot be made the subject of such meetings. She noted there will be a second process which KeNHA will start in due course. At this point she went on to explain what a RAP is in details and how it is undertaken and then the mandate of NLC.

At the request of the stakeholders, who now agreed that due process has to be followed on matters of land and allowing the EIA public participation to continue, Dr. Wairimu, then went through the designs Eng. Kato had previously. She did this in Kikuyu language to ensure the public understood. She highlighted the main route of the road and major areas of concern such as the interchanges, social enhancement features, environmental and social concerns.

Hon Ferdinand Waititu (and a section of the political unit) asked to be allowed to form a committee to engage KeNHA to which Dr Wairimu highlighted has to happen after the meeting closes since she needed the public to get an opportunity to raise their concerns as provided for by the law.

After Dr Wairimu, recapped by use of the maps and designs the Major Interchanges at Gitaru, Magu stage, Wangige, Karura, Ndenderu, Rumingi and Ruaka, The main questions and concerns raised:

a) **On Design of the road:**
- At King’eeero, there are many accidents, KeNHA should consider a foot bridge
- Hon. Waititu: Suggested formation of a committee to represent the residents to follow up on detailed issues on the road design to avoid mistakes that have happened on previous roads. The committee to be formed by residents and the MP and other members of County Assembly.

KeNHA welcomed the committee offered to share detailed design to the committee on behalf of the residents.

- Could KeNHA consider many footpaths since many people own plots and need their plots without necessarily having to walk a very long distance?

The project has provided for 5 footbridges along the road. Where there are underpasses too, there will be sections for the public to cross the road. It is therefore not envisaged that people will walk for long distances.

- Can KeNHA consider sewer line during construction of the road since the area is not served by any?

There was a public utilities company meeting. However Karuri Water and Sanitation Company was not able to attend. There will be a joint site visit and utility companies have been asked to
provide information on their needs along the road. KeNHA will then see if and how (where possible) to accommodate such requests without inflating the costs of the budget and infringing on other agencies responsibility to provide the services as mandated by law.

- Is it possible to design pedestrian bridges to be on the ground level instead of raised to make it easy to cross by residents?

Design of foot bridges is planned for level ground. However there are areas where due to gradient and drainage the footpaths will have to be over or under e.g. at underpasses.

b) Accessibility
- Will there be an access road to join the Nairobi Southern Bypass?
  Yes. All access roads will be interconnected. All public roads will join the service road, there will be restricted points which join the major bypass directly.
- How will joining the main bypass be from the service roads? Will motorists have to go long distances before joining?
  There will be designated U-turn points where there are no interchanges. To join the main road will not be more than 800m to turn or find an interchange point.
- The Nairobi Western Bypass (NWP) should not be like the Nairobi Southern Bypass whereby it’s very difficult to join the main highway from the service lane.
  KeNHA being the same agency that is responsible for Southern bypass has leaned from mistakes made there and endeavour to improve on this in Western bypass.
- Consider an access from Rungiri to Gitaru
  KeNHA to put underpasses and footbridges and access roads where deemed necessary and usable.

c) Safety and Health
- At interchanges: There are many accidents at interchanges. What will be done to avert these?
  Foot bridges will be provided for safe crossing of pedestrians. All vehicle manoeuvres at interchange points in the design factor in safety aspects. Roads will also be appropriately marked to show direction.
  - Will footpaths design consider the elderly and physically challenged persons and persons who use wheel chairs?
    This has been considered in the design. The gradient is to ensure use by all including those on wheel chairs.
  - Is it possible to restrict use of foot bridges by bodabodas?
    Given footbridges are often wide, the main issue if enforcement to ensure boda bodas do not cause safety risks.

d) Drainage
- Footbridge opposite Mlango Wa Soko has a drainage problem. Also the tunnel floods what can be done to improve? Will all storm water be directed to the rivers?
The entire road design has approximately 84Km of drainage. This will well catered for. Existing drainage and footbridges will be redesigned to address current issues.

- At Gatara where there is a river, what design will be incorporated?

There will be a box culvert or together necessary designed to cater for the capacity of the flow.

e) Project Timeline
- What is the expected time of project?

The project is expected to begin in October if all goes well. The project is an EPC project. Project timeline is determined by the EPC contractor. Walter shall confirm the approximate timeline.

f) Resettlement, Relocation and Land Acquisition
- About land with existing court cases. What will happen if they are affected by the proposed project?

In such cases, Courts and the NLC deals with matters of contested land.

- There will be many Project Affected Persons (PAPs). KeNHA needs to ensure the PAPs are compensated adequately.

Compensation will be fair and just.

- About relocating the bus stage. Have the Kiosk owners who serve the stage been considered?

A RAP will deal with such issues in detail and address all the issues.

- Who will benefit in the case of communally owned family land.

RAP will address the issue. Furthermore the NLC will engage with these issues. However if it is Community land, there is the Community Land Act to give guidance on how to deal with such matters.

- Pegging of the road map has already caused loss of tenants who have moved in anticipation. How will KeNHA consider such cases?

The RAP will address the issue of tenants. However, KeNHA cannot really control matters of speculation.

