

APPENDIX 11 Supplementary Environmental Impact Assessment Report

SUPPLEMENTARY ENVIRONMENTAL IMPACT ASSESSMENT REPORT

PREPARATORY SURVEY ON MOMBASA CITY ROAD DEVELOPMENT PROJECT

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APPENDIX

Appendix-1 Principles of the JBIC Guidelines (Summary), Comparison of Kenyan and JBIC Guidelines/World Bank Policies

Appendix-2 List of Vascular Plants, Birds and Butterflies in the Study Area

Appendix-3 Records of Stakeholder Consultation Meetings

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CHAPTER 1 POLICY AND LEGAL FRAMEWORK

1.1 Introduction

The “Environmental and Social Impact Assessment for Mombasa Bypass Road Study” (hereafter referred to as the original EIA report) for the F/S was submitted to the National Environmental Management Authority (NEMA) in March 2011.

The JICA survey Team closely examined the EIA report in accordance with the “JBIC Guidelines for Confirmation of Environmental and Social Considerations (2002 April)” (hereafter referred to as the JBIC Guidelines).

This “Supplementary Environmental Impact Assessment Report” (hereafter referred to as the supplementary EIA report) was specifically prepared based on the results of the supplemental EIA surveys by the JICA Survey Team.

1.2 Laws and Policy in Kenya

Laws and Policy in Kenya associated with this Project in terms of the following items were addressed in Chapter 10 of the original EIA report.

- Environmental Policy
- Institutional Arrangements
- Legal Framework
- Project Codes and Standards
- Administrative Framework

1.3 JBIC Guidelines and World Bank's Operational Policy

Principles of the JBIC Guideline are shown in Appendix A1. The principle of JBIC Guidelines is fundamentally harmonized with World Bank Operational Policies.

The World Bank Operational Policy with respect to the land acquisition and resettlement framework was described in Chapter 18, Section 18.3 of the original EIA report.

1.4 Gap Analysis and Project Policy

In principal, JICA respects the legal framework of the borrower’s environmental and social considerations. However in the case of the borrower’s legal framework and common practices for such consideration are significantly different from regional practices or/and internationally acceptable level, JICA may request the responsible authorities of the ODA recipient(s) to reconsider the acceptable level of environmental and social consideration. Due to the recent reorganization of the Japanese ODA agencies in 2008, specifically JICA and JBIC, the JBIC Guideline was applied for the Project.

The Resettlement Action Plan (RAP) also complies with JBIC Guidelines. The RAP should include the items which are required in the World Bank Safeguard Policy OP 4.12 Annex A Resettlement Plan. The details of the RAP preparation procedure were referred to Involuntary Resettlement Sourcebook Planning and Implementation in Development Projects prepared by the World Bank.

Comparison of Kenyan EIA regulations and the JBIC Guidelines were summarized in the table in Appendix A1.

Regarding the resettlement and compensation, comparison of Kenya and World Bank Policies/ JBIC Guidelines were also tabulated in Appendix A1.

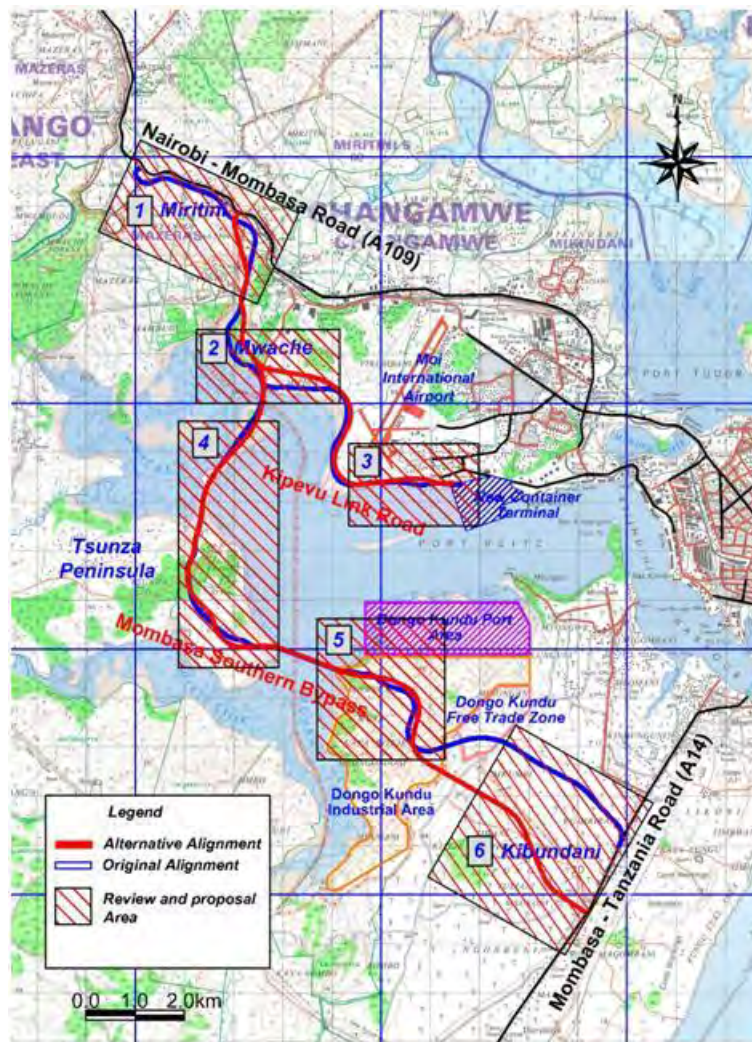
The JICA survey Team reviewed the EIA report in accordance with the JBIC Guidelines and prepared the supplementary EIA report based on the results of the supplemental EIA surveys.

CHAPTER 2 PROJECT DESCRIPTION

2.1 Project Location

The Project roads are comprised of two roads, namely Mombasa Southern Bypass and Kipevu Link Road. Mombasa Southern Bypass branches off from Nairobi-Mombasa Road (A109) at Miritini then runs down to Tsunza Peninsula and Dongo Kundu, and finally emerges with Mombasa-Tanzania Road (A14). The Kipevu Link Road branches off from Mombasa Southern Bypass at Mwache then runs to Mombasa New Port Container Terminal.

Mombasa Southern Bypass is about 20.0 km and Kipevu Link Road is about 5.7 km.



Source: JICA Survey Team

Figure A11.2-1 Location of the Project

2.2.2 Bridge Design (Mwache Bridge and Mteza Bridge)

Based on the profile along the road alignment, Mwache Bridge length was planned 900 m and Mteza Bridge length was planned 1,450 m. Basic structure of the long bridges was reviewed and the alternative was proposed as shown in Figure A11.1-3.

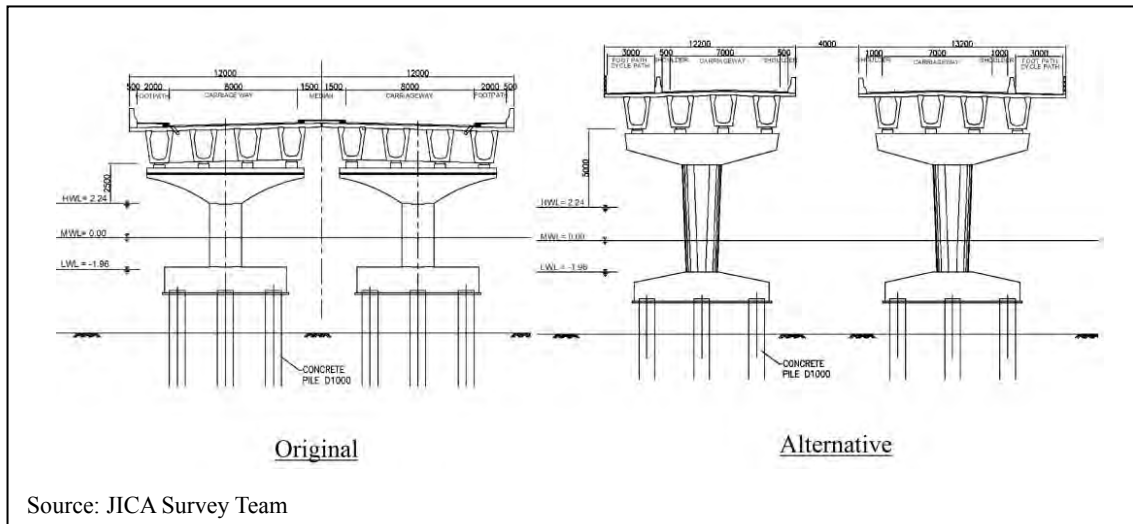


Figure A11.2-3 Basic Structure of Long Bridges

A 1,200 m long pile-slab viaduct was proposed for the tidal flat land section instead of originally proposed embankment (Figure A11.1-4).

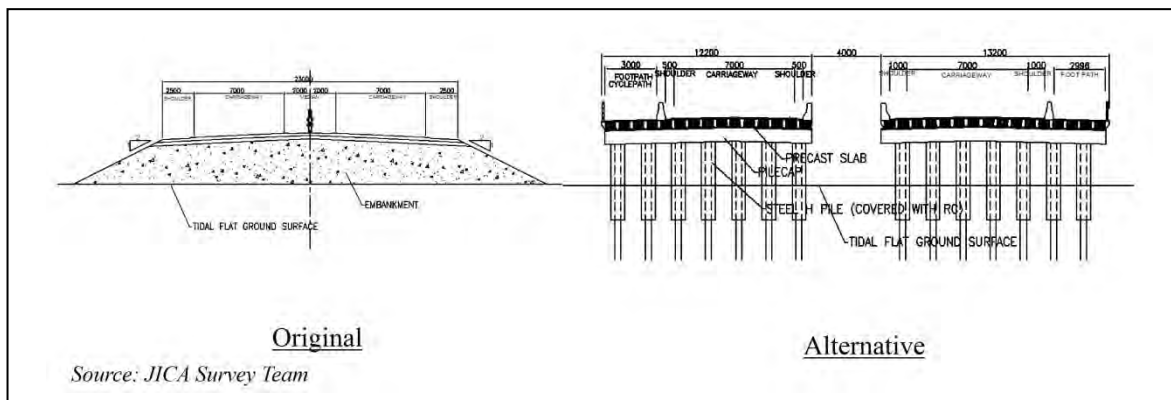


Figure A11.2-4 Basic Structure of Long Bridges

2.3 Project Implementation Schedule

The project road is divided into three packages as shown in Figure A11.2-5. The draft project implementation schedule is shown in Table A11.2.1.

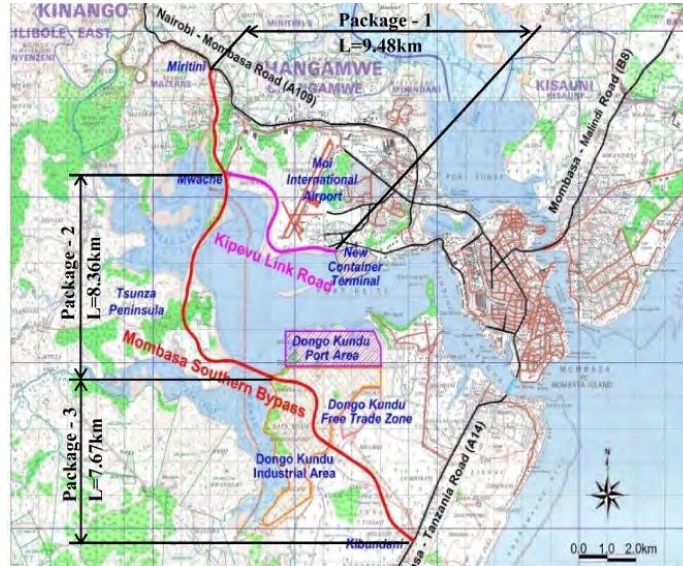


Figure A11.2-5 Project Packaging

Table A11.2-1 Proposed Project Implementation Schedule

	2012	2013	2014	2015	2016	2017	2018	2019
Loan Agreement								
Selection of Consultant	██████████	(10M)						
Land Acquisition		██████████		(26M)				
Utility Relocation			██████████	(18M)				
Detailed Design								
Package-1: Miritini - Mwache - Kipevu	JICA Survey	██████████	(9 M)					
Package-2: Mwache - Tunza - Mteza		██████████	(12 M)					
Package-3: Mteza - Kitundani		██████████	(9 M)					
Tendering								
Package-1: Miritini - Mwache - Kipevu		██████████		(15M)				
Package-2: Mwache - Tunza - Mteza			██████████	(15M)				
Package-3: Mteza - Kitundani			██████████	(15M)				
Construction								
Package-1: Miritini - Mwache - Kipevu			██████████		(24 M)			
Package-2: Mwache - Tunza - Mteza				██████████		(41 M)		
Package-3: Mteza - Kitundani				██████████	(24 M)			

Source: JICA Survey Team

2.4 Project Cost Estimate

The draft Project cost is shown in Table A11.2-2. Exchange rates of currencies are considered as follows:

- Kenya shilling to US\$: 96.4Ksh/US\$
- Japanese yen to US\$: 76.8Yen/US\$

Table A11.2-1 Project Cost

Item	FC & Total: million Yen, LC: million Ksh		Total
	FC	LC	
A. ELIGIBLE PORTION			
I) Procurement / Construction	8,444	19,251	23,845
Package1 :Miritini-Mwache-Kipevu	257	6,388	5,367
Package2 :Mwache-Tunza-Mteza	6,624	4,544	10,259
Package3 :Mteza-Kibundani	244	1,704	1,607
Utility Relocation	0	0	0
Base cost for JICA financing	7,125	12,636	17,233
Price escalation	551	4,865	4,444
Physical contingency	768	1,750	2,168
II) Consulting services	1,425	2,461	3,394
Base cost	1,226	1,684	2,573
Price escalation	70	554	512
Physical contingency	130	224	309
Total (I + II)	9,869	21,712	27,239
B. NON ELIGIBLE PORTION			
a Procurement / Construction	2,111	5,190	6,263
Package1 :Miritini-Mwache-Kipevu	64	1,597	1,342
Package2 :Mwache-Tunza-Mteza	1,656	1,136	2,565
Package3 :Mteza-Kibundani	61	426	402
Utility Relocation	0	285	228
Base cost	1,781	3,444	4,537
Price escalation	138	1,274	1,157
Physical contingency	192	472	569
b Land Acquisition	0	1,553	1,242
Base cost	0	1,211	969
Price Contingency:	0	201	160
Physical contingency	0	141	113
c Administration cost	0	2,172	1,737
d VAT	0	0	0
e Import Tax	0	0	0
Total (a+b+c+d+e)	2,111	8,915	9,243
TOTAL (A+B)	11,980	30,627	36,482

Source: JICA Survey Team

CHAPTER 3 BASELINE DATA

3.1 Natural Environment

3.1.1 Natural Conditions

Natural conditions in terms of the following items were described in Chapter 9 of the original EIA report.

- Topography and Geology
- Climate
- Hydrology
- Marine Waters such as Oceanographic Conditions, Coastal Currents and Surface Transport, Waves, Transparency, and Tides or Sea Level Fluctuations
- Soils and Agro Ecology

3.1.2 Natural Environment

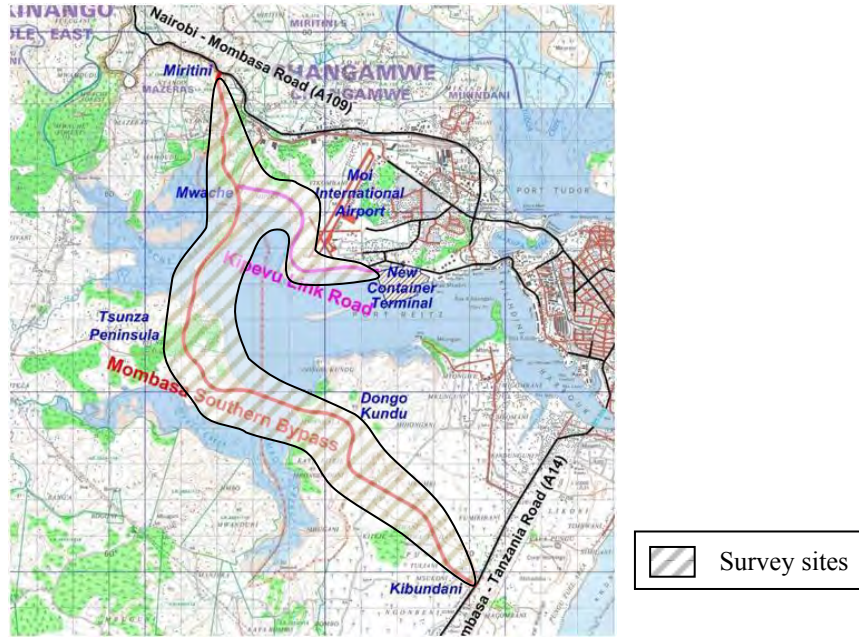
Natural environment in terms of the following items were reported in Chapter 11, Section 11.2 of the original EIA report.

- Marine Fauna: Macro Benthos
- Marine Fauna: Fish
- Marine Flora: Mangrove Forests
- Terrestrial Flora

3.1.3 Flora and Fauna

(1) Survey Method

Although there are no protected areas in and around the project area of the proposed road alignments, any existence of protected species should be confirmed by the field survey. Also terrestrial fauna including avian species were not investigated in the original EIA report. Thus based on the information obtained with the literature survey, the flora and fauna survey was conducted in July 2011 to investigate the existence of any protected species of flora and fauna in the vicinity of the proposed road alignments, especially mangrove and tidal flat areas shown in Figure A11.3-1. Table A11.3-1 summarized target species to be surveyed, survey method and survey period.



Source: JICA Survey Team

Figure A11.3-1 Location of Flora and Fauna Survey

Table A11.3-1 Flora and Fauna Survey Specification

Items	<ul style="list-style-type: none"> Protected species declared as endangered or threatened species under the relevant Kenyan acts and regulations; Threatened species (grouped as EN, CR, VU) in the IUCN Red List; Avian species, which are included in the list of the “Agreement on the Conservation of African-Eurasian Migratory Waterbirds”; and Locally significant species for the livelihood of local residents 		
Survey Location	Mwache Creek, Tsunza Peninsular and Mteza Creek (Figure A11.3-1)		
Survey Method	Mangroves and terrestrial vegetation	Visual observation, transect method	
	Marine and terrestrial fauna	Mammals	Tracks and Scats, Traps
		Birds	Visual, call census and transect method
		Amphibian	Active searches
		Reptilian	Active searches
Insects	Active searches, Traps		
Period/Schedule	10 days in July 2011		

Source: JICA Survey Team

(2) Results of Floral Diversity

The area investigated notably consisted of varied vegetation types that were physiognomically identifiable through vascular plant tree cover, dominant species and the floristic composition. Although some floral plants were generalists (found in more than one

vegetation type), others maintained presence only in given vegetation areas. The vegetation types were arbitrarily distributed through the entire alignment, in varied sizes that ranged from a few square meters to a couple of hectares. A generalized overview of the vegetation formations in close vicinity of the Project area is shown in Figure A11.3-2. Major vegetation types include:

- mangrove wetland forest
- terrestrial high canopy forest area
- secondary thicket, closed and open types
- farmland area with cash and for subsistence



Mangrove Forest



High Canopy Terrestrial Forest



Open Secondary Thicket



Farmland

Source: The JICA Survey Team

Figure A11.3-2 Major Vegetation Types in the Project Area

With the exception of mangrove formations which occur exclusively in the halophytic shores of the sea, other floral formations such as the agricultural vegetation types were

transformation of the terrestrial forest, and the secondary thicket was at an advanced progressive stage of succession, dependent on presence/absence of disturbance forces. Brief accounts on each of the dominant formations are provided here below.

Mangrove Formation

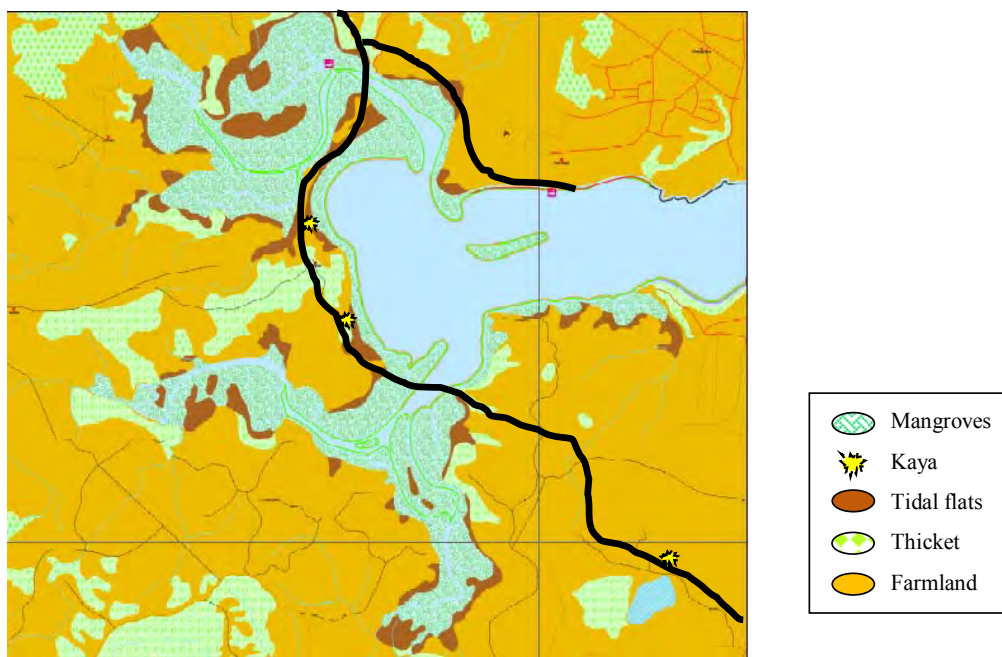
i) Occurrence and Composition

This is by far, the most unique and ecologically fragile floral formation. In the route of traverse, mangrove forests dominate the creeks of Mwache and Mteza rivers and the entire shoreline of the Tsunza peninsula covering an estimated 15 square kilometers (1,500ha) out of the national resource of 54,000ha. In the mangrove wetland forest, Kenya coastline carries nine true mangrove species namely: *Rhizophora mucronata*, *Bruguiera gymnorrhiza*, *Ceriops tagal*, *Avicennia marina*, *Xylocarpus granatum*, *X. moluccensis*, *Heritiera littoralis*, *Lumnitzera racemosa*, and *Sonneratia alba*, all of which were recorded in Mwangal, Tsunza and Mkupe along the proposed road alignment area. None of the mangrove species is endemic to Kenya and they occur widely along the tropical reaches of the Indian Ocean coastline.

Mangrove distribution in Kenya is biased with *Rhizophora mucronata* and *Ceriops tagal* being the most common- a finding that concurs with the observation that the two species account for 70% of the mangrove population (Ferguson 1993, Kairo *et al.* 2002). The mangrove species that recorded low populations include: *Heritiera littoralis* and *Xylocarpus granatum* which were recorded in only one point at the seaward side of the abandoned gas tanks. At this point, a very large specimen of *Heritiera littoralis* currently used as a traditional prayer site (*mzimu*) was recorded. As well, *X. moluccensis* was recorded in two sites namely at Mwangala area and near the salt pan to the south of Mkupe. This species though regarded as a non-mangrove (Tomlinson, 1986), is usually included by virtue of its association. According to Gillikin & Verheyden (2002), in Kenya *X. moluccensis* is very rare (only two individuals known in the Gazi Bay forest), but other reports indicate that the species is found beyond the Gazi bay. A potentially new and the tenth mangrove species for Kenya, *Excoecaria agallocha* was only reported verbally to occur in the area but this could not be verified.

ii) Economic Importance of Mangrove Formation

Mangrove wetlands are multiple use systems that provide protective, productive and economic benefits to the local communities. The ecosystem services of mangroves can be broadly classified as ecological, environmental and economical, as indicated in Table A11-3.2.



Source: JICA Survey Team

Figure A11.3-3 Ethno Botanical / Vegetation Map along the Mombasa Bypass Road

Table A11-3.2: Ecosystem Services of Mangrove Wetland Forest

Ecological	Environmental	Economical
Provides nest/home to specific fauna and flora	Stabilizes sediments and protects siltation	Increases fisheries production and earnings to fish-folk
Feeding grounds for some sea animals	Controls erosion of the coastal line	Supplies quality fuel-wood (firewood and charcoal)
Provides breeding and nursery area for fish and other sea animals	Enhances reduced vulnerability of coastal shores to environmental shocks and stresses such as severe waves and Tsunami	Source of timber and building poles for housing, construction and furniture.
Production of organic matter	Important in carbon sequestration	Creates informal employment sector for local population
Act as a filtering system for pollutants (heavy metals, toxic substances, and suspended matter (sewage)).	Enhances improved access to safe water and sanitation for corals and sea-grasses	Source of medicine and other ethno botanical values to the local communities

Source: The JICA Survey Team

iii) Trends and Concerns

Threats from exploitation: Within the route of traverse, size distribution of *Rhizophora mucronata*, *Bruguiera gymnorrhiza* and *Ceriops tagal* was noted to be declining especially at Mkupe and Mwangala where large diameter stems were quite rare. These areas were dominated by relatively small diameter tree while deeper into the creeks and away from exploitation reach, the sizes were relatively larger. *Rhizophora mucronata* is the most favored

for wood (poles, post and withies) and is therefore most harvested and consequently the most threatened by local utilization (Table A11.3-3 and Figure A11.3-3). The observed wide occurrence of large specimens of *Avicennia marina* could not be immediately explained as its still highly valued for firewood. Signs of collection were obvious especially for *Rhizophora mucronata*, *Bruguiera gymnorrhiza*, *Ceriops tagal*, and *Sonneratia alba*. Informal ranking of the resource collection threats shows a descending order as follows: *Rhizophora mucronata*, *Ceriops tagal*, *Sonneratia alba* and *Bruguiera gymnorrhiza*. However, this data may be biased by the low population of *Bruguiera gymnorrhiza*.

Table A11-3.3: Ethnobotanical Details of Mangrove Species

Mangrove Species	Local name (Swahili)	Local Uses	Preference Level	Comments
<i>Rhizophora mucronata</i>	Mkoko	Timber, fuelwood	Very high	Most threatened
<i>Bruguiera gymnorrhiza</i>	Muia	Timber, fuelwood	High	Threatened, in low population
<i>Ceriops tagal</i>	Mkandaa	Timber, fuelwood	High	Hardly above 3m in height
<i>Sonneratia alba</i>	Mlilana	Timber, fuelwood	High	Low
<i>Avicennia marina</i>	Mchu	Fuelwood	Average	Low threats
<i>Lumnitzera racemosa</i>	Kikandaa	Fuelwood, ribs for boat	Low	Locally rare
<i>Xylocarpus granatum</i>	Mkomafi	Timber, fuelwood and carving	Low	Locally rare
<i>Xylocarpus molucensis</i>	Mkomafi dume	Fuelwood	Low	Locally rare
<i>Heritiera littoralis</i>	Msindikazi	Timber	Low	Locally rare

Source: The JICA Survey Team



Source: The JICA Survey Team

Figure A11.3-3: *Rhizophora* poles ready for the market and mass death of mangrove trees

The point to underline is that mangrove formations are currently undergoing degradation due to commercial exploitation of *Rhizophora mucronata* to feed the local construction industry. As well, given the observed correlation between exploitation radius and accessibility, the potential role of the proposed bypass in accelerating exploitation requires to be subjected to further scrutiny.

Remnants of High Canopy Brachystegia Forest

High canopy forests originally pre-dominated the entire coastal plain and are considered to have been the most northern expression of the Miombo Woodlands of Tanzania. However, on account of human activity, such formations are today restricted to the culturally protected areas namely Kaya forests, sacred grooves and burial grounds which today are the only sites where indigenous tree formation of over 5m height will be found.

Within the route of traverse, Kaya forests such as Kaya Chonyi (Duruma), showed a strong presence of *Brachystegia speciformis* both as the emergent and the short tree layers. However, these layers were not consistently present and where they occurred, were devoid of canopy interlock thus depicting a woodland vegetation equivalent to the Miombo woodland of Tanzania and Northern Mozambique. This vegetation is characterized by the presence of scattered trees with a canopy cover of between 40 -60%, and the main tree floral components are *Brachystegia speciformis*, *Julbernardia magnistipulata* and *Salvadora persica*, all of which were recorded in the Kaya. The *Brachystegia spiciformis* showed a strong presence to the extent that, it can be considered as the indicator species for former occurrence of the Miombo woodland. The presence of *Brachystegia spiciformis* and *Uapaca nintida* in the *Brachystegia* community indicates its typical similarities with the Miombo woodland in Central Africa (Moomaw 1960). The *Brachystegia* communities in the Kaya can be said to form part of the northernmost extension of 'Miombo' woodland vegetation and according to Moomaw (1960) a vegetation similar to 'Miombo' was identified as 'Woodland' by Gillman (1949), and as 'Dry forest' by Shantz & Marbut (1923).

The *Brachystegia* woodland vegetation was extensive and continuously into the central parts of the Kaya, but interrupted by the termite mound clusters of size ranging from 50 to 200m² and height of 2 to 5m. The mould vegetation clumps are very distinct from the woodland vegetation in that they are dominated by *Salvadora persica* and *Tamarindus indica* as most common spp. The floristic variation between these termite mounds and the surrounding *Brachystegia* woodland was distinct and other spp included, *Cynometra suaheliensis*, *Carissa tetramera*, *Vitellariopsis kirkii*, *Dobera loranthifolia*, *Thespesia danis* and *Vernonia wakefieldii*. To the periphery, the *Brachystegia* woodland was replaced by *Acacia* woodland, comprising *Acacia xanthophloea* (yellow) and *Acacia zanzibarica* in different population densities.

Secondary Thicket

The secondary thicket mostly bordered farmland areas, and seemed to be slowly subjected to clearing as the neighboring farmlands were extended. Some of the secondary thickets were undisturbed and therefore very dense, but other thickets were highly disturbed and consisted of more than 50% grass cover. The most common disturbance factors, based on the visible signs in those areas, were plant material collection, grazing and bush fire. All the secondary thickets were found on hill slopes, probably used as soil conservation strategies. However, they were side to side with the farmland areas, and commonly encroached as the farmlands were expanded.

The closed secondary thickets were recorded on the slopes North of Mkupe Jetty, the slopes towards Mwangala area. Open thicket was recorded mostly along the proposed Kipevu link especially within land controlled by the Kenya Airports authority. The Mkupe area shared a lot of floral components with the sacred groves on Tsunza Peninsula including the presence of the ornamental cycad *Encephalartos hildebrandtii*. The closed secondary thicket is dominated by; - *Markhamia zanzibarica*, *Harrisonia abyssinica*, *Grewia plagiophylla*, *Lamprothamnus zanguebaricus*, *Diospyros cornii*, *Hoslundia opposita*, *Uvaria acuminata* among others. The open secondary thicket had important floral components that included: *Ormocarpum kirkii*, *Dichrostachys cinerea*, *Dalbergia melanoxylon*, *Thespesia danis*, *Commiphora edulis*, *Adansonia digitata*, *Hyphaene compressa*, *Cassia afrodistula*, and *Acacia spp.* While in both cases the species may not form restricted pyhtosociological communities, the indications here are that the closed secondary thicket is at an advanced succession level of forest regeneration compared to the open secondary thicket. The latter is subject to continued grazing and fire, as indicated by the presence of *Hyphaene compressa*, which was totally absent in the closed thicket areas.

Farmlands

The farmland areas were either with perennial cash crops (*Cocos nucifera* – coconut trees, *Anacardium occidentale* – cashew nut tree, *Mangifera indica* – mango tree, among others) and ground floor dominated by herbaceous species (especially graminoids), or carried annual subsistence crops (*Zea mays* – maize, *Manihot esculenta* – cassava, *Cajanus cajan* – cow pea, *Musa sp.* – Banana, etc) that had been weeded. Occasionally, the cash crops and the subsistence crops were grown in the same land parcel.

The areas under farming were noted to be not exclusively void of indigenous wild plant species. Although the communities favoured exotic tree and shrub species for agro-forestry, ornamentation and beauty (*Cassia siamea*, *Thevetia peruviana*, *Azadirachta indica*, *Melia azedarach*, *Hibiscus sabdariffa*, *Lawsonia inermis*, *Pithecellobium dulce* and *Nerium*

oleander); there were indigenous wild plants that were natured on the farms e.g. *Terminalia spinosa*, *Salvadora persica*, *Diospyros cornii*, *Tamarindus indica*, *Acacia sp.*, *Manilkara mochisia*, *Diospyros squarosa*, *Adansonia digitata*, among others. There was a clear signal that the relatively slow growth of the indigenous species was discouraging the locals from intentional growing on their farms. However, their unquestionable values and rarity has encouraged the farmers to maintain them when found on their farms, hence cared for and owned more or less as the crop plants.

Kaya Forests and Sacred Groves

i) Occurrence

To date, Kaya Forests and sacred groves form an important feature in the traditional belief and worship of the Digo and Duruma who traditionally occupied the areas traversed by the proposed road. Indeed, this study came across 4 remnants of Kaya Forests (Figure A11.3-4) and sacred groves within the proposed alignment. The same are listed in Table A11.3-4.

Table A11.3-4 Inventory of Kayas and Sacred Groves

Name of Kaya	Location	Status
Kaya Chonyi	Kiteje	Well preserved
Kaya Mlangatani	Kiteje	Preserved
Kaya ya Mshahame Mwatela	Tsunza	Preserved
Kaya Kifunduni	Tsunza	Degraded

Source: The JICA Survey Team

ii) Ecological Roles of Kaya Forests:

These sacred areas contained a relatively higher tree canopy species in given area space compared to the other terrestrial vegetation dynamics. The main floral components varied from site to site, but with some generalists among the species. Commonly shared were the light loving species in the gaps and the periphery of the tree canopy cover, which are also found in disturbed thickets and farmland. Such floral components include herbaceous species *Asystesia gangetica*, *Commelina benghalensis*, *Asparagus fulcatus*, *Triumffeta rhomboidea*; shrub species: *Uvaria acuminata*, *Thespesia danis*, *Bridelia cathartica*, *Lantana camara*; and tree species *Lannea schweinfurthii*, *Azadirachta indica*, *Grewia plagiophylla*, *Diospyros cornii*.



Source: The JICA Survey Team

Figure A11.3-4 Kaya Kifunduni in Tsunza

iii) Threats and Concerns:

Colonization by invasive species: Some Kayas are threatened by invasion by invasive species key of which is *Azadirachta indica*, *Lucaena lucocephala*, *Lantana camara* and strangler climber species *Pleicosepalous parviflorus* [chibugu-sichokolo]. The latter usually covers the crown of host tree and suffocates it to death. In most Kayas investigated within the traverse, both invasive species and the strangler climber plants were recorded. In addition to these intrinsic threats, there were anthropogenic activities especially at Mlangateni sacred grove and the grove on Tsunza Peninsula that are likely to affect the vegetation and ecology of these forest areas.

Encroachment by human activity: Though many Kayas forests and groves occur widely in the route of traverse, the same are however not documented on available maps and are in poor conservation state. On the ground, Kaya Kiteje was noted to have suffered major disturbance and the only vegetated remnant (now referred to as *Mzukani* – a scared grove) is less than 10m². The main force of disturbance is sand harvesting, which seem to override cultural beliefs. The future of the remnant area remains uncertain, as in the neighborhood, trees ringed up on their root system and destined to death were visible, an indication that the damage is ongoing. Kaya Chonyi (Duruma) was noted to be in a more intact condition and protection efforts were more effective.

(3) Local Values for Flora and Fauna

The most dramatic outcome of the flora and fauna survey is that, most of the local people admitted to relying on biodiversity for either food or trade and the trees, shrubs and herbs occurring in the area have varied uses including food, fuel wood, building wood, medicinal and spiritual rites.

Utilization of Flora Resources

Coastal agriculture is mainly based on tree crops- coconut, cashew, mango, pawpaw, neem, tamarind, mitomoko, among others and all these were found widely occurring in the area. A whole range of the floral biodiversity encountered in the study area inclusive of main uses is provided in Appendix 2 based on the cultural values of the Digo and Duruma communities. Figure A11.3-5 illustrates some common uses of the coconut tree, the most common tree in the area.



(i) Palm wine awaiting shipping at Tsunza beach (ii) Sawn timber from coconut in Miritini

Source: The JICA Survey Team

Figure A11.3-5 Utilization of Biodiversity

Utilization of Fauna Resources

Fauna biodiversity in the study area is mainly utilized for food and as items of trade whereby marine biodiversity; - fish, crabs and prawns account for the lion share (Figure A11.3-6). Outside of marine species, other fauna commonly reported as food items include hare, dickdick, weaver birds, guinea fowl, kerengende while honey from bees doubles up as a food and trade item.

Use of fauna biodiversity for food is more predominant in Tsunza where all the local people reported regularly relying on wildlife for food.



(i) A live-size crab for food



(ii) a crab rearing pen in Tzunza



(iii) Skinning a catch



(iv) the Kea Dzuha fish pond at Port reitz

Source: The JICA Survey Team

Figure A11.3-6 Utilization of Fauna Biodiversity

(4) Treats to Tree and Plant Species

A total of 203 vascular plant species were recorded from the area under study, this number included 10 species that are exotic. A list of all the plant species encountered along the proposed Road alignment area is presented in Appendix A2. Eight plant species, including four mangrove species are locally threatened by timber and firewood users. Details of the threats are described below.

Mangrove species: Among the mangrove spp., *Rhizophora mucronata*, *Bruguiera gymnorhiza*, *Ceriops tagal* and *Sonnerata alba*, are locally threatened by timber and firewood users as described above. The threat to these species is increased by their high demand due to their durability as timber material and their high thermal value when used for fuel. *Rhizophora mucronata* of all these species is most threatened due to its multiple uses at all plant sizes. Its growth habit, usually straight up, makes it the best contender for building houses, and its large diameter stem can be used as fence poles. On the other hand, women frequent the seaside in search of *Rhizophora* firewood.



Source: Lang'at and Kairo (KMFRI)

Figure A11.3-7 *Rhyzophora* Posts, Poles and Withies

Dalbergia melanoxylon (Black Ebony) is endangered due to its heightened value in the carving industry. The species, with unusually hard and dense wood, has several different uses for the local people. Its hardness makes it valuable for making durable utensils and tools for the local people (such as hoes). Its dense wood is a source of very high-energy yielding fuel, which makes it ideal for making charcoal. Other parts of the tree have other uses, e.g., leaves for fodder, and root and stem for local medicines. In the tourism industry *Dalbergia's* black-beautiful finishing hard wood has been popular for wood carvings of wildlife and cultural themes that are popular with tourists. The indiscriminate/uncontrolled selective cutting of rare tree species precipitated the 1986 Presidential ban on felling of indigenous trees, preventing any form of exploitative management of indigenous forests in forest reserves. However, the ban was not effective and the species continue to face threats from users. Within the proposed road alignment, *Dalbergia melanoxylon* was recorded in small populations, sometimes only one or two individuals in a site, and commonly small sizes or sprouts from a cut down tree. However, places near the Ziwani swamp area/Kaya Kiteje, there was a noticeable high concentration of *Dalbergia melanoxylon*. This population, although comprising of small to medium sized individuals, is worthy protecting and monitoring. There was no immediate explanation of the species concentration, but probably the area has had an even large populace of the species in the past.

Zanthoxylum chalybeum is a highly valued medicinal plant by the local community. It also has other use values such as timber, fuel wood and the leaves are used for making tea. The twigs are used as toothbrushes and the bark extract is used to cure malaria (Olila *et. Al.*, 2001) and other ailments (Pakia and Cooke, 2003). *Z. chalybeum* is a tree of medium to low altitudes in dry woodland or grasslands, often to be found on termite mounds. It has been registered to have dwindling population trends locally and thus, although not captured in the IUCN Red list, locally it is threatened with local extinction.

Encepharlatos hildbrandtii (Mombasa Cycad) is an ornamental cycad that has been poached and used in landscaping around private houses and hotels. The cycad, a member of the old

plants world, Gymnospermae, has attracted users from its palm like features. However, the species is monoecious, and grows very slowly. In the event that it flowers and there is no pollination then the population is likely to be checked. The threat here is more on the wild germplasm being threatened with local extinction, since collectors go for large plant specimens and in mass. The National Museum of Kenya at the South Coast reported an incidence of illegal mass harvesting of the species from the wild by Hoteliers. The species was recorded in only two areas: in a sacred grove along the Tsunza Peninsula and on a closed secondary thicket near Mkupe Jet point. In both localities the species occur in concentration clusters that comprise members of different ages. Both sites are right in the proposed road alignment. Its aesthetic value should not be allowed to go to waste, where affected, thus it is here recommended that the specimens be used for landscaping the road sides.

Salvadora persica: Although it does not offer preferred timber, it is extensively harvested for toothbrush sticks that are sold in urban centres. The mode of harvesting threatens its population expansion, as the needed parts are the young branches up the tree. Some collectors fell down substantial aerial plant part to easy collection of target parts. Many individuals of the species thus are relatively short in height, with dense sprouts from the previous harvests. The species is worthy a recognition and protection from further damages, where collectors can be advised to exercise sustainable harvesting methods.

(5) Activities of Conservation Groups

Two conservation groups namely the Mbuta Mazingira Conservators of Mwangala and the mangrove conservation group of Tsunza. Both groups are registered as self help groups under the Department of Social Services for purposes of developing livelihoods through conservation of the shoreline in respective villages. Activities have mainly focused on replanting degraded mangrove sites with seedlings stocks harvested from overstocked sites but attempts have also been made to mobilize villagers to abandon exploitation of mangrove forests which has currently left them degraded. Other activities include harvesting of oyster cultures which are then stocked into ponds and sold upon maturity while beehives have also been mounted for purposes of honey production. Both groups comprise of unemployed youth desperate to earn a living through sale of their labour and time. A programme in which they can be motivated through cash income to reforest mangrove areas is recommended.

(6) Results of Fauna Biodiversity

Occurrence of Bird Species

Of the 1,100 bird species recorded in Kenya, more than 450 species (41%) are found in the coastal strip out of which only 50 bird species (11.3%) were recorded within the traverse of the proposed Mombasa bypass road route of traverse. This indeed is a very small fraction of

the total avian biodiversity accounted for by coastal Kenya. Of the 50 bird species counted in the traverse, Tsunza recorded 18 including 2 mangrove specialists (the Malachite Kingfisher and the Mangrove Kingfisher), Kiteje 22, Miritini 16, Mwangala 15 and Port Reitz 11 species shown in Table A11.3-5 (For details, Appendix A2). About 25 of the species counted including the Common Drongo, Speckled Mouse bird, Carmine bee eater, Emerald-spotted wood dove, House sparrow, Indian house crow, were observed in 2 or more sites while the rest 23 were specific to only one site. Kiteje and Tzunza had the highest bird counts and 10 out of the 23 specialist birds were counted in Tzunza. The Port Reitz area had the lowest bird count of 7 and recorded only one specialist bird count. Among tidal creeks and isles the Great White Egret, almost 90 cm long, with striking white plumage, entirely black legs and a noticeably long black or yellow bill. It is a member of the heron family and closely related to the Yellow-billed Egret and the Little Egret. Locally seen at coastal salt pans, estuaries and creeks is another similar sized bird, also with all-white plumage, but with bare red legs and face. This is the African Spoonbill with its distinctively shaped bill. In lagoons and estuaries, it is often possible to come across the Sacred Ibis with its white feathers, bare black head and neck, and its down-curved elongated bill. A strange-looking bird, about 35 cm long, with a large head and big yellow eyes, is the Water Thicknee which is widespread along the creeks and islands. The large eyes are an adaptation for its mainly nocturnal habit.

A full complement of the bird species counted within the entire traverse is provided in Appendix A2. Applying the IUCN Red List criteria to all birds recorded in the traverse area, none of the species was classified as the threatened status. However, only one species of bird, Plain-backed sunbird (*Anthreptes reichenowi*) is categorized as being Near Threatened, i.e., likely to become endangered in the near future.

Kenya is also a signatory to the Bonn Convention on Conservation of Migratory Species and its daughter Agreement; the African-Eurasian Migratory Waterbird Agreement (AEWA). Four bird species, African Spoonbill (*Platalea alba*), African Sacred Ibis (*Mycteria ibis*), Yellow-billed Stork (*Threskiornis aethiopicus*) and Marabou Stork (*Leptoptilos crumeniferus*) which are listed in Table 1 of Annex 3 of AEWA, were encountered in the tidal flat of Port Reitz area.

Table A11.3-5 Bird Counts within the Route of Traverse

Site	Total Count	Specialist Bird Counts	Species Counted
Tsunza	18	10	Dimorphic egret, Hamercop, Malachite kingfisher, Mangrove kingfisher, Pintail whydah, Sooty gull and Spotted thick-knee
Kiteje	22	4	African firefinch, Grey penduline tit, Lizard buzzard, Rattling cisticola
Mwangala	15	4	Blue capped cordon-blue, Brown hooded kingfisher, Pied crow, Pied kingfisher
Miritini	16	4	Black kite, House crow, Mascarene martin, Tropical boubou
Port Reitz	11	5	Grey-headed bush shrike, African Spoonbill, African Sacred Ibis, Yellow-billed Stork, Marabou Stork.

Source: The JICA Survey Team

Insect Pollinators

i) Butterflies

Distribution of butterfly species varied with the study sites. A total of 58 butterflies (Appendix A2) were recorded with 124 counts being made in Pungu (17), Miritini (21), Kitenje (24), Tsunza (26), Port Reitz (16) and Mwangala (20). Again Kiteje and Tsunza had the highest counts with 24 and 26 counts respectively while Port Reitz had the lowest at count of 16 spp. 26 butterflies were counted in only one site with Pungu accounting for 7 of the same. Among the species, *Junonia oenone* and *Papilio demodocus* (Citrus Swallowtail) was common in all the 6 sites investigated. With regard to conservation status, the IUCN has no entries on fries (Table A11.3-6) probably implying no recorded threats yet.

Table A11.3-6 Prevalence of Butterflies in the Traverse Area

Species	IUCN Red List Category
<i>Acraea eponina</i>	No Entry Found
<i>Acraea insignis</i>	No Entry Found
<i>Amauris niavius</i>	No Entry Found
<i>Amauris ochlea</i>	No Entry Found
<i>Anthene butleri</i>	No Entry Found
<i>Astictopterus stellata</i>	No Entry Found
<i>Axiocerses harpax</i>	No Entry Found
<i>Azanus jesous</i>	No Entry Found
<i>Baliochila hildegarda</i>	No Entry Found
<i>Belenois aurota</i>	No Entry Found
<i>Belenois creona</i>	No Entry Found
<i>Belenois thysa</i>	No Entry Found
<i>Bicyclus safitza</i>	No Entry Found

Species	IUCN Red List Category
<i>Byblia anvatarata</i>	No Entry Found
<i>Byblia ilithyia</i>	No Entry Found
<i>Catopsilia florella</i>	No Entry Found
<i>Charaxes varanes</i>	No Entry Found
<i>Colitis दौरa</i>	No Entry Found
<i>Colitis euipe</i>	No Entry Found
<i>Colitis vesta</i>	No Entry Found
<i>Colotis antevippe</i>	No Entry Found
<i>Colotis danae</i>	No Entry Found
<i>Colotis protomedia</i>	No Entry Found
<i>Colotis vesta</i>	No Entry Found
<i>Cupidopsis iobates</i>	No Entry Found
<i>Danaus chrysippus</i>	No Entry Found
<i>Deudorix antalus</i>	No Entry Found
<i>Deudorix dinochares</i>	No Entry Found
<i>Euphaedra neophron</i>	No Entry Found
<i>Eurema brigitta</i>	No Entry Found
<i>Eurema floricola</i>	No Entry Found
<i>Eurema regularis</i>	No Entry Found
<i>Eurytela dryope</i>	No Entry Found
<i>Freyeria trochylus</i>	No Entry Found
<i>Graphium angolanus</i>	No Entry Found
<i>Hamanumida daedalus</i>	No Entry Found
<i>Hypolimnna misippus</i>	No Entry Found
<i>Hypolycaena philippus</i>	No Entry Found
<i>Junonia hierta</i>	No Entry Found
<i>Junonia natalica</i>	No Entry Found
<i>Junonia oenone</i>	No Entry Found
<i>Junonia orithya</i>	No Entry Found
<i>Lampides boeticus</i>	No Entry Found
<i>Leptotes adamsoni</i>	No Entry Found
<i>Melanitis leda</i>	No Entry Found
<i>Papilio demodocus</i>	No Entry Found
<i>Pardopsis punctatissima</i>	No Entry Found
<i>Phalanta phalantha</i>	No Entry Found
<i>Physcaeneura leda</i>	No Entry Found
<i>Salamis parhassus</i>	No Entry Found
<i>Spialia kituina</i>	No Entry Found
<i>Tirumala petiverana</i>	No Entry Found
<i>Tuxentius calice</i>	No Entry Found
<i>Tuxentius spp</i>	No Entry Found
<i>Vanessa cardui</i>	No Entry Found
<i>Ypthima asterope</i>	No Entry Found
<i>Zizina antanossa</i>	No Entry Found
<i>Zizula hylax</i>	No Entry Found

Source: The JICA Survey Team

ii) Bees (Apidae)

The most common species in the family was Honey bees, which is a subset of bees in the genus *Apis*. *Apis mellifera* observed in all survey sites on flowering trees, shrubs, herbs and garden vegetables though in varying frequency. Stingless bees *Melliponula spp.* was common on flowering herbs and vegetables. Their occurrence was dependent on availability of the above characteristic plants. Stingless bees normally inhabit hollow trunks, tree branches, underground cavities and wall cavities. Carpenter bees derive their name from the fact that nearly all species build their nests in burrows in dead wood, bamboo or structural timbers. However, the genus *Proxyllocopa* nests in the ground. They were observed in all sites but were few in counts. They were observed mostly on flowering shrubs and trees. This group was rarely observed in Miritini area within shortest distance made in the survey transects. The ground nesting bees *Prodylocopa spp.* were commonly observed in Tsunza area along the dry sandy beach, near the shoreline. However, they were rarely observed in Pungu, Kitenje, Miritini and the Port Reitz areas.

Generally, bees plays important role in pollination. For instance, in developed countries bees have been used for pollination and sometimes introduced in farms. Studies have shown that stingless bees are efficient pollinator of crops such as macadamias and mangoes. Other crops that would benefit from stingless bees are strawberries, watermelons, citrus and avocados.

Table A11.3-7 Conservation Status for Bees based on IUCN Classification

Species	IUCN Red List Category
<i>Apis mellifera</i>	No Entry Found
<i>Melliponula spp.</i>	No Entry Found
<i>Proxyllocopa</i>	No Entry Found

Source: The JICA Survey Team

Mammal Species

Few mammal species were observed during the survey of the study area. These included: in Kibundani Vervet monkey (*Cercopithecus aethiops*) and Four-toed elephant-shrew (*Petrodromus tetradactylus*), in Tsunza Red-legged sun squirrel (*Heliosciurus rufobrachium*) and Four-toed hedgehog (*Eraniceus albiventris*), while in Mwangala, the four-toed hedgehog (*Eraniceus albiventris*) and Crested porcupine (*Hystrix cristata*) were observed. In Miritini recorded the Crested porcupine (*Hystrix cristata*) and the Four-toed hedgehog (*Eraniceus albiventris*). The African Hare was common in all the survey sites observed through their droppings. Fruit Bats were observed in abandoned wells patching on overhanging walls of the wells (Figure A11.3-9). From discussion with the locals, some species realized occur in the area. Rats and moles were noted by the local.

Table A11.3-8 Conservation Status of Mammal Species based on IUCN Criteria

Common Name	Scientific Name	IUCN Red List Category
Vervet monkey	<i>Cercopithecus aethiops</i>	Least Concern
Four-toed elephant-shrew	<i>Petrodromus tetradactylus</i>	Least Concern
Red-legged sun squirrel	<i>Heliosciurus rufobrachium</i>	Least Concern
Four-toed hedgehog	<i>Eraniceus albiventris</i>	Least Concern
Crested porcupine	<i>Hystrix cristata</i>	Least Concern

Source: The JICA Survey Team

All the 5 mammal species recorded are accorded a Least Concern Category in the IUCN Red List.



Source: The JICA Survey Team

Figure A11.3-9 Fruit Bats Observed in Over-Hanging Walls of the Well at Kibundani

Reptiles and Amphibians

The group is technically known as herptiles. They consist of reptiles snakes, lizards, geckos, and amphibians including frogs and toads. Observations of some species were made during the field survey. Among snakes, Puff Udder (*Bitis arietans*) was physically recorded in Mwangala. Accounts from the locals revealed it is widespread posing threats in the area. This snake is a venomous viper normally found in savannah and grasslands. It is responsible for most fatal deaths in Africa. It normally feed on small mammals, birds, amphibians and lizards. Speckled sand snake *Psammophis punctulatus* was observed in Tsunza (Figure A11.3-10), but accounts from locals also reveals it's widespread in the region.

Black mamba (*Dendroaspis polylepis*) was not observed but was accounted by the local people. Its distribution is wide due to its adaptation to variety of climates ranging from savanna, woodlands/shrubs, rocky slopes, dense forests and even humid swamps. They feed on smaller prey such as birds, rats, bush babies and small chickens.



Source: The JICA Survey Team

Figure A11.3-10 Photograph of Speckled Sand Snake (*Psammophis punctulatus*)

Assessment of conservation status of the species in these groups in IUCN Red list of threatened species is generally less concern (LC) and others does not have entries in the IUCN red list database.

Table A11.3-9 IUCN Classification of Reptiles Typical of the Bypass Traverse Area

Common Name	Scientific Name	IUCN Redlist Category
Puff Udder	<i>Bitis arietans</i>	No Entry Found
Speckled sand snake	<i>Psammophis punctulatus</i>	No Entry Found
Black mamba	<i>Dendroaspis polylepis</i>	Least Concern
African Clawed Frog	<i>Xenopus laevis</i>	Least Concern
African Common Toad	<i>Amietophrynus gutturalis</i>	Least Concern
Flap-necked chameleon	<i>Chameleon dilepis</i>	No Entry Found
Pygmy chameleon	<i>Rampholeon kerstenii</i>	No Entry Found
Black-collared lizard	<i>Agama agama cyanogaster</i>	No Entry Found
Black-lined plated lizard	<i>Gerrhosaurus nigrolineatus</i>	No Entry Found
Day gecko	<i>Lygodactylus picturatus</i>	Least Concern
Variable ground skink	<i>Mabuya varia</i>	No Entry Found
Long-tailed sand lizard	<i>Latastia longicaudata</i>	No Entry Found

Source: The JICA Survey Team

Chameleons

Generally chameleons fall in the family Chamaeleonidae. Subfamilies include Chamaeleoninae and Brookesiinae. Chameleons are found in the tropics savanna, rainforests and deserts. Most of chameleons from subfamily chamaeleoninae are usually found on trees or bushes with few partially or largely terrestrial. Chameleons from the subfamily Brookesiinae prefers living low in vegetation or among litters.

During field survey two species of chameleons were recorded after a careful search on leaves of shrubs and herbs. These included the Flap-necked chameleon (*Chameleon dilepis*) in area

near the Mombasa International Airport and the Pygmy chameleon (*Rampholeon kerstenii*) in Ktenje.



Source: The JICA Survey Team

Figure A11.3-11 Chameleons Recorded in the Traverse Area

Lizards

Several lizard species namely, Black-collared (*Agama agama cyanogaster*) and Black-lined plated lizard (*Gerrhosaurus nigrolineatus*), Day gecko (*Lygodactylus picturatus*), Variable ground skink (*Mabuya varia*) and Long-tailed sand lizard (*Latastia longicaudata*) were observed in the route of traverse.

Marine Species

Assessment was made for marine organisms in Tsunza area (Port Reitz). Observation was made along the beach and intertidal areas. Catch landings were scrutinized to record species that occur in the Tsunza and contributes to the local economy. In addition to these, interview was made with the fisherfolks to find out other species that exist but are not of commercial value. The major groups recorded were the crustaceans, mollusks, fishes and birds.

i) Crabs

Hermit crabs were noted on sandy shores from their scurry marks on sandy intertidal area. From literature account, several species occur along the Kenya shore. Two families were common in Port Reitz (Tsunza area). These included the Portunidae (Swimming crabs) and Ocyponidae (subfamily Ocyponinae Fiddler crab). Among the Portunidae, *Scylla serrata* the mangrove or mud crab (Figure A11.3-12) was recorded from catch landings in Port Reitz. The species occur inside the mangrove forest and most of the species in this family are fished commercially where *S. serrata* is most preferred for mariculture along the coast. Crab farming is practiced in Tsunza in pens for commercial purpose.



Source: The JICA Survey Team

Figure 10.3-12 *Scylla serrata* (Mangrove or Mud Crab)

Three species of Fiddler Crabs (*Uca*) were observed along the beach on upper side of the dry sandy beach and seaward of mangroves. Some were also observed in catch landings in Port Reitz (Tsunza area). These included *Uca tetragonon*, *Uca urvillei* and *Uca inversa*. Habitat preference of *U. tetragonon* is seawards edge of mangrove forests, often associated with sand substrate. While, *U. urvillei* prefers muddy substrate, often in the Rhizophora zone in the centre of mangrove forest. *U. inversa* prefers bare sandy areas in the upper parts of the mangroves where salinity of the soils and temperatures are often high. Other species accounted by literature but were not observed during the survey were *U. vocans var. hesperiae*, *U. chlorophthalmus* and *U. lacteal annulipes*.

ii) Lobster (Palinura)

One species was commonly recorded from catch landings in Port Reitz. *Panulirus longipes longipes* (Long-legged Spiny Lobster) was noted common from the catch and accounts from the local fishers. *P. longipes longipes* (Figure A11.3-13) belong to the family Palinuridae (Spiny lobsters). All spiny lobster have long tapering antennae and pair of frontal horns over the eyes. They usually occur around coral reefs upto 20 m deep. Other potentially occurring species are *Palinurus delagoae*, *P. homarus*, *P. versicolor*, *P. penicillatus*, *P. ornatus*, *Palinurellus wieneckii*, *Thenus orientalis*, *Parribacac antarcticus*, *Scyllarides squammosus*.



Source: The JICA Survey Team

Figure A11.3-13 *Panulirus longipes longipes* (Long-legged Spiny Lobster)

iii) Prawns and Shrimps:

The most common prawns in Port Reitz are *Penaeus monodon* and *Fenneropenaeus indicus*. Others include *Penaeus latisulcatus*, *P. semisulcatus*, *Macrobrachium rude*. Members of the genus *Penaeus* support commercial prawn fisheries. In most catches in the region, *Fenneropenaeus indicus* forms the bulk of the catch.

iv) Aquatic Molluscs

Ceruthidea decollate (Figure A11.3-14) is common species observed on the trunks of the mangrove trees. This species belong to the family Potamididae and they feed on microalgae and detritus. Other species recorded from literature common along the coast are *Terebralia palustris* which occur in the eulittoral mud or in mangrove swamps.



Source: The JICA Survey Team

Figure A11.3-15 *Ceruthidea decollate* (Mangrove Whelk) or Mud Creeper

v) Oysters (Class Bivalvia)

Saccostrea cucullata (Hooded Oyster) was observed in the mangroves and recorded in catch landings (Fig 4.7). The species belong to the family Ostreidae (Oysters) that are edible and commercially important. *S. cucullata* inhabit eulittoral forming conspicuous zone on rocks, aerial roots or trunks of mangroves.



Source: The JICA Survey Team

Figure A11.3-16 *Saccostrea cucullata* (Hooded Oyster)

vi) Squids

In this group, one species *Sepioteuthis lessoniana* was observed (Fig 4.8). The species belong to the phylum Mollusc, Class Cephalopoda, Order Teuthoidea (Squids), Family Loliginidae. They mostly occur near the shorelines. According to literature, this squid is used in biomedical research all over the world.



Source: The JICA Survey Team

Figure A11.3-17 Squids - *Sepioteuthis lessoniana*

**Table A11.3-10 Conservation Status of Marine Crustaceans, Molluscs and Finfishes species
based on IUCN Red List of Threatened Species**

Common Name	Scientific Name	IUCN Redlist Category
Mangrove or mud crab	<i>Scylla serrata</i>	Entry not Found
	<i>Uca tetragonon</i>	Entry not Found
	<i>Uca urvillei</i>	Entry not Found
	<i>Uca inversa</i>	Entry not Found
	<i>Uca vocans var. hesperiae</i>	Entry not Found
	<i>Uca chlorophthalmus</i>	Entry not Found
	<i>Uca lacteal annulipes</i>	Entry not Found
Long-legged Spiny Lobster	<i>Panulirus longipes longipes</i>	Entry not Found
	<i>Palinurus delagoae</i>	Least Concern
	<i>Palinurus homarus</i>	Entry not Found
Painted Spiny Lobster	<i>Palinurus versicolor</i>	Least Concern
	<i>Palinurus penicillatus</i>	Entry not Found
Ornate Spiny Lobste	<i>Palinurus ornatus</i>	Least Concern
Indo-Pacific Furry Lobster	<i>Palinurellus wieneckii</i>	Least Concern
Flathead Lobster	<i>Thenus orientalis</i>	Least Concern
Sculptured Mitten Lobster	<i>Parribacus antarcticus</i>	Least Concern
Blunt Slipper Lobster	<i>Scyllarides squammosus</i>	Least Concern
	<i>Penaeus monodon</i>	Entry not Found
	<i>Fenneropenaeus indicus</i>	Entry not Found
	<i>Penaeus latisulcatus</i>	Entry not Found
	<i>Penaeus semisulcatus</i>	Entry not Found
	<i>Macrobrachium rude</i>	Entry not Found
	<i>Fenneropenaeus indicus</i>	Entry not Found
	<i>Cerithidea decollate</i>	Entry not Found
	<i>Terebralia palustris</i>	Entry not Found
	<i>Cerithium nodulosum</i>	Entry not Found
Hooded Oyster	<i>Saccostrea cucullata</i>	Entry not Found
BlackSpot Snapper	<i>Lutjanus fulviflamma</i>	Entry not Found
	<i>Lutjanus sp</i>	-
Silver Moony	<i>Monodactylus argenteus</i>	Entry not Found
Yellowfin Goatfish	<i>Mulloides vanicolensis</i>	Entry not Found
Pickhandle Barracuda	<i>Sphyaena jello</i>	Entry not Found

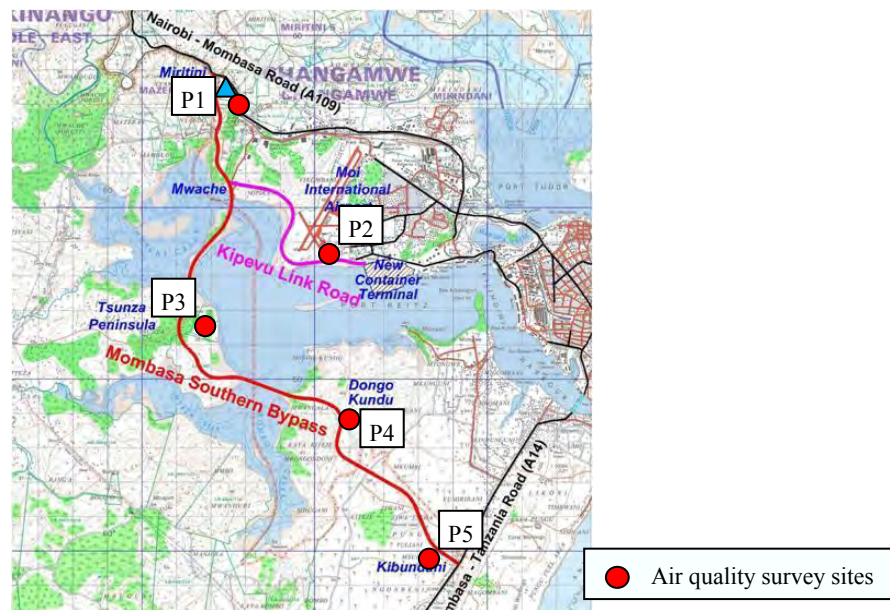
Source: The JICA Survey Team

3.2 Pollution Control

3.2.1 Ambient Air Quality

(1) Survey Method

The ambient air quality survey was conducted in the middle of July 2011 to understand the present air quality conditions in the vicinity of the road development areas shown in Figure A11.3-18. Table A11.3-11 summarized measurement parameters, survey method, sampling period and prediction method.



Source: JICA Survey Team

Figure A11.3-18 Location of Ambient Air Quality Surveys

Table A11.3-11 Ambient Air Quality Survey Specification

Parameters	Particulates (PM ₁₀), Nitrogen Oxides (NO _x), Sulphur Oxides (SO _x), Carbon Monoxide (CO), Ozone (O ₃), Lead (Pb) and wind direction and wind speed				
Survey Location	5 sites (Figure 19.3-1)				
	P1	P2	P3	P4	P5
	Miritini	Port Reitz	Tsunza	Mwangala	Kibundani
	S 4° 00' 00"	S 4° 02' 05"	S 4° 03' 20"	S 4° 04' 47"	S 4° 07' 00"
	E 39° 34' 29"	E 39° 36' 10"	E 39° 33' 47"	E 39° 35' 44"	E 39° 38' 02"
Survey Method	Continuous measurement with air sampler				
Period/Schedule	24 hours x 1 day (July 2011)				
Prediction Method	Air pollutant levels are predicted by the plume model based on the increased emissions from the road traffic.				

Source: JICA Survey Team

(2) Results

The measurement result of the ambient quality survey is summarized in Table A11.3-12.

Table A11.3-12 Result of Ambient Air Quality Survey

Pollutant	Unit	Location					Kenya *1	WHO *2	Time weighted average
		P1 Miritini	P2 Port Reitz	P3 Tsunza	P4 Mwangala	P5 Kibundani			
PM ₁₀	µg/m ³	11	12	17	15	14	100 50	50 20	24 hours 1year
SO _x (SO ₂)	µg/m ³	ND	18	ND	ND	ND	80 60	20 -	24 hours 1year
NO _x (NO ₂)	µg/m ³	ND	26	18	ND	8	80 60	40 (NO ₂)	24 hours 1year
CO	µg/m ³	379	510	427	381	404	4,000 2,000	- -	1 hour 8 hours
O ₃	ppm	ND	ND	ND	ND	ND	0.12 1.25	- 100	1 hour 8 hours
Lead	µg/m ³	ND	ND	4.4	ND	3.8	1 0.75	-	24 hours 1year
Wind speed	m/s	3.8	3.5	3.5	4	4	-	-	-
Wind direction	-	SW	SW	S	SW	SE	-	-	-

Source: The Survey Team

Note: ND: Not detected (less than the quantification limits).

*1: (Draft) The Environmental Management and Coordination (Air Quality) Regulations, 2008.

*2: WHO Air Quality Guidelines for Particulate Matter, Ozone, Nitrogen Dioxide and Sulfur Dioxide, Global Update 2005

The observed pollutant concentrations were compared with the tolerance limits of the draft Kenya air quality regulations shown in Table A11.3-12. The pollutant concentrations were well below the tolerance limits of the draft Kenyan regulations and also satisfied the WHO air quality standards.

The wind survey conducted with the ambient air quality survey showed that the wind blew from the south or the southwest and southeast where there are currently no anthropogenic emission sources of air pollutants. Since the project area along the road alignments is located south and west of the industrial areas in Changamwe and Mombasa Island, the background air quality in the project area might not be deteriorated.

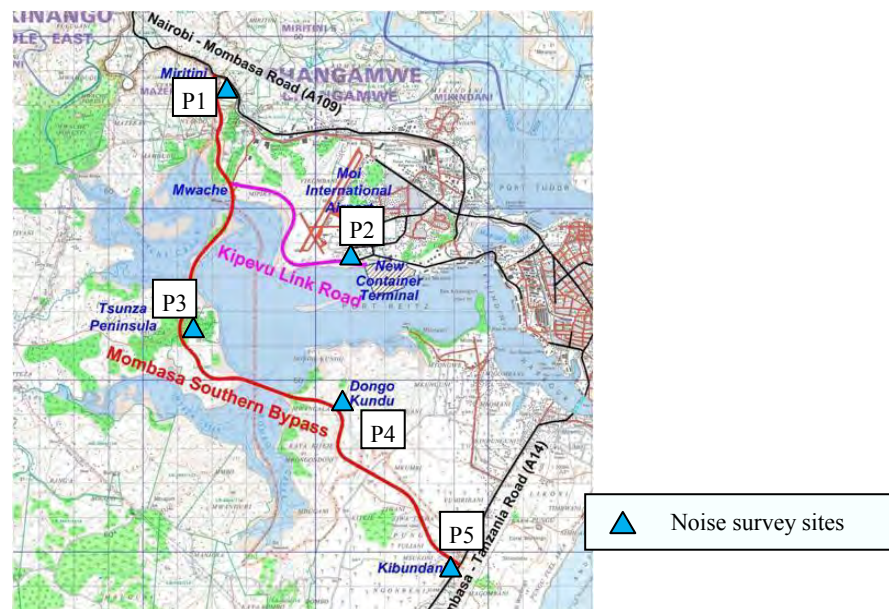
Airborne Lead was detected at Points 3 and 5 and exceeded the tolerance limits of the draft Kenyan regulations. These concentrations were however much lower than those that were

previously reported in Nairobi, Kenya¹. Since leaded gasoline has been phased out in Kenya since 2006² and there are no other emission sources around the survey sites, the airborne lead might not increase over the present level due to the road traffic.

3.3.2 Noise Survey

(1) Survey Method

The noise survey was conducted in the middle of July 2011 to grasp the present noise levels of areas along the proposed road alignments shown in Figure A11.3-19. Table A11.3-13 summarized measurement parameters, survey method, sampling period and prediction method.



Source: JICA Survey Team

Figure A11.3-19 Location of Noise Surveys

¹ Mulaku, *et al.*, "Mapping and Analysis of Air Pollution in Nairobi, Kenya," *International Conference on Spatial Information for Sustainable Development*, Nairobi, Kenya, October 2001.

² UNEP website: <http://www.unep.org/Documents.Multilingual/Default.Print.asp?DocumentID=392&ArticleID=4476&I=en>

Table A11.3-13 Noise Survey Specification

Parameters	Equivalent sound level: L_{Aeq} , L_{Amax} and L_{Amin}				
Survey Location	5 sites (Figure 19.3-1)				
	P1	P2	P3	P4	P5
	Miritini	Port Reitz	Tsunza	Mwangala	Kibundani
	S 4° 00' 00"	S 4° 02' 05"	S 4° 03' 20"	S 4° 04' 47"	S 4° 07' 00"
	E 39° 34' 29"	E 39° 36' 10"	E 39° 33' 47"	E 39° 35' 44"	E 39° 38' 02"
Survey Method	Noise level will be measured by the installation of noise level meter at survey sites during day and night time				
Period/Schedule	24 hours x 1 day (July 2011)				
Prediction Method	Road traffic noise is predicted by the model of Acoustical Society of Japan based on the traffic increase.				

Source: JICA Survey Team

(2) Results

The measurement result of the noise survey is summarized in Table A11.3-14.

Table A11.3-14 Result of Noise Survey

dB(A)		Day (6.01 a.m. - 8.00 p.m.)	Night (8.01 p.m. - 6.00 a.m.)
Location		L_{Aeq} (Min.-Max.)	L_{Aeq} (Min.-Max.)
P1	Miritini	61 (49 – 75)	47 (44 – 51)
P2	Port Reitz	49 (45 – 60)	47 (45 – 60)
P3	Tsunza	45 (43 – 58)	43 (40 – 51)
P4	Mwangala	57 (49 – 64)	45 (42 – 51)
P5	Kibundani	56 (49 – 75)	46 (44- 54)
Kenyan ^{*1} Regulations		50 (residential) 60 (commercial)	35 (residential) 35 (commercial)
IFC Guidelines ^{*2}		55 (residential) 70 (industrial)	45 (residential) 70 (industrial)

Source: The Survey Team

Note: 1) The Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009. Time Frame: Day: 6.01 a.m. – 8.00 p.m.; Night: 8.01 p.m. – 6.00 a.m.

Note: 2) General EHS Guidelines; Environmental Noise Management, International Finance Corporation: IFC 2007. Time Frame: Day: 7.00 a.m. – 10.00 p.m.; Night: 10.00 p.m. – 7.00 a.m.

According to the Kenyan noise regulations, the noise levels during the day at three sites exceeded the maximum permissible noise level of 50 dB(A) for a residential zone. The noise levels at all five sites during the night exceeded the maximum permissible noise level of 35 dB(A) for a residence zone.

However, it is said that the maximum permissible noise levels of Kenyan regulations are extremely stricter than the international standards. Therefore, the present noise levels should be evaluated by the international standards, such as the guidelines of International Finance Corporation (2007), although the definition of the time frame of the day and night is different from the Kenyan regulations.