- PAPs from Kingeero requested to be part of the team that will follow up on detailed road design. Several of them noted that they had noticed there was no planned footbridge at Kingeero and that this should be considered in the final designs.

- There are bodaboda sheds near the market in Wangige. What will happen to these?

The RAP also addresses such issues to ensure these too are relocated. If there is available space elsewhere identified by the County, these can be relocated.
g) Noise

- Just like Ndenderu School, consider a noise barrier for the church and school at Kingeero.

All comments and suggestions will be considered since the design is still at preliminary stages.

- Noise barrier at Ndenderu Primary School. What about the other schools? Will they be considered for a noise barrier?

All comments and suggestions will be considered since the design is still at preliminary stages.

h) Comments on Environmental Aesthetics/Visual Intrusion

- Consider an Environmental friendly design that will not leave the landscape scarred and with bad visual impact
- KeNHA should ensure design is inspired by local setting i.e. to ensure the design blend with the local setting
- KeNHA should ensure that the design tries as much as possible to cause visual intrusion.

i) Employment and related concerns

- On Employment Labour bureaus. How will they be regulated to avoid exhortation and tribalism and to protect the minority?

The county government will oversee such employment bureaus and labour issues to include minorities and ensure equal employment opportunities.

- How will the project ensure that gender concerns are addressed in dealing with the impacts e.g. most people in the market next to Wangige bus terminal are women.

The ESIA raises gender concerns. The RAP will however detect in details what are the detailed gender concerns and how these can be addressed, more so those related to impact on gendered livelihoods.

- Will jobs only be provided for locals?

This is determined by qualifications and skills needed by the contractor.

- Some of the people were born and have only known this area, how will the jobs be distributed to ensure such are not discriminated on the basis of ethnicity and language?

Nowadays we refer more to national content rather than the term local content. This is largely because the latter is used to refer to tribal concerns. The constitution protects all rights and since national cohesion is important, all people are considered and no employer is allowed to discriminate on the basis of tribe or any other related considerations.

Closing Remarks

Hon. Waititu gave a vote of thanks. He emphasized above all Land is the main concern and urged the residents to remain behind to form the committee which will receive any opinions, suggestions and complains for forwarding to the relevant Authorities.
Hon. Waititu pledged to introduce the committee to KeNHA.

Dr. Wairimu then displayed her company email address and personal mobile phone number and asked whoever still had concerns to visit the office or call her.

The meeting ended at 13.34pm with a prayer by Mr. Anthony Kihara.

Minutes prepared by:  

Ms. Hellen Mwende  
Earthiscare Services Limited  

Augustine Juma  
Earthiscare Services Limited  

Date  

23rd February 2017
V. Ndenderu Public Forum

PROCEEDINGS OF THE PUBLIC CONSULTATIVE MEETING FOR THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT ON THE PROPOSED NAIROBI WESTERN BYPASS PROJECT, HELD ON 19TH JANUARY 2017, AT ST. ANDREWS CHURCH NDENDERU, KIAMBU COUNTY

The meeting was called to order at exactly 3.00pm at the Church’s meeting hall with a word of prayer from Rev. Titus of St. Andrew’s ACK Ndenderu.

ATTENDEES: See Appendix E V.

Agenda

1. Welcoming Stakeholders
2. Introductions
3. Road project design concept, technical standards and proposed major interchanges presentation
4. Environmental and social concerns and proposed mitigation measures
5. Plenary – Question and Answer
6. Resettlement, Relocation and Land Acquisition
7. Closing remarks

1. Welcoming Stakeholders and Opening remarks by the Chair.
The Chair, Mr. Anthony Kihara from Earthcare Services Limited welcomed all the stakeholders and briefly informed them that the meeting was mainly about social and environmental issues e.g. water, drainage among other issues. He explained that Kenya National Highways Authority (KeNHA), National Lands Commission (NLC) and National Environment Management Authority (NEMA) come in at different levels during project implementation. He emphasized the meeting was about the environmental and social issues concerning the proposed road.
In his statement, he explained the purpose of the meeting and thanked the residents of Kiambaa for turning up in such a large number for the occasion. He explained the order of the meeting, the agenda of the meeting and language of communication- which included English, Kiswahili and Kikuyu to ensure that everyone’s opinion is adequately covered.

2. Introductions
Introductions were done by representatives from Earthcare Service Limited, Dr. Winnie Wairimu and Antony Kihara.
Mr Antony introduced and recognized the presence of Honourable members, District Officer, Members of Kiambu County Assembly (MCA’s), Area Chiefs and Sub-chiefs, Clergymen, those in attendance and the whole audience for turning up for the public meeting. On the other hand Dr. Wairimu introduced Earthcare Services Limited team.
Among others, the presence of Hon. Paul Koinange, Member of Parliament (M.P) Kiambaa Constituency, and representatives from the Member of Parliaments office, Church priest, Titus
Mwangi, Retired Senior Chief Mr. Eliud Ngure, representative from the office of the Senator among others were recognized.

3. **Opening remarks from Titus Mwangi- Church priest, St. Andrews Church Ndenderu**
He welcomed all stakeholders and urged the attendants to listen keenly, respond and give comments accordingly.