Compared with the IFC's EHS guidelines, except at P1, the noise levels observed during the day were almost at the same level as the IFC guideline values. At P1, the noise level largely exceeded the guideline value of 55 dB(A) for a residential area during the day. Because the sampling site at P1 (Miritini) was close to the Nairobi-Mombasa Road (A119), the road traffic noise of A109 might result in the loudest sound levels.

On the other hand, the noise levels observed during the night at all sites were almost the same level of the IFC guideline value of 45 dB(A) for a residential area.

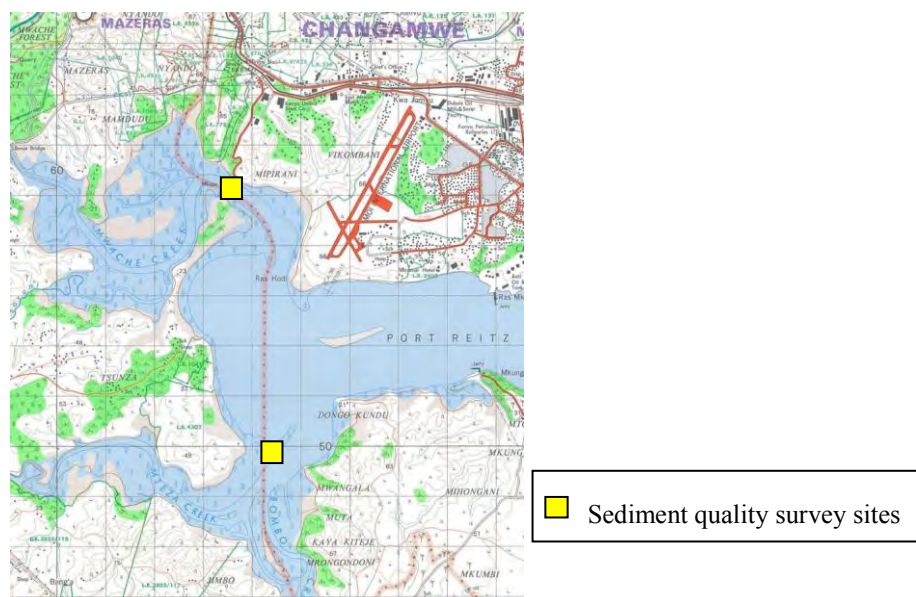
3.2.3 Water Quality

Water quality of Mkupe (Mwache) and Mwangala (Mteza) Creeks was measured in April 2009. The methodology and results are reported in Chapter 11 of the original EIA report.

3.2.4 Sediment Quality

Sediment quality of Mkupe (Mwache) and Mwangala (Mteza) Creeks was measured in April 2009. The methodology and results are reported in Chapter 11 of the original EIA report.

In addition, the sediment quality survey was carried out in July 2011 to investigate the present concentrations of hazardous chemicals and heavy metals in sediment of the creeks, where piers and abatement of the bridges will be installed. The sampling location is shown in Figure A11.3-20. Table A11.3-15 summarized measurement parameters, sampling period and survey method.



Source: JICA Survey Team

Figure A11.3-4 Location of Sediment Quality Survey

Table A11.3-15 Sediment Quality Survey Specification

Parameters	Physical characteristics		Particle Size Distribution, Moisture Content
	Nutrients		Total Organic Carbon (TOC), Total Nitrogen (T-N), Total Phosphorus (T-P)
	Heavy Metals		As, Cd, Cr, Cu, Pb, Hg, Ni, Ag and Zn;
	Persistent Organic Pollutants (POPs)		HCB, DDT, Chlordane, Aldrin, Dieldrin, Endrin and total PCB
	Polycyclic Aromatic Hydrocarbon		Total PAHs
Survey Location	2 sites (Figure 19.3-4)		
	Mwache Creek	Mteza Creek	
	S 4° 01'40"	E 39° 34'25"	
	S 4° 04'36"	E 39° 35'04"	
Survey Method	Sediment samples were collected and analyzed at the NEMA's certified laboratories: SGS Kenya Ltd. and National Agricultural Research Laboratories.		
Period/Schedule	Field sampling x 1day (July 2011)		

Source: JICA Survey Team

(2) Results

The result of the sediment quality survey is summarized in Table A11.3-16.

Table A11.3-16 Result of Sediment Quality Survey

Parameters	Unit	Location		CEFAS Guidelines ^{*1}		Canada Guidelines ^{*2}	
		Mwache Creek	Mteza Creek	Action Level 1	Action Level 2	ISQG	PEL
Moisture content	%	17.5	30.3	-	-	-	-
Nutrients							
TOC	%	0.24	1.02	-	-	-	-
T-N	%	0.02	0.06	-	-	-	-
T-P	%	<0.02	0.05	-	-	-	-
Metals							
Arsenic (AS)	mg/kg	ND (<0.005)	ND (<0.005)	20	100	7.24	41.6
Cadmium (Cd)	mg/kg	ND (<0.02)	ND (<0.02)	0.4	5	0.7	4.2
Chromium (Cr)	mg/kg	3.9	23.6	40	400	52.3	160
Copper (Cu)	mg/kg	7.0	15.8	40	400	18.7	108
Nickel (Ni)	mg/kg	0.9	16.2	20	200	-	-
Silver (Ag)	mg/kg	ND (<0.02)	168.5	-	-	-	-
Zinc (Zn)	mg/kg	29.1	20	130	800	124	271
Lead (Pb)	mg/kg	ND (<0.02)	13.9	50	500	30.2	112
Mercury (Hg)	mg/kg	ND (<0.005)	ND (<0.005)	0.3	3	0.13	0.7
Hazardous chemicals							
HCB	µg/kg	ND (absent)	ND (absent)			0.32	0.99
DDT	µg/kg	ND (<0.01)	ND (<0.01)	1.0 ^{*1-1}		1.19	4.77
Chlordane	µg/kg	ND (absent)	ND (absent)			2.26	4.79
Aldrin	µg/kg	ND (<0.01)	ND (<0.01)	-	-	-	-
Dieldrin	µg/kg	ND (<0.01)	ND (<0.01)	5.0 ^{*1-1}		0.71	4.3
Endrin	µg/kg	ND (<0.01)	ND (<0.01)			2.67	62.4
Total PCBs	µg/kg	ND (absent)	ND (absent)	20	200	21.5	189
Total PAHs	µg/kg	ND (<0.01)	ND (<0.01)	100 ^{**1-2}		-	-

Source: The Survey Team

Note: ND (<0.01) indicates that the quantification limit (e.g., 0.01) was specified by the lab. On the other hand, ND (absent) means that data were less than the quantification limits but not specified by the lab.

*1 Centre for Environment, Fisheries & Aquaculture Science (CEFAS) Guideline Action Levels (2003)

*1-1: These levels were set in 1994. *1-2: In 2003 a new set of action levels has been presented as revised action levels for England and Wales (DEFRA, 2003). These are still not in use.

*2 Canadian Sediment Quality Guidelines for the Protection of Aquatic Life (2002), Interim marine sediment quality guidelines (ISQGs; dry weight), probable effect levels (PELs; dry weight),

Nutrients

The levels of TOC, Total Kjeldahl Nitrogen and Total Phosphorus recorded at these creeks were relatively low. Therefore it is inferred that the nutrients concentrations in the bottom sediments does not reflect the characteristics of an estuarine environment greatly enriched by organic matter and nutrients. There is no risk of eutrophication due to dredging and disposal of the dredged spoil.

Heavy Metals

The concentrations of heavy metals in the sediments of two creeks are summarized in Table A11.3-12. These concentrations were compared with the British guideline values established by the Centre for Environment, Fisheries & Aquaculture Science (CEFAS).

In general, a case by case decision is made based on the Action Levels:

- Case I: Contaminant concentrations below Action Level are generally considered of no concern with their potential to cause pollution;
- Case II: Material with contaminant concentrations between Action Levels 1 and 2 are likely to require further consideration either by additional sampling and analysis, testing (possibly by bioassay) or a change to the proposed dredge/placement method.
- Case III: Contaminant concentrations above Action Level 2 are considered to be unsuitable for sea disposal and will most likely require additional investigation and consideration, which may include treatment management practices.

The metal levels observed in two sampling points were below the Action Level 1 of CEFAS Guideline values as shown in Table A11.3-16. The concentrations of As, Cd and Hg were below the detection limits.

Hazardous Chemicals

The data of Organochlorine Pesticides, Polychlorinated Biphenyls (PCBs) and Polycyclic Aromatic Hydrocarbons (PAHs) in Table A11.3-16 shows that these concentrations of chemicals in two creeks were consistently below the detection limits of the analytical methods. That is, these chemicals are well below the CEFAS Action Level 1 and also the Canadian Sediment Quality Guidelines for the Protection of Aquatic Life (2002).

3.3 Social Environment

Social environment in terms of the following items were addressed in Chapter 9 of the original EIA report.

- Demography
- Land Use
- Physical Infrastructure such as Sea Transport, Railway and Airport Network
- Electricity
- Water Supply
- Housing and Sanitation
- Fisheries
- Tourism
- Poverty

CHAPTER 4 ENVIRONMENTAL IMPACT STUDY

4.1 Natural Environment

Potential impacts on the natural conditions and natural environment due to the Project during the construction and operation phases were assessed in Chapters 8 and 15 of the original EIA report.

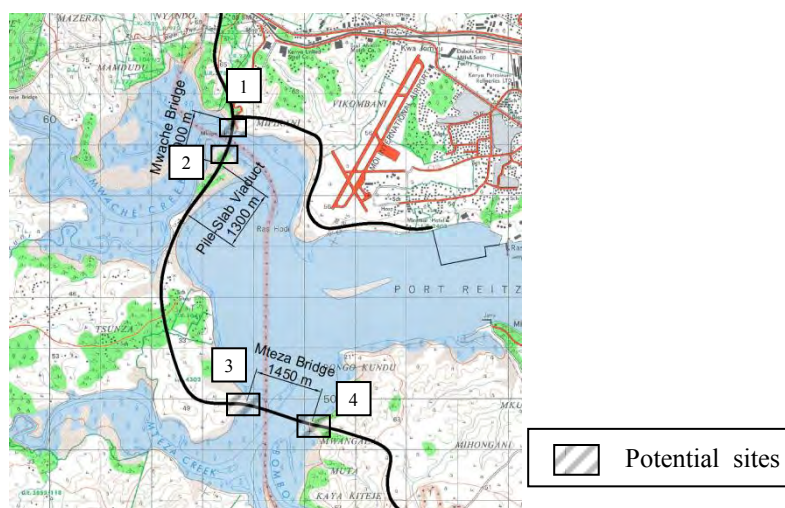
On the basis of the results of the supplemental EIA surveys, potential impacts on flora and fauna are also assessed. Impact analysis focuses on the possible interaction between proposed development and operation of the Project on both terrestrial and aquatic ecosystems. Within both ecosystems the environmentally sensitive resources include Kayas on terrestrial ecosystem and mangrove swamps in the intertidal areas. An assessment of potential impacts on such ecosystems is summarized provided in Table A11.4-1.

Table A11.4-1 Potential Impacts of the Road Construction and Operation

Project Phase	Activities	Potential Impacts	Severity & Persistence	Viability of Mitigations
Construction	Stripping of vegetation and topsoil	Loss of genetic material and habitat for both flora and fauna. Migratory and feeding corridor restrictions	Low. Long-term	Irreversible
	Excavation in mangrove and open water areas for bridge anchorage	Loss of habitat for both mangrove and allied fauna	High but involves small area. Long-term	Reversible
		Displacement of fish and other fauna by noise and vibrations	Low. Short-term	Reversible
		Generation of sediment and debris with potential for pollution	Low. Short-term	Reversible
	Fixing of formworks and laying of concrete	Pollution from debris and contaminated water	Low. Short-term	Reversible
Operation	Discharge of road runoff into aquatic areas	Threat of pollution of open water quality and mangrove ecosystems	Medium. Long-term	Irreversible
	Emission of air pollutants	Acid rain impacts on plants	Low Long-term	Irreversible
	Soil erosion and deposition	Retreat of mangrove swamps and tidal flats.	High Long-term	Irreversible

4.1.1 Impact on Mangroves and terrestrial trees

The potential mangroves cutting sites are the costal swamps of Mwache and Mteza Creeks where the bridges are constructed as shown in Figure A11.4-1. The estimate of mangrove area to be cleared is presented in Table A11.4-2.



Source: JICA Survey Team

Figure A11.4-1 Potential Mangrove Cutting Area along the Long Bridges

Table A11.4-2 Area of Potential Mangrove Cutting

No	Site	Estimated Area (m ²)	Calculation
1	Mwache Bridge (Mkupe side)	1,500	15.0 m x 100 m
2	Mwache Bridge (Tsunza side)	4,500	15.0 m x 300 m
3	Mteza Bridge (Tsunza side)	10,500	15.0 m x 700 m
4	Mteza Bridge (Mwangala side)	1,500	15.0 m x 100m
Total		18,000	-

Source: JICA Survey Team

A total of 14,413 economic trees were counted within ROW as shown in Table A11.4-3. These trees are likely to be displaced due to construction of the roads.

Table A11.4-3 Trees to be Displaced

Trees	Number of Trees	Remarks
Coconuts	3,147	-
Cashew	1,158	-
Fruits	4,384	Bananas: 2093, Mangoes: 868, Pawpaws: 814, Avocadoes: 397, Citrus: 67, Others: 145
Indigenous	5,724	Dominated by Neem and Raffia. Others are Tamarid, Baobab, Jacaranda, Vanguelia, Kapok tree, etc.
Total	14,413	-

Source: JICA Survey Team

4.1.2 Impact on Crustaceans and Mollusks

These groups of organisms are found in the coastal shorelines that comprise of mangrove swamps and tidal flats. Movements of these species are normally along the coastal shoreline which provides them with connectivity for the adults and their larvae. Anchoring the bridge for the bypass may require clearing of the mangroves formations. Clearing of the mangroves and construction of the road will cut the connection of the shoreline habitats and consequently, the population of Tsunza will be isolated from other seaward population.

Activity of dredging seabed for anchoring bridge will potentially affect movement of swimming crabs into deep sea for breeding purposes and their return to the shore for protection of juveniles. As well, movements of prawns and shrimps in the open waters might be affected by wave shocks and increased turbidity from civil works.

4.1.3 Impacts on Fish and Fisheries

Impacts of the project will be eminent during construction phase. Dredging and explosion of rocks for bridge anchors is likely to send shocks in the water that could scare off fishes from the area. Implications of the activities are likely to manifest through reduced fish catch at Tsunza and Port Reitz areas.

4.1.4 Impact on Birds

Some birds are insectivorous feeding on insects, seeds and fruits; others predate on other birds. Road construction will have potential impact on their habitats/shelter, cover from prey, shelter from sun-heat, and foraging grounds. Birds that were covered in the survey were terrestrial and coastal/marine bird species.

- Common characteristics with the birds are that they move from one place to another looking for food. As they move they rely on connectivity of vegetation mosaic for local movement, foraging and cover. Construction of the road will therefore create breaks to the connected habitat for the birds. Bird preys may be made vulnerable to predators due to limited vegetation covers.
- Associated development of roads such as expansion of settlements and trading centers will potentially favor growth of predator birds such as the Indian Crow that will predate on others.
- The low flying birds are likely to suffer road kills by running vehicles. Road kills will be high in the initial period of operation since the areas have not experienced heavy traffic (vehicle movements).
- Such development will in future indirectly influence clearing of the area for other developments along the road on what would be a buffer zone where vegetation would

be conserved. Consequently, habitats for the birds will reduce considerably along the road.

- Clearance of vegetation might reduce foraging grounds for some species of birds. The area for the bypass comprises of grass areas, bushes and woodlands, mangrove swamps that provide different food types to different bird species. Construction of the road and indirect development will considerably affect; for instance the ground feeding birds that depend on seeds from grasses and insects, canopy feeding birds, and birds that derive their food from the mangrove swamp.

4.1.5 Impact on Bees and Butterflies

Clearing for road construction will potentially remove plant species that provide pollinator species with food in the form of nectars, habitats and cover. Most of the areas traversed by the designed road have various vegetation types that make the insect pollinators diverse. Normally pollination services conducted by the organisms facilitate reproduction in flowering plants and sustain population in the system. Some of the agricultural crops rely on the services of the insect pollinator for quality fruits production.

- Clearing of various habitats (vegetation types) will have negative impact on the diversity of the insect pollinators. Some of the insect pollinators have preference for specific flowering plant species while others can utilize various flowering plant species. The former would be affected adversely when their target plant population is reduced in the area.
- The natural system acts as refugia for insect pollinator for crops. When flowering seasons for agricultural crops or vegetables are over, the insect pollinators change foraging areas to the natural system. This sustain the pollination services of the organisms.

4.1.6 Impact on Mammals

Most of the mammals occurring in the area are rodents. These include rats, elephant shrew, hedgehog, porcupine, squirrels, moles, African hare. Other include mammal species is monkey. Monkey and squirrel prefers areas with trees, while others prefers grass areas, woodland and near farm areas. The construction has potential of destroying habitats for the mammals. The various groups will be affected in varying magnitude depending on the habitat affected most.

- Ground movements of ground moles across the land will be prevented by the hard strata and compressed layers of the road. Populations will potentially be separated by the road. This might make one or all separated population vulnerable to developments.

- During the operation of the road, rats, elephant shrew, hedgehog, porcupine, African hare that would be crossing roads will be prone to road kills. This would be so since the road could be on the ranging areas of the animals.
- Clearance of trees and shrub species might reduce habitat ranges and foraging areas for the monkeys and squirrels.

4.1.7 Impact on Reptiles and Amphibians

Impacts on the group will be experienced during construction and operation.

- Clearing and excavation area for road construction would destroy habitats for the animals. The group occurs in grass areas, bushes, and woodlands that will be affected varyingly.
- During operation of the road this group of animals would be affected by road kills since the road area could be their natural ranging areas.

4.2 Pollution Control

4.2.1 Impacts Analysis of the original EIA report

The potential impacts on physical environment of the Project during the construction and operation phases were addressed in several chapters of the original EIA report.

- The assessment methods were explained in Chapter 8.
- The possible occupational hazards during the construction of the Project were described in Chapter 12.
- The potential impacts on air quality, noise environment and water resources were mentioned in Chapter 15.
- The waste generated during the construction and operation phase was described in Chapter 7.

4.2.2 Prediction of Impacts on Ambient air quality

On the basis of the results of the supplemental EIA surveys, the impact on ambient air quality during the operation phase is also assessed.

(1) Prediction Method

The prediction method established in the “Technical Handbook for Environmental Impact Assessment of Roads”³ is used to predict the pollutant levels in ambient air based on the projected traffic volume. The basic principles and procedure are as follows:

³ Japan Highway Environment Research Institute (HERI), “Technical Handbook for Environmental Impact Assessment of Roads, 2007 edition”.

- 1) To obtain the emission of pollutants from vehicles based on the projected traffic volume;
- 2) To compute the concentration increment of pollutants by the atmospheric dispersion models such as a Plume Model; and,
- 3) To estimate the pollution levels adding the computed increment to the background conditions.

(2) Emission of Pollutants in Exhaust Gas from Vehicles

The average emission of gaseous pollutants is calculated by the following equation.

$$Q_t = V_W \times \frac{1}{3600} \times \frac{1}{1000} \times \sum_{i=1}^2 (N_{it} \times E_i) \quad (\text{eqn. 1.1})$$

where

Q_t : the average emission of a gaseous pollutant at hour t [g/km·day]

E_i : the emission factor of the i -th type of vehicle [g/km· vehicle]

N_{it} : the hourly traffic volume of the i -th type of vehicles [vehicle/hr]

V_W : the conversion coefficient [mL/g or mg/g]

The emission factor of the i -th type of vehicle, E_i is calculated by the following equation.

$$E_i = a/V + bV + cV^2 + d \quad (\text{eqn. 1.2})$$

where V is the average running speed of the i -th type of vehicle and a , b , c , and d are regression coefficients given in Table A11.4-2 (Technical Handbook for Environmental Impact Assessment of Roads¹ provide the coefficients of NO_x, PM₁₀, CO and SO₂). Table A11.4-4 shows the calculated emission factors for the light and heavy vehicles at the velocities of 60, 70 and 80 [km/hr].

Table A11.4-4 Pollutant Emission Factors for Vehicle Types

Pollutants	Vehicle Size	a	b	c	d	Average Speed of Vehicle [km/hr]		
						60	70	80
NO _x	Light	-0.902	-0.00578	4.39E-05	0.261	0.0572	0.0586	0.0683
	Heavy	-7.12	-0.0895	0.000735	3.93	1.0873	1.1648	1.3850
PM ₁₀	Light	-0.069	-0.00039	2.87E-06	0.017	0.0031	0.0031	0.0037
	Heavy	0.0318	-0.0031	2.27E-05	0.158	0.0543	0.0527	0.0557
CO	Light	-12.5	-0.0559	0.000448	2.2	0.2505	0.3036	0.4390
	Heavy	10.9	-0.0168	0.000115	1.19	0.7777	0.7332	0.7183
SO ₂	Light	0.0783	-0.00016	1.31E-06	0.0112	0.0075	0.0074	0.0076
	Heavy	0.0411	-0.0007	5.51E-05	0.0424	0.1995	0.2640	0.3396

Source: The Survey Team

(3) Pollutant Dispersion Model: Plume Model

Pollutant concentrations in ambient air were computed using the Plume Model, which expressed the dispersion of pollutants emitted from the moving vehicles when the wind is over one meter per second (> 1 [m/s]). According to “Technical Handbook for Environmental Impact Assessment of Roads (2007)”, the pollutant concentration at point (x, y, z) is given by:

$$C(x, y, z) = \frac{Q}{2\pi \cdot u \cdot \sigma_y \cdot \sigma_z} \exp\left(-\frac{y^2}{2\sigma_y^2}\right) \left[\exp\left\{-\frac{(z+H)^2}{2\sigma_z^2}\right\} + \exp\left\{-\frac{(z-H)^2}{2\sigma_z^2}\right\} \right] \quad (\text{eqn. 1.3})$$

where

$C(x, y, z)$: pollutant concentration at any prediction point (x, y, z) [ppm or mg/m³]

Q : air pollutant emission rate [mL/s or mg/s]

u : average wind speed [m/s]

H : height of emission source [m]

x : distance from an emission source to the prediction point along the wind direction [m]

y : horizontal distance from the prediction point perpendicular to the x -axis [m]

z : vertical distance from the prediction point perpendicular to the x -axis [m]

σ_y, σ_z : dispersion width of toward y dimension and z dimension [m]

in which

$$\sigma_y = W/2 + 0.46L^{0.81} \quad (\text{in case of } x < W/2: \sigma_y = W/2)$$

$$\sigma_y = \sigma_{z0} + 0.31L^{0.83} \quad (\text{in case of } x < W/2: \sigma_z = \sigma_{z0})$$

σ_{z0} : initial vertical dispersion width [m]

- without noise barrier $\sigma_0 = 1.5$

- with noise barrier (height > 3 m) $\sigma_0 = 4.0$

L : distance from the road edge to the prediction point [m]

W : road width [m]

(4) Input Data and Calculation Conditions

The future ambient air quality was calculated based on the projected traffic volume according to the recommendations of the preparatory survey. In this scenario, during the Phase-1 until 2025, Sections 1 and 2 of the Kipevu Link Road is 4-lane, and Sections 3 and 4 of the Mombasa Southern Bypass Road is 2-lane.

Tables A11.4-5 to A11.4-7 show the projected traffic volume by vehicle types at four sections. In this calculation, cars, matatus and LGVs were categorized as the light vehicles, and MGVs, HGVs and buses were categorized as the heavy vehicles.

Table A11.4-5 Average Daily Traffic Volume at Section 1 [vehicles/day]

Year	2015	2020	2025	2035 ^{*1}
Light Vehicle	956	2163	3652	8855
Heavy Vehicle	4456	5809	9906	18916
Average Velocity [m/s]	80	80	80	78
Number of Lanes	4	4	4	4

Source: The Survey Team

Note1: In 2035 the Mombasa Southern Bypass Road is 2-lane in 2035.

Table A11.4-6 Average Daily Traffic Volume at Section 2 [vehicles/day]

Year	2015	2020	2025	2035 ^{*1}
Light Vehicle	956	6948	10349	13597
Heavy Vehicle	4456	6385	9117	14618
Average Velocity [m/s]	80	80	80	78
Number of Lanes	4	4	4	4

Source: The Survey Team

Note1: In 2035 the Mombasa Southern Bypass Road is 2-lane in 2035.

Table A11.4-7 Average Hourly Traffic Volume at Section 3 [vehicles/day]

Year	2015	2020	2025	2035 ^{*1}
Light Vehicle	0	6681	11001	14272
Heavy Vehicle	0	1067	3803	9410
Average Velocity [m/s]	-	65	43	26
Number of Lanes	-	2	2	2

Source: The Survey Team

Note1: In 2035 the Mombasa Southern Bypass Road is 2-lane in 2035.

Table A11.4-8 Average Daily Traffic Volume at Section 4 [vehicles/day]

Year	2015	2020	2025	2035 ^{*1}
Light Vehicle	0	6681	8545	12974
Heavy Vehicle	0	1067	2037	3550
Average Velocity [m/s]	-	65	57	43
Number of Lanes	-	2	2	2

Source: The Survey Team

Note1: In 2035 the Mombasa Southern Bypass Road is 2-lane in 2035.

According to Appendix 1 Meteorological Data of the F/S Report, almost 90% of the wind speed at Moi International Airport exceeded 3.6 [m/s] (7 knots), and about 80% of wind is in the south or the south-southwest.

In this prediction, the wind speed of 2 [m/s] from the south was adopted to obtain more conservative estimates, i.e., higher pollutant concentrations. According to the *eqn.1.2*, the pollutant concentration $C(x, y, z)$ increases inversely with the wind speed.

The prediction point was set at the edge of ROW. The horizontal distance from the centre of the road to the prediction point is 55 meters since ROW is 110 meters wide.

(5) Predicted Ambient Air Quality

The pollutant emissions calculated by *eqn.1.1* based on the projected traffic volume are summarized in Tables A11.4-9 to A11.4-12.

Table A11.4-9 Average Emission of Pollutants at Section 1 [g/km·day]

Pollutants	2015	2020	2025	2035
NO _x	6,237	8,193	13,969	25,235
PM ₁₀	252	331	565	1,058
CO	3,620	5,122	8,718	17,065
SO ₂	1,521	1,989	3,392	6,040

Source: The Survey Team

Table A11.4-10 Average Emission of Pollutants at Section 2 [g/km·day]

Pollutants	2015	2020	2025	2035
NO _x	6,237	9,318	13,334	20,327
PM ₁₀	252	381	546	848
CO	3,620	7,636	11,091	16,020
SO ₂	1,521	2,221	3,175	4,833

Source: The Survey Team

Table A11.4-11 Average Emission of Pollutants at Section 3 [g/km·day]

Pollutants	2015	2020	2025	2035
NO _x	0	1,559	5,648	18,691
PM ₁₀	0	77	302	974
CO	0	2,574	7,225	19,880
SO ₂	0	293	531	749

Source: The Survey Team

Table A11.4-12 Average Emission of Pollutants at Section 4 [g/km·day]

Pollutants	2015	2020	2025	2035
NO _x	0	1,559	2,719	5,439
PM ₁₀	0	77	140	292
CO	0	2,574	3,753	7,593
SO ₂	0	293	440	523

Source: The Survey Team

(6) Predicted Pollutant Concentrations

The increments of pollutant concentration at the edge of ROW computed by *eqn. 1.3* were summarized in Tables A11.4-13 to A11.4-16.

Table A11.4-13 Average Emission of Pollutants at Section 1 [$\mu\text{g}/\text{m}^3$]

Pollutants	2015	2020	2025	2035
NO _x	3.5	4.6	7.9	14.3
PM ₁₀	0.1	0.2	0.3	0.6
CO	2.0	2.9	4.9	9.7
SO ₂	0.9	1.1	1.9	3.4

Source: The Survey Team

Table A11.4-14 Average Emission of Pollutants at Section 2 [$\mu\text{g}/\text{m}^3$]

Pollutants	2015	2020	2025	2035
NO _x	3.5	5.3	7.5	11.5
PM ₁₀	0.1	0.2	0.3	0.5
CO	2.0	4.3	6.3	9.1
SO ₂	0.9	1.3	1.8	2.7

Source: The Survey Team

Table A11.4-15 Average Emission of Pollutants at Section 3 [$\mu\text{g}/\text{m}^3$]

Pollutants	2015	2020	2025	2035
NO _x	0.0	0.9	3.2	10.6
PM ₁₀	0.0	0.0	0.2	0.6
CO	0.0	1.5	4.1	11.2
SO ₂	0.0	0.2	0.3	0.4

Source: The Survey Team

Table A11.4-16 Average Emission of Pollutants at Section 4 [$\mu\text{g}/\text{m}^3$]

Pollutants	2015	2020	2025	2035
NO _x	0.0	1.8	3.1	6.2
PM ₁₀	0.0	0.1	0.2	0.3
CO	0.0	2.9	4.3	8.7
SO ₂	0.0	0.3	0.5	0.6

Source: The Survey Team

(7) Impact on Ambient Air Quality

The pollution levels of ambient air were estimated by adding the computed increments to the background pollutant concentrations shown in Table A11.3-12. Table A11.4-17 shows the predicted pollutant levels in 2025 (at the end of Phase 1).

Table A11.4-17 Predicted Pollutant levels in 2025 [$\mu\text{g}/\text{m}^3$]

Pollutants	Section 1	Section 2	Section 3	Section 4	Kenya Regulations * ¹ (Residential area)
NO _x	8	34	18	12	80 (24 hours) 60 (1year)
PM ₁₀	12	12	17	15	100 (24 hours) 50 (1year)
CO	384	510	427	408	4,000 (1 hour) 2,000 (8 hours)
SO ₂	20	18	1	1	80 (24 hours) 60 (1year)

Source: The Survey Team

Note 1: (Draft) The Environmental Management and Coordination (Air Quality) Regulations, 2008

Because the present background pollutant levels are well below the tolerance limits for a residential area stipulated in the draft Kenya air quality regulations, the predicted pollutant concentrations of NO_x, PM₁₀, CO and SO₂ at the edge of ROW along the Kipevu Link Road will not exceed the tolerance limits in 2025.

Also the predicted pollutant concentrations of NO_x, PM₁₀, CO and SO₂ along the Mombasa Southern Bypass Road will be still lower than the tolerance limits of the draft Kenya air quality regulations in 2025.

Furthermore the predicted concentrations of these pollutants in 2025 might not largely exceed the WHO guidelines which are stricter than Kenya air quality regulations.

However, it should be noted that there are some constraints in this prediction. Due to the lack of the pollutant emission factors from vehicles in Kenya, the emission factors were referred to the values used in Japan according to the “Technical Handbook for Environmental Impact Assessment of Roads (2007)”. Therefore in order to obtain more accurate concentrations, the emission factors measures in Kenya should be adopted.

The ambient air quality survey was conducted in just one day in the middle of July. In order to grasp background pollutant levels and determine the baseline conditions for the Environmental Monitoring Plan, the monitoring campaign should be carried out before construction.

4.2.3 Prediction of Road Traffic Noise

(1) Prediction Method

The mathematical model “ASJ RTN-Model 2008” developed by the Acoustical Society of Japan⁴ is used to predict the noise levels based on the projected traffic volume.

The principles and basic formulas used in the prediction model are as follows.

First, obtain the time variation of the A-weighted sound level L_A (unit pattern) observed at a prediction point for a single vehicle which is passing along the road under consideration. Then, calculate its time integrated value over the duration of its passage, i.e., L_{AE} (the single-event level sound exposure level).

$$L_{AE} = 10 \log_{10} \left(\frac{1}{T_0} \sum_{i=1} 10^{L_{A,i}/10} \cdot \Delta t_i \right) \quad (\text{eqn. 2.1})$$

where

- $L_{A,i}$: the A-weighted sound pressure level at the prediction point emitted from the i -th section of the road [dB]
- Δt_i : $\Delta D_i / V$
- ΔD_i : the length of the i -th section of the road [m]
- V : the average running speed of the vehicle in the i -th section [m/s]

The A-weighted sound pressure level $L_{A,i}$ for noise propagation from the i -th source to the prediction point is calculated by considering the sound propagation in a hemi-free field from an omni-directional point source as:

$$L_{A,i} = L_{WA,i} - 8 - 20 \log_{10} r + \Delta L_{cor,i} \quad (\text{eqn. 2.2})$$

where

- $L_{WA,i}$: the A-weighted sound pressure level at a single running vehicle at the i -th source [dB]
- r_i : the direct distance from the the i -th source to the prediction point [m]

The correction term $\Delta L_{cor,i}$ [dB] is related to the various attenuation factors such as the correction for diffraction ($\Delta L_{dif,i}$), correction for ground effect ($\Delta L_{grd,i}$) and correction for atmospheric absorption ($\Delta L_{air,i}$). Therefore,

$$\Delta L_{cor,i} = \Delta L_{dif,i} + \Delta L_{grd,i} + \Delta L_{air,i} \quad (\text{eqn. 2.3})$$

The A-weighted sound power level of a road vehicle $L_{WA,i}$ [dB] is given by

⁴ K. Yamamoto, “Road traffic noise prediction model “ASJ RTN-Model 2008”: Report of the Research Committee on Road Traffic Noise,” Acoust. Sci. & Tech. 31, 1 (2010)

$$L_{AW,i} = a + b \log_{10} V + C \quad (\text{eqn. 2.4})$$

where V is the vehicle speed [km/h], a and b are regression coefficients, and C is the correction term such as correction for pavement condition, road gradient and so on.

Finally, the time averaged value of the noise at a prediction point, L_{Aeq} (the equivalent continuous A-weighted sound pressure level is obtained by taking account of the traffic conditions such as traffic volume (N: number of vehicles per hour) and vehicle types (light and heavy vehicles).

$$L_{Aeq} = 10 \log_{10} \left(10^{L_{AE}/10} \cdot \frac{N}{3600} \right) \quad (\text{eqn. 2.5})$$

(2) Input Data and Calculation Conditions

The future noise levels were calculated based on the projected traffic volume according to the recommendations of the preparatory survey. In this scenario, Sections 1 and 2 of the Kipevu Link Road is 4-lane, and Sections 3 and 4 of the Mombasa Southern Bypass Road is 2-lane.

Tables A11.4-18 to A11.4-21 show the projected traffic volume by vehicle types at four sections. In this calculation, cars, matatus and LGVs were categorized as the light vehicles, and MGVs, HGVs and buses were categorized as the heavy vehicles.

Table A11.4-18 Average Hourly Traffic Volume at Section 1

Year	2015		2020		2025		2035	
Time	Day	Night	Day	Night	Day	Night	Day	Night
Light Vehicle [unit/hr]	58	14	424	104	631	155	829	204
Heavy Vehicle [unit/hr]	267	71	383	102	547	146	877	234
Average Velocity [m/s]	80	80	80	80	80	80	78	78
Number of Lanes	4	4	4	4	4	4	4	4

Time Frame: Day: 6.01 a.m. – 8.00 p.m.; Night: 8.01 p.m. – 6.00 a.m.

Source: The Survey Team

Table A11.4-19 Average Hourly Traffic Volume at Section 2

Year	2015		2020		2025		2035	
Time	Day	Night	Day	Night	Day	Night	Day	Night
Light Vehicle [unit/hr]	58	14	132	32	223	55	540	133
Heavy Vehicle [unit/hr]	267	71	349	93	594	158	1135	303
Average Velocity [m/s]	80	80	80	80	80	80	77	77
Number of Lanes	4	4	4	4	4	4	4	4

Time Frame: Day: 6.01 a.m. – 8.00 p.m.; Night: 8.01 p.m. – 6.00 a.m.

Source: The Survey Team

Table A11.4-20 Average Hourly Traffic Volume at Section 3

Year	2015		2020		2025		2035	
Time	Day	Night	Day	Night	Day	Night	Day	Night
Light Vehicle [unit/hr]	0	0	408	100	671	165	871	214
Heavy Vehicle [unit/hr]	0	0	64	17	228	61	565	151
Average Velocity [m/s]	-	-	65	65	43	43	26	26
Number of Lanes	-	-	2	2	2	2	2	2

Time Frame: Day: 6.01 a.m. – 8.00 p.m.; Night: 8.01 p.m. – 6.00 a.m.

Source: The Survey Team

Table A11.4-21 Average Hourly Traffic Volume at Section 4

Year	2015		2020		2025		2035	
Time	Day	Night	Day	Night	Day	Night	Day	Night
Light Vehicle	0	0	408	100	521	128	791	195
Heavy Vehicle	0	0	64	17	122	33	213	57
Average Velocity [m/s]	-	-	65	65	57	57	43	43
Number of Lanes	-	-	2	2	2	2	2	2

Time Frame: Day: 6.01 a.m. – 8.00 p.m.; Night: 8.01 p.m. – 6.00 a.m.

Source: The Survey Team

In this prediction, the correction term C is omitted for simplification in *eqn. 2.4*, then the A-weighted sound pressure levels at a single running vehicle $L_{WA,i}$ along the steady traffic flow are given as

$$\text{Light vehicle} \quad : \quad L_{AW,i} = 46.7 + 30 \log_{10} V \quad (\text{eqn. 2.5})$$

$$\text{Heavy vehicle} \quad : \quad L_{AW,i} = 53.2 + 30 \log_{10} V \quad (\text{eqn. 2.6})$$

Furthermore, the correction terms for attenuation $\Delta L_{cor,i}$ in *eqn. 2.3* were neglected. This simplification provided the conservative estimates, i.e., slightly higher noise levels.

The prediction point was set at the edge of ROW. The horizontal distance from the centre of the road to the prediction point is 55 meters since ROW is 110 meters wide. The height of the prediction point was set at 1.2 meters above the ground.

(3) Predicted Noise Levels

The predicted noise levels at the edge of ROW based on the projected traffic volume are shown in Table A11.4-22 for four sections.

Table A11.4-22 Predicted Noise Levels: L_{Aeq} [dB]

Year		2015		2020		2025		2035	
Road Section		Day	Night	Day	Night	Day	Night	Day	Night
Section 1		65	59	68	62	69	63	71	65
Section 2		65	59	67	61	69	63	71	66
Section 3		-	-	61	55	61	55	60	54
Section 4		-	-	61	55	62	56	61	55
Kenyan ^{*1} Regulations	Residence	50	35	50	35	50	35	50	35
	Commercial	60	35	60	35	60	35	60	35
IFC Guidelines ^{*2}	Residence	55	45	55	45	55	45	55	45
	Industrial	70	70	70	70	70	70	70	70

Source: The Survey Team

Note: 1) The Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009. Time Frame: Day: 6.01 a.m. – 8.00 p.m.; Night: 8.01 p.m. – 6.00 a.m.

Note: 2) General EHS Guidelines; Environmental Noise Management, International Finance Corporation: IFC 2007. Time Frame: Day: 7.00 a.m. – 10.00 p.m.; Night: 10.00 p.m. – 7.00 a.m.

The predicted noise levels at the edge of ROW along the Kipevu Link Road, in 2015, will exceed the maximum permissible noise levels for a residential zone (outdoor) and even for a commercial zone, set in the Kenyan noise regulations both during the day and the night.

Also the predicted noise levels along the Mombasa Southern Bypass Road, in 2020, will exceed the maximum permissible noise levels of Kenyan regulations both during the day and the night.

It is said that the maximum permissible noise levels of Kenyan regulations are extremely stricter than the international standards such as the General EHS Guidelines of International Finance Corporation (2007).

If compared with the IFC noise guidelines shown in Table 19.3-6, the predicted noise levels at the edge of ROW in 2025 might exceed the IFC noise guideline levels by 6 to 18 dB(A) along the Kipevu Link Road, and by 6 to 11 dB(A) along the Mombasa Southern Bypass Road.

Since the present noise levels are considered to be almost at the same levels of IFC guidelines as shown in Table A4-2, the predicted noise levels may increase by about 5 to 20 dB(A) from the present conditions. In particular, the increase of the noise level during the night could be over 10 dB(A).

4.2.4 Waste Generation

The waste generated during construction is presented in Table A11.4-23.

Table A11.4-23 Potential Waste Generated by Construction

Type	Items
Solid waste	<ul style="list-style-type: none"> • Bituminous material • Cement (Dust) • Paper and Cards • Plastic bottles, cans, drums & bags • Aggregates • Vehicle parts • Glass • Rags and Oil Adsorbents • Light bulbs and tubes • Paint cans and brushes • Stone and Rocks • Tyres • Cleared Trees & Branches • Cleared undergrowth, shrubs etc • Waste Timber • Concrete Shuttering
Waste soil	<ul style="list-style-type: none"> • Soil
Sludge	<ul style="list-style-type: none"> • Oily/greasy sludge • Sanitary sludge
Metals	<ul style="list-style-type: none"> • Welding rods • Reinforcement steel • Isolated steel piles wasted lengths • Copper (electrical wires etc)
Domestic	<ul style="list-style-type: none"> • Food
Liquid	<ul style="list-style-type: none"> • Wash down water and drum water • Oily water • Domestic wastewater

Source: Based on the original EIA Report

Among others, the estimate of waste soil is about 334,000 m³, mostly generated at Sections 1 and 2. Although the waste soil can be used to fill the valley in Section 1 at Miritini, the contractor shall develop a landfill site.

The principal waste disposal options for each waste stream will be as indicated in Table A11.4-23. The volumes of waste requiring ultimate disposal will be minimized both through the control of waste generation and through incineration.

Table A11.4-24 Waste Disposal Options Based on Type of Waste

Waste Type	Classification/Description	Principle Disposal Option
Inert	Waste as defined in Article 2 of the Landfill directive 1999/31/EEC- essentially non degradable, non-leaching and non-reactive materials.	<ul style="list-style-type: none"> • Transfer to a third party for recycling or reuse • Processed and used for construction and reinstatement purposes • Burial in a landfill designed and operated in general accordance with Landfill directive (1999/31/EEC)
Hazardous Waste	Waste classified as hazardous according to article 1(4) of Directive 91/689/EEC	<ul style="list-style-type: none"> • Transfer to a third party for recycling or reuse. A special case of this is to spread it on land for agricultural purposes. The waste, the land and the spreading operation will be in accordance with EC Directive 1986/278/EEC. • Burial in a landfill designed and operated

Waste Type	Classification/Description	Principle Disposal Option
		generally according to the Landfill Directive (1999/31/EEC).
Non-hazardous Waste	Waste that is neither inert, nor hazardous nor wastewater. It includes 'municipal waste' as defined in Article 2 of the Landfill Directive 1999/31/EEC.	<ul style="list-style-type: none"> • Transfer to a third party for re-use • Burial in a landfill designed and operated generally according to the Landfill Directive (1999/31/EEC).
Wastewater	Fresh water that is contaminated as a result of project activity, such as wastewater from the temporary site office, work sites and subsidiary operations such as vehicle and equipment washing.	<ul style="list-style-type: none"> • A collection chamber will be built at the end of soakaways, and effluent collected shall be monitored for acceptability of discharge into the Ocean. • If not acceptable, treat the effluent chemically such as chlorination.

Source: Based on the original EIA Report

4.3 Social Environment

The potential impacts on social environment of the Project for the construction and operation phases were assessed in several chapters of the original EIA report.

- The assessment methods were explained in Chapter 8.
- The issues of community health and safety, such as communicable diseases (HIV), traffic accidents, were mentioned in Chapters 13 and 15.
- The socio-economic impacts were analyzed in Chapter 16.

CHAPTER 5 ANALYSIS OF ALTERNATIVES

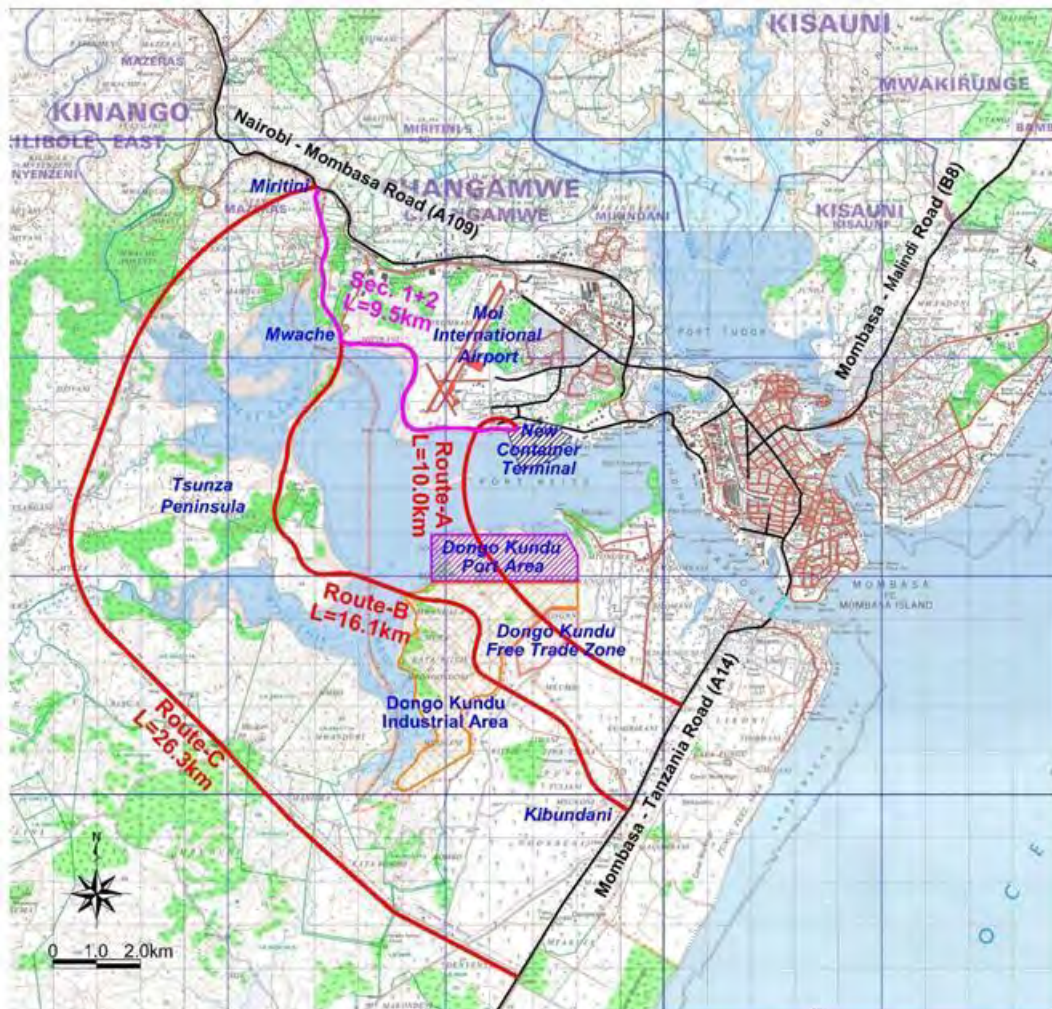
5.1 Project Alternatives and Analysis

Project Alternatives were analyzed in Chapter 3 of the original EIA report. In addition to three Bypass routes, Suspension Bridge at Likoni Ferry and Railway Links and No Action alternative (without project case) were examined.

5.2 Comparison of Bypass Route Alternatives

5.2.1 Bypass Route Alternatives

There are three alternative Bypass routes as shown in Figure A11.5-1. The Bypass Route-B was selected in the F/S with its preliminary design. The justification of the selection of the Bypass Route-B was reviewed as follows.



Source: JICA Survey Team

Figure A11.5-1 Bypass Route Alternatives

5.2.2 Bypass Route-A

The Bypass Route-A requires a high and long span bridge to cross the navigation area. This is most costly. According to the F/S report, KPA strongly objected to this route as it precludes port development to the west. Therefore, the Bypass Route-A is no longer considered.

5.2.3 Bypass Route-C

The Bypass Route-C is the longest route. However it does not require long bridges except one bridge which is approximately 500m in length at the upstream of Mwache Creek. The topography along the Bypass Route-C is generally hilly. Small hills and creeks cross the route one after another. Reserved forests, Kaya (sacred forests) and Mwaluganje Elephant Sanctuary exist along the roadside.



Source: JICA Survey Team

Figure A11.5-1 Roadside of the Bypass Route-C

5.2.4 Comparison of the Bypass Route-B and C

A comparison between the Bypass Route-B and C is shown in Table A11.5-1.

Overall, the Bypass Route-B is superior to the Bypass Route-C since the economic and traffic benefit and the contributions to the area development of the Bypass Route-B is more than that of the Bypass Route-C despite construction cost of the Bypass Route-B is higher than the Bypass Route-C.

Table A11.5-1 Comparison of the Bypass Route-B and Route-C

View Point	Bypass Route-B		Bypass Route-C	
Impact on Natural Environment	It is feasible if appropriate mitigation measures are implemented despite the Bypass Route-B passes through mangroves and tidal flats.	○	It is feasible if appropriate mitigation measures are implemented despite the Bypass Route-C passes near Kaya Forests and Mwaluganje Elephant Sanctuary.	○
Impact on Social Environment	Number of PAPs is not many since the Bypass Route-B avoids highly populated area.	○	Number of PAPs is many since the Bypass Route-C is long and passes near existing roads.	△
Construction Cost	Approx. ¥ 33 Billion	△	Approx. ¥ 24 Billion	◎
Constructability	Construction of 2 long bridges (900m and 1500m) over the sea is required.	△	Construction of one long bridge (500m) over river is required.	◎
Economic Evaluation	EIRR=20.2%, B/C=3.32, NPV=US\$493B.	◎	EIRR=13.9%, B/C=1.38, NPV=US\$91B.	△
Traffic Benefit	US\$131M./year (2025)	◎	US\$72M./year (2025)	△
Contribution to Southern Coast Area Development	Construction the Bypass Route-B will trigger the development of Dongo Kundu industrial area including Mombasa South Port and Free Trade Zone.	◎	Contribution to the development of Dongo Kundu area is not significant because the Bypass Route-C does not pass through the	△
Others	Contribution to mitigate traffic congestion at Likoni Ferry and Mombasa City roads is significant.	◎	It will contribute to develop the roadside areas of the Bypass Route-C.	○
Overall Evaluation	The Bypass Route-B is superior to the Bypass Route-C since the economic and traffic benefit and the contributions to the area development of the Bypass Route-B is more than the Bypass Route-C despite construction cost of the Bypass Route-B is higher than the Bypass Route-C.			

Note: ◎= Good, ○= Fair, △= Bad

CHAPTER 6 ENVIRONMENTAL MANAGEMENT PLAN

On the basis the results of the environmental impact study in Chapter 4, an environmental management plan has been prepared. The environmental management plan provides information on the proposed mitigation measures and environmental monitoring plan.

Mitigation measures for negative impacts and environmental monitoring plan were proposed in the original EIA report as follows.

- Mitigation measures on natural environment and pollution control: Chapters 7 and 15
- Mitigation measures on social environment: Chapters 13 and 16
- Environmental and social management and monitoring plan: Chapter 17
- Management and monitoring plan for the occupational health and safety during the construction phase: Chapter 12

6.1 Mitigation Measures

6.1.1 Mitigation Measures for Natural Environment

(1) Mitigation Measures during the Planning and Construction Phases

In addition to the mitigation measures proposed in the original EIA report, the following mitigation measures are proposed:

- To avoid and minimize the direct destruction of mangrove forests and Kayas, alternative road alignments were proposed.
- On the tidal flats, instead of embankment, jetty structure (the pile-slab type viaduct) was proposed so as not to block the tide exchanges (Figure A11.2-4).
- Clearance under the bridge was made higher so as not to block the growth of mangroves (Figure A11.2-3).
- To minimize the degradation of mangroves and marine species due to the direct discharge of the contaminated storm water from the road, an oil separator (grit chamber) should be installed in the drainage facilities.
- To secure migration path for small animals, underpass culvert should be installed, where necessary.
- If cutting of mangroves could not be avoided by any means, to restore mangroves, replanting should be implemented (Refer to the Mangrove Reforesting Plan below)
- Before clearing of vegetation on the road corridor, seedlings and saplings of indigenous trees and other important plant species should be recovered and applied in restocking of degraded sites.
- When the abutments of the bridges are installed, turbidity in the creeks should be monitored.

(2) Mitigation Measures during the Operation Phase

In addition to the mitigation measures proposed in the original EIA report, the following mitigation measures are proposed:

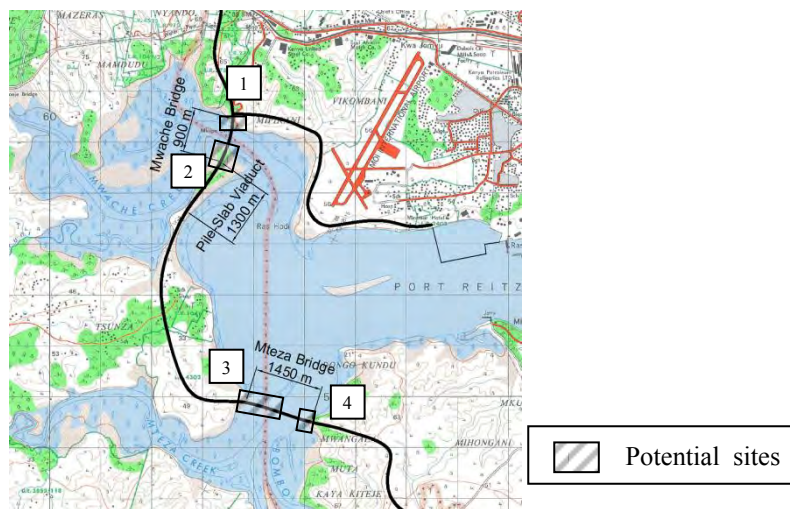
- To conduct regular maintenance of the grit chambers to secure the function of oil separation.
- To monitor the growth of replanting mangroves (Refer to the Mangrove Reforesting Plan).
- To monitor the fish catch.

6.1.2 Mangrove Reforesting Plan (MFP)

(1) Mangroves to Be Cleared

The potential mangroves cutting sites are the costal swamps of Mwache and Mteza Creeks, Port Reitz where the bridges and roads are constructed as shown in Figure A11.6-1. The rough estimate of mangrove area to be cleared is presented in Table A11.6-1. The total area or the number of mangroves to be cleared at each site shall be clarified at the detail design stage.

Mangrove species: *Rhizophora mucronata*, *Bruguiera gymnorrhiza*, *Ceriops tagal*, *Avicennia marina*, *Xylocarpus granatum*, *X. moluccensis*, *Heritiera littoralis*, *Lumnitzera racemosa* and *Sonneratia alba*, were recorded in Mwache, Tsunza and Mteza along the proposed road alignments.



Source: JICA Survey Team

Figure A11.6-1 Potential Mangrove Cutting Area along the Long Bridges

Table A11.6-1 Area of Potential Mangrove Cutting

No	Site	Estimated Area (m ²)	Calculation
1	Mwache Bridge (Mkupe side)	1,500	15.0*100=1,500
2	Mwache Bridge (Tsunza side)	4,500	15.0*300=4,500
3	Mteza Bridge (Tsunza side)	10,500	15.0*700=10,500
4	Mteza Bridge (Mwangala side)	1,500	15.0*100=1,500
Total		18,000	-

(2) Contents of MFP

- KeNHA shall entrust preparation of a MFP to the consultant cooperated with Kenya Forest Service (KFS) and Kenya Marine and Fisheries Research Institute (KMFRI) who have rich experience in mangrove replanting, prior to commencement of construction.
- The contractor should implement the MFP during the construction phase by entrusting the experienced local consultants/NGOs.
- After completion of construction, KeNHA shall monitor the growth of mangroves replanted for four years by entrusting the local consultants/NGOs.

Contents:

- Objective: To replant, restore and conserve the mangrove forests cleared by the road development.
- Replanting mangrove forest with main species found in Mwache, Tsunza and Mteza.
- Criteria for selection of above species are a) grows well at the local conditions of soil, topology, water quality tide and climate; b) have high ecological and or economic values; c) easy and low cost in replanting.
- Criteria for site selection are a) Former area of mangrove forests, but now the mangrove trees have low density; b) Not far from the project construction site; c) have suitable natural conditions for mangrove replanting (topography, soil, water, tide, sediment etc.; d) Land may be agreed by local residents or authorities for mangrove replanting (land will not be planned for industry, port or residential development).
- Planting know-how, techniques and labour will be provided from local agencies (KFS, KFMRI) and mangrove conservation NGOs such as the Mbuta Mazingira Conservators of Mwangala and the Tsunza Mangrove Conservation Group. As explained in Chapter 3, these groups have experience in planting mangroves (the project owner will pay for this cost).
- Time frame of replanting, monitoring and trimming could be also suggested by local agencies (KFS, KFMRI) and mangrove conservation groups.

(3) Consultation

Schedule of future consultations with local and forestry officials to determine suitable species and locations for replanting is proposed as follows.

- Meeting with the local office of Kenya Forest Service (KFS) to prepare MFP: first 3 months after the commencement of construction.
- Consultation with local office of KFS on location of replanting sites and species, cost etc: first 6 months after the commencement of construction.
- Implementation of reforestation plan, include agreement in land use, site preparation, seed provision, planting etc: from month 12 to month 24.
- Implementation of MFP monitoring: from month 12 to month 48 (or completion of construction).

(4) Terms of Reference for MFP

The Terms of Reference for preparation of MFP is presented in Appendix 4.

6.1.3 Mitigation Measures for Noise Impacts

(1) Mitigation Measures during the Planning and Construction Phases

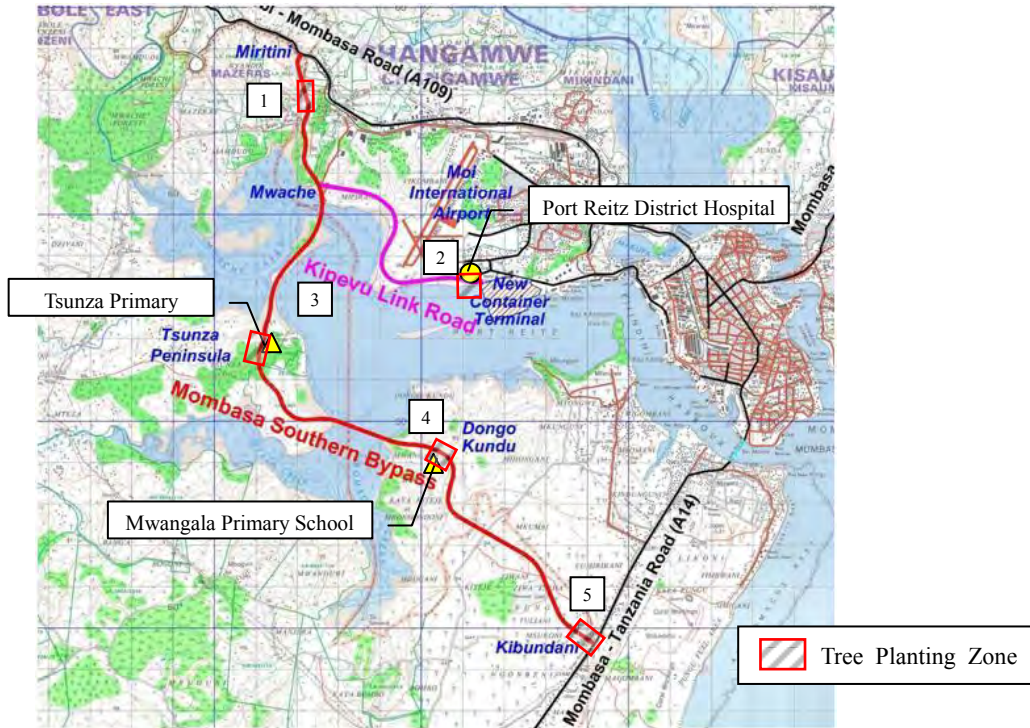
In addition to the mitigation measures proposed in the original EIA report, the proper and feasible abatement measures should be implemented along the roads close to the residential areas, especially schools, hospitals and religious facilities. Table A11.6-1 shows the examples of noise abatement measures, their functions and effectiveness.

Trees should be planted in the environmental buffer zones within ROW at the sensitive areas shown in Figure A11.6-2 and Table A11.6-2. Based on the monitoring results of noise levels after opening the roads, installation of noise barriers should be considered where necessary.

Table A11.6-1 Typical Noise Abatement Measures

Mitigation measures	Function	Effectiveness
Noise barriers	Noise barriers reduce noise by diffraction.	About 10 dB
Environmental buffer zone (e.g., vegetation)	Trees are planted to create green spaces and reduce noise by distance from noise sources.	5~10 dB

Source: Road Development and Environmental Measures, Ministry of Land, Infrastructure, Transportation, and Tourism (<http://www.mlit.go.jp/road/ir/data/souon/souon3.html>)



Source: JICA Survey Team

Figure A11.6-1 Tree Planting Zones for Noise Abatement

Table A11.6-1 Potential Tree Planting Zones

No	Site	Estimated Length (m)
1	Residential zone at Miritini	1,000
2	Hospitals and residential zone at Port Reitz	400
3	School and residential zone at Mwangala	700
4	Hospitals and residential zone at Port Reitz	200
5	Residential zone at Kibundani	1,000 x 2 (both sides)
Total		4,300

Source: JICA Survey Team

(2) Mitigation Measures during the Operation Phase

In addition to the mitigation measures proposed in the original EIA report, the following mitigation measures are proposed:

- Install warning signs on road for horn ban, speed control and lane restriction
- Regular maintenance on road to keep road surface good condition
- Develop a mechanism to record and respond to monitoring results and complaints

6.1.4 Mitigation Measures Matrix

The comprehensive mitigation measures proposed both in the original EIA report and the supplementary EIA report are summarized in Tables A11.6-2 through A11.6-6.

Table A11.6-2 Environmental Management Plan/ Mitigation measures – Construction Phase

Items	Environmental Impacts	Mitigation measures	Responsibility	
			Implementation	Supervision/ Monitoring
I. Natural Environment		Activities: Bridge and Road Construction		
Mangroves	Loss of mangrove trees	<ul style="list-style-type: none"> To avoid and minimize the direct destruction of mangrove forests and Kayas, alternative road alignments were proposed. On the tidal flats, instead of embankment, jetty structure (the pile-slab type viaduct) was proposed so as not to block the tide exchanges Clearance under the bridge was made higher so as not to block the growth of mangroves. If cutting of mangroves could not be avoided by any means, to restore mangroves, replanting should be implemented (Refer to the Mangrove Reforesting Plan below) Before clearing of vegetation on the road corridor, seedlings and saplings of indigenous trees and other important plant species should be recovered and applied in restocking of degraded sites. 	DE/ Contractor	KeNHA/ SC
Aquatic habitat	Aquatic habitat loss/ fragmentation/damage	<ul style="list-style-type: none"> Minimize cutting of mangroves by use of a viaduct bridge at Mkupe, Tsunza peninsula and Mwangala creeks and replanting of cut mangroves. When the abutments of the bridges are installed, turbidity in the creeks should be monitored. 	DE/ Contractor	KeNHA/ SC
	Aquatic migration/feeding corridor restrictions	<ul style="list-style-type: none"> Construction of viaduct bridge by using piles. 	DE/ Contractor	KeNHA/ SC
	Loss of benthic fauna	<ul style="list-style-type: none"> To minimize the impact there shall be use of floating devices during construction. 	DE/ Contractor	KeNHA/ SC
	Disturbance of benthic fauna during drilling and piling	<ul style="list-style-type: none"> To minimize the impact there shall be use of floating devices during construction. When the abutments of the bridges are installed, turbidity in the creeks should be monitored. 	DE/ Contractor	KeNHA/ SC

Items	Environmental Impacts	Mitigation measures	Responsibility	
			Implementation	Supervision/ Monitoring
	Fluctuation of physiochemical variables (phosphorus, ammonia, DO, nitrates) and organic matter during drilling and pilling	<ul style="list-style-type: none"> To minimize the impact there shall be use of floating devices during construction. When the abutments of the bridges are installed, turbidity in the creeks should be monitored. 	DE/ Contractor	KeNHA/ SC
	Siltation due to soil erosion	<p>1) The design of the road drainage</p> <ul style="list-style-type: none"> Frequent scour checks at correct intervals such that the run-off does not scour the land, and to lower the speed of the run-off, decreasing its erosion potential; The use of lined channels in severe incidences; Appropriate angles to all earth cuttings, to allow vegetation to grow, cut and fill activities should be balanced, and where slopes are steep, concrete drainage channels should be used; Use of diversion channels and silt traps to minimize erosion of soil materials into waterways; Riprap, or rock material embedded in a slope face and combined with planting especially at Mkupe, Mwangala and at the airport hill on road to the New Container Terminal; Retaining structures such as gabions will also be used at Mwangala, Mkupe and at airport hill side on road to the New Container Terminal; Retaining walls will be used at the steep hills on the road to the New Container Terminal at the airport fence; Reinforced earth and use of geotextiles will be employed where required. <p>2) Stabilization of the soil</p> <ul style="list-style-type: none"> All earth cuttings need to be at a gentle angle in order to allow vegetation to grow – steep sides tend to result in seeds washing away rather than having a chance to establish. Terracing may be incorporated in such slopes to slow down the speed of water. Soil retaining structures should 	DE/ Contractor	KeNHA/ SC

Items	Environmental Impacts	Mitigation measures	Responsibility	
			Implementation	Supervision/ Monitoring
		<p>be constructed in very loose soils.</p> <ul style="list-style-type: none"> All excavations and earth movements should be done in the dry seasons, as far as possible. Indigenous grasses (such as the kikuyu grass) should be planted as widely as possible by the roadside, slopes and in ditches. All planting should be timed to take advantage of the rainy seasons. The contractor should be obliged to carry out the planting and looking after the vegetation and tree seedlings, until established, during the construction and the immediate post construction period. <p>3) The cooperation and participation of the landowners and local community for revegetation measures.</p>		
	Oil / Petrol Spillage	<ul style="list-style-type: none"> To minimize the degradation of mangroves and marine species due to the direct discharge of the contaminated storm water from the road, an oil separator (grit chamber) should be installed in the drainage facilities. Establish an oil spill monitoring system and a rapid response unit in the contractor's team. 	DE/ Contractor	KeNHA/ SC
Flora	Loss of Vegetation cover	<ul style="list-style-type: none"> Planting of trees and grass in road rights of way and adjacent areas 	Contractor	KeNHA/SC
Fauna	Habitat loss / damage	<ul style="list-style-type: none"> Planting of trees and grass in road rights of way and adjacent areas; Avoid clearing/altering of any adjacent land unless necessary and use of best practices that minimize disturbance of the land resources flora and fauna; Application of soil control measures. 	Contractor	KeNHA/ SC
	Loss of migratory / feeding corridors	<ul style="list-style-type: none"> Construction of viaduct bridge at the Tsunza peninsula to enhance free movement of fauna. To secure migration path for small animals, underpass culvert should be installed, where necessary. 	DE/ Contractor	KeNHA/ SC

Items	Environmental Impacts	Mitigation measures	Responsibility	
			Implementation	Supervision/ Monitoring
	Noise from Construction equipment and respective disturbance to Marine life	<ul style="list-style-type: none"> • Proper service of equipment; • Install sound barriers for pile driving activity; • Construction activities to be restricted during day time hours only. 	Contractor	KeNHA/ SC
	Dust generation	<ul style="list-style-type: none"> • All trucked material will be covered during transportation; • Speed limits for vehicles to be set during dry seasons; • Sprinkling the dusty surfaces with water during dry weather and during earthworks/sub-base construction. Watering to be done thrice a day during dry season at 10am, 2pm and 5pm; • Sequence of operations e.g. haulage, spreading and compacting of material to be sequential and as immediate as practically possible; 	Contractor	KeNHA/ SC
Topography And geology	Soil erosion as natural soil is modified through construction process and stockpiling; Land slides due to destabilization of slopes	<p>1) The design of the road drainage</p> <ul style="list-style-type: none"> • Frequent scour checks at correct intervals such that the run-off does not scour the land, and to lower the speed of the run-off, decreasing its erosion potential; • The use of lined channels in severe incidences; • Appropriate angles to all earth cuttings, to allow vegetation to grow, cut and fill activities should be balanced, and where slopes are steep, concrete drainage channels should be used; • Use of diversion channels and silt traps to minimize erosion of soil materials into waterways; • Riprap, or rock material embedded in a slope face and combined with planting especially at Mkupe, Mwangala and at the airport hill on road to the New Container Terminal; • Retaining structures such as gabions will also be used at Mwangala, Mkupe and at airport hill side on road to the New Container Terminal; • Retaining walls will be used at the steep hills on the road to the New Container Terminal at the airport fence; 	DE/ Contractor	KeNHA/ SC

Items	Environmental Impacts	Mitigation measures	Responsibility	
			Implementation	Supervision/ Monitoring
		<ul style="list-style-type: none"> • Reinforced earth and use of geotextiles will be employed where required. 2) Stabilization of the soil <ul style="list-style-type: none"> • Stabilization of the soil along the roadside and in the road reserve through extensive revegetation measures • All earth cuttings need to be at a gentle angle in order to allow vegetation to grow – steep sides tend to result in seeds washing away rather than having a chance to establish. Terracing may be incorporated in such slopes to slow down the speed of water. Soil retaining structures should be constructed in very loose soils. • All excavations and earth movements should be done in the dry seasons, as far as possible. • Indigenous grasses (such as the kikuyu grass) should be planted as widely as possible by the roadside, slopes and in ditches. • All planting should be timed to take advantage of the rainy seasons. The contractor should be obliged to carry out the planting and looking after the vegetation and tree seedlings, until established, during the construction and the immediate post construction period. 3) The cooperation and participation of the landowners and local community for revegetation measures 		
Soil	Loss of productive soils at Miritini, Tsunza, Mwangala, Bububu and Likoni areas	<ul style="list-style-type: none"> • Minimizing the area of ground clearance; • Compensation for alternative productive land. 	DE/ Contractor/ RIT	KeNHA/SC RC
	Contamination of soils due to accidental oil / chemical spills and pollutants settling in soils	<ul style="list-style-type: none"> • Development of both spill prevention plan and accident emergency response plan; • Preparation and implementation of chemical/oil handling and storage procedures and train employees on their use; • Regular visual inspection of hazardous material/oil storage areas; 	Contractor	KeNHA/ SC

Items	Environmental Impacts	Mitigation measures	Responsibility	
			Implementation	Supervision/ Monitoring
		<ul style="list-style-type: none"> Labeling and storage at safe designated areas of chemical / oil containers; Oil absorbent material, tarps and storage drums will be used to control and contain any minor releases of engine and other equipment oil. 		
Water Resources	Ground water quality interference and contamination; Surface runoff interference and contamination; Surface water quality interference and contamination	<ul style="list-style-type: none"> Design of alignment to avoid community borehole locations, but where inevitable compensation by undertaking to construct other boreholes before demolition or acquisition of the existing. Construction of culverts and retaining walls on underground water sources at the road to the New Container Terminal near the airport fence; Soil erosion control measures to be applied on steep slopes at the underground water source location on the road to the New Container Terminal; Ensure that stockpiling areas are above and sufficiently separated (depth wise) from the ground water table; Following of proper oil spillage prevention measures to avoid contamination; Proper location of site work crew pit latrines and septic tanks; Preparation and implementation of chemical handling and storage procedures and train employees on their use. 	DE/ Contractor	KeNHA/ SC
Aesthetics and Landscape	Deterioration of landscape due to the major cuts and fills on hills and valleys at Mkupe, Mwangala, Bububu and the airport hill side.	<ul style="list-style-type: none"> The viaduct bridge will enhance the aesthetics of Mkupe, Tsunza peninsula and Mwangala areas. The vertical and horizontal alignment will follow the natural relief as closely as possible within technical constraints such as slopes and radii. Curves to enhance aesthetics; Landscaping to fit with local vegetation; Soil erosion control measures; Regulating the use of billboard advertising. 	DE/ Contractor	KeNHA/ SC
	Deterioration of landscape due to	<ul style="list-style-type: none"> Replanting of the cut trees and mangroves; 	DE/	KeNHA/