4. **Opening remarks by Hon. Koinange, M.P Kiambaa Constituency.**
He welcomed all and urged members to give their comments and views. He acknowledged that a previous meeting had happened at Radisson Blu and in which the political unit had put across some requests and considerations on the design of the road and he was keen to hear developments on these.

5. **Opening remarks by Dr. Winnie Wairimu-Lead Environmental Expert, Earthcare Services Limited**
Dr. Winnie Wairimu welcomed the attendants to the meeting. In her address, she explained the core functions of National Environment and Management Authority which include coordination of all environmental related activities, review of land use guidelines, promoting the integration of environmental considerations into development policies, plans and projects to ensure sustainable resource management as well as overseeing environmental issues in Kenya. To do so, NEMA Registers and Licenses Environmental Experts and Environmental Consultancy firms such as Earthcare Services Limited to undertake environmental studies and assessment reports for projects for decision making by NEMA.
She highlighted laws such as the Constitution, (Environmental Management and Coordination Act Cap 387 (EMCA) and the EMCA (Environmental Impact Assessment and Audit) Regulations of 2003 which give the Authority and call for public participation whereby the stakeholders give opinions on social and environmental issues and their suggestion on how to deal with the issues. Their concerns and suggestions are incorporated into the project design and during various phases of implementation.

**Summary of the statement made by Dr. Wairimu with regard to NEMA and Environmental and Social Impact Assessment include:-**

a. The background of NEMA which is established under the Environmental Management and Coordination Act (EMCA cap. 387) as the principal institution of government in the management and coordination of environmental matters. The audience were enlightened that EMCA provides an institutional framework and procedures for management of the environment including provisions for conflict resolutions.

b. The Environmental Impact Assessment process and what it entails- she further explained that an EIA process is one of the synergistic of initiating a project. Other considerations would be on Land acquisition which is of interest to most of the attendees and of which the principal agency as mandated by law is the National Land Commission.

c. Relevant policies and laws governing environment issues such as noise, pollution, waste management etc.
d. Highlights on Consultation and Public Participation- she explained to the audience that holding public meeting and engagement of stakeholders is one of the processes entailed in an Environmental and Social Impact Assessment where PAP’s, stakeholders, locals and the interested parties are given a chance to express their objective views on environmental issues that might impact on their surrounding and such views are put into considerations and a list mitigations measures to counteract such impacts are given to the project proponent to implement during project implementation process.

e. Use of questionnaires as a tool for engaging locals and stakeholders- she explained the structure of the questionnaires as well as the reasons as to why environmental experts normally administered questionnaires.

She explained that the consultants inform the stakeholders of both positive and negative social and environmental concerns and looks into/discusses the pertinent issues and solutions raised during such meetings which need attention and provides enhancement/mitigation measures in accordance with environmental laws and best practices.

She asked the attendees to give their opinion on social and environmental issues and their suggestions on how to deal with the issues. She also informed the meeting that there were questionnaires available and as they came into the meeting some had received. These she requested them to fill where possible and whoever needed help in filling these could request any of the assistants in yellow reflector jackets for assistance.

Further she added that the outcome of the whole process will be an Environmental and Social Impact Assessment study report which will be submitted to NEMA. A copy of the document will be a public document accessible from NEMA website, and whose summary will be advertised in the newspapers inviting members of the public to comment.

She also noted that the meeting with the political unit in December bore some fruits. Some of the mitigation measures proposed are a result of the meeting with the Kiambu political unit in December and which had since been incorporated into the design of the road e.g. the additional fifth footbridge and the improvement of some feeder roads which will also be in use as diversions. Dr. Wairimu finished her first session and welcomed the introductory remarks and presentations by the KeNHA.

6. Opening Remarks by Mr. Walter B. Nyatwanga- Manager, Environment & Social Interests –KeNHA

Mr Walter, thanked the participants for attending on behalf of Director General, who was in Naivasha attending a meeting. He then introduced KeNHA team members among them being;

<table>
<thead>
<tr>
<th>Name</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. Mr. Njue Njiru</td>
<td>Land Valuer</td>
</tr>
<tr>
<td>ii. Mr. Eliud Munene</td>
<td>Surveyor</td>
</tr>
<tr>
<td>iii. Anthony Mugo</td>
<td>Civil Engineer</td>
</tr>
<tr>
<td>iv. Eng. George Kato</td>
<td>Engineer</td>
</tr>
<tr>
<td>v. Ms Lucy Wainaina</td>
<td>Sociologist</td>
</tr>
<tr>
<td>vi. Rebecca Mutunga</td>
<td>Communication (Feedback and Concerns)</td>
</tr>
<tr>
<td>vii. Mr. Otiago</td>
<td>Communication (Feedback and Concerns)</td>
</tr>
</tbody>
</table>
He highlighted KeNHA’s mandate as the public entity entrusted with Managing, Developing and Maintenance of the National trunk roads as per Roads Act of 2007. In his presentations he explained the other key functions of KeNHA and its areas of expertise, which included rolling out highway road projects such as the proposed Western Bypass. He reiterated that the objective mandate lies on Highways and Bypasses, however, there are other government bodies such as Kenya Urban Road Authority (KURA) (dealing with Urban roads development and maintenance), Kenya Rural Roads Authority (KeRRA) (dealing with rural roads development and maintenance).