Items	Environmental Impacts	Mitigation measures	Responsibility	
			Implementation	Supervision/ Monitoring
	vegetation clearance especially where trees, mangroves and agricultural crops	<ul style="list-style-type: none"> • Aesthetics enhancement measures by landscaping; • Soil erosion control measures. 	Contractor	SC
II. Pollution Control Measures		Activities: Bridge and Road Construction		
Air Quality	Emission from construction vehicle and equipment <ul style="list-style-type: none"> ✓ Upper respiratory diseases in humans ✓ Acid rain impacts on plants, soil and buildings 	<ul style="list-style-type: none"> • Construction vehicle emission standards checks as well as inspection and maintenance; • Use of low emission vehicles or retrofitting of high consumption and polluting vehicles; • Efficiency traffic management of construction vehicles; • Provision of nose masks in areas where emissions are inevitable. 	Contractor	KeNHA/ SC
	Impacts due to dust generation <ul style="list-style-type: none"> ✓ Upper respiratory diseases in humans ✓ Staining of buildings and other items ✓ Interference with pollination and photosynthesis in plants 	<ul style="list-style-type: none"> • All trucked material to be covered during transport; • Personnel working directly with dust generating materials will be provided with personal protective equipment and training; • Speed limits for vehicles to be set during dry season; • Sprinkling of water on dusty surfaces three times a day during dry season. • Provision of nose dust masks in areas where dust generation is inevitable 	Contractor	KeNHA/ SC
Water Quality	Fluctuation of physiochemical variables (phosphorus, ammonia, DO, nitrates) and organic matter during drilling and piling	<ul style="list-style-type: none"> • To minimize the impact there shall be use of floating devices during construction. 	DE/ Contractor	KeNHA/ SC
	Oil / Petrol Spillage	<ul style="list-style-type: none"> • Incorporate appropriate mechanical devices in the design to forestall any oil spill. • Following of proper oil spillage prevention measures to avoid contamination; • Establish an oil spill monitoring system and a rapid response unit in the contractor's team. 	DE/ Contractor	KeNHA/ SC

Items	Environmental Impacts	Mitigation measures	Responsibility	
			Implementation	Supervision/ Monitoring
Noise and Vibration	Impacts on human welfare and health such as source of annoyance, communication problems, elevated stress levels, auditory fatigue, temporary or permanent lessening of hearing ability, sleep disorders and learning problems in children	<ul style="list-style-type: none"> • Proper service of equipment; • Route truck traffic away from noise sensitive areas where feasible; • Construction activities to take place during day time only to allow for movement of terrestrial fauna during the day; • Monitoring and coordination to ensure noise levels do not exceed stipulated levels; • Provision of hearing protective devices such as ear plugs and ear muffs particularly when noise levels exceed 85-90 dB(A). 	Contractor	KeNHA/ SC
	Vibrations induced by resonance of traffic can have a detrimental effect on structures near the road.	<ul style="list-style-type: none"> • Visual monitoring of structural integrity of adjacent structures during vibrations and necessary strengthening measures to be taken where the structures are showing signs of failure. 	Contractor	KeNHA/ SC
	Impacts on terrestrial fauna from approaching road corridors due to fear and scare	<ul style="list-style-type: none"> • Construction activities to take place during day time to allow for movement of terrestrial fauna during the night 	Contractor	KeNHA/ SC
Waste	Waste generation	<ul style="list-style-type: none"> • Prior to the commencement of the construction program, Project Waste Management Plan (PWMP) shall be prepared including proposal for the minimization/collection/storage/treatment/re-use/disposal routes for all waste streams as per the Environmental Management and Coordination (Waste Management) Regulations, 2006. • To promote segregation and recycling (3R: Reduce, Re-use and Recycle). Each waste stream will be managed according to the following hierarchy of techniques, considering their safety and practicability: <ul style="list-style-type: none"> - Eliminate or minimize the waste stream by choice of procedure or technology - Re-use as a material - Re-use as a fuel 	KeNHA/SC Contractor	KeNHA/ SC

Items	Environmental Impacts	Mitigation measures	Responsibility	
			Implementation	Supervision/ Monitoring
		<ul style="list-style-type: none"> - Process and re-use as a material - Process and re-use as a fuel - Incinerator or re-use or landfill the ash. - Landfill - Landscape- Landfill with appropriate vegetation planted - Discharge to a receiving water course (applicable only to wastewater) 		

Source: JICA Survey Team

DE: Design Engineer, SC: Supervising Consultant, RIT: RAP Implementation Team, RC: RAP Implementation Committee, KeNHA: Special Project Department

Table A11.6-3 Environmental Management Plan/ Mitigation measures – Operation Phase

Items	Environmental Impacts	Mitigation measures	Responsibility	
			Implementation	Supervision/ Monitoring
I. Natural Environment				
Mangroves	Loss of mangrove trees	<ul style="list-style-type: none"> • To monitor the growth of replanting mangroves (Refer to the Mangrove Reforesting Plan). • To conduct regular maintenance of the grit chambers to secure the function of oil separation. • To regularly monitor the fish catch and benthos 	KeNHA	KeNHA/ MOR/NEMA
II. Pollution Control Measures				
Noise level	Traffic increase impacts	<ul style="list-style-type: none"> • Trees should be planted in the environmental buffer zones within ROW at the sensitive areas. Based on the monitoring results of noise levels after opening the roads, installation of noise barriers should be considered where necessary. • To conduct regular monitoring of noise levels along the roadside. • Install warning signs on road for horn ban, speed control and lane 	KeNHA	KeNHA/ MOR/NEMA

		restriction. • Regular maintenance on road to keep road surface good condition. • Develop a mechanism to record and respond to monitoring results and complaints.		
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Source: JICA Survey Team

DE: Design Engineer, SC: Supervising Consultant, RIT: RAP Implementation Team, RC: RAP Implementation Committee,

MOR: Ministry of Roads, NEMA : National Environment Management Authority

Table A11.6-4 Environmental Management Plan/ Mitigation measures – Social Environment

Items	Socio-economic Impacts	Mitigation measures	Responsibility	
			Implementation	Supervision/ Monitoring
V. Social Environment		Activities: Bridge and Road Construction and Operation		
Involuntary Resettlement	Loss of property and land: Demolition of houses and business properties	<ul style="list-style-type: none"> The designed alignment to try and avoid builtup areas as much as possible. Proper compensation for land and properties that will be demolished or acquired. Proper notice of vacation to be given before demolition to allow time for preparation and movement of tenants and property owners in a humane way. 	DE/ Contractor RIT	KeNHA/ RC
	Displacement of squatters and their property:	<ul style="list-style-type: none"> Proper compensation for squatters. A committee to be set up to identify, buy land and build houses for them. Proper notices to be given to allow time for relocation. The acquired land (road reserve) to be marked at every 50m to prevent future encroachments. 	RIT	KeNHA/ RC
Local economy/ Livelihood	Loss of roadside business due to reduced accessibility to business premises during construction and business loss due to demolitions	<ul style="list-style-type: none"> Liaising with Mombasa Municipal Council to deal with those affected as per the Municipal byelaws and regulation. Those genuinely and legally affected shall be compensated. Construction of temporary access roads with cut back bitumen MC 30 so 	RIT	KeNHA/ RC

Items	Socio-economic Impacts	Mitigation measures	Responsibility	
			Implementation	Supervision/ Monitoring
	and competition during operation of the road.	that access to business premises is not interrupted, where necessary.		
	The bypassed community: Travel patterns and routes will change and the business communities at the ferry and near the ferry area will be affected as traffic will be attracted to the bypass.	<ul style="list-style-type: none"> Provision of service areas on the road i.e., laybys, trucks/bus parking with shelters so that business can thrive. The suitable location to be along Miritini, Tsunza and Mwangala, where necessary. 	DE/ Contractor	KeNHA/ SC
Livelihood/ Farmers	Permanent loss of farming, grazing and hunting land	<ul style="list-style-type: none"> The designed alignment to try and avoid cultivated areas as much as possible. Proper compensation for farming, grazing and hunting land using current market rates. Proper compensation for cut crops and trees of commercial value using current market rates. Proper planning for road construction vegetation clearance programme to enable affected farmers harvest crops in farms before land acquisition. Proper notice of vacation to be given to allow time for preparation and movement of farms owners in a humane way. 	DE/ Contractor RIT	KeNHA/ RC
Livelihood/ Fishing	Fishing and landing sites: Reduced fishing ground and landing sites during construction of the viaduct bridge	<ul style="list-style-type: none"> Construction of landing sites at Mkupe, Mwangala and Port Reitz and access roads to these landing sites for ease of mobility. Provision of modern fishing gear to fishermen will enhance productivity. Provision of modern fishing gear for fishermen to venture into deep sea including training. 	DE/ Contractor RIT	KeNHA/ RC
	Access to fishing sites will be affected during construction of the viaduct bridge.	<ul style="list-style-type: none"> Construction and maintenance of access roads to fishing sites. 	Contractor RIT	KeNHA/ RC
	Fish traders:	<ul style="list-style-type: none"> Construction and maintenance of access roads to the landing sites for 	Contractor	KeNHA/

Items	Socio-economic Impacts	Mitigation measures	Responsibility	
			Implementation	Supervision/ Monitoring
	Reduction of daily fish catch and access to the landing sites might affect their business.	traders.	RIT	RC
Livelihood/ Motor boats and canoes	Boat transport pickup points at Mkupe and Tsunza will be affected during construction. Permant loss of traditional mode of transport at Tsunza which is mainly use of boats, walking, bicycles and motorbicycles as residents will revert to the use of cheaper, faster and efficient public transport (Matatus or buses).	<ul style="list-style-type: none"> • Construction of a docking place for motor boats and canoes that will also serve after construction. • Introduce tours around the creek. • Introduce boat rides for viewing of mangroves to promote ecotourism. 	RIT	KeNHA/ RC
Land use	Gentrification effect: The value of land will be increase by infrastructural development leading to higher rental values, a turnover in occupancy leading to the replacement of lower income tenants and residents by those who can afford higher rates.	<ul style="list-style-type: none"> • Proper land use plans as per the physical and urban planning regulations or plans of Mombasa Municipal Council. 	Mombasa Municipal Council	-
	Housing: Demolition of houses will lead to shortage and demand for housing units. After road construction housing demand will be high and so will be the rents due to improved	<ul style="list-style-type: none"> • Improved accessibility will lead to attraction of investors in the housing sector which will meet the shortfall in housing. • Tenants will relocate to other areas thus reducing the housing demand at the demolished sites. 	Mombasa Municipal Council	-

Items	Socio-economic Impacts	Mitigation measures	Responsibility	
			Implementation	Supervision/ Monitoring
	accessibility.			
Local Resources	Mangrove harvesting: Loss of the breeding grounds of fish and other marine life. Local traders of mangroves will also be affected. Locals who use the mangroves for firewood and building houses will also be affected.	<ul style="list-style-type: none"> • Cut mangroves to be replanted. • Cut mangroves to be given to locals and mangrove traders under guidance from forestry department. 	Contractor RIT	KeNHA/ SC/RC
Medicinal trees/shrubs	Vegetation clearance will destroy valued trees and shrubs which have medicinal value and which are a source of energy in form of firewood, e.g., 'mkilifi' and 'mwarubaine (neem)'.	<ul style="list-style-type: none"> • Valued vegetation and trees to be avoided during design and where the cutting is inevitable, proper management and planning measures to be undertaken for replanting of more trees to benefit the locals under guidance from forestry department. 	Contractor	KeNHA/ SC/RC
Community severance	Splitting Tsunza community: The bypass will split Tsunza village and cut traditional paths of travel to neighbours, farmlands and other places thereby creating two communities that will have difficulties in their normal relations and activities.	<ul style="list-style-type: none"> • Provision of pedestrian and livestock underpasses, service road, foot and bridges. • Provision of street lighting to enhance security of the village. 	DE/ Contractor	KeNHA/ SC
Religion	During construction accessibility to the churches and mosques could be affected.	<ul style="list-style-type: none"> • Creation of temporary taccoat roads for easy access to churches and mosques. 	Contractor	KeNHA/ SC
Cultural and	Sacred religious sites (Mizimu &	<ul style="list-style-type: none"> • Alignment design to avoid community grave yards, sacred sites and 	DE/	KeNHA/

Items	Socio-economic Impacts	Mitigation measures	Responsibility	
			Implementation	Supervision/ Monitoring
religious heritage	Kayas) might be affected.	where inevitable proper liaison with community elders to be undertaken to find the way forward.	Contractor	SC
Social infrastructures and services /Public transportation	Matatus and buses: Traffic jams and diversions during construction will affect motorised transport, and might lead to an increase in transport expenditure	<ul style="list-style-type: none"> Temporary traffic diversions to be in good condition and where the diversion is a gravel road then prime coat MC 30 cutback bitumen or tack coat MC 300 should be applied so that the surface is rideable and dust free. 	DE/ Contractor	KeNHA/ SC
	Motorcycles: Traffic jams during construction and diversions during construction will affect motorcycle transport business, bicycle movement and pedestrian movement. It might lead to an increase in transport expenditure since diverted motorcycles will hike fares.	<ul style="list-style-type: none"> Temporary traffic diversions to include walkways and cycle tracks. 	DE/ Contractor	KeNHA/ SC
	Railway transport will be affected at Miritni outlet station thereby causing delays during the construction of the bypass underpass.	<ul style="list-style-type: none"> Liaising with Kenya Railways Corporation (KRC) for assistance in mitigation that shall involve construction of a temporary bridge to facilitate the construction of an underpass. 	KRC/ KeNHA DE/ Contractor	KRC/ Ministry of Roads
	Kenya Ferry Services will also incur a reduction in revenue due to traffic attracted to the bypass especially the trucks, lorries and buses that pay high fees to use the ferry.	<ul style="list-style-type: none"> Improvement and widening of western relief road for efficient traffic movement to the ferry. Kenya Ferry Services planning to introduce state of the art ferries. 	Kenya Ferry Services	-

Items	Socio-economic Impacts	Mitigation measures	Responsibility	
			Implementation	Supervision/ Monitoring
Social infrastructures and services /Utilities	Power lines: During construction power cables may be moved or relocated thereby affecting power distribution in Miritini, Likoni and their environs.	<ul style="list-style-type: none"> • Liaising and coordination with Kenya Power & Lighting Company (KPLC) that will involve application process to facilitate relocation, protective measures advertising in the local dailies. 	KPLC/ KeNHA DE/ Contractor	Ministry of Roads
	Petroleum and gas pipelines near the proposed new KPA container terminal at Port Reitz.	<ul style="list-style-type: none"> • Liaising and coordination with Kenya Pipeline Corporation (KPC) and Kenya Petroleum Refineries Ltd (KPRL) that will involve application process to facilitate protective and cautious measures due to sensitivity and technical knowledge required. 	KPC/KPRL KeNHA/ DE/ Contractor	Ministry of Roads
	Telephone cables : During construction telephone cables might be moved or relocated thereby affecting communication.	<ul style="list-style-type: none"> • Liaising and coordination with Telkom Kenya that will involve application process to facilitate protective measures, relocation and advertising in the local dailies, and ensuring timely execution of the relocation of telephone cable lines. 	KPC/KPRL KeNHA/ DE/ Contractor	Ministry of Roads
	Water pipelines: During construction water pipelines may be moved or relocated thereby affecting water distribution. Sewerage pipelines that are near the road will also be affected.	<ul style="list-style-type: none"> • Liaising and coordination with Kwale, Mombasa Water & Sewerage Companies (KMWSC) that will involve application process to facilitate protective measures, relocation and advertising in the local dailies and ensuring timely execution of the relocation of water and or sewage pipelines. 	KMWSC/ KeNHA/ DE/ Contractor	Ministry of Roads
Water usage/ Groundwater	Water source disruption e.g. boreholes that are nearby the road could be affected hence disrupting water supply in these areas. Sharing of water with the contractor will be a problem since	<ul style="list-style-type: none"> • Design of alignment to avoid community borehole locations, but where inevitable compensation by undertaking to construct other boreholes before demolition or acquisition of the existing. • Use of culverts and or retaining walls to protect underground water sources at Hodi area along road to KPA and also providing water outlet points on the said structures. 	DE/ Contractor	KeNHA/ SC

Items	Socio-economic Impacts	Mitigation measures	Responsibility	
			Implementation	Supervision/ Monitoring
		cleaner.		
Community Safety	Increased road accidents during construction and operation of the road	<ul style="list-style-type: none"> • Emphasizing safety aspects among construction equipment drivers; • Construction activities to take place during the day; • Regular maintenance of construction equipment and vehicles; • Minimizing pedestrian interaction with construction vehicles; • Use of safe traffic control measures, including road signs and flag persons to warn of dangerous conditions during construction; • Provision of shoulders, speed bumps, walkways, cycle tracks, road marking, signage, guard rails where bridges and provision of footbridges, where necessary. • Provision of guard rails at bridges; • Speed limiting measures; • Parking prohibition measures 	Contractor	KeNHA/ SC

Source: JICA Survey Team

DE: Design Engineer, SC: Supervising Consultant, RIT: RAP Implementation Team, RC: RAP Implementation Committee, KeNHA: Special Project Department

Table A11.6-5 Environmental Management Plan/ Mitigation measures – Labor Camp Management

Items	Environmental Impacts	Mitigation measures	Responsibility	
			Implementation	Supervision/ Monitoring
Fundamental Infrastructure and healthcare services	Potable water	<ul style="list-style-type: none"> • The Contractor will construct and maintain all labor accommodation in such a fashion that uncontaminated water is available for drinking, cooking and washing. • The Contractor will also provide potable water facilities within the precincts of every workplace in an accessible place, as per standards set by the Occupational Safety and Health Act, 2007. 	Contractor	KeNHA/ SC

		<ul style="list-style-type: none"> • The contractor will also guarantee the following: <ul style="list-style-type: none"> i) Supply of sufficient quantity of potable water in every workplace/labor camp site at suitable and easily accessible places and regular maintenance of such facilities. ii) If any water storage tank is provided that will be kept such that the bottom of the tank at least 1m from the surrounding ground level. iii) If water is drawn from any existing well, the contractor shall ensure that sharing water will not cause any shortage in the local community. iv) Testing of water will be done every month as per parameters prescribed in the Environmental Management and Coordination, (Water Quality) Regulations 2006. 		
	Sanitation and sewage system	<ul style="list-style-type: none"> • The sewage system for the camp are designed, built and operated in such a fashion that no health hazards occurs and no pollution to the air, ground water or adjacent water courses take place • Separate toilets/bathrooms, wherever required, screened from those from men (marked in vernacular) are to be provided for women. • Adequate water supply is to be provided in all toilets and urinals. • Provide hand washing facilities at all cooking and eating areas. • Provide good mobile toilets for each construction site. Alternatively, install two chamber septic tanks toilets for each construction team of 50 - 100 workers 	Contractor	KeNHA/ SC
	Waste management	<ul style="list-style-type: none"> • The contractor shall provide segregated rubbish bins in the camps and ensure that these are regularly emptied and disposed off as per the Project Waste Management Plan (PWMP). • Provide many rubbish bins around camp. Discourage throwing of garbage, waste food, cigarettes, drinks cans on ground. Empty bins to skips regularly and transfer to landfill when full or at least weekly. • Arrangements for disposal of night soils (human excreta) approved by the local municipal authorities or as directed by ESC will have to be provided by the contractor. 	Contractor	KeNHA/ SC

	Transmission of infectious diseases from local people to workers and vice versa	<ul style="list-style-type: none"> • Improve awareness of infectious diseases prevention, particularly HIV/AIDS and flu for workers. • Set up a medical facility for large-size construction camps for first aid and health care for workers. • Install sign boards, lighting system at the construction sites, borrow pits, or places which may cause accidents for people and workers. • Fill up holes, ponds created by filling, cutting and earthworks to prevent health risk and remove vector growth places. • Fill up ponds at worker sites and kill rats, bugs, flies and mosquitoes. 	Contractor	KeNHA/ SC
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Source: JICA Survey Team

DE: Design Engineer, SC: Supervising Consultant, KeNHA: Special Project Department

Table A11.6-6 Environmental Management Plan/ Mitigation measures – Material Extraction/Sites

Items	Environmental Impacts	Mitigation measures	Responsibility	
			Implementation	Supervision/ Monitoring
I. Natural Environment				
Topography	Excavation activities at construction materials extraction sites often involve major topographical and land-cover changes to allow extraction activities, often including clearing of pre-existing vegetation.	<ul style="list-style-type: none"> • Selection of appropriate low-impact extraction (e.g. excavation, quarrying, and dredging) methods that should result in final site contours supportive of habitat restoration principles and final land use; • Establishment of buffer zones from the edge of extraction areas, considering the characteristics of the natural habitats and the type of extraction activities; • To reduce the consumption of land area and, consequently, the loss of soil, preference for extraction should be given to thicker deposits; • Vegetation translocation and relocation techniques should be used as necessary. Vegetation cover, such as native local plants, topsoil, overburden, or spoils feasible for sustaining growth should be removed in separate operations and segregated for later use during site reinstatement, 	Contractor	KeNHA/ SC

Items	Environmental Impacts	Mitigation measures	Responsibility	
			Implementation	Supervision/ Monitoring
		<p>and materials to be used for site reinstatement should be stockpiled and protected from wind and water erosion, as well as from contamination;</p> <ul style="list-style-type: none"> • During extraction, ecological niches should be preserved and protected as far as possible; • Smaller, short-lived extraction sites should be reclaimed immediately, and larger sites with a useful lifespan beyond 3 - 5 years should be subject to ongoing rehabilitation; • Management of further site development through routine topographical and land surveys; • During reinstatement, affected land should be graded and appropriately scarified before soil layers are reapplied, sustaining vegetative re-growth as needed (the combined thickness of topsoil and the growth layer should not be less than that prevailing in the undisturbed areas); • Affected land should be rehabilitated to acceptable uses consistent with local land use plans. Land that is not restored for a specific community use should be seeded and re-vegetated with native species; 		
Hydrology	Quarry pond / Storm water retention and control	<ul style="list-style-type: none"> • Drainage facilities and ponds to cut the peak runoff for a particular design storm; • Quarry pond dredging activities should be designed and implemented to minimize drawdown with consideration of potential impacts to surface and groundwater resource flow and availability, including potential ecological impacts; • To the extent that it is consistent with the post-closure plan, a quarry pond should have a sufficient water depth to ensure the establishment of a stable aquatic ecosystem. 	Contractor	KeNHA/ SC
II. Pollution Control Measures				
Air quality	Dust generation	<ul style="list-style-type: none"> • Land clearing, removal of topsoil and excess materials, location of haul 	Contractor	KeNHA/

Items	Environmental Impacts	Mitigation measures	Responsibility	
			Implementation	Supervision/ Monitoring
		<p>roads, tips and stockpiles, and blasting should be planned with due consideration to meteorological factors (e.g. precipitation, temperature, wind direction, and speed) and location of sensitive receptors;</p> <ul style="list-style-type: none"> • A simple, linear layout for materials-handling operations to reduce the need for multiple transfer points should be designed and installed (e.g. processing plants should be preferably located within the quarry area); • Dust emissions from drilling activities should be controlled at the source by dust extractors, collectors, and filters, and wet drilling and processing should be adopted, whenever possible; • Dust emissions from processing equipment (e.g. crushers, grinders, screens) should be adequately controlled through dust collectors, wet processing, or water spraying. Dust control applications should consider the final use of extracted material (e.g. wet-processing stages are preferred when wet materials or high water contents would not negatively affect their final use); • Procedures to limit the drop height of falling materials should be adopted; • Internal roads within material site area should be adequately compacted and periodically graded and maintained; • A speed limit for trucks should be considered; • Water spraying and surface treatment (e.g. hygroscopic media, such as calcium chloride, and soil natural-chemical binding agents) of roadways and exposed stockpiles using a sprinkler system or a "water-mist cannon" should be implemented; • Exposed surfaces of stockpiled materials should be vegetated. 		SC
	Blasting: Toxic and nontoxic gases are normal by products generated by blasting activities,	<ul style="list-style-type: none"> • Alternatives to blasting, such as hydraulic hammers or other mechanical methods; • If blasting is necessary, planning of the blasting (arrangement, diameter, 	Contractor	KeNHA/ SC

Items	Environmental Impacts	Mitigation measures	Responsibility	
			Implementation	Supervision/ Monitoring
	regardless of the explosive materials used. Emissions of NO ₂ , CO, and NO are generated during the explosions.	<p>and depth and direction of blast holes) should be implemented;</p> <ul style="list-style-type: none"> The correct burning of the explosive, typically composed of a mixture of ammonium nitrate and fuel oil, should be ensured by minimizing the presence of excess water and avoiding incorrect or incomplete mixing of explosive ingredients. 		
Noise and vibrations	<p>Noise emissions: The main noise sources are associated with drilling, breaking, crushing and handling–moving, screening, and transport. In dimension stone quarrying, flame-jet cutting is a specific noise source, if adopted.</p>	<ul style="list-style-type: none"> Reduction of noise from drilling rigs by using down-hole drilling or hydraulic drilling; Implementation of enclosure and cladding of processing plants; Installation of proper sound barriers and (or) noise containments, with enclosures and curtains at or near the source equipment (e.g. crushers, grinders, and screens); Use of rubber-lined or soundproof surfaces on processing equipment (e.g. screens, chutes, transfer points, and buckets); Use of rubber-belt transport and conveyors; Installation of natural barriers at facility boundaries (e.g. vegetation curtains or soil berms); Optimization of internal-traffic routing, particularly to minimize vehicle-reversing needs (reducing noise from reversing alarms) and to maximize distances to the closest sensitive receptors; The use of electrically driven machines should be considered; A speed limit for trucks; Avoidance of flame-jet cutting; Construction of berms for visual and noise screening. 	Contractor	KeNHA/ SC
	<p>Vibration emissions: The most significant vibration emissions are associated with blasting activities, whereas minor</p>	<ul style="list-style-type: none"> Use of specific blasting plans; correct charging procedures and blasting ratios; delayed, micro-delayed, or electronic detonators; and specific in situ blasting tests (the use of down-hole initiation with short-delay detonators improves fragmentation and reduces ground vibrations); 	Contractor	KeNHA/ SC

Items	Environmental Impacts	Mitigation measures	Responsibility	
			Implementation	Supervision/ Monitoring
	emissions are commonly associated with use of rock hammers.	<ul style="list-style-type: none"> • Development of blast design, including a blasting-surfaces survey, to avoid over confined charges and a drill-hole survey to check for deviation and consequent blasting recalculations; • Implementation of ground vibration and overpressure control with appropriate drilling grids (e.g. grid versus hole length and diameter, orientation of blasting faces) and appropriate charging and stemming process of boreholes, to limit potential issues with fly rock and air blasts; • Hydraulic hammers or other mechanical methods should be preferred to improve rock fragmentation and minimize fly-rock risks, instead of using secondary blast (plaster blasting); • Mechanical ripping should be preferably used to avoid or minimize the use of explosives; • Other sources of vibrations are primary crushers and plant screening equipment. Adequately designed foundations for these facilities should sufficiently limit vibrations. 		
Water quality	Wastewater discharge: Dewatering of the quarrying pit, diamond-wire cutting, and surface water runoff can generate a wastewater discharge high in suspended solids.	<ul style="list-style-type: none"> • Adoption of settlement ponds, sumps, and lagoons designed to allow adequate retention time. Lagoons should be sealed with impervious material, as needed, and adequate maintenance programs of the settlement lagoons should be implemented, including side-slope stability, pipe cleaning/maintenance, and removal of settled materials; • Recycling or processing of wire cutting waters; • Construction of a dedicated drainage network; • Settlement enhancement by using flocculants or mechanical means, particularly where limited space prevents or limits the use of lagoons; • Installation of sediment traps along water drainages, including fascines, silt fences, and vegetation traps. • Where blasting is used, there is a potential for nitrate and ammonia 	Contractor	KeNHA/ SC

Items	Environmental Impacts	Mitigation measures	Responsibility	
			Implementation	Supervision/ Monitoring
		residues, especially in groundwater. This should be managed through appropriate blasting design and procedures, including ensuring the correct burning of explosives.		
Waste	Rock waste and removed topsoil/overburden are the main inert wastes produced by quarrying activities.	<ul style="list-style-type: none"> Operational design and planning should include procedures for the reduction of waste production (e.g. blending high-quality rock with poor rock); Topsoil, overburden, and low-quality materials should be properly removed, stockpiled near the site, and preserved for rehabilitation; Hazardous and non-hazardous waste management plans shall be prepared. Management of other waste generated during extraction site operations (e.g. oily debris and contaminated soils recovered from lubricants or fuel spills, metal scraps, demolition materials) shall also be prepared in the Project Waste Management Plan (PWMP). 	Contractor	KeNHA/ SC
III. Community Health and Safety				
Land stability	Large-scale spoil-material disposal, water ponds, or mined land areas may be susceptible to landslide or collapse that could cause catastrophic incidents in surrounding populated areas.	<ul style="list-style-type: none"> Geological and geotechnical control programs in large areas, specifically focused on long-term land stability; Geotechnical monitoring of slopes, disposal sites, and water drainage, if possible by remotely controlled monitoring systems. 	Contractor	KeNHA/ SC
Explosives Safety	Blasting activities may cause accidental explosions and affect surrounding populated areas.	<ul style="list-style-type: none"> Particular attention should be given to all explosives handling phases to prevent theft / improper use; Blasting should be conducted according to a consistent timetable. If changes to the blasting timetable occur, nearby communities should be immediately informed of those changes; Community awareness and emergency preparedness and response 	Contractor	KeNHA/ SC

Items	Environmental Impacts	Mitigation measures	Responsibility	
			Implementation	Supervision/ Monitoring
		<p>planning should be undertaken, including control of third-party access to blasting areas;</p> <ul style="list-style-type: none"> Vibrations caused by blasting have potential community impacts. Monitoring (e.g. preconstruction surveys of buildings, infrastructure, and structures, including photographic and video image recording) should be implemented to ensure that potential household damages caused by the project activities can be adequately identified and managed. 		
	Decommissioning	<ul style="list-style-type: none"> All structures should remain stable such that they do not impose a hazard to public health and safety as a result of physical failure or physical deterioration. The structures should continue to perform the function for which they were designed. They should not erode or move from their intended location under extreme events or perpetual disruptive forces; physical hazards such as unguarded roads, quarries, and other openings should be effectively and permanently blocked from all access to the public until such time that the site can be converted into a new beneficial land use based on changed conditions at the site, as well as alternative uses by local communities or other industries for roads, buildings and other structures. Surface water and groundwater should be protected against adverse environmental impacts resulting from excavation and processing activities. Leaching of chemicals into the environment should not endanger public health or safety or exceed water quality objectives in downstream surface water and groundwater systems. 	Contractor	KeNHA/ SC

Source: JICA Survey Team

DE: Design Engineer, SC: Supervising Consultant, KeNHA: Special Project Department

6.2 Environmental Monitoring Plan

6.2.1 Environmental Monitoring Plan for Construction Phase

The comprehensive Environmental Monitoring Plan during the construction phase which are proposed both in the original EIA report and the supplementary EIA report is presented in Table A11.6-7.

Table A11.6-7 Environmental Monitoring Plan for Construction Phase

Monitoring Programme	Location	Parameters	Frequency/Schedule	Responsibility
Environmental Compliance Inspection and Monitoring	Construction sites and labor camps	Environmental compliance with mitigation measures (Tables A11.6-2 to A11.6-6)	Monthly for a construction period of each package ^{*1}	KeNHA/SC
Replanted Mangroves	Mwache, Mteza, and Tsunza	Mangroves: density, height and diameter	Once a month for a construction period of each package ^{*1}	KeNHA/SC KFS/NGOs
Birds	Mwache, Mteza, Tsunza and Port Reitz	Bird species and counts	2 surveys (two different seasons) per year for a construction period of each package ^{*1}	KeNHA/SC
Fish Catch	Mwangala, Mkupe, Kitanga Juu, and Tsunza	Fish and Prawn: species, number caught, size	2 surveys (two different seasons) per year for a construction period of each package ^{*1}	KeNHA/SC
Benthos Diversity	Mwache and Mteza	Species composition and density	2 surveys (two different seasons) per year for a construction period of each package ^{*1}	KeNHA/SC
Ambient Air Quality	5 sites (Figure A11.3-20)	PM ₁₀ , NO ₂ (NO _x), SO ₂ (SO _x), CO	One campaign before construction to determine the baseline conditions and twice a year for a construction period of each package ^{*1}	KeNHA/SC
Noise and vibrations	5 sites (Figure A11.3-20)	Noise level: L _{Aeq} (day and night) Vibrations: velocity or acceleration	One campaign before construction to determine the baseline conditions and twice a year for a construction period of each package ^{*1}	KeNHA/SC
Seawater Quality	Mwache, Mteza, Tsunza and Port Reitz	Turbidity (or SS) Oil & Grease	Every work day during construction of two bridges and ripraps along the coasts ^{*1}	KeNHA/SC

Seawater Quality	Mwache, Mteza, Tsunza and Port Reitz	pH, Temperature, Salinity, BOD, COD, Total Nitrogen, Total Phosphorus, Oil & Grease, Cyanides, Phenols, Sulphide, Total Suspended Solids, E.coli, Arsenic, Lead, Cadmium, Nickel, Chromium, Mercury, Alkyl Benzyl Sulphonates, Total pesticide residues	One campaign before construction to determine the baseline conditions and twice a year for a construction period of each package ^{*1}	KeNHA/SC
Groundwater quality	Likoni, Miritini, Tsunza and Port Reitz	pH, Suspended solids, Nitrate, Ammonia, Nitrite, Total Dissolved Solids, E.coli, Fluoride, Phenols, Arsenic, Cadmium, Lead, Selenium, Copper, Zinc, Alkyl benzyl sulphonates, Permanganate value	One campaign before construction to determine the baseline conditions and twice a year for a construction period of each package ^{*1}	KeNHA/SC
Public Meeting (Safety Measures)	Likoni, Miritini, Tsunza and Port Reitz	Community health and safety issues, grievance	2 locations per year for a construction period of each package ^{*1}	KeNHA/SC Contractor

Source: JICA Survey Team

Note 1) Monitoring shall be conducted even when construction period is extended more than three years.

2) SC: Supervising Consultant, KeNHA: Special Project Department, KFS: Kenya Forest Service

6.2.2 Environmental Monitoring Program for Operation Phase

The comprehensive Environmental Monitoring Plan during the operation phase which are proposed both in the original EIA report and the supplementary EIA report is presented in Table A11.6-8.

Table A11.6-8 Environmental Monitoring Plan for Operation Phase

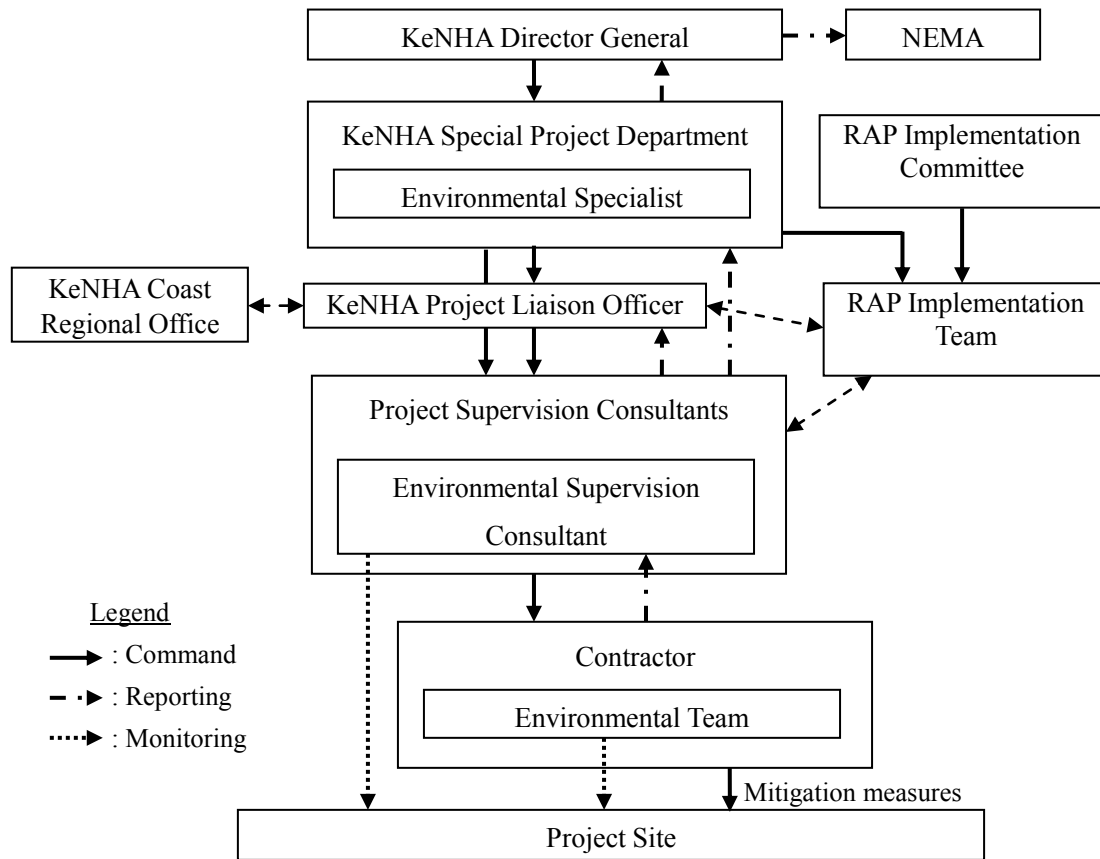
Monitoring Programme	Location	Parameters	Frequency/Schedule	Responsibility
Reforestation Mangroves	Mwache, Mteza, Tsunza and Port Reitz	Mangroves: density, height and diameter	1 survey for first four operational years	KeNHA
Birds	Mwache, Mteza, Tsunza and Port Reitz	Bird species and counts	2 surveys (two different seasons) for first three	KeNHA

			operational years	
Fish Catch	Mwangala, Mkupe, Kitanga Juu, and Tsunza	Fish and Prawn: species, number caught, size	2 surveys (two different seasons) for first three operational years	KeNHA
Ambient Air Quality	5 sites (Figure A11.3-20)	PM ₁₀ , NO ₂ (NO _x), SO ₂ (SO _x), CO	Twice a year after opening the roads	KeNHA
Noise and vibrations	5 sites (Figure A11.3-20)	Noise level: L _{Aeq} (day and night) Vibrations: velocity or acceleration	Twice a year after opening the roads	KeNHA
Seawater Quality	Mwache, Mteza, Tsunza and Port Reitz	pH, Temperature, Salinity, BOD, COD, Total Nitrogen, Total Phosphorus, Oil & Grease, Cyanides, Phenols, Sulphide, Total Suspended Solids, E.coli, Arsenic, Lead, Cadmium, Nickel, Chromium, Mercury, Alkyl Benzyl Sulphonates, Total pesticide residues	Twice a year after opening the roads	KeNHA
Public Meeting (Pollution control Measures)	Likoni, Miritini, Tsunza and Port Reitz	Community health and safety issues, grievance	2 locations per year after opening the roads	KeNHA

Source: JICA Survey Team

6.2.3 Diagram for Environmental Management and Monitoring Plan

The organization chart of the environmental management and monitoring is depicted in Figure A11.6-2. The institutional framework for the RAP implementation is referred to RAP.



Source: JICA Survey Team

Figure A11.6-2 Organization Chart for Environmental Management and Monitoring Plan

(1) KeNHA

Construction Phase:

KeNHA is Project owner, responsible for project management including overall environmental management. To carry out overall environment management, in KeNHA Special Project Department, an Environment Specialist and Social Safeguard Specialist shall be assigned. The Environmental Specialist is in charge of guiding and supervising implementation of the EMP for the Project.

- Ensure that sufficient funds are available to properly implement the EMP;
- Ensure that EMP provisions are implemented for the entire Project regardless of financing source;
- Ensure that Project implementation complies with the Kenyan and JICA environmental policy, principles and requirements;
- Submit quarterly environmental monitoring reports to JICA during the construction phase.

Operation Phase:

- Set up an operation and Maintenance Unit to control the Link and Bypass Roads operation;
- Hire Environmental Monitoring Consultants to carry out environmental monitoring in operational phase;
- Implementing the EMP in the first three year of operation;
- Investigating and monitoring of environmental matters in the first three year of operation. For the mangrove monitoring: four year of operation;
- Submit biannual environmental monitoring reports to JICA in the first three operation years;
- Submit the environmental audit report to NEMA within a period of twelve months of the commencement of the operations.

(2) KeNHA Special Project Department

KeNHA Special Project Department is responsible for implementation of the Project. Its responsibilities include:

- Overall planning, management and monitoring of the environmental management;
- Ensuring that all environmental protection and mitigation measures of environmental impacts are carried out in accordance with policies regulations on environment and other relevant laws;
- Organizing training courses for local staff and contractor's teams on mitigation measures and safety methods;
- Carrying out internal monitoring and supervising independent monitoring, which will be contracted with other consulting services of the project;
- Supervising and providing budget for monitoring activities;
- Ensure that environmental protection and mitigation measures proposed in the EMP are incorporated in the detailed design and that the Project is implemented following the JICA Guidelines;
- Ensure that tender documents and civil works contracts include the EMP and specify requirement for preparation and implement of Constructor's EMP;
- Review and approve the Constructor's EMP with assistance from the Construction Supervision Consultant;
- Recruit an external monitoring consultant(s) to monitor EMP implementation and to verify monitoring information submitted by KeNHA to JICA;
- Recruit an environmental supervision consultant to undertake ambient baseline data collection and monitoring during various project phases;
- Based on the results of EMP monitoring, identify environmental corrective actions and prepare a corrective action plan, as necessary, for submission to JICA;

- Establish an environmental grievance redress mechanism to receive and facilitate resolution of affected peoples' concerns, complaints, and grievances about the Project's environmental performance.

Environmental Specialist:

- Together with the supervising consultants, monitoring of construction sites and preparing monitoring methods;
- Monitoring of construction activities in combination with obtaining community opinions to ensure the fulfillment of requirements in the EMP;
- Suspending any activity that triggers a serious negative environmental impact; suspending construction if contractors fail to observe requirements in the EMP or take any mitigation measures.

(3) Supervision Consultants

- Prepare and submit to KeNHA and JICA technical and financial proposals in their bids for environmental monitoring and other services.
- Engage Environmental Supervision Consultants to undertake regular project monitoring and reporting based on EMP provisions
- Prior to implementation of civil works, assist KeNHA Special Project Department in reviewing the Constructor's EMP to ensure that these are consistent with the provisions of the EMP
- Assist KeNHA Special Project Department in monitoring the implementation of mitigation measures during preconstruction phase and the environmental performance of contractors based on the EMP and the EMPs prepared by contractors.
- Providing technical supports for KeNHA Special Project Department; preparing periodical reports on environmental management and compliance monitoring.
- Incorporate in the environmental monitoring reports the results of environmental effects monitoring and undertake data analysis.
- Making recommendations and strengthening environmental management and monitoring capability of contractors
- Assist KeNHA Special Project Department in preparing monitoring reports for submission to JICA on a quarterly basis.
- Assist KeNHA Special Project Department to ensure that the EMP provisions are included in the tender documents and civil works contracts

(4) Contractors and their Environmental Team

The Construction Contractors (Contractors) will be selected by KeNHA. Their responsibility includes construction works and following contractor specifications outlined in the EIA and EMP. This includes:

- Recruit a qualified Environmental Officer on a fulltime basis to ensure compliance to environmental contractual obligations and proper implementation of the Contactor's EMP;
- Prepare and submit to KeNHA Special Project Department the Contactor's EMP prior to commencement of civil works;
- Ensure proper implementation of the Contactor's EMP;
- Carrying out contractor's environmental monitoring monthly and submit monthly reports to KeNHA Special Project Department/ Supervision Consultants on the monitoring results and implementation of environmental mitigation measures;
- Implement additional environmental mitigation measures, as necessary;
- Applying all mitigation measures suggested in EMP/Contactor's EMP during construction of road and bridges;
- Ensuring safety of construction workers and local people during construction.

(5) NEMA

- Monitoring the implementation of mitigation measures suggested in the EIA report approved by NEMA to minimize the project impacts in the construction and operation phases (compliance monitoring).
- Checking the environmental audit report.
- Conducting the control audit, whenever NEMA deems it necessary to check compliance with the environmental parameters set for the Project or to verify self-auditing reports

6.2.3 Report Submission

KeNHA has the responsibility to prepare the reports of environmental monitoring results in accordance with the Environmental Management and Monitoring Plans and submit them to JICA in the form as shown in Appendix 12. The monitoring reports shall be submitted to JICA quarterly during the construction phase. During the operation phase after opening the roads, the report shall be submitted to JICA biannually for three years.

KeNHA has also the responsibility to submit the environmental audit report to NEMA within a period of twelve months of the commencement of the operations.

CHAPTER 7 PUBLIC PARTICIPATION AND INFORMATION DISCLOSURE

Public participation, consultation and analysis were summarized in Chapter 14 of the original EIA report. Several public consultation meetings were held and where necessary more than once. Tools used in information disclosure and opinion identifying included: stakeholder analysis, focus group discussions through interactive forums, key informant interviews, face to face meetings with organizations, and structured questionnaire surveys.

Two stakeholder meetings were held by KeNHA to inform all stakeholders about the revised road alignments and the issues of the social and environmental considerations.

7.1 First Stakeholder Consultation Meetings

7.1.1 Objectives

The objectives of the first stakeholder consultation meetings are to disseminate the outline of the project, and social and environmental considerations.

7.1.2 First Stakeholder Consultation Meeting in Changamwe

550 stakeholders from local residents, government/private sectors, research/educational institutions and media participated in the meeting. Most of the participants expressed favour of the project expecting its promotion of economic activity and tourist industry. In addition, since this area has been under constant strain of heavy traffic jam caused by vehicles related to port activity, the project is highly expected to alleviate the traffic jam.

However, some attendances requested to implement careful social and environmental considerations.

7.1.3 First Stakeholder Consultation Meeting in Likoni

471 stakeholders from local residents, government/private sectors, educational institutions and media participated in the meeting. Most of the participants expressed favour of the project expecting its promotion of economic activity and employment opportunity related to the construction of the proposed roads.

However since a lot of PAPs are located in Likoni area, questions and inquires concerning compensation and the proposed alignment were raised.

7.1.4 Response of KeNHA to Questions/Comments

The questions/comments and answers during discussion are summarized in TableA11.7-1. The handout and records of the First Stakeholder Meeting are presented in Appendix A3.

Table A11.7-1 Response of KeNHA to Questions/Comments

Questions Asked	Response given
Where the road passes are there affected people?	It is estimated that about 83 families could be living along the alignment and the supplemental socio-economic survey will be undertaken to establish and identify the Projected Affected Persons (PAPs). The survey will finally enable us to determine the number of the PAPs.
Local residents in the project area should be given 75% of employment opportunities when the road construction starts	It was indicated that the non-skilled job opportunities will be given to the local residents but skilled labour will be sourced from qualified professional regardless of where they hail from. The local administration will be involved in the identification of those to be recruited as casual labour
Will the project affect the fishermen especially there landing areas and structures they have constructed?	The socio economic survey will establish this and if the fishermen will be affected; full compensation will be given to them. The project won't involve the construction of the embankments hence fishing activities will go on. Mangroves which provide breeding grounds will be protected as much as possible. GoK and JBIC guidelines will be followed in determining compensation.
Will access roads to industrial areas be provided for during construction of Kipevu link road	Informed that the road will on focus on the proposed alignment. Construction of Kipevu link road won't involve the construction of access roads to open up other areas. The access road is not part of the scope of the proposed project.
Will the supplementary socio-economic and environmental survey provide employment for local enumerators? Will the local NGOs be involved in the supplementary survey exercise	The consultant welcomed the suggestion to recruit enumerators for the community. He indicated that he will want to recruit 10 enumerators for 2 weeks. The RAP process will be all inclusive and stakeholders and partners including NGOs, local administration, civil society organizations and relevant government departments operating in the project area with legitimate interests will be involved during the survey.
How will livelihood affected by the project be restored? E.g. payment for coconut trees, maize and the like	Compensation will include all property on the land. This includes buildings, trees e.g. mango, cashew nuts or coconut. Trees are permanent while maize is seasonal. The crops like coconuts will be compensated using government rates and a formula will be established to compensate for income lost for a certain number of years. For crops like maize the residents will be allowed to harvest.
Road Transport Association wanted to know how the quality of roads will be assured and whether weighbridges will be installed to check on overloading	Overloading will be monitored by KeNHA while Kenya Ports Authority will install weighbridges inside the container terminal. The pavement will be designed for 10 years afterwards rehabilitation will be done. The

	construction will be supervised by qualified Engineers where international standards will be applied. The bridge design life will be 100 years.
What will be done to ensure that people affected are adequately compensated	The communities were requested to collaborate with the consultants who will be on the ground in order for them to undertake a factual asset survey. The Government of Japan will also monitor the compensation process
How will already existing houses be compensated? Is it cost of building new houses, alternative plot or building new house for affected person?	The RAP report will determine the cost of affected houses and discuss with the PAPs the compensation options available. An agreement will be arrived at as to what is the best option
What will be the impact on air quality?	Emission reduction measures will be put in place if the standard limits are exceeded. For dust which is a temporal impact, watering will be done by the contractor and KeNHA will monitor the process.
How will the process make use of the earlier committees established	The consultant will liaise with the District Commissioners and determine how to work with local administration in this exercise. A grievance redress mechanism will also be established within the community and this will include the formulation of a committee whose members must be accepted by the community.
How will the project compensate women that will be affected by the proposed road	The RAP process will include identification of vulnerable groups that will include single women headed households, orphans and will propose the mode of compensation.
How many Kilometers or meters is the new proposed alignment from the old alignment	The new alignment is about 200 to 300 meters away from the previous alignment where it joins the Mombasa-Lunga Lunga (A14) Road
Why is the road construction pushed to 2014?	This time will be needed for GoK to engage in the negotiation for the Loan to construct the road in 2012. Year 2013 will allow for development of a detailed road design and land acquisition
What happens to the earlier enumerated PAPs who had signed the consent form and did not further develop their land/did not grow crops	This stakeholders meeting is a forum to share information with people affected and the general community. The meeting is an avenue for further updates of the process including any changes that may occur from time to time. A supplementary RAP will be undertaken to confirm who the PAPs are. The next forum will be conducted in September to share results with the stakeholders.

Source: KeNHA

7.2 Second Stakeholder Consultation Meetings

7.2.1 Objectives

The objectives of the second stakeholder consultation meetings are to present the result of the supplementary EIA surveys and draft RAP based on socio-economic survey carried out shortly after the first stakeholder consultation meetings.

7.2.2 Second Stakeholder Meeting in Changamwe

226 stakeholders, mainly PAPs participated in the meeting. The main concern of participants is proper and adequate compensation for PAPs and no adverse claim and view is raised.

7.2.3 Second Stakeholder Meeting in Likoni

238 stakeholders, mainly PAPs participated in the meeting. Most of participants showed understanding of compensation for PAPs. Meanwhile participants from Pungu village in Kwale District expressed strong opposition to the proposed road alignment which passes through the village.

7.2.4 Response of KeNHA to Questions/Comments

The questions/comments and answers during discussion are summarized in Table A11.7-2.

The handout and records of the Second Stakeholder Meeting are presented in Appendix A3.

Table A11.7-1 Response of KeNHA to Questions/Comments

Questions Asked	Response given
Which plots will be affected by the road?	It was indicated that an aerial photography was undertaken however a detailed survey will be concluded to determine the actual plots that will be affected.
What Mechanisms will be put in place to enhance accountability?	The project will be funded by an independent financier who will monitor the implementation of the Resettlement Action Plan (RAP) and ensure that all conditions of the RAP are met.
What will be done to the Kayas and burial sites that will be affected?	It was indicated that the RAP survey is still on going and a team of the consultants are expected to hold discussions with the community's village elders for an amicable solution on how to address or compensate for these sites.
Pungu residents asked for the alignment to be moved from their community.	It was agreed that a team comprising of KeNHA, the Provincial Administration and the Consultant will

	engage the community to agree on a way forward.
Do the beacons mounted on the ground show the road corridor and the land that will be affected? And if not can they be removed?	The participants were informed that the beacons on the ground are control points for survey. The road corridor boundary beacons will be put up during the detailed survey process.
How will compensation for business affected by the road be undertaken especially for those who use the boat for transport to sell their palm wine?	It was indicated that all people whose livelihoods will be affected by the project will be compensated. The Palm wine business is under the small scale category of livelihoods that will be affected and the compensation will be three (3) months cash handout worth of gross daily profit.
What will be done to ensure that all the affected persons are compensated and not other people?	Verification will be undertaken to establish the rightful owners and the list will be made public.
Will there be other consultative meetings in the future?	The consultation meetings will be ongoing until the road is implemented as per the schedule. The meetings will continue until the end of the project.
How will the project benefit the residents of Likoni?	The bypass road will serve everyone and is important for the development of this country.
What traffic measures will be put to ensure safety of the school going children, churches and other pedestrians? and also to put up bumps	It was indicated that road safety measures will definitely form part of the entire project and take care of all the categories of people. It was however indicated that it is not the policy of the Government to erect bumps on highways but on assessment of the safety needs of the road, bumps may be erected on case by case.
What will be done to ensure that the noise pollution is minimised	Noise pollution will be included in the environmental monitoring and management plan and the survey has suggested planting of trees near schools, hospitals and churches to minimize the noise levels
Will land with no title be compensated the same as land with title	The participants were informed that all land will be compensated
Will compensation for cashew nuts and coconuts be considered	It was indicated that all trees including the cashew nuts and coconuts that will be affected were taken into consideration for compensation.
What measures will be put for the boreholes and community assets that will be affected during the road construction	They were informed that all properties and development on the proposed alignment will be compensated.

Source: KeNHA

7.3 Other Stakeholder Consultation Meetings

7.3.1 Objectives

The objectives of the meetings are to ask for potential PAPs cooperation for the socio-economic survey and collect detail opinions and views toward the Project from them.

7.3.2 Stakeholder Consultation Meeting in Village Level

The local consultant together with KeNHA and the local provincial administration organized and facilitated a total of 11 stakeholder consultation meetings in village level.

Table A11.7-3 Record of Stakeholder Meetings in Village Level

Date	District	Village	No. of Participants
23 rd July 2011	Likoni	Pungu, Kwale	45
		Kiteje, Kwale	28
24 th July 2011	Changamwe	Miritini	37
26 th July 2011	Kinango	Tsunza	36
	Likoni	Mtongwe	68
27 th July 2011	Changamwe	Port Reitz	39
29 th July 2011	Changamwe	Miritini	45
25 th August 2011	Likoni	Mwangala	186
10 th September 2011	Kwale	Pungu	132
21 st September 2011	Likoni	Shikadabu	129
27 th September 2011	Kwale	Pungu	125

Source: JICA Survey Team

7.4 Summary of the Opinions and Views Expressed

7.4.1 Comments from Land/Asset Owners

- PAPs require adequate and prompt compensation where land and property will be affected.
- PAPs need adequate notice to vacate their current residence. Once being compensated, they should be given ample time to vacate since they will need to look for alternative accommodation.
- Some PAPs need transport to enable them to move their goods to the new residences that they will obtain.
- All PAPs generally fear that they will not get adequate compensation for land and economic tree affected.
- All PAPs need practical and free access grievance redress mechanism.

7.4.2 Comments from Fishermen

- Fishermen fears that they may be denied access to their fish land and fishing sites where the bridges site is fenced out. They demanded that alternative access to the sea for fish should be provided.
- Fishermen fears that they may not catch fish during the bridges construction. Also during operation, they fear that discharge s of runoff from the bridge will pollute the creeks thus spoil the fishing industry little by little.

7.4.3 Comments from Fish Traders

- Fish traders fear that they will be unable to get fish thus loose the income from fishing trade.
- Fish traders feat that they will be unable to travel to other markets to obtain fish for sale.

7.4.4 Comments from Boat Operators

- Boat operators fear that their transport business will die out once the bridges are constructed and operational.

7.4.5 Comments from Conservation Groups

- Conservation groups fear that once their area of operation is fenced out for the bridges, they will lose their current income from fish farming and mangrove seeding.

7.5 Reflections of Opinions and Views from Stakeholders

In consideration of opinions and views raised in the stakeholder consultation meetings, countermeasures are elaborated as follows:

- Alternative road alignment which avoids Pungu village
- Proper and adequate compensation for PAPs
- Practical grievance redress mechanism for all PAPs, especially for poor PAPs
- Employment measures during construction stage
- Mitigation measures against noise impact and impact on flora & fauna
- Installation of oil separators to avoid water pollution

7.6 Public consultations with Project Affected Persons during detailed design and construction stage

KeNHA confirmed to conduct the public consultations with Project Affected Persons (“PAP”) at least twice a year to apprise them on the status and the progress of the project and the following items during detailed design and construction stage.

- 1) Negative impacts on environment and mitigation measures
- 2) Status of mangrove reforestation
- 3) Land acquisition and resettlement
- 4) Income restoration measures
- 5) Special assistance for Vulnerable affected person

CHAPTER 8 COST AND BUDGET

8.1 Cost Estimates for Mitigation Measures

Cost estimate for the environmental mitigation measures during the construction and operation phases proposed in Chapter 6 are summarized in Table A11.8-1.

Table A11.8-1 Cost Estimate for Environmental Mitigation Measures

Item	Stage	Mitigation Measures	Unit	Unit Cost (Ksh)	Quantity	Total Cost (Ksh)
Mangroves	Construction	Mangrove replanting (Refer to “Mangrove Reforesting Plan”)	L.S.	-	-	3,618,000
	Operation	Reforesting monitoring	year	1,196,000	3	3,588,000
Aquatic Habitat	Construction	Oil separator (grit chamber) with drainage facilities	-	-	-	Covered in Engineering Cost
	Operation	Regular maintenance of oil separators, waste disposal	-	-	-	KeNHA
Flora and Fauna	Construction	Planting of trees and grass in road rights of way and adjacent areas (seedlings and saplings of indigenous trees and other important plant species before clearing of vegetation)	-	-	-	Covered in Engineering Cost
	Construction	Underpass culvert to secure migration path for small animals	site	1,404,432	11	15,448,747
Topography and Geology	Construction	Design of drainage facilities to avoid soil erosion and slope stabilization measures	-	-	-	Covered in Engineering Cost
Groundwater	Construction	Protection measures: construction of culverts and retaining walls, soil erosion control, oil spillage prevention and monitoring.	-	-	-	Covered in Engineering Cost
Air Quality	Construction	Dust control measures: sprinkling of water; covers of the trucked material during transportation	-	-	-	Covered in Engineering Cost
	Construction	Pollutant emission control measures: low emission construction vehicles, maintenance and inspection.	-	-	-	Covered in Engineering Cost
Seawater Quality	Construction	Oil separator (grit chamber) with drainage facilities	-	-	-	Covered in Engineering Cost
	Construction	Establish an oil spill monitoring system and a rapid response	-	-	-	Covered in Engineering Cost

Item	Stage	Mitigation Measures	Unit	Unit Cost (Ksh)	Quantity	Total Cost (Ksh)
		unit in the contractor's team.				
	Operation	Regular maintenance of oil separators, waste disposal	-	-	-	KeNHA
Noise and Vibrations	Construction	Noise and vibration control measures: Proper service of equipment; installation of sound barriers for pile driving activity; construction activities to be restricted during day time hours only.	-	-	-	Covered in Engineering Cost
	Construction	Plant trees in environmental facility zones	m	25,514	4,300	109,710,200
	Operation	Install warning signs on road for horn ban, speed control and lane restriction	-	-	-	KeNHA
	Operation	Regular maintenance on road to keep road surface good condition	-	-	-	KeNHA
	Operation	Develop a mechanism to record and respond to monitoring results and complaints (Regular meeting: twice a year)	-	-	-	KeNHA
	Waste	Construction	Project Waste Management Plan (PWMP): To promote segregation and recycling (3R: Reduce, Re-use and Recycle)	-	-	-
Community severance	Construction	Provision of pedestrian and livestock underpasses, service road, foot bridges and street lighting.	-	-	-	Covered in Engineering Cost
	Construction	Temporary traffic diversions to include walkways and cycle tracks.	-	-	-	Covered in Engineering Cost
Community Health and Safety	Construction	Public meetings regarding health and safety issues during construction, grievance redress (2 locations per year for a construction period of each package)	-	-	-	Covered in Engineering Cost
	Operation	Public meetings regarding pollution control measures after road opening, grievance redress (2 locations per year)	-	-	-	KeNHA
Labor Camp	Construction	Occupational health and safety for labor camp	-	-	-	Covered in Engineering Cost
Total Cost for Environmental Mitigation Measures						132,364,947

Source: JICA Survey Team

8.2 Cost Estimates for Environmental Monitoring Plan

Cost estimate for the Environmental Monitoring Plans during construction and during the operation phase, proposed in Chapter 6, are summarized in Table A11.8-2 and A11.8-3 respectively.

Table A11.8-2 Cost for Environmental Monitoring Plan during Construction

No.	Monitoring Works	Unit	Unit Cost (Ksh)	Quantity	Total Cost (Ksh)
1	Environmental Compliance Inspection and Monitoring	-	-	-	Covered by Mitigation cost
2	Replanted Mangroves	-	-	-	Covered by Mitigation cost
3	Birds	No.	300,000	4 sites x 2 times/year	2,400,000
4	Fish Catch	No.	300,000	4 sites x 2 times/year	2,400,000
5	Benthos Diversity	No.	300,000	2 sites x 2 times/year	1,200,000
6	Ambient Air Quality	No.	450,000	5 sites x 2 times/year	4,500,000
7	Noise and Vibrations	No.	154,750	5 sites x 2 times/year	1,547,500
8	Seawater Biannual Quality	No.	450,000	4 sites x 2 times/year	3,600,000
9	Groundwater Quality	No.	300,000	2 sites x 2 times/year	1,200,000
10	Public Meetings	-	-	-	Covered in Engineering Cost
Annual Cost for Environmental Monitoring (No.1 to 10)					16,847,500
Construction years		Package 1	Section 1	2 years	
			Section 2	2 years	
		Package 2		3.42 years	
		Package 3		2 years	
		Total		9.42 years	
Total Cost for Environmental Monitoring during Construction (No.1 to 10)					158,703,450
11	Seawater Daily Quality	Month	503,125	22 months during bridge construction	11,068,750
Total Cost for Environmental Monitoring Plan during Construction					169,772,200

Source: JICA Survey Team

Table A11.8-3 Annual Cost for Environmental Monitoring Plan during Operation

No.	Monitoring Works	Unit	Unit Cost (Ksh)	Quantity	Total Cost (Ksh)
1	Replanted Mangroves	L.S.	1,196,000	-	1,196,000
2	Birds	No.	300,000	4 sites x 2 times/year	2,400,000
3	Fish Catch	No.	300,000	4 sites x 2 times/year	2,400,000
4	Benthos Diversity	No.	300,000	2 sites x 2 times/year	1,200,000
5	Ambient Air Quality	No.	450,000	5 sites x 2 times/year	4,500,000
6	Noise and Vibration	No.	154,750	5 sites x 2 times/year	1,547,500
	Seawater Quality	No.	450,000	4 sites x 2 times/year	3,600,000
7	Public Meetings	L.S.	500,000	2 sites x 2 times/year	2,000,000
Annual Cost for Environmental Monitoring Plan during Operation					18,843,500

Source: JICA Survey Team

8.3 Budget

8.2.1 Budget for Mitigation Measures

Total cost for environmental mitigation measures during the construction phase is estimated at Ksh 132,364,947 (equivalent to USD 2,154,377) for construction years as shown in Table A11.8-1. The budget for implementing the mitigation measure is under JICA loan.

The contractors are responsible for studying, preparing options and implementing the environmental mitigation measures. These costs shall be included incorporated in the bidding documents for the contractors.

8.2.2 Budget for Environmental Monitoring Plan

Total cost for the Environmental Monitoring Plan during the construction phase is estimated at Ksh 169,772,200 (equivalent to USD 2,763,220) for construction years as shown in Table A11.8-2. The budget for implementing the Environmental Monitoring Plan during the construction phase is under the construction supervision item and covered by JICA loan.

Total annual cost for the Environmental Monitoring Plan during the operation phase is estimated at Ksh 18,843,500 (equivalent to USD 306,700) for first three operational years. From the fourth year after opening the road, the annual cost Ksh 6,047,500 for the surveys of ambient air quality and noise and vibrations will be incurred. The budget for implementing the Environmental Monitoring Plan during the operation phase shall be covered by KeNHA.

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**APPENDIX OF
THE SUPPLEMENTARY ENVIRONMENTAL IMPACT ASSESSMENT
REPORT**

Appendix-1 Principles of the JBIC Guidelines (Summary), Comparison of Kenyan and JBIC Guidelines/World Bank Policies

Appendix-2 List of Vascular Plants, Birds and Butterflies in the Study Area

Appendix-3 Records of Stakeholder Consultation Meetings

Appendix-4 Terms of Reference for Mangrove Reforesting Plan

Appendix-5 Environmental Management Plan Monitoring Form for Submitting to JICA

**APPENDIX A1 Principles of the JBIC Guidelines,
Comparison of Kenyan and JBIC Guidelines/World Bank Policies**

1. Principles of the JBIC Guidelines

JBIC requires that, in principle, appropriate environmental and appropriate environmental and social considerations be undertaken, according to the nature of the project, based on the following:

(Underlying Principles)

- Environmental impact which may be caused by a project must be assessed and examined from the earliest planning stage possible. Alternative proposals or minimization measures to prevent or reduce adverse impact must be examined and incorporated into the project plan:
- Such examination must include analysis of environmental costs and benefits in as quantitative terms as possible and be conducted in close harmony with economic, financial, institutional, social and technical analysis of the project;
- The findings of the examination of environmental and social considerations must include alternative proposals, mitigation measures and be recorded as separate documents or as a part of other documents. Environmental Impact Assessment (EIA) reports must be produced for projects in which there is a reasonable expectation of particularly large adverse environmental impact; and
- For projects that have particularly large potential adverse impact or are highly contentious, a committee of experts may be formed to seek their opinions, in order to increase accountability.

(Examination of Measures)

- Multiple alternative proposals must be examined to prevent or minimize adverse impact and to choose a better project option in terms of environmental and social considerations. In examination of measures, priority is to be given to the prevention of environmental impact, and when this is not possible, minimization and reduction of impact must be considered next. Compensation measures must be examined only when impact cannot be prevented by any of the aforementioned measures; and
- Appropriate follow-up plans and systems, such as monitoring plans and environmental management plans, must be prepared; and costs of implementing such plans and systems, and financial methods to fund such costs, must be determined. Plans for projects with particularly large potential adverse impact must be accompanied by detailed environmental management plans.

(Scope of Impact to be Examined)

- Environmental impact to be investigated and examined includes factors that impact human health and safety as well as the natural environment, such as: air, water, soil, waste, accidents, water usage, ecosystems, and biota. Social concerns include: involuntary resettlement of the population, the indigenous people, cultural heritage, landscape, gender, children's rights and communicable diseases such as HIV/AIDS and impact that may lead to trans-boundary and global environmental problems; and

- In addition to the direct and immediate impact of projects, derivative, secondary and cumulative impacts are also to be examined and investigated to a reasonable extent. It is also desirable that the impact which can occur at any time during the duration of the project be continuously considered throughout the life cycle of the project.

(Compliance with Laws, Standards and Plans)

- Projects must comply with laws, ordinances and standards relating to environmental and social considerations established by the governments that have jurisdiction over the project site (including both national and local governments). They are also to conform to environmental and social consideration policies and plans of the governments that have jurisdiction over the project site; and
- Projects must, in principle, be undertaken outside protected areas that are specifically designated by laws or ordinances of the government for the conservation of nature or cultural heritage (excluding projects whose primary objectives are to promote the protection or restoration of such designated areas). Projects are also not to impose significant adverse impact on designated conservation areas.

(Social Acceptability and Social Impacts)

- Projects must be adequately coordinated so that they are accepted in a manner that is socially appropriate to the country and locality in which the project is planned. For projects with a potentially large environmental impact, sufficient consultations with stakeholders, such as local residents, must be conducted via disclosure of information from an early stage where alternative proposals for the project plans may be examined. The outcome of such consultations must be incorporated into the contents of the project plan; and
- Appropriate consideration must be given to vulnerable social groups, such as women, children, the elderly, the poor, and ethnic minorities, all of whom are susceptible to environmental and social impact and who may have little access to the decision-making process within society.

(Involuntary Resettlement)

- Involuntary resettlement and loss of means of livelihood are to be avoided where feasible, exploring all viable alternatives. When, after such examination, it is proved unfeasible, effective measures to minimize impact and to compensate for losses must be agreed upon with the people who will be affected;
- People to be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported by the project proponents, etc. in timely manner. The project proponents, etc. must make efforts to enable the people affected by the project, to improve their standard of living, income opportunities and production levels, or at least to restore them to pre-project levels. Measures to achieve this may include: providing land and monetary compensation for losses (to cover land and property losses), supporting the means for an alternative

sustainable livelihood, and providing the expenses necessary for relocation and the re-establishment of a community at relocation sites; and

- Appropriate participation by the people affected and their communities must be promoted in planning, implementation and monitoring of involuntary resettlement plans and measures against the loss of their means of livelihood.

(Indigenous Peoples)

- When a project may have adverse impact on indigenous peoples, all of their rights in relation to land and resources must be respected in accordance with the spirit of the relevant international declarations and treaties. Efforts must be made to obtain the consent of indigenous peoples after they have been fully informed.

(Monitoring)

- It is desirable that, after a project begins, the project proponents monitor: (i) whether any situations that were unforeseeable before the project began have arisen, (ii) the implementation situation and the effectiveness of the mitigation measures prepared in advance, and that they then take appropriate measures based on the results of such monitoring;
- In cases where sufficient monitoring is deemed essential for the achievement of appropriate environmental and social considerations, such as the projects for which mitigation measures should be implemented while monitoring their effectiveness, project proponents must ensure that project plans include monitoring plans which are feasible;
- It is desirable that project proponents make the results of the monitoring process available to project stakeholders; and
- When third parties point out, in concrete terms, that environmental and social considerations are not being fully undertaken, it is desirable that a forum for discussion and examination of countermeasures be established based on sufficient information disclosure and include the participation of stakeholders in the relevant project. It is also desirable that an agreement be reached on procedures to be adopted with a view to resolving the problem.