Additionally, he informed the residents that KeNHA has many ongoing and upcoming projects such as James Gichuru- Rironi road, Rironi- Mau Summit dualling, Nairobi Eastern and Nairobi Northern Bypasses expansion and Ndenderu- Banana- Kanunga roads among others. He added that it is evident that KeNHA has successfully completed a number of Bypass projects for instance, the Southern Bypass, Eastern and Northern Bypass.

In his presentation, he explained further the Bypass Project which is in line with Kenya’s Vision 2030 under infrastructural development and noted that the Nairobi Western Bypass was the missing link of the Nairobi Bypass Project to complete the ring around Nairobi. He added that KeNHA will not construct single carriage rather a dual carriage like the newly opened Southern bypass aims at easing traffic and congestion in Nairobi.

He informed the attendants of various meeting that KeNHA has had a various meetings with other teams and stakeholders being:

a. Meeting with the Kiambu Senator and Members of Parliament for Kiambu County held at Radisson Blu Hotel on 20th December 2016.

b. Meeting with Utility companies to plan way forward on relocation of services and utilities held on 11/1/2017 at Sarova Panafric Hotel.

c. Technical officers meeting from Kiambu County (including Deputy Governor) where technical details were shown and the team gave opinions., held at AICAD Centre, Jomo Kenyatta University of Agriculture and Technology on 12/1/2017

In his statement he reiterated that public meeting is part of feasibility study of the project and that KeNHA shall continue holding myriads of meetings to ensure all considerations are covered. He said that it is important to present an overview of the project detail on how the road will be constructed.

Mr. Walter ended by mentioning that the road was expected to commence in October, 2017 if all goes as planned. He welcomed Engineer George Kato to give a non-technical brief presentation on the design of the road.

7. Road project design concept, technical standards and proposed major interchanges presentation

In his address to the meeting, Eng. Kato further explained the mandate of KeNHA which lies under the Ministry of Roads and Infrastructural Development- is responsible for development and maintaining of Highways. The Authority conducts rigorous assessment of roads to see what is required for that particular road and finally comes up with a Plan.
In his presentation, he explained that the KeNHA team have considered critical issues that were missing in the previous Bypass Projects which is going to be a lesson learned in order to carry out an effective work. This includes dualling of Western Bypass as compared to single lane in Northern Bypass.

His presentation highlighted several key issues;

a) Western bypass is the missing link in the Nairobi Bypass project. KeNHA and the utility companies for planning purposes.

b) Western bypass starts from end of Southern Bypass, intersects A8 (A104), and ends at Ruaka town at junction with Northern Bypass. It passes several busy towns: Gitaru, Wangige, Ndenderu and Ruaka etc. Length of main alignment is 16.358km

c) Significance of Nairobi Western Bypass of the bypass includes:
   - Contribution to Vision 2030 ‘World class infrastructure’
   - Nairobi will be completely ringed by a modern high-capacity highway system
   - Effective reduction of traffic pressure in Nairobi city greatly.
   - Reduction of transport cost and decrease traffic accidents significantly

Eng. Kato showed the overall Route Map of Nairobi Western Bypass Project. Using pictures and diagrams he highlighted the central features of the bypass which includes:
- Western Bypass will be a Class A National Trunk Highway
- It will entail 4 lanes each 3.5m
- A projected speed of 80km/h
- Major Interchanges at Gitaru, Magu stage, Wangige, Karura, Ndenderu, Rumingi and Ruaka

He added that the proposed service roads shall be about 17km and the proposed interchanges will be of different designs; some complex and some simple. E.g. the Gitaru interchange will be a full clover leaf. He showed the designs of all the interchanges and in some explained a bit about the manoeuvres on some interchanges.

He further explained that the biggest interchange will be in Ndenderu and the space allocated is little but the authority would not wish to interfere with the property of the residents. The project has tried to ensure minimal interruptions and land acquisition.

On land acquisition and utility allocation, he explained that the main land excluding interchange will require 64 hectares piece of land while the interchange along main alignment will need 47.63 hectares. Other relocation shall include buildings and electric facilities. He reiterated that this was just a preliminary list on land acquisition and relocation and that the final list shall be established in the approved final design of the project.

He ended by saying that the meeting was mainly focusing on social and environmental aspects in that the road designs shall still be discussed with the members of the public.

8. Environmental and Social Concerns and proposed mitigation measures presentation

Dr. Winnie Wairimu from Earthcare Services Limited explained she is overseeing environmental and social issues of the project that might potentially affect the stakeholders. She explained that the environmental expert uses preliminary designs for the proposed road, to single out potential
project impacts likely to impact the biophysical and social environment and ways to avert, enhance and minimize the impacts as much as possible.

She noted some positive social benefits including:

a) Social enhancement
   - Bus stops and parks (improving the condition of bus terminal at Wangige)
   - Walkways on both sides of service road
   - 0.5m width of foot path on both sides of underpasses
   - Footbridges (Kwa Mbao stage, near Munyaka dispensary/Munyaka road, near Furaha/KAG Ndenderu, Near Mirai court/Mifereji, Ndenderu interchange) and other Pedestrian facilities

b) Availability of employment opportunities

c) Increase in Local incomes e.g. from informal businesses spurred
d) Increase in property value
e) Ease in traffic congestion
f) Reduced transport costs and accidents
g) Local revenue generation

She highlighted the project design which has avoided affecting (structures) owned by major schools and churches.

Some highlighted negative social and environmental concerns and their mitigation measures are shown in table below:

<table>
<thead>
<tr>
<th>Impact</th>
<th>Phase</th>
<th>Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss of land and Structures as a result of compulsory relocation</td>
<td>Planning</td>
<td>There will be a Resettlement Action Plan. She explained that developing this is a comprehensive process. The process of Land acquisition is governed by laws e.g. the Constitution 2010, The Land Act and the National Land Commission Act.</td>
</tr>
<tr>
<td>Loss of public spaces</td>
<td>Construction/Operation</td>
<td>Others will be gained and modernized, the markets and bus stops e.g. Wangige bus terminal for instance will be modernized and relocated</td>
</tr>
<tr>
<td>Disruption of livelihood and income</td>
<td>Construction</td>
<td>Resettlement Action Plan and Adequate compensation would shield the residents from loss of their income.</td>
</tr>
<tr>
<td>Inaccessibility to the property</td>
<td>Operation &amp; Construction</td>
<td>All properties will have access as per the road design. However, this access is controlled through location of access roads and where these access roads can meet the main road to ensure smooth traffic.</td>
</tr>
<tr>
<td>Safety and Health Risks (public)</td>
<td>Operation &amp; Construction</td>
<td>Construction of bridges, underpasses pedestrian/median and a central barrier to prevent people from jumping from one side of the road to the other and resulting in accidents.</td>
</tr>
<tr>
<td>Safety and Health risks (workers)</td>
<td>Operation &amp; Construction</td>
<td>Provision of appropriate PPEs, emergency response plans, availability of First Aid Kits and first aiders as well as trained Health and Safety officers.</td>
</tr>
<tr>
<td>Disruption of utilities and services</td>
<td>Construction &amp; Planning</td>
<td>In consultation with Utility companies, the project shall have provisions for service ducts to avoid eyesore criss cross of power and telecom lines for instance, damage to roads and vegetation during setting up of new lines etc.</td>
</tr>
</tbody>
</table>
Utility companies and contractors will employ socially acceptable strategies to ensure minimal disruption to consumers include setting up of mechanisms for engagement to ensure a quick and smooth relocation of the services.

<table>
<thead>
<tr>
<th>Noise</th>
<th>Construction &amp; Operation</th>
<th>The proponent to comply with permissible noise standard, erection of Noise barriers i.e. near institutions e.g. at Ndenderu Primary School</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic Management</td>
<td>Construction</td>
<td>Priority construction of service roads and diversions so as not to interfere with traffic flow as the existing road is already a busy road. Improvement of some feeder roads which can be used as diversions,</td>
</tr>
<tr>
<td>Inaccessibility of property</td>
<td>Construction</td>
<td>Improve accessibility of highways and service roads</td>
</tr>
<tr>
<td>Airborne emissions (dust mainly)</td>
<td>Construction</td>
<td>The proponent to ensure Speed control, spray water to suppress dust, cover loads of friable materials on transit.</td>
</tr>
<tr>
<td>Impact on natural drainage</td>
<td>Operation</td>
<td>Natural drainage to be enhanced, incorporate grits, soil erosion control devices, design incorporates flood frequency, drainage protection (84km) i.e. drains, ditches, chute and catch drain. Soil erosion control devices have been factored in the design.</td>
</tr>
<tr>
<td>Soil erosion and contamination</td>
<td>Construction</td>
<td>Re-vegetation of embankments</td>
</tr>
<tr>
<td>Vegetation clearance</td>
<td>Construction</td>
<td>The proponent to ensure re-landscaping and re-vegetation where appropriate.</td>
</tr>
<tr>
<td>Solid waste generation</td>
<td>Construction</td>
<td>The proponent to engage the services of a licensed waste handler, recyclable materials to be segregated from the waste generated, reusable materials to be sorted.</td>
</tr>
<tr>
<td>Increased water use and demand</td>
<td>Construction</td>
<td>Borehole to supplement water needs for both road construction and campsite. The proponent to seek Water Resource Management Authority approvals of the borehole drilling.</td>
</tr>
<tr>
<td>Effluent/wastewater management</td>
<td>Construction</td>
<td>The proponent to provide Portable toilets for the workers. Thorough and routine inspection/monitoring of drainage system.</td>
</tr>
</tbody>
</table>

Using some pictures she showed examples of some of the proposed mitigation measures e.g. proposed noise barrier around the school in Ndenderu, the central barrier, footbridges etc.