Table A11-A1 Comparison of Kenyan EIA Regulations and JBIC Guidelines/World Bank Safeguard Policies

JBIC Guidelines/ Comprehensive World Bank Safeguard Policies	Relevant Kenyan Laws and Regulations	Comparison/Gaps
<p>Confirm that project proponents are undertaking appropriate environmental and social considerations, through various measures, so as to prevent or minimize the impact on the environment and local communities which may be caused by the projects, and not to bring about unacceptable effects.</p>	<p>No proponent shall implement a project - (a) likely to have a negative environmental impact; or (b) for which an environmental impact assessment is required under the Act or these Regulations; unless an environmental impact assessment has been concluded and approved in accordance with these Regulations (EIA/EA 2003, 4(1)). The State shall - (a) ensure sustainable exploitation, utilisation, management and conservation of the environment and natural resources, and ensure the equitable sharing of the accruing benefits; (g) eliminate processes and activities that are likely to endanger the environment. (The Constitution of Kenya, 2010, 69(1) (a)(g))</p>	<p>Because the project which is likely to have a significant negative impact is required to conduct the EIA study and approved, there is no gap between Kenyan laws and JBIC Guidelines.</p>
<p>Projects must comply with laws, ordinances and standards relating to environmental and social considerations established by the governments. They are also to conform to environmental and social consideration policies and plans of the governments that have jurisdiction over the project site.</p>	<p>An environmental impact assessment study shall be conducted in accordance with the general environmental impact assessment guidelines and administrative procedures issued by the Authority. An environmental impact assessment study shall include Environmental Guidelines and Standards (National Legislation, International guidelines. International Conventions and Treaties). (EIA/EA 2003, Third Schedule)</p>	<p>There is no gap between Kenyan laws and JBIC Guidelines in terms of compliance of Laws and Standards. However, Kenyan laws do not clearly stipulate the considerations on involuntary resettlement and indigenous peoples.</p>

JBIC Guidelines/ Comprehensive World Bank Safeguard Policies	Relevant Kenyan Laws and Regulations	Comparison/Gaps
<p>Environmental impact to be investigated and examined includes factors that impact human health and safety as well as the natural environment, such as: air, water, soil, waste, accidents, water usage, ecosystems, and biota. Social concerns include: involuntary resettlement of the population, the indigenous people, cultural heritage, landscape, gender, children's rights and communicable diseases such as HIV/AIDS and impact that may lead to trans-boundary and global environmental problems</p>	<p>The following issues may, among others, be considered in the making of environmental impact assessments.</p> <ol style="list-style-type: none"> 1. Ecological considerations 2. Social considerations 3. Landscape 4. Land uses 5. Water <p>(EIA/EA 2003, Second Schedule)</p>	<p>There is no gap between Kenyan laws and JBIC Guidelines in terms of environmental considerations.</p>
<p>During the screening process, each project is classified in terms of its potential environmental impact. The subsequent environmental review will then be conducted in accordance with the procedures for that category.</p> <p>Category A: Borrowers and related parties must submit Environmental Impact Assessment (EIA) reports. For projects that will result in large-scale involuntary resettlement, basic resettlement plans must be submitted.</p> <p>Category B: Where an EIA procedure has been conducted, the EIA report may be referred to.</p>	<p>Any person, being a proponent of a project, shall submit a project report to the Authority. (EMCA 1999, 58 (1))</p> <p>Where the Authority is satisfied that the project will have no significant impact on the environment or that the project report discloses sufficient mitigation measures, the Authority may issue a licence.</p> <p>If the Authority finds that the project will have a significant impact on the environment, and the project report discloses no sufficient mitigation measures, the Authority shall require that the proponent undertake an environmental impact assessment study. (EIA/EA 2003, 10 (2)(3))</p>	<p>A project which is likely to have a significant negative impact is required to conduct the EIA study and approved by NEMA.</p> <p>However project categorization is not stipulated in Kenya EIA regulations. The criteria which determine the necessity of the EIA study based on the Project Report have not been clearly defined.</p> <p>In addition, Kenyan laws do not stipulate the requirement of Resettlement Action Plan and Indigenous People Plan.</p>
<p>For projects with a potentially large environmental impact, sufficient consultations with stakeholders, such as local</p>	<p>During the process of conducting an environmental impact assessment study, the proponent shall seek the views of</p>	<p>There is no gap between Kenyan laws and JBIC Guidelines in terms of</p>

JBIC Guidelines/ Comprehensive World Bank Safeguard Policies	Relevant Kenyan Laws and Regulations	Comparison/Gaps
<p>residents, must be conducted via disclosure of information from an early stage where alternative proposals for the project plans may be examined. The outcome of such consultations must be incorporated into the contents of the project plan.</p> <p>Consultations with relevant stakeholders, such as local residents, should take place if necessary throughout the preparation and implementation stages of a project. Having consultations is highly desirable, especially when the items to be considered in the EIA are being selected, and when the draft report is being prepared.</p>	<p>persons who may be affected by the project.</p> <p>In seeking the views of the public, after the approval of the project report by the Authority, the proponent shall publicize the project and its anticipated effects and benefits. The proponent shall hold at least three public meetings with the affected parties and communities to explain the project and its effects, and to receive their oral or written comments.</p> <p>(EIA/EA 2003, 17 (1)(2))</p> <p>CPP should be undertaken mainly during project planning, in implementation and decommissioning phases. (EIA/EA Guidelines 2002)</p>	<p>Consultation and Public Participation.</p>
<p>EIA reports are required to be made available in the country and to the local residents where the project is to be implemented. The EIA reports are required to be available at all times for perusal by project stakeholders such as local residents and that copying be permitted.</p>	<p>The Authority shall, at the expense of the proponent, publish a public notice inviting the public to submit oral or written comments on the environmental impact assessment study report.</p> <p>The invitation for public comments under this regulation shall state:</p> <ul style="list-style-type: none"> (a) the nature of the project; (b) the location of the project; (c) the anticipated impacts of the project and the proposed mitigation measures to respond to the impacts; (d) the times and place where the full report can be inspected; and (e) the period within which the Authority shall receive 	<p>The EIA study report is disclosed by NEMA according Kenyan EIA regulations. On the other hand, information disclosure by the proponent is not stipulated in the regulations.</p> <p>However the proponent shall hold at least three public meetings with the affected parties and communities to explain the project and its effects and benefits.</p>

JBIC Guidelines/ Comprehensive World Bank Safeguard Policies	Relevant Kenyan Laws and Regulations	Comparison/Gaps
	comments. (EIA/EA 2003, 21 (2)(3))	
<p>Confirms that the results of monitoring the items which have a significant environmental impact by the project proponents. This is in order to confirm the project proponents' undertaking of environmental and social considerations for category A and B projects.</p> <p>The information necessary for monitoring needs to be supplied by the borrowers and related parties by appropriate means. When necessary, JBIC may also conduct its own investigations.</p> <p>The results of its environmental reviews of project in Categories A, B and FI are provided for public perusal on the website.</p>	<p>In executing a project, after the environmental impact assessment study report has been approved by the Authority, or after the initial audit of an ongoing project, the proponent shall take all practical measures to ensure the implementation of the environmental management plan by:</p> <p>(a) carrying out a self-auditing study on a regular basis;</p> <p>(b) preparing an environmental audit report after each audit and submitting the report to the Authority annually or as may be prescribed by the Authority; and</p> <p>(c) ensuring that the criteria used for the audit is based on the environmental management plan developed during the environmental impact assessment process or after the initial audit. (EIA/EA 2003, 34)</p>	<p>There is no gap between Kenyan laws and JBIC Guidelines in terms of monitoring implementation.</p> <p>However the monitoring for the project which was screened out and prepared only Project Report is not stipulated in the EIA regulations.</p>

Source: JICASurvey Team based on the information provided by JICA

Table A11-A2 Comparison of Kenyan and World Bank Policies/JBIC Guideline on Resettlement and Compensation

Types of Affected Persons/Lost Assets	Kenyan Law	World Bank OP4.12/JBIC Guidelines	Comparison/Gaps	Countermeasure and/or Recommendations to Bridge the Comparison/Gaps
Section I : Property and Land Rights				
Land Owners	There are two systems of substantive land law, three systems of conveyances, and five systems of registration. The two systems of substantive law are under: (i) the Indian Transfer of Property Act 1882 as amended by 1959 Amendment Act; and (ii) the Registered Land Act. The three systems of conveyances are those applicable to land registered under: (i) Government Land Act Chapter 280, part X Laws of Kenya and Land Titles Act Chapter 282, Part III Laws of Kenya; and (iii) Registered Land Act. The five registration systems are those under the: (i) Government Land Act; (ii) Registration of Titles Act; (iii) Land Titles Act; (iv) Registration of Documents Act Chapter 285 Law of Kenya; and (v) Registered Land Act.	Through census and socio-economic surveys of the affected population, identify, assess, and address the potential economic and social impacts of the project that are caused by involuntary taking of land (e.g., relocation or loss of shelter, loss of assets or access to assets, loss of income sources or means of livelihood, whether or not the affected person must move to another location) or involuntary restriction of access to legally designated parks and protected areas. Land-for-land exchange is the preferred option; compensation is to be based on replacement cost.	Kenya has no specific legislation that explicitly addresses the issues of involuntary resettlement or forced evictions. There are laws and legislations that have provisions referring to resettlement but they vary in substance and process.	From the socio-economic survey, it proved that the project has been supported and hence there is no compulsory acquisition to be invoked. The replacement costs approach will apply in compensation packaging in line with World Bank OP4.12/JBIC guidelines.
Land Tenants/Informal	Rentals and leases are valued separately. Landlord and tenant	For those without formal legal rights to lands or claims to such	Those without formal legal rights or claims to such lands are not	From the socio-economic survey, most tenants were observed to

Types of Affected Persons/Lost Assets	Kenyan Law	World Bank OP4.12/JBIC Guidelines	Comparison/Gaps	Countermeasure and/or Recommendations to Bridge the Comparison/Gaps
Settlers	(shops, hotels catering, small businesses) Cap 301 Section 4 of the Act provides that: (i) notwithstanding the provisions of any other written law or anything contained in the term and conditions of a controlled tenancy, no such tenancy shall terminate or be terminated, and no term or condition in, or right or service enjoyed by the tenant of, any such tenancy shall be altered, otherwise than in accordance with the following provisions of this Act; (ii) a landlord who wished to terminate a controlled tenancy, or to alter, to the detriment of the tenant under, such a tenancy, shall give notice in that behalf to the tenant in the prescribe form.	land that could be recognized under the laws of the country, the government should provide resettlement assistance in lieu of compensation for land, to help improve or at least restore those affected persons' livelihood.	entitled to be resettled or compensated.	have only 2 month-worth of rent as deposit held by the landlord. Therefore they will be given adequate notice to vacate to ensure that such deposits are exhausted. However, in case of commercial leases, the remaining equivalent of the lease will be paid to tenants as compensation.
Land Users	Sections 117 and 118 cover expropriation of unregistered trust lands. Parliament may empower a county council to set apart trust land for: (i) the use and occupation of any public body or authority for public purposes; (ii) prospecting or	Identify and address impacts also if they result from other activities that area: (a) directly and significantly related to the proposed project, (b) necessary to achieve its objectives, and (c) carried out or planned to be carried out contemporaneously	No equivalence between World Bank/JBIC and Kenyan system for identifying and addressing impacts resulting from project related activities.	The Supplementary RAP came across households that were allocated county council land in the Shika- Adabu area. However, since they are all willing to surrender the land for road construction, Compulsory acquisition will not apply.

Types of Affected Persons/Lost Assets	Kenyan Law	World Bank OP4.12/JBIC Guidelines	Comparison/Gaps	Countermeasure and/or Recommendations to Bridge the Comparison/Gaps
	<p>mining purposes; or (iii) the use and occupation of any person or persons for a purpose which is likely to benefit the residents of the area. Trust lands refer to that land that is still under African customary tenure. The title of this land is said to vest in the Country Council in trust for its inhabitants, hence the term “Trusts”(Land Acquisition Act Chapter 288).</p>	<p>with the project.</p>		<p>Instead, compensation will be paid as per the replacement cost approach.</p>
<p>Owners of Non-permanent Buildings</p>	<p>There are no specific provisions in Kenya law and regulation dealing separately with non-permanent building.</p>	<p>For those without formal legal rights to lands or claims to such land or assets that could be recognized under law of the country, World Bank/JBIC policy provides for resettlement assistance in lieu of compensation for land, to help improve or at least restore their livelihoods.</p>	<p>World Bank OP 4.12 states that if the impacts include physical relocation, the resettlement plan or resettlement policy framework includes measures to ensure that the displaced persons are- (i) provided assistance (such as moving allowances) during relocation; and (ii) provided with residential housing, or housing sites, or, as required, agricultural sites for which a combination of productive potential, locational advantages, and other factors is at least equivalent to the advantages of the old site. The Kenyan system does not allow</p>	<p>Majority of the houses affected by the Project are temporary dwellings. However the Supplementary RAP should not discriminate in compensation between permanent and non-permanent buildings.</p>

Types of Affected Persons/Lost Assets	Kenyan Law	World Bank OP4.12/JBIC Guidelines	Comparison/Gaps	Countermeasure and/or Recommendations to Bridge the Comparison/Gaps
			for provision of residential housing for project affected people and is only in favor of compensation.	
Owners of Permanent Buildings	There are no specific provisions in Kenya law and regulation dealing separately with permanent buildings.	Entitled to in-kind compensation or cash compensation at full replacement cost including labor and relocation expenses, prior to displacement.	As above	As above
Section II : Resettlement and Compensation Process				
Calculation of Compensation and Valuation	According to the Land Acquisition Act Chapter 295 Section 10, the Collector of Compensation inspects the affected land and values it for compensation. After the inquiry, the Collector will issue an award depending on his own assessment. The award is issued in a prescribed form, together with a statement form. The prescribed form indicates the amount of compensation awarded, while the statement gives the landowners the option of acceptance or rejection of the award. If the land owner accepts the award, the collector will issue a cheque in settlement together	Bank policy requires: (a) prompt compensation at full replacement cost for loss of assets attributable to the project; (b) of there is relocation, assistance during relocation, and residential housing, or housing sites, or agricultural sites of equivalent productive potential, as required; (c) transitional support and development assistance, such as land preparation, credit facilities, training or job opportunities as required, in addition to compensation measures; (d) cash compensation for land when the impact of land acquisition on livelihoods is minor; and (e) provision of civil infrastructure	There are no equivalent provisions on relocation assistance, transitional support, or the provision of civic infrastructure.	World Bank O.P 4.12/JBIC Guidelines should be applied.

Types of Affected Persons/Lost Assets	Kenyan Law	World Bank OP4.12/JBIC Guidelines	Comparison/Gaps	Countermeasure and/or Recommendations to Bridge the Comparison/Gaps
	with a formal “Notice of Taking Possession and Vesting” (Section 19). Compensation is based on the market value for private land (Section 19).	and community services as required.		
Relocation and Resettlement	The Registration Land Act Chapter 300 provides for the absolute proprietorship over (exclusive rights) by the state, and such land can be acquired by the land under the Land Acquisition Act in the project area. Furthermore, the Land Acquisition Act Chapter 95 provides for ascertainment of interests prior to land registrations under Registered Lands Act.	To avoid or minimize involuntary resettlement and, where this is not feasible, to assist displaced persons in improving or at least restore their livelihoods and standard of living in real terms relative to pre-displacement levels or to levels prevailing prior to the beginning of project implementation, whichever is higher.	Kenyan laws do not appear to make provisions for avoidance of minimizing of involuntary resettlement.	The Supplementary RAP came across very few cases where absolute relocation will be required. In most cases, households will be relocated to their properties to another part of the same land away from the designated road reserve hence eliminating the need for resettlement.
Completion of Resettlement and Compensation	According to the new constitution, “every person having an interest or right in or over property which is compulsory taken possession of or whose interest in or right over any property is compulsorily acquired shall have a right of direct access to the High Court for the determination of his interest or right, the legality of	Implement all relevant resettlement plans before project completion and provide resettlement entitlements before displacement or restriction of access. For projects involving restrictions of access, impose the restrictions in accordance with the timetable in the plan of actions.	There is no equivalence between Kenyan law and World Bank policies on implementing relevant resettlement plans before project completion or on providing resettlement entitlements before displacement or restriction of access.	Compensation will be paid before ground breaking in line with the new constitution.

Types of Affected Persons/Lost Assets	Kenyan Law	World Bank OP4.12/JBIC Guidelines	Comparison/Gaps	Countermeasure and/or Recommendations to Bridge the Comparison/Gaps
	the taking of possession or acquisition of the amount of any compensation to which he is entitled;			
Livelihood Restoration and Assistance	There are no specific provisions for livelihood restoration, but references are made to some for assistance.	Livelihoods and living standards are to be restored in real terms to pre-displacement levels or better.	Kenyan policy and legislation would need to be aligned with Bank policy to effectively guarantee rights of all affected persons of involuntary resettlement.	World Bank OP 4.12/JBIC Guidelines should be applied. Thus, all livelihood affected persons, fishermen and fish traders, boat owners operators, small scale traders, boda-boda operators etc. have been allocated for in the Entitlement Matrix in the RAP.
Consultation and Disclosure	Land Acquisition Act Cap 295, Section 3 also provides that: "Where the Minister is satisfied that the need is likely to arise for the acquisition of some particular land under section 6, the Commissioner may cause notice thereof to be published in the Gazette, and deliver a copy of the notice to every person who appears to him to be interested in the land.	Consult project-affected persons, host communities and local NGOs, as appropriate. Provide them opportunities to participate in the planning, implementation, and monitoring of the resettlement program, especially in the process of developing and implementing the procedure for determining eligibility for compensation benefits and development assistance (as documented in a resettlement plan), and for establishing appropriate and accessible grievance mechanism.	Even though notices are made in the Gazette, the practice has been that where a mitigation plan affects local communities, proceedings are conducted in the local language. This is significant considering the compensation of those most likely to be affected(e.g. squatters).	The entire project was disclosed in local media in line with EMCA 1999. Further, a total of 15 meetings were held to disclose the Project inclusive of the Supplementary RAP in line with World bank OP4.12/JBIC Guidelines.

Types of Affected Persons/Lost Assets	Kenyan Law	World Bank OP4.12/JBIC Guidelines	Comparison/Gaps	Countermeasure and/or Recommendations to Bridge the Comparison/Gaps
Section III : Dispute Resolution				
Grievance Mechanism and Dispute Resolution	Grievance procedures may be invoked at any time, depending on the complaint. No person or community from whom land or other productive assets are to be taken will be required to surrender those assets until any complaints she/he has about the method or value of the assets or proposed measures are satisfactorily resolved.	Establish appropriate and accessible grievance mechanisms.		A practical grievance redress procedure has been proposed for in this RAP in line with World Bank OP 4.12/JBIC Guidelines.

Source: Safeguards Diagnostic Review for Piloting the Use of Kenyan Systems to Address Environmental Safeguard Issues in the Proposed World Bank-Assisted Kenya Energy Development and Access Project (KEDAP), December 2006

APPENDIX A2

List of Vascular Plants, Birds and Butterflies in the Study Area

Appendix A2-1 List of Vascular Plants in the Study Area

Appendix A2-2 List of Birds in the Study Area

Appendix A2-3 List of Butterflies in the Study Area

Appendix A2-1 List of Vascular Plants in the Study Area

No.	Botanical Name	Life Form	Vernacular Name (Digo/ Duruma)	Local Values/Uses
1	<i>Panicum maximum</i>	Grass	Bondo	Used for making a broom and fodder
2	<i>Pyrenacantha kaurabassana</i>	Liana	Bundi/Ganzi	Used for making container that carry chicken feeds
3	<i>Tephrosia villosa</i>	Herb	Chibalazi chanze	Medicine for coughs, fever and pains
4	<i>Commiphora lindensis</i>	Tree	Chibambara	Medicine for pregnancy ailment [<i>shango</i>],
5	<i>Hypoestes forskaolei</i>	Herb	Chibaruti	-
6	<i>Plicosepalus curviflorus</i>	Liana	Chibugu sicho kolo	Medicine for stomach-ache
7	<i>Toddaliopsis sansibariensis</i>	Shrub	Chidimu tsaka	Medicine for mouth wounds, snake bite and spiritual ailments
8	<i>Harrisonia abyssinica</i>	Shrub	Chidori	Medicine for chest pains, menstrual disorders, and for liver ailments.
9	<i>Phyllanthus amarus</i>	Herb	Chihumbo utsungu	Medicine for stomach-ache
10	<i>Capparis viminea</i>	Shrub	Chikombe tsui	Medicine for urinal track infection, stomach-ache and abnormal vaginal secretion
11	<i>Acacia adenocalyx</i>	Tree	Chikwata	Medicine for boils, septic swellings and snake bites. Also for fuelwood and poles.
12	<i>Acacia mellifera</i>	Tree	Chikwata kombe	Medicine for convulsions and snakebite; used for fuelwood and building poles.
13	<i>Oxygonum sinuatum</i>	Herb	Chindiri	Vegetable
14	<i>Clerodendrum glabrum</i>	Shrub	Chinuka cha mmasai	-
15	<i>Cissampelos pareira</i>	Herb	Chisikio paka	Leaves chewed in a special prayer for good luck
16	<i>Ormocarpum kirkii</i>	Tree	Chitadzi	Medicine for septic swells and magical power
17	<i>Striga asiatica</i>	Herb	Chitsai	Used for magical concoction; affects maize crop
18	<i>Encephalartos hildebrandtii</i>	Shrub	Chitsapu	Medicine for asthma
19	<i>Aganthisanthemum bojeri</i>	Herb	Chivuma nyuchi	Medicine for pregnancy complications [<i>shango</i>], skin disease and convulsions
20	<i>Ocimum suave</i>	Herb	Chivumbani	Used as tea to treat uterus complexion [<i>shango</i>],
21	<i>Synadenium pereskiiifolium</i>	Shrub	Chiyuyu	Used as a fish poison
22	<i>Euphorbia hirta</i>	Herb	Chiziyaziya	Medicine for boils and septic swells
23	<i>Asystasia gangetica</i>	Herb	Futswe	Vegetable
24	<i>Euphorbia nyikae</i>	Shrub	Ganga	Latex is poisonous
25	<i>Aloe sp.</i>	Shrub	Golonje	Medicine for array of diseases
26	<i>Adenia gummifera</i>	Liana	Gore	Medicine for cough and body pains
27	<i>Hypoestes aristata</i>	Herb	Jirimata futswe	-

No.	Botanical Name	Life Form	Vernacular Name (Digo/ Duruma)	Local Values/Uses
28	<i>Cenchrus mitis</i>	Herb	Jirimata lume	-
29	<i>Commelina benghalensis</i>	Herb	Kongwe	Concoction for cleaning evil in society
30	<i>Sansevieria kirkii</i>	Shrub	Konje tsaka	Leaves for tying materials
31	<i>Afzelia quanzensis</i>	Tree	Mbambakofi	Timber
32	<i>Abutilon zanzibaricum</i>	Shrub	Mbangula mavi	Used as wipes in toiletry
33	<i>Abutilon sp</i>	Shrub	-	-
34	<i>Grewia forbesii</i>	Shrub	Mbavubavu mkulu	Medicine for child diseases, fruits edible
35	<i>Ancylobotrys petersiana</i>	Liana	Mbohoya	Fruits edible, wood for crafting
36	<i>Annona senegalensis</i>	Shrub	Mbokwe	Fruits edible; medicine for <i>shango</i>
37	<i>Bourreria nemoralis</i>	Shrub	Mbunduchi	Building poles, fuel-wood and medicine for kidney problems
38	<i>Dichrostachys cinerea</i>	Tree	Mchinjiri	Medicine for stomach-pain [<i>mshipa</i>], waist pain [<i>nyongoo</i>], and also for fuel-wood, building pole
39	<i>Lannea schweinfurthii</i>	Tree	Mchumbu	Gum used in oil as perfume; used for making canoe, medicine to induce labour pains
40	<i>Hyparrhenia sp.</i>	Herb	Mdembe	Used for making music instrument [<i>kayamba</i>] and for thatching house
41	<i>Suregada zanzibariensis</i>	Tree	Mdimutsaka	Building poles; medicine for antenatal complications [<i>chau cha mwadzulu</i>] and chest pain
42	<i>Cissus rotundifolia</i>	Liana	Mdokadoka	Medicine to induce menstrual periods; Used for tying guard collecting palm wine during tapping
43	<i>C. quinquangularis</i>	Tree	Mdokdoka	Used for tying guard on palm during wine tapping
44	<i>Thevetia peruviana*</i>	Shrub	Mkode	Hedge and shade plants
45	<i>Zanthoxylum chalybeum</i>	Tree	Mdungu	Medicine for body pains, septic swells, and cough; used as a tea, building poles and for fuel-wood.
46	<i>Hibiscus sabdariffa*</i>	Shrub	Maua	Ornamental; Blood booster to the sick
47	<i>Bruguiera gymnorhiza</i>	Tree	Mdzaigo/Mkoko bara	Timber, fuel-wood, and fence posts
48	<i>Catunaregam nilotica</i>	Shrub	Mdzongodzongo	Medicine for constipation and indigestion
49	<i>Garcinia livingstonei</i>	Shrub	Mfidzofidzo	Building poles, made cooking sticks [<i>fidzofidzo</i>]
50	<i>Vitex payos</i>	Tree	Mfudu	Fruits are edible
51	<i>Vitex mombassae</i>	Tree	Mfudu madzi	-Medicine for gonorrhoea and body5 swells [<i>mburushi</i>]; also source of building materials

No.	Botanical Name	Life Form	Vernacular Name (Digo/ Duruma)	Local Values/Uses
52	<i>Canthium kilifiensis</i>	Shrub	Mfumula ndolwa	Prohibited from use as fuel-wood or building poles
53	<i>Schlechterina mitostemmatoides</i>	Liana	Mfunga nyama	Used as tying material for traps and snares
54	<i>Heinsia crinita</i>	Shrub	Mfyofyo	Fruits are edible; stem used for making arrows
55	<i>Sterculia rhynchocarpa</i>	Tree	Mgoza	Bark for tying materials; medicine for labour pain induction
56	<i>Acacia stuhlmannii</i>	Tree	Mgunga	
57	<i>Lantana camara**</i>	Shrub	Mjasasa	Fruits edible
58	<i>Flueggea virosa</i>	Shrub	Mkambavitu	Medicine for stomach-ache and kidney problem
59	<i>Crotalaria emarginata</i>	Herb	Mkelekele	Medicine for eye infection
60		Herb	Komba	Vegetable
61	<i>Vitellariopsis kirkii</i>	Shrub	Mkilishangwe	Building poles and wood-fuel
62	<i>Sideroxylon inerme</i>	Tree	Mkoko bara/Mziyaziya	Low quality timber, poles, firewood
63	<i>Hyphaene compressa</i>	Tree	Mkoma	Wood fuel, fruits are edible, and can harvest palm wine from the tree.
64	<i>Grewia plagiophylla</i>	Tree	Mkone	Building poles for sacred 'hut', for making carves for ancestor [<i>vigango</i>], medicine for stomach pain [<i>shango</i>] and diarrhoea.
65	<i>Grewia densa</i>	Shrub	Mkone chibugu	Medicine for sexual promiscuity
66	<i>Balanites wilsoniana</i>	Tree	Mkonga	Medicine for muscle pains and tissue injuries
67	<i>Combretum schumannii</i>	Tree	Mkongolo	Timber, building poles, for making house hold tools (hoe), and for wood-fuel.
68	<i>Ziziphus mauritiana</i>	Tree	Mkunazi	Fruits edible
69	<i>Terminalia catappa</i>	Tree	Mkungu	Shade tree, fruits are edible
70	<i>Sorindeia madagascariensis</i>	Tree	Mkunguma	Fruits are edible
71	<i>Digitaria milanjana</i>	Herb	Mkuse	Fodder
72	<i>Ficus sp</i>	Tree	Mkuyu	-
73	<i>Tamarindus indica</i>	Tree	Mkwadzu	Fruits are edible, used as a spice; sticks for making walking/fighting sticks; medicine for <i>mshipa</i>
74	<i>Strychnos madagascariensis</i>	Tree	Mkpwakwa	Fruits are edible
75	<i>Phyllanthus reticulatus</i>	Shrub	Mkpwamba lungu	Medicine for convulsions, and snakebite
76	<i>Sclerocarya birrea</i>	Tree	Mng'ongo	Timber, and fruits are edible,
77	<i>Uvaria acuminata</i>	Shrub	Mngweni mchetu	Used for making magical protective charm. Medicine for <i>nyongoo</i> , coughs, snakebite

No.	Botanical Name	Life Form	Vernacular Name (Digo/ Duruma)	Local Values/Uses
78	<i>Uvaria lucida</i>	Shrub	Mngweni mlume	Used to make protective charm against 'evil eye'
79	<i>Cussonia zimmermannii</i>	Tree	Mnyala	Used in witchcraft, timber used in funeral rites.
80	<i>Parkia filicoidea</i>	Tree	Mnyendze	Timber
81	<i>Flacourtia indica</i>	Shrub	Mnyondoya	Fruits are edible, source of fuelwood.
82	<i>Keetia zanzibarica</i>	Shrub	Mnyundzu	Fruits are edible
83	<i>Triumfetta rhomboidea</i>	Herb	Mnyururika	-
84	<i>Markhamia zanzibarica</i>	Tree	Mpalawanda	Timber, building poles, wood-fuel, and for crafting
85	<i>Gloriosa superba</i>	Herb	Mpewa	-
86	<i>Achyranthes aspera</i>	Herb	Mphulula mbuzi	Medicine for STD [<i>tego</i>] that are magically induced
87	<i>Acacia zanzibarica</i>	Tree	Mpiga kululu	Building poles, wood-fuel
88	<i>Deinbollia borbonica</i>	Shrub	Mpwakapwaka	Fruits edible, medicine for diabetes, and strengthens penile erection
89	<i>Diospyros squarrosa</i>	Tree	Mpweke	Fruits edible, stem is used for building poles, to make bows and walking sticks. Medicine for <i>nyongoo</i> .
90	<i>Lecaniodiscus fraxinifolius</i>	Tree	Mremero	Fruits edible, building poles and fuel-wood
91	<i>Sesamum calycinum</i>	Herb	Mrenda	Vegetable
92	<i>Dioscorea dumetorum</i>	Herb	Mriga	Tuber edible (famine food)
93	<i>Brachystegia spiciformis</i>	Tree	Mrihi	Timber
94	<i>Pluchea dioscoridis</i>	Herb	Mrinda ziya	Medicine for spiritual ailments
95	<i>Commiphora edulis</i>	Shrub	Mryakwembe	Used as hedge plant; medicine for child diseases
96	<i>Hugonia castaneifolia</i>	Liana	Chikuro	Medicine for snakebite
97	<i>Ficus exasperata</i>	Tree	Msasa	Used as sandpaper in carpentry and crafting
98	<i>Senna occidentale</i>	Herb	Mtsalafu	Medicine for stomach-ache [<i>dzongo</i>]
99	<i>Albizia versicolor</i>	Tree	Mtsani ndzovu	Timber
100	<i>Acalypha fruticosa</i>	Shrub	Mtsatsa	Medicine for spiritual ailments
101	<i>Grewia glandulosa</i>	Shrub	Mtsaye	-
102	<i>Hoslundia opposita</i>	Shrub	Mtserere	Fruits edible, Medicine for fresh wounds
103	<i>Polysphaeria parvifolia</i>	Shrub	Mtsonga nyomba	Used for making arrows
104	<i>Hibiscus micranthus</i>	Herb	Mtsunga ng'ombe	Used in witchcraft
105	<i>Launaea cornuta</i>	Herb	Mtsunga wa utsungu	Vegetable

No.	Botanical Name	Life Form	Vernacular Name (Digo/ Duruma)	Local Values/Uses
106	<i>Jasminum meyeri-johannis</i>	Shrub	Mtunda hofu	Used in oil to give scent
107	<i>Ximenea americana</i>	Shrub	Mtundukula	Fruits edible, fuelwood
108	<i>Solanum incanum</i>	Shrub	Mtungudza koma	Medicine for evil eye [<i>dzongo</i>]
109	<i>Strychnos spinosa</i>	Tree	Muhonga	Fruit edible, medicine for pregnancy complications
110	<i>Thespesia danis</i>	Shrub	Muhowe	Used in traditional cleansing, and burial rites
111	<i>Senna singueana</i>	Shrub	Muhumba	Medicine for venereal diseases [<i>tego</i>] and pregnancy complications [<i>nyongoo</i>]
112	<i>Julbernardia magnistipulata</i>	Tree	Mukwe	Timber, building pole, and tying material
113	<i>Ricinus communis</i>	Shrub	Muono	Source of oil used in cultural rites
114	<i>Dalbergia melanoxylon</i>	Tree	Muphingo	Poles, fence posts, fuelwood and carving
115	<i>Avicennia marina</i>	Tree	Mutsu	Fuelwood
116	<i>Saba comorensis</i>	Liana	Muungo	Fruits edible and stem used for crafting
117	<i>Premna hildebrandtii</i>	Shrub	Muurusa pungu	Medicine for child diseases
118	<i>Haplocoelum inoploeum</i>	Tree	Mfungu-sanzu	Woodfuel
119	<i>Adansonia digitata</i>	Tree	Muuyu	Fruit edible, leaves are vegetable.
120	<i>Millettia usaramensis</i>	Shrub	Mvamva	Building poles
121	<i>Vangueria infausta</i>	Tree	Mviru	Fruits edible, wood prohibited from use as fuel
122	<i>Premna chrysoclada</i>	Shrub	Mvuma	Medicine for child diseases
123	<i>Allophylus rubifolius</i>	Shrub	Mvundza kondo	Medicine for complications in pregnancy [<i>shango</i>], convulsions, and persistent headache [<i>mkomo</i>].
124	<i>Kigelia africana</i>	Tree	Mvungunya	-
125	<i>Adenium obesum</i>	Shrub	Mwadiga	Medicine for bewitched persons; known poisonous
126	<i>Rottboellia exaltata</i>	Grass	Mwamba nyama	-
127	<i>Bridelia cathartica</i>	Shrub	Mwambeberu	Fruits used in children games
128	<i>Eucalyptus</i> sp.*	Tree	-	Timber
129	<i>Terminalia sambesiaca</i>	Tree	Mwanga	Timber, building poles, fuel-wood, wood used for making spiritual markers [<i>vigango</i>] for ancestors
130	<i>Abrus precatorius</i>	Herb	Mwangala nyuchi	Medicine for asthma
131	<i>Bombax rhodognaphalon</i>	Tree	Mware	Medicine for diarrhoea [<i>ndani za peho</i>], cough, asthma, and used to make charm for cleansing kaya

No.	Botanical Name	Life Form	Vernacular Name (Digo/ Duruma)	Local Values/Uses
132	<i>Azadirachta indica</i> **	Tree	Mwarubaini	Medicine for array of diseases, shade plant, and for carving
133	<i>Cyphostemma adenocaula</i>	Shrub	Mwenjere	-
134	<i>Vanilla roscherii</i>	Liana	Mkazikazi	Medicine to induce release of after-birth
135	<i>Asparagus falcatus</i>	Herb	Mwinika ngulu	Used in witchcrafting
136	<i>Syzygium cumini</i>	Tree	Mzambarau	Timber, Fruits edible, and shade plant.
137	<i>Mariscus spp.</i>	Herb	Ndago lume	Used in magical aspects.
138	<i>Sterculia appendiculata</i>	Tree	-	-
139	<i>Sterculia rhyncocarpa</i>	Tree	Mgoza	Tying material
140	<i>Kyllinga erecta</i>	Herb	Ndago munda	-
141	<i>Cyperus rotundus</i>	Herb	Ndago ziya	-
142	<i>Synaptolepis kirkii</i>	Herb	Njira mbiri	Used in witchcraft and spiritual ailments
143	<i>Gossypoides kirkii</i>	Shrub	Pamba mwitu	-
144	<i>Vernonia hildebrandtii</i>	Shrub	Phatsa	Used as symbolic/spiritual markers [<i>koma</i>]
145	<i>Corchorus olitorius</i>	Herb	Phombo	Vegetable
146	<i>Hyptis suaveolens</i>	Herb	Pungahewa	Used in magical treatments
147	<i>Solanecio angulatus</i>	Herb	Reza	Used in spiritual treatment
148	<i>Bidens pilosa</i>	Herb	Todza	Vegetable
149	<i>Heteropogon contortus</i>	Herb	Todza	-
150	<i>Ocimum gratissimum</i>	Herb	Vumbamanga	Used to attract bees into beehive; medicine for toothache and body swells [<i>mwadzulu</i>]
151	<i>Psychotria sp.</i>	Shrub	Mkamasi	Medicine for convulsions
152	<i>Psydrax sp.</i>	Shrub	-	-
153	<i>Agave siselana</i> *	Shrub	Konje	Boundary marker, tying material and roofing poles
154	<i>Cassia siamea</i> *	Tree	Mkarabai	Shade plant, timber, fuel-wood and building poles
155	<i>Cassia afrodistula</i>	Tree	Muhumba-mkulu	Woodfuel
156	<i>Manilkara mochisa</i>	Tree	Mnago	stem is used for making traditional1 beehives, and wood used for making domestic tools e.g. combs. Medicine for coughs, colds and snakebites.
157	<i>Antidesma venosum</i>	Shrub	Mdzenga-tsongo	Root bark chips rubbed to fishing nets to increase its strength
158	<i>Diospyros cornii</i>	Tree	Mkulu	Timber, building poles, fruits edible. Used for making magical charm and treat spiritual ailments

No.	Botanical Name	Life Form	Vernacular Name (Digo/ Duruma)	Local Values/Uses
159	<i>Sonnerata alba</i>	Tree	Mpie	Timber, poles, and fuelwood
160	<i>Ceriops tagal</i>	Tree	Mkandaa	Timber and fuelwood
161	<i>Rhizophora mucronata</i>	Tree	Mkoko	Timber, pole, fuelwood
162	<i>Lumnitzera racemosa,</i>	Tree	Kikandaa	Fuelwood, and for making boat 'ribs'
163	<i>Heritiera littoralis,</i>	Tree	Msindikazi	Timber
164	<i>Xylocarpus granatum,</i>	Tree	Mkomafi	Timber, fuel-wood and carving
165	<i>X. moluccensis,</i>	Tree	Mkomafi-dume	Fuel-wood
166	<i>Avicennia marina,</i>	Tree	Mutsu	Fuel-wood
167	<i>Bruguiera gymnorrhiza,</i>	Tree	Mkoko-mwagala	Timber, poles, fuel-wood
168	<i>Tricalysia ovalifolia</i>	Shrub	Mmangitovu	Concoction for spiritual ailments
169	<i>Carrisa tetramera</i>	Shrub	Mtandambo	Fruits are edible, decoction used to treat spiritual ailments, stomach-ache [<i>shango</i>], and convulsions
170	<i>Combretum hereroense</i>	Liana	Mchira-ng'ombe	Medicine for chest pain, concoction for charm that enhances victory.
171	<i>Lucaena lucosifolia**</i>	Shrub	-	Fodder, building poles, fuel-wood
172	<i>Terminalia spinosa</i>	Tree	Mwanga	Timber, building poles, fuel-wood, ancestral carves [<i>vigango</i>]
173	<i>Casuarina equisetifolia*</i>	Tree	Kaswarina	Timber, building poles, fence posts, fuel-wood.
174	<i>Delonix regia*</i>	Tree	Msukukuu	Shade plant and ornamental
175	<i>Indigofera sp.</i>	Herb	Lihago	Used for making a broom
176	<i>Piliostigma thonningii</i>	Shrub	Mtseketse	Medicine for coughs
177	<i>Euphorbia aphylla</i>	Shrub	-	-
178	<i>Scilla sp.</i>	Herb	-	-
179	<i>Sida acuta</i>	Herb	-	-
180	<i>Surina maritim</i>	Herb	Munyanya-nvula	-
181	<i>Albizia adianthifolia</i>	Tree	Mtsani-tsiye	Timber
182	<i>Tetracera boiviniana</i>	Shrub	Mkalafisi	Medicine for stomach ailments (<i>shango</i>), and venereal diseases (<i>tego</i>). Timber used to make beds
183	<i>Digitalis velutina</i>	Herb	Nyasi	Fodder
184	<i>Pleicosepalous parviflorus</i>	Liana	Chibugu-sichikolo	Magical charm for dominance
185	<i>Aerva lanata</i>	Herb	-	-

No.	Botanical Name	Life Form	Vernacular Name (Digo/ Duruma)	Local Values/Uses
186	<i>Monanthes fornicata</i>	Shrub	Mgweni-mlume	Medicine for pre-natal stomach complications, pains during menses [<i>shango</i>], and body pains
187	<i>Bulbophyllum maximum</i>	Herb	-	-
188	<i>Trichilia emetica</i>	Tree	Mnwa-madzi	-
189	<i>Pandanus kirkii</i>	Tree	Mkadi	Used to treat spiritual ailments
190	<i>Lamprothamnus zanguebaricus</i>	Shrub	Mtsome	Medicine to induce diarrhoea after poisoning; ripe fruits indicate harvesting time during short rains.
191	<i>Salvadora persica</i>	Tree	Mswaki/ Mrungurungu	Timber, poles, and toothbrush (commercialised in urban centres)
192	<i>Opuntia vulgaris</i>	Shrub	Mwatsa	Used as a live fence, fruits are edible.
193	<i>Salacia madagascariensis</i>	Liana	Mdoma	Tying material, and fuel-wood
194	<i>Solanum</i> sp	Herb	-	-
195	<i>Encephalartos hildebrandtii</i> .	Shrub	Chitsapu	Ornamental, medicine for septic swells, and rachis used for making traditional baskets [<i>lungo</i>].
196	<i>Ziziphus mucronata</i>	Tree	Mgugune/ Mgogodera	Decoction used as an infusion /a cold bath for body swellings [<i>mwadzulu</i>].
197	<i>Ipomoea</i> sp.	Liana	-	-
198	<i>Achyrothalamus marginatus</i>	Herb	Mweza-moyo	Decoction to restore penile erection, sexual vigour
199	<i>Talinum portulacifolium</i>	Herb	Komba	Vegetable
200	<i>Albizia anthelmintica</i>	Tree	Mporojo	Timber used for making house-hold items: beds, stool, motors; and traditional bee-hive. Medicine for convulsion
201	<i>Physalis</i> sp.	Herb	-	-
202	<i>Ormocarpum senoides</i>	Climber	Chikwadzu	Medicine for ailment from prohibited sexual relations [<i>maphinga</i>]
203	<i>Flagellaria guineensis</i>	Herb	Kalumwi	Medicine for stomach problems [<i>mshipa</i>]

Note:

(i) Liana stands for true liana, scandent climbers and any twining growth habit.