9. Plenary – Question and Answer
The first person to raise concerns mentioned that when the residents heard about the project, they formed their own committee called Western Bypass Stakeholders Forum and elected some leaders. During a previous meeting, they raised some concerns (of which the chair noted that some had been addressed by Dr Wairimu and Eng. Kato.

Notes of the meetings of Ndenderu, Karura and Ruaka on Western Bypass Project and its Implications.
The meeting was held at ACK St. Andrew’s Church- Ndenderu attended by 42 people. The meeting was chaired by Edward Kieni and facilitated by Karanja Thariki. Rev. Titus Mburu stated
gave a brief background to the basis of the meeting, in his presentation he stated that there has been a fear that proposed bypass will affect the church and Ndenderu Primary and Secondary School. Most residents were apprehensive due to no official communication from the KeNHA. He explained that he has attended several meetings with KeNHA staff and the road design will not affect the institutions named. The residents were however worried about the impacts of the project due to lack of official communications from KeNHA.

Mr. Karanja made a presentation that gave an explanation on the nature of the Bypass and its funding.

After plenary questions and answers, the following were agreed upon by the 42 member team:

- An EIA should be done to assess and evaluate the impacts of the project
- Public participation of the affected local community where their interests, needs, values are taken into account
- The Bypass should make it easier for the residents to access to the existing centres efficiently
- The service roads should allow easier access to the centres and homesteads along the bypass
- A market should be constructed at Ndenderu to create more business opportunities in that there is already land allocated by the government for the market development.
- The bypass should avoid public and permanent buildings as much as possible
- Fair compensation which commensurate with current market value and should be speeded up.
- Mode of compensation to be discussed in details in their next meeting with government officials
- In addition to compensation for land, costs for damages to buildings during construction should be considered as well as assessment of the state of the buildings before construction to avoid disputes.
- The residents will consider putting in place an arbitrator in case of compensation disputes
- For the safety of the residents: a footbridge should be constructed in major shopping centres as well as ramps for easy accessibility by disabled persons. Erection of speed bumps strategically along the service lanes to avoid accidents.
- Construction of footpaths
- Street lights should be installed strategically and use of solar energy be prioritized
- Sufficient signage with good lighting should be installed
- Source of materials and labour should be acquired locally
- Youths employed should be paid according to the market rates
- To build the capacity of the youths, they should not only be employed but opportunities should be created to train them on road construction to improve their skills
- Non-local contractors and workers should respect the community by appreciating the basic cultures of the residents
- KeNHA should provide a document and maps to residents when explaining the project design
- Women should consider forming groups to provide food to road workers
- CSR activity suggested by members; that is construction of a TVET in Ndenderu and Ruaka to train young people in road construction equipped with training of trainers and modern equipment.
- Dust pollution should be minimized by constant watering of the road under construction.

Other main questions and concerns raised in the plenary include:

a) Design of the road
   - Is it possible to put up foot bridges and permanent barriers at Ruaka to prevent accidents related to illegal crossings?

KeNHA and the contractor did a survey of the route and reached an agreement on which sections require foot bridges. About permanent barriers, the road design includes a central barrier. However, KeNHA is looking for alternative material for permanent barriers as the current designs of barriers are prone to vandalism.

- What will be the duct intervals? Define in Kilometres.

The intervals will depend with the specifications given by the service providers. The utility companies and KeNHA have planned joint site visits and there will be assessments on where best to place service ducts. This will be considered in the final design.

- Given the road will be in use by trucks, will there be climbing lanes?

The gradient of the road will allow trucks to safely climb the road including interchanges without much difficulty.

- Are service lanes 1 or 2 way.

This is determined by costs of the project and necessity, so it might vary from place to place.

b) Accessibility
   - There has always been loss in economic activities of small towns due to construction of bypasses. How does the road design cater for access to small towns along the bypass?

KeNHA is trying not to interfere with the existing market centres, the small towns will however be served by service lanes/roads like the ones in Kikuyu town.

- Will the underpasses be having lighting systems to enhance security?

All the tunnels and underpasses will be provided with sufficient lighting.

c) Drainage
   - There was a tunnel at a river in Karura which after construction caused damage to property and farms due to flow back. What will be the drainage considerations in that area to prevent a similar occurrence?

Hydrological studies have been done as part of the feasibility to determine the kind of bridges and tunnels to be done in the area.
d) Project Timeline

- What is the Project Timeline?

There is no exact duration given by the constructors but as per the government the project should commence in October, 2017.

e) Safety

- According to the designs, there are places with no bridges, for instance from Gitaru to Ruaka is a big gap.

There are 5 footbridges and several underpasses along the whole route. Disability footbridges and footpaths shall be erected with ramp to ensure that everyone is catered for. The interval of the bridges shall be considered as well this will be depend on finances due to the financial implications of construction them.

- Motorcyclists and non-motorists are always on the wrong side of the road, what safety measures are there in place?

There shall be a dedicated line for these groups in our design so their safety is guaranteed. E.g. motorbike users can use the main road and service lanes. There are footpaths along the road for pedestrians.

- Vandalism of road structures has always been the case with Bypasses like the case of Thika Superhighway, what is KeNHA doing about this to prevent vandalism e.g. of guard rails?

Unfortunately, this remains one of the biggest challenge to the authority, however, research is underway at the KeNHA to establish which materials can be used that have no scrap value to replace the current materials used. Also highway patrol try to deter such cases.

- There is need for a footbridge at Ndenderu market.

f) Noise abatement

- How is the noise going to be managed within the schools and institutions during road construction?

KeNHA had a meeting with relevant authorities where possible mitigations measures were discussed and shall be implemented to curb the noise. For instance a noise barrier will be constructed around Ndenderu primary school.

g) Employment and CSR

- What will be the minimum wage given to the employees?

Minimum wage is determined by the Labour laws so the contractor has no mandate to pay below or above the average amount required.

- Will the contractor introduce some Corporate Social Responsibility (CSR) related endeavours in the community during project implementation?
This is encouraged but cannot be a condition set on the contractor. CSR is a voluntary endeavour.

**h) Environment**

- What measures has NEMA put in place to ensure that the proposed drainage for the road is purposely for the run-offs but not drainage system that will pollute River Ruaka?

There are laws and regulations governing usage of natural resources and waste management under EMCA Cap 387. However much KeNHA might want to work within the regulations to ensure zero pollution to the water bodies along the project area, it recognizes that enforcement of such is the mandate of NEMA and WRMA.

- What measures are in place to ensure that proponent does not leave open borrow pits in our lands?

The issue has been addressed in our ESIA report and procedures have been highlighted so the project proponent will be guided by our report. Also the contractor will be required to undertake EIAs for all secondary sites and which will address such issues where campsites, borrow pits, quarries etc. are concerned.

- Will the authority invest in solar lighting system in the roads to promote better and cleaner energy?

Where possible, such will be considered and given priority by the authority.

**i) Land Acquisition and Compensation**

- How will contractors pay for the trees to be felled during project implementation?

The proponent have been given guideline report to follow whereby there will be re-vegetation programmes. However payment for trees is handled by NLC during land acquisition.

- Where land acquired is large and remnant is not economically viable, will the remaining be acquired?

In the past KeNHA encouraged that, however, there have been challenges where people still resae the remnant section even after NLC has acquired on behalf of KeNHA. This is a big challenge given KeNHA is enjoined in similar court cases thus discouraging the agency from acquiring he remnant pieces.

- There are a number of facilities and services that serve the general public e.g. the police post, dispensaries, Chief’s home which will most likely be affected by the Ndenderu interchange. Is it not possible to avoid those?

The project design has tried to avoid acquisition of land where it is not necessary to do so. However, in some cases it might not be possible to completely avoid some facilities given the interchanges have to be at certain gradient to enable trucks use the road. I.e. avoiding too steep climbs. Where public facilities are affected, these are relocated.
For some families, the land involved is historical. Most of the people lining in an area are related but land acquisition will disperse families. For others it will cause anxiety especially for the elderly.

**Presentation by Mr. Munene of KeNHA on Land Acquisition**

He stated that the Land and NLC Acts are clear, in that they give the mandate for compensation to NLC. It will engage valuers and compensate the affected persons fair and just prices.

He explained to the attendants that the road reserve was placed at 61 meters way back in 1970’s during land acquisition. He reiterated that indeed, Ndenderu interchange will require a large chunk of land but then the final design is not yet completed which will show the total amount of land required. The plan shall be presented to NLC who does the valuation and later gazettment of the land to be acquired.

Mr. Munene explained that there shall be an enquiry where members of the public can express their interests. A succession must be available if the land owner had died.

He enlightened the public that valuation of the land shall be conducted and the land owners must inform the valuers of the existing underground cables, trees and other resources within the land in question. In addition, people are asked to make presentations at the Enquiries and the award can either be accepted or rejected. For rejected land, a written letter must be presented to show why the owner or a member has rejected the award.

He highlighted the mode of payments which included bankers cheques and banking through making direct deposits.

He winded up his statements by advising the public that every affected person can enquire from National Land Commission for notice period to vacate the premises or land.

**11. Closing Remarks**

**Remarks by District Officer**

He thanked the residents for an overwhelming turn out to the event which he said is entrenched in the constitution involving various sectors including environmental, land and political sectors. He added that during compensation, the land issue has always been a problematic within the areas of Ndenderu, having served the community for such a long time, he urged the residents to accept the compensation given where deemed fair and just, and to avoid long delays in the project given that the project is of benefit to the area.

**Remarks by Hon Paul Koinange MP, Kiambaa.**

The Hon member ask the residents to stay in peace in that the team from KeNHA shall do a recommendable job concerning relocation, compensation and land acquisition processes to avoid unnecessary conflicts.

He reminded the residents of Ndenderu that indeed the proposed interchange is near the dam, but this should not be a problem given that the structural designs are under approval process. Other benefits of the project (if explored to happen concurrently) can include a sewer line. He added that he attended the meeting organized by KeNHA and about the noise abatement issue within the institutions and schools, he has seen that mitigation measures have been put in place to curb the noise. E.g. Ndenderu Primary school.
He added that a police station and fire bridge are in county plans for the area.

Dr, Wairimu then displayed her company email address and personal mobile phone number and asked whoever still had concerns to visit the office or call her.

There being no any other business, the meeting ended at exactly 5.35pm with a closing prayer from Rev Titus-ACK Ndenderu Church.

**Minutes prepared by:**

Ms. Hellen Mwende
Earthcare Services Limited
Date: 23rd February 2017

Augustine Juma
Earthcare Services Limited
Date: 23rd February 2017
Appendix E – Meeting Participants/Attendees

I. Political leaders
II. Utility Companies
III. County Government of Kiambu
IV. Wangige Public Forum
V. Ndenderu Public Forum
Appendix F – Initial Newspaper Advert

DAILY NATION | Wednesday December 14, 2016

Kenya National Highways Authority (KENHA) in conjunction with Earthcare Services Ltd (Environmental Consultants) wishes to inform all members of public living along the proposed Western Bypass that there will be public participation forum meetings on 16/12/2016 to discuss the Environmental Impacts of the proposed project. All members of public living along Ruaka, Ndenderu, Karura, Wangige, Kingeero, Kanyariri, Muthure, Gitaru and Kikuyu are invited to come and participate in the discussions.

The objective of the meetings will be to inform and seek participation of the public on the proposed construction of the Western bypass. The Public consultation meeting forums for the members of the general public have been scheduled as follows;

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<tr>
<th>Date</th>
<th>Venue</th>
<th>Time</th>
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<tbody>
<tr>
<td>16/12/2016</td>
<td>Anglican Church of Kenya - Ndenderu Parish</td>
<td>2pm – 4pm</td>
<td>Ndenderu</td>
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<tr>
<td>16/12/2016</td>
<td>ACK St. Peter’s Church Wangige</td>
<td>10am – 12pm</td>
<td>Wangige</td>
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Yours Faithfully,

Eng. Peter M. Mundinia
Director General
Appendix G – Copy of Public Participation Invitation Letter
## Appendix H – List of stakeholders that received a letter

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<th>No.</th>
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<td>Members of Parliament, Kikuyu, Kabete, Kiambaa, Limuru (and others if necessary)</td>
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<td>14.</td>
<td>The County Director Water, Environment &amp; Natural Resources</td>
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<td>15.</td>
<td>County Minister and County Director for Roads, Transport &amp; Public Works</td>
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<td>County Minister and County Director for Trade, Tourism, Industry &amp; Co-operatives</td>
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<td>County Minister and County Director for Land, Housing &amp; Physical Planning</td>
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<td>County Minister and County Director for Youth, Sports &amp; Communication</td>
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Appendix I – Public Notice
Appendix J – Kameme FM Classifieds Western Bypass Public Forums Advert
Appendix K – Air Quality Study
Appendix L – Noise Quality Study
Appendix M – Proposed Traffic Implementation Scheme

Section 1: K0+000--K5+200

1) K0+000—K2+900

As shown in the figure below, Priority construction for the Service Road 1, Service Road 2, Service Road 15 and Service Road 16. Combination and Utilization of Service Roads as divisions to meet residents traffic requirements.

2) K2+900-K3+500

One side under construction, another side open for traffic, shown as the figure below.

3) K3+500-K4+700

As shown in the figure below, Priority construction for the Service Road 3, Service Road 4 and Service Road 14. Combination and utilization of those Service Road as divisions to meet residents traffic requirements.
4) K4+700-K5+200

One side under construction, another side open for traffic, shown as the figure below.

Section 2: K5+200—K10+500

1) K5+200-K6+400

As shown in the figure below, Improvement of existing road on the right side of main line and Priority construction for the Service Road 5, Service Road 6. Utilization of those Service Roads
as divisions to meet resident’s traffic requirements. Improvement of existing road on the right side of main line, as shown in the figure.

2) K6+400-K7+200

One side under construction, another side open for traffic, shown as the figure below.

3) K7+200-K8+600

As shown in the figure below, Priority construction for the Service Road 7 and Service Road 8, improvement of existing road, Combination and utilization of Service Roads and improved existing road as divisions to meet residents traffic requirements.
Nairobi Western Bypass Project
Environmental and Social Impact Assessment Report

4) K8+600-K8+800

One side under construction, another side open for traffic, shown as the figure below.

5) K8+800-K10+500

As shown in the figure below. Priority construction for the Service Road 9, Service Road 10, Service Road 17 and Service Road 20, Combination and Utilization of Service Roads and existing paved Gitaru Road as divisions to meet resident’s traffic requirements.
Section 3: K10+500-K15+358

1) K10+500—K12+600

As shown in the figure below. Priority construction for the Service Road 11, Service Road 12, Service Road 18 and Service Road 19, Combination and Utilization of Service Roads as divisions to meet residents traffic requirements.

2) K12+600-K13+700

As shown in the figure below, Improvement of existing road on the right side of main line and Priority construction for the Service Road 13 and Service Road 14. Combination and Utilization of improved existing road and Service Roads as divisions to meet residents traffic requirements.
3) K13+700-K15+358

One side under construction, another side open for traffic, shown as the figure below.
Appendix N – Earthcare and Expert’s licences and renewal receipts
Appendix O – Detailed Designs