(ii) asterisk (*) indicate exotic species, and double asterisks (**) indicates invasive species (vernacular names, uses adopted from Pakia (2000))

Appendix A2-2 List of Birds in the Study Area

No	Common Name	Scientific Name	Tsunza	Pungu	Miritini	Mwangala	Port Reitz	Total Tally	Conservation Status	
									IUCN Criteria	AEWA Annex 3 Table 1
1	African broadbill	<i>Smithornis capensis</i>			√	√		2	LC	NE
2	African firefinch	<i>Lagonosticta rubricata</i>		√				1	LC	NE
3	African palm swift	<i>Cypsiurus parvas</i>		√		√		2	LC	NE
4	African pied wagtail	<i>Montacilla aguimp</i>	√	√				2	LC	NE
5	Black kite	<i>Milvus migrans</i>			√			1	NE	NE
6	Black saw-wing	<i>Psalidoprocne pristoptera</i>		√	√			2	LC	NE
7	Black-backed puff-back	<i>Dryoscopus cubla</i>		√			√	2	NE	NE
8	Blue capped cordon-blue	<i>Uraeginthus cyanocephalus</i>				√		1	NE	NE
9	Bronze mannikin	<i>Spermestes cucullatus</i>		√		√		2	NE	NE
10	Brown hooded kingfisher	<i>Halcyon albiventris</i>				√		1	NE	NE
11	Carmine bee eater	<i>Merops nubicoides</i>		√	√	√		3	NE	NE
12	Common bulbul	<i>Pycnonotus barbatus</i>		√			√	2	LC	NE
13	Common drongo	<i>Dicrurus adsimilis</i>	√		√	√	√	4	NE	NE
14	Dimorphic egret	<i>Egretta dimorpha</i>	√					1	NE	NE
15	Emerald-spotted wood dove	<i>Turtur chalcospilos</i>		√	√	√		3	LC	NE
16	Fiery-necked nightjar	<i>Caprimulgus pectoralis</i>	√	√				2	LC	NE
17	Grey penduline tit	<i>Anthoscopus</i>		√				1	LC	NE
18	Grey-headed bush shrike	<i>Malaconotus blanchoti</i>					√	1	LC	NE
19	Hamercop	<i>Scopus umbretta</i>	√					1	LC	NE
20	House crow	<i>Corvus splendens</i>			√			1	LC	NE

No	Common Name	Scientific Name	Tsunza	Pungu	Miritini	Mwangala	Port Reitz	Total Tally	Conservation Status	
									IUCN Criteria	AEWA Annex 3 Table 1
21	House sparrow	<i>Passer domesticus</i>	√		√		√	3	LC	NE
22	Indian house crow	<i>Corvus splendens</i>	√			√	√	3	LC	NE
23	Lesser crested tern	<i>Thalasseus bengalensis</i>	√					1	LC	NE
24	Lilac breasted roller	<i>Coracias caudatus</i>	√		√			2	LC	NE
25	Lizard buzzard	<i>Kaupifalco monogrammicus</i>		√				1	LC	NE
26	Malachite kingfisher	<i>Alcedo cristata</i>	√					1	NE	NE
27	Mangrove kingfisher	<i>Halcyon senegaloides</i>	√					1	LC	NE
28	Mascarene martin	<i>Phedina borbonica</i>			√			1	LC	NE
29	Pale batis	<i>Batis soror</i>		√		√		2	LC	NE
30	Pied crow	<i>Corvus albus</i>				√		1	LC	NE
31	Pied kingfisher	<i>Ceryle rudis</i>				√		1	LC	NE
32	Pigmy falcon	<i>Polyhierax semitorquatus</i>			√	√		2	NE	NE
33	Pintail whydah	<i>Vidua macroura</i>	√					1	NE	NE
34	Plain-backed sunbird	<i>Anthreptes reichenowi</i>	√	√				2	N T	NE
35	Rattling cisticola	<i>Cisticola chiniana</i>		√				1	LC	NE
36	Red cheeked cordon blue	<i>Uraeginthus bengalus</i>	√	√				2	NE	NE
37	Red eyed dove	<i>Streptopelia semitorquata</i>		√	√			2	NE	NE
38	Ring-necked dove	<i>Streptopelia capicola</i>		√		√		2	LC	NE
39	Sooty gull	<i>Lchthyaetus hemiprichii</i>	√					1	LC	NE
40	Speckled mousebird	<i>Colius striatus</i>	√	√	√		√	4	LC	NE
41	Spotted thick-knee	<i>Burhinus capensis</i>	√					1	LC	NE
42	Tropical bouboul	<i>Laniarius aethiopicus</i>			√			1	NE	NE
43	White-browed coucal	<i>Centropus superciliosus</i>		√	√			2	NE	NE
44	Winding cisticola	<i>Cisticola galactotes</i>		√				1	LC	NE

No	Common Name	Scientific Name	Tsunza	Pungu	Miritini	Mwangala	Port Reitz	Total Tally	Conservation Status	
									IUCN Criteria	AEWA Annex 3 Table 1
45	Yellow-throated longclaw	<i>Macronyx croceus</i>		√		√		2	LC	NE
46	African Spoonbill	<i>Platalea alba</i>					√	1	LC	Column B1
47	African Sacred Ibis	<i>Mycteria ibis</i>					√	1	LC	Column B1
48	Yellow-billed Stork	<i>Threskiornis aethiopicus</i>					√	1	LC	Column C1
49	Marabou Stork	<i>Leptoptilos crumeniferus</i>					√	1	LC	Column C1
50	Zanzibar red bishop	<i>Euplectes nigroventris</i>	√		√			2	LC	NE
	Totals	-	18	22	16	15	15	82		

LC= Least Concern; NE= No Entry Found; NT= Near Threatened;
 AWEA= Agreement on the Conservation of African-Eurasian Migratory Waterbirds

Appendix A2-3 List of Butterflies in the Study Area

No.	Scientific Name	Pungu	Miritini	Kiteje	Tsunza	Port Reitz	Mwangala	Total Tally	IUCN Red List category
1	<i>Acraea eponina</i>	√	√	√	√	√	√	6	No Entry Found
2	<i>Acraea insignis</i>		√	√	√	√	√	5	No Entry Found
3	<i>Amauris niavius</i>	√						1	No Entry Found
4	<i>Amauris ochlea</i>							0	No Entry Found
5	<i>Anthene butleri</i>				√			1	No Entry Found
6	<i>Astictopterus stellata</i>			√				1	No Entry Found
7	<i>Axiocerses harpax</i>				√		√	2	No Entry Found
8	<i>Azanus jesous</i>					√		1	No Entry Found
9	<i>Baliochila hildegarda</i>			√				1	No Entry Found
0	<i>Belenois aurota</i>	√						1	No Entry Found
11	<i>Belenois creona</i>			√	√	√	√	4	No Entry Found
12	<i>Belenois thysa</i>							0	No Entry Found
13	<i>Bicyclus safitza</i>	√	√	√		√		4	No Entry Found
14	<i>Byblia anvatarata</i>							0	No Entry Found
15	<i>Byblia ilithyia</i>		√	√	√		√	4	No Entry Found
16	<i>Catopsilia florella</i>		√		√	√	√	4	No Entry Found
17	<i>Charaxes varanes</i>		√		√			2	No Entry Found
18	<i>Colitis दौरा</i>		√	√	√		√	4	No Entry Found
19	<i>Colitis euipe</i>		√		√			2	No Entry Found
20	<i>Colitis vesta</i>	√		√				2	No Entry Found
21	<i>Colotis antevippe</i>		√					1	No Entry Found
22	<i>Colotis danae</i>		√		√		√	3	No Entry Found
23	<i>Colotis protomedia</i>				√			1	No Entry Found
24	<i>Colotis vesta</i>					√		1	No Entry Found
25	<i>Cupidopsis iobates</i>		√					1	No Entry Found

No.	Scientific Name	Pungu	Miritini	Kiteje	Tsunza	Port Reitz	Mwangala	Total Tally	IUCN Red List category
26	<i>Danaus chrysippus</i>	√		√	√	√	√	5	No Entry Found
27	<i>Deudorix antalus</i>		√	√	√			3	No Entry Found
28	<i>Deudorix dinochares</i>						√	1	No Entry Found
29	<i>Euphaedra neophron</i>	√						1	No Entry Found
30	<i>Eurema brigitta</i>	√	√	√				3	No Entry Found
31	<i>Eurema floricola</i>	√	√	√			√	4	No Entry Found
32	<i>Eurema regularis</i>						√	1	No Entry Found
33	<i>Eurytela dryope</i>	√				√		2	No Entry Found
34	<i>Freyeria trochylus</i>			√				1	No Entry Found
35	<i>Graphium angolanus</i>				√			1	No Entry Found
36	<i>Hamanumida daedalus</i>				√			1	No Entry Found
37	<i>Hypolimnas misippus</i>							0	No Entry Found
38	<i>Hypolycaena philippus</i>							0	No Entry Found
39	<i>Junonia hierta</i>							0	No Entry Found
40	<i>Junonia natalica</i>	√	√		√	√	√	5	No Entry Found
41	<i>Junonia oenone</i>	√	√	√	√	√	√	6	No Entry Found
42	<i>Junonia orithya</i>				√			1	No Entry Found
43	<i>Lampides boeticus</i>		√	√	√		√	4	No Entry Found
44	<i>Leptotes adamsoni</i>	√		√				2	No Entry Found
45	<i>Melanitis leda</i>	√		√				2	No Entry Found
46	<i>Papilio demodocus</i>	√	√	√	√	√	√	6	No Entry Found
47	<i>Pardopsis punctatissima</i>		√		√		√	3	No Entry Found
48	<i>Phalanta phalantha</i>						√	1	No Entry Found
49	<i>Physcaeneura leda</i>			√				1	No Entry Found
50	<i>Salamis parhassus</i>					√		1	No Entry Found
51	<i>Spialia kituina</i>		√					1	No Entry Found
52	<i>Tirumala petiverana</i>				√	√		2	No Entry Found
53	<i>Tuxentius calice</i>	√		√	√		√	4	No Entry Found

No.	Scientific Name	Pungu	Miritini	Kiteje	Tsunza	Port Reitz	Mwangala	Total Tally	IUCN Red List category
54	<i>Tuxentius spp</i>		√					1	No Entry Found
55	<i>Vanessa cardui</i>						√	1	No Entry Found
56	<i>Ypthima asterope</i>			√	√	√		3	No Entry Found
57	<i>Zizina antanossa</i>				√	√		2	No Entry Found
58	<i>Zizula hylax</i>	√		√				2	No Entry Found
	Totals	17	21	23	26	16	20	123	

APPENDIX A3
Records of the Stakeholder Consultation Meetings

Appendix A3-1 First Stakeholder Meeting Handout

Appendix A3-2 Minutes of the First Stakeholder Meeting

Appendix A3-3 Second Stakeholder Meeting Handouts

Appendix A3-4 Minutes of the Second Stakeholder Meeting

Appendix A3-1 First Stakeholder Meeting Handout

1st Stakeholder Meeting Handout

**Preparatory Survey on
Mombasa City Road Development Project in
the Republic of Kenya**

Stakeholder Consultation Meeting

12 July 2011
Kenya Petroleum Refinery Estate Hall
14 July 2011
YWCA Social Hall, Shelly Beach Road, Likoni

 Kenya National Highways Authority
JICA Survey Team
(Katahira & Engineers International)




Agenda

1. Opening of the Meeting
2. JICA Preparatory Survey on Mombasa City Road Development Project
 - 2.1 Outline of Preparatory Survey
 - 2.2 Social considerations
 - 2.3 Environmental considerations
3. Discussion
Comments and suggestions by stakeholders
4. Closing of the Meeting

Preparatory Survey on Mombasa City Road Development Project / JICA Survey Team

Objective of This Meeting

- To explain an outline of the Preparatory Survey conducted by the JICA Survey Team.
- To explain the proposed road alignments.
- To comply with JBIC Guidelines because Government of Japan intends to provide the ODA Loan.
- To obtain comments/suggestion of stakeholders on the Project and Environmental and Social considerations.



Comments/suggestion of stakeholders will be taken into account in the Project and the ESIA study.

Preparatory Survey on Mombasa City Road Development Project / JICA Survey Team

JICA Preparatory Survey on Mombasa City Road Development Project

Outline of Preparatory Survey

Preparatory Survey on Mombasa City Road Development Project / JICA Survey Team

Project Road
Mombasa Southern Bypass & Kipevu Link Road



Preparatory Survey on Mombasa City Road Development Project / JICA Survey Team

Outline of JICA Preparatory Survey

- To review previous F/S data on environmental & social consideration, engineering appropriateness and financial and economic feasibility.
- To conduct supplemental survey.
- To update and revise the design, if necessary.
- To facilitate formation of the project to be implemented with Japanese ODA Loan.

Preparatory Survey on Mombasa City Road Development Project / JICA Survey Team

Schedule of Project Implementation

- Preparatory survey: June 2011 to Nov. 2011
- Project evaluation by GOJ in Dec. 2011
- In case project will be implemented; the following is expected:*
- Procurement of consultant start: Middle of 2012
- Detailed design start: End of 2012
- Construction start: Middle of 2014

Preparatory Survey on Mombasa City Road Development Project / JICA Survey Team

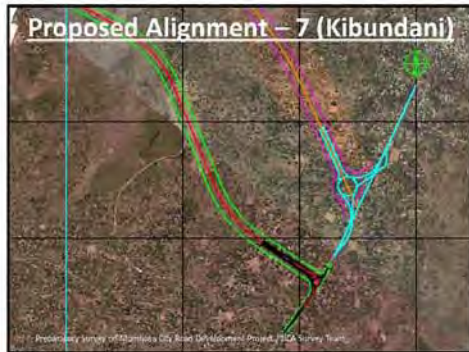
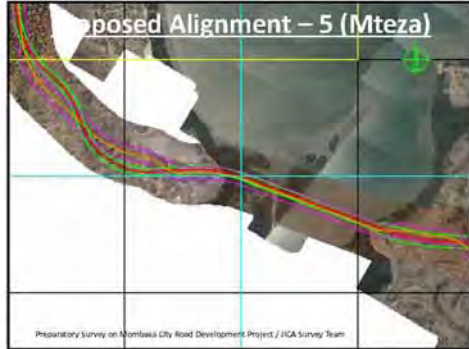
Why Revised Alignments is Required?

- 1) To Avoid Too Much Relocations (Reduce Relocation Cost and Numbers of Project Affected Peoples)
- 2) To Consider Natural Conditions (Mangrove, Coast Line, Kaya, etc.)
- 3) To Provide Better Horizontal Alignments (Not Too Sharp Bend Applied)
- 4) To Provide Better Vertical Alignment (Not Too Steep Slope Applied)
- 5) To Secure Road Reserve to Accommodate Proper Number of Lanes, Verges, Utility Spaces as well as Space for Future Developments (including NMT & Service Road Installations)

Preparatory Survey on Mombasa City Road Development Project / JICA Survey Team



1st Stakeholder Meeting Handout



JICA Preparatory Survey on Mombasa City Road Development Project

Social Considerations

Preparatory Survey on Mombasa City Road Development Project / JICA Survey Team

Number of Project Affected Persons (PAPs)

Category	Unit	Original Alignment	Proposed Alignment (Tentative)	Difference
Land Owners	Persons	597	Detailed survey required	-
Household (Structure)	HH	336	83	↓ -253
Schools	No.	2	0	↓ -2
Mosques	No.	2	0	↓ -2
Churches	No.	1	0	↓ -1
Fishermen	Persons	220	Detailed survey required	-
Famer	Persons	95		-

※ Exact number will be clarified by the detailed survey.

Preparatory Survey on Mombasa City Road Development Project / JICA Survey Team

Number of Project Affected Household (PAH)

District	Village	Original Alignment	Proposed Alignment (Tentative)	Difference
Changamwe	Mwandudu, Maganda, Mpirani, Ngare, Skembo	35	20	↓ -15
	Kinango	Tsunza	18	↓ -13
	Likoni	Mwangala, Mbudu, Bububu, Kibundani, Shikadadu	270	45
Total		336	83	↓ -253

※ Exact number will be clarified by the detailed survey.

Preparatory Survey on Mombasa City Road Development Project / JICA Survey Team

1st Stakeholder Meeting Handout

JBIC Guideline* for Involuntary Resettlement

- Involuntary resettlement and loss of means of livelihood are to be avoided where feasible, exploring all viable alternatives.

When, after such examination it is found to be unfeasible, effective measures to minimize impact and to compensate for losses must be agreed upon with people who will be affected.

*Japan Bank for International Cooperation (JBIC) Guidelines for Confirmation of Environmental and Social Considerations (2002 April)

Preparatory Survey on Mombasa City Road Development Project / JICA Survey Team

JBIC Guideline for Compensation of Involuntary Resettlement

- People to be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported by the project proponents in a timely manner.

The project proponents must make efforts to enable the people affected by the project, to improve their standard of living, income opportunities and production levels, or at least to restore them to pre-project level.

Preparatory Survey on Mombasa City Road Development Project / JICA Survey Team

Supplemental Socio-economic Survey

Type of Survey	Contents
Census Survey	All occupants in project area shall be counted in order to confirm the number of PAPs.
Assets & Land Survey	Item and magnitude of PAPs asset affected by the project physically and economically shall be evaluated.
Livelihood & Living Survey	Standard characteristics of the household including description of production system, labor, household, baseline information on livelihoods and standard of living shall be surveyed.

Preparatory Survey on Mombasa City Road Development Project / JICA Survey Team

Socio-economic Survey Schedule

Field Work (Data Collection)

- Supplemental Socio-economic Survey will start from the middle of July 2011.
- Your cooperation to the surveys will be much appreciated.

Results

- Draft result of the survey will be reported in the 2nd Stakeholder meeting scheduled to be held in September 2011.

Preparatory Survey on Mombasa City Road Development Project / JICA Survey Team

JICA Preparatory Survey on Mombasa City Road Development Project

Environmental Considerations

Preparatory Survey on Mombasa City Road Development Project / JICA Survey Team

Environmental Impact Assessment (EIA)

- In accordance with Kenya's law (EMCA, 1999), KeNHA submitted the EIA Report to NEMA in March 2011.
- Under its reviewing process, NEMA noticed to the public to submit comments on an EIA report for proposed Mombasa Bypass Road Study in Mombasa District. (from May 30th for 30 days)
- In addition, because of requirement of Japanese ODA Loan, JICA requests the ODA recipients to comply with "JBIC Guidelines (2002)".

Preparatory Survey on Mombasa City Road Development Project / JICA Survey Team

1st Stakeholder Meeting Handout

Review of EIA Report

- “JBIC Guidelines (2002)”
- 1) Baseline conditions of natural and social environment
- 2) Compliance with Kenya’s laws, ordinances and standards
- 3) Analysis of alternatives
- 4) Scope of impact to be examined
- 5) Predicted environmental and social impacts
- 6) Mitigation measures
- 7) Stakeholder Consultation
- 8) Environmental Monitoring Plan (EMP)
- 9) Cost and Budget

Preparatory Survey on Mombasa City Road Development Project / JICA Survey Team

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Supplemental EIA Surveys

- In order to understand the current environment, predict and assess the impacts, and consider the mitigation measures, the supplemental surveys are necessary:
- 1) Ambient air quality
- 2) Noise level
- 3) Sediment quality
- 4) Flora and fauna

Preparatory Survey on Mombasa City Road Development Project / JICA Survey Team

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Ambient Air Quality Survey



Parameters	PM10, NOx, SOx, CO, O ₃ , Pb
	Wind speed and direction

Preparatory Survey on Mombasa City Road Development Project / JICA Survey Team

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Noise Survey



Sound levels	Day (6:00am - 8:00pm)
	Night (8:00pm - 6:00am)

Preparatory Survey on Mombasa City Road Development Project / JICA Survey Team

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Sediment Quality Survey



Parameters
Physical parameters
Organics & nutrients
Heavy metals
Hazardous chemicals

Survey sites

Preparatory Survey on Mombasa City Road Development Project / JICA Survey Team

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Flora and Fauna Survey



● Protected species
● Threatened species
● Locally significant species
Mangroves and terrestrial vegetation
Marine and terrestrial fauna including Birds

Survey sites

Preparatory Survey on Mombasa City Road Development Project / JICA Survey Team

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1st Stakeholder Meeting Handout

Supplemental EIA Survey Schedule

Field Work

- Supplemental EIA survey will be carried out by local consultants from this week till the end of July.
- Your cooperation to the surveys will be much appreciated.

Results

- Main results of the survey will be reported with assessment in the 2nd Stakeholder meeting.

Preparatory Survey on Mombasa City Road Development Project / JICA Survey Team

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The Second Stakeholder Consultation Meeting

Objectives

To explain:

- 1) Main results of the supplemental EIA survey
- 2) Main results of the supplemental socio-economic survey

Date

September 2011

Preparatory Survey on Mombasa City Road Development Project / JICA Survey Team

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Asante sana!

Preparatory Survey on Mombasa City Road Development Project / JICA Survey Team

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Discussion

Comments / suggestions will be much appreciated

Preparatory Survey on Mombasa City Road Development Project / JICA Survey Team

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Appendix A3-2 Minutes of the First Stakeholder Meeting

MOMBASA CITY SOUTHERN BYPASS – PUBLIC CONSULTATION MEETING

Venue: Kenya Petroleum Refinery Estate Social Hall, Chagamwe District and Young Men Christian Association (YMCA) Likoni District

Dates: Tuesday 12th July 2011 and Thursday 14th July 2011

Both meetings started at 9.45 a.m. with introduction and welcoming remarks. Both meetings were chaired by the host District commissioners. A total of 800 participants attended the two meetings. The Chagamwe meeting was chaired by the Chagamwe District Commissioner Mr. Douglas Mutai. The meeting was attended to by participants from two (2) districts; Chagamwe and Kinango Districts. The locations represented were Mwamdudu, Maganda, Mpirani, Ngare and Skembo Locations in Chagamwe District and Tsunza location in Kinango District. The Chagamwe meeting was attended by a total of about 350 participants.

The stakeholder's meeting in Likoni District was chaired by Likoni District Commissioner Mr. Kinyua. All five (5) local Councilors in Likoni Constituency were in attendance. The District Commissioner of Kinango District also attended the meeting. About 450 participants attended the meeting.

KeNHA Headquarters, through the Environment and Social Interest Section, KeNHA Regional Office and the JICA consultants; Katahira & Engineers International attended both meetings. Other stakeholders represented included Kenya Airport Authority, Kenya Ports Authority, etc

The objective of the stakeholders' meeting was:-

- To explain an outline of the Preparatory Survey conducted by the JICA Team
- To explain the proposed road alignment
- To comply with the JBIC Guidelines because Government of Japan intends to provide ODA Loan
- To obtain comments/suggestion of stakeholders on the project and Environmental and Social considerations.

The agenda of the meeting included:--

1. Opening of the meeting
2. Presentation of JICA Preparatory Survey on Mombasa City Road Development Project
 - a. Outline of Preparatory Survey
 - b. Social Considerations
 - c. Environmental considerations

3. Discussion
 - a. Comments and suggestions by stakeholders
4. Closing of the meeting

The JICA consultants sensitized the participants on their role through sharing:-

1. An outline of JICA preparatory survey
2. Schedule of the project Implementation
3. Justification for the revised alignment
4. Proposed alignment of the proposed road
5. Social consideration and JBIC guidelines for involuntary resettlement
6. Supplementary RAP and EIA surveys
7. Schedule of preparatory social consideration and environmental surveys
8. Schedule for sharing results of the surveys

It came out clearly that the revised alignment will reduce the number of the project affected households substantially from 336 households to approximately 83 households. The newly proposed alignment will reduce impact on social amenities such that no school, church or mosque will be affected. The previous alignment was to affect two (2) schools, two (2) mosques and a church. It is also not known how many fishermen and farmers will be affected by the revised alignment however; it is anticipated that the revised alignment will substantially reduce the number of the fishermen and farmers that would have been affected. This is as a result of the deliberate effort made by the JICA Survey team to safeguard mangrove trees that act as fishermen's source of livelihood in the region. The mangroves trees are breeding sites for crustacean and other types of fish.

The questions/comments and answers during discussion are summarized below:

#	Questions Asked	Response Given
1.	Where the road passes are there affected people?	It is estimated that about 83 families could be living along the alignment and the supplemental socio-economic survey will be undertaken to establish and identify the Projected Affected Persons (PAPs). The survey will finally enable us to determine the number of the PAPs.
2.	Local residents in the project area should be given 75% of employment opportunities when the road construction starts	It was indicated that the non-skilled job opportunities will be given to the local residents but skilled labour will be sourced from qualified professional regardless of where they hail from. The local administration will be involved in the identification of those to be recruited as casual labour
3.	Will the project affect the fishermen especially there landing areas and structures they have constructed?	The socio economic survey will establish this and if the fishermen will be affected; full compensation will be given to them. The project won't involve the construction of the embankments hence fishing activities will go on. Mangroves which provide breeding grounds will be protected as much as possible. GoK and JBIC guidelines will be followed in determining compensation.
5.	Will access roads to industrial areas be provided for during construction of Kipevu link road	Informed that the road will on focus on the proposed alignment. Construction of Kipevu link road won't involve the construction of access roads to open up other areas. The access road is not part of the scope of the proposed project.
6.	Will the supplementary socio-economic and environmental survey provide employment for local enumerators? Will the local NGOs be involved in the supplementary survey exercise	The consultant welcomed the suggestion to recruit enumerators for the community. He indicated that he will want to recruit 10 enumerators for 2 weeks. The RAP process will be all inclusive and stakeholders and partners including NGOs, local administration, civil society organizations and relevant government departments operating in the project area with legitimate interests will be involved during the survey.
7.	How will livelihood affected by the project be restored? E.g. payment for coconut trees, maize and the like	Compensation will include all property on the land. This includes buildings, trees e.g. mango, cashew nuts or coconut. Trees are permanent while maize is seasonal. The crops like coconuts will be compensated using government rates and a formula will be established to compensate for income lost for a certain number of years. For crops like maize the residents will be allowed to harvest.
8.	Road Transport Association wanted to know how the quality of roads will be assured and whether weighbridges will be installed to check on overloading	Overloading will be monitored by KeNHA while Kenya Ports Authority will install weighbridges inside the container terminal. The pavement will be designed for 10 years afterwards rehabilitation will be done. The construction will be supervised by qualified Engineers where international standards will be applied. The bridge

		design life will be 100 years.
9.	What will be done to ensure that people affected are adequately compensated	The communities were requested to collaborate with the consultants who will be on the ground in order for them to undertake a factual asset survey. The Government of Japan will also monitor the compensation process
11.	How will already existing houses be compensated? Is it cost of building new houses, alternative plot or building new house for affected person?	The RAP report will determine the cost of affected houses and discuss with the PAPs the compensation options available. An agreement will be arrived at as to what is the best option
13.	What will be the impact on air quality?	Emission reduction measures will be put in place if the standard limits are exceeded. For dust which is a temporal impact, watering will be done by the contractor and KeNHA will monitor the process.
14.	How will the process make use of the earlier committees established	The consultant will liaise with the District Commissioners and determine how to work with local administration in this exercise. A grievance redress mechanism will also be established within the community and this will include the formulation of a committee whose members must be accepted by the community.
15.	How will the project compensate women that will be affected by the proposed road	The RAP process will include identification of vulnerable groups that will include single women headed households, orphans and will propose the mode of compensation.
16	How many Kilometers or meters is the new proposed alignment from the old alignment	The new alignment is about 200 to 300 meters away from the previous alignment where it joins the Mombasa-Lunga Lunga (A14)Road
17	Why is the road construction pushed to 2014?	This time will be needed for GoK to engage in the negotiation for the Loan to construct the road in 2012. Year 2013 will allow for development of a detailed road design and land acquisition
18	What happens to the earlier enumerated PAPs who had signed the consent form and did not further develop their land/did not grow crops	This stakeholders meeting is a forum to share information with people affected and the general community. The meeting is an avenue for further updates of the process including any changes that may occur from time to time. A supplementary RAP will be undertaken to confirm who the PAPs are. The next forum will be conducted in September to share results with the stakeholders.

Address by the Local Administration office

- The District Officer of Changamwe; Alice Wachira-indicated in the meeting that the division has problems which relates to insecurity and lack of well-equipped hospitals. She requested JICA to support the local programmes that seek to address insecurity and provision of health care.
- The District Officer of Jomvu; Victoria Ndago welcomed the proposed road project and reiterated that the local residents stand to benefit as the project will be increase business opportunities within the area. She cautioned the PAPs not to sell out their property/or invite outsiders into their land once census survey is undertaken.
- The Kinango District Officer; Mrs Ngetich also welcomed the proposed project and asked residents of her division to cooperate with supplementary survey team undertaking both the EIA and RAP.
- Mr Mutai, the District Commissioner of Changamwe District; also welcomed the project and encouraged the people to cooperate and freely give their details to facilitate a quick compensation. He encouraged the local residents not to sell off their land as it will be precious like gold once the project is implemented. The DC also informed the stakeholders to note the project implementation timelines as indicated by the JICA survey team in order to avoid misinformation.
 - The Likoni District Commissioner Mr. Kinyua also welcomed the proposed project and commended the proposed changes made on the alignment as it is focused on reducing the impact on the PAPs in Likoni. He also requested the people to corporate in order for the task to be completed on schedule.

Appendix A3-3 Second Stakeholder Meeting Handout

2nd Stakeholder Meeting Handout

Mombasa City Road Development Project

Stakeholder Consultation Meeting

15 September 2011
YWCA Social Hall, Shelly Beach Road, Likoni
16 September 2011
St. Mary's Catholic Church Hall



Kenya National Highways Authority

Agenda

1. Opening of the Meeting
2. Results of the Preparatory Survey on Mombasa City Road Development Project
 - 2.1 Outline of Preparatory Survey
 - 2.2 Social considerations
 - 2.3 Environmental considerations
3. Discussion
Comments and suggestions by stakeholders
4. Closing of the Meeting

Mombasa City Road Development Project

Objective of This Meeting

- To explain an outline of the Preparatory Survey on Mombasa City Road Development Project.
- To explain the proposed road alignments.
- To comply with the Guidelines of International Donors.
- To obtain comments/suggestion of stakeholders on the Project and Environmental and Social considerations.

↓

Comments/suggestion of stakeholders will be taken into account in the Project and the ESIA study.

Mombasa City Road Development Project

Preparatory Survey on Mombasa City Road Development Project

Outline of Preparatory Survey

Mombasa City Road Development Project

Project Road

Mombasa Southern Bypass & Kipevu Link Road



Mombasa City Road Development Project

Outline of Preparatory Survey

- To review previous F/S data on environmental & social consideration, engineering appropriateness and financial and economic feasibility.
- To conduct supplemental survey.
- To update and revise the design.
- To facilitate formation of the project.

Mombasa City Road Development Project

Schedule of Project Implementation

- Preparatory survey: June 2011 to Nov. 2011
- The following implementation schedule is proposed by the Survey Team (Earlier implementation is requested by GOK and being studied).*
- Procurement of consultant start: Middle of 2012
- Detailed design start: End of 2012
- Tendering and contract: End of 2013 - End of 2014
- Construction start: End of 2014

Mombasa City Road Development Project

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Why Revised Alignments is Required?

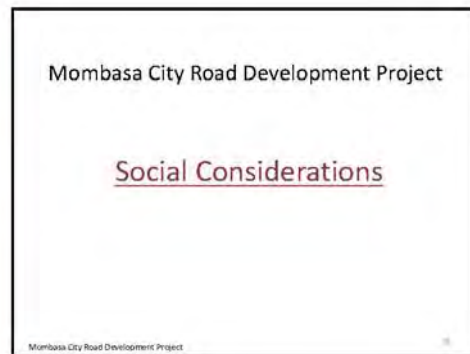
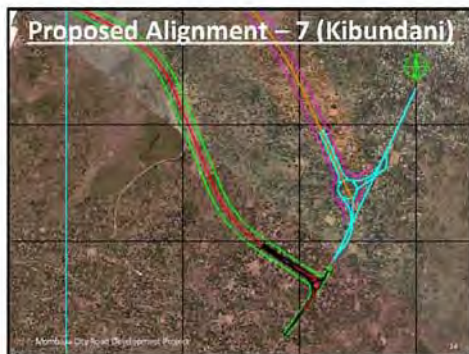
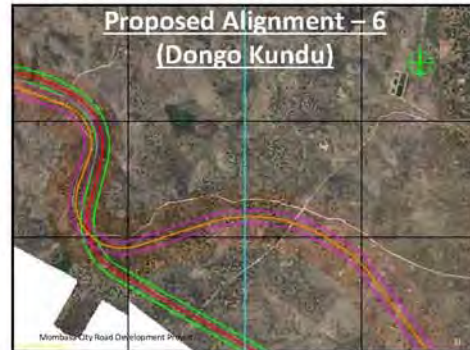
- 1) To Avoid Too Much Relocations (Reduce Relocation Cost and Numbers of Project Affected Peoples)
- 2) To Consider Natural Conditions (Mangrove, Coast Line, Kaya, etc.)
- 3) To Provide Better Horizontal Alignments (Not Too Sharp Bend Applied)
- 4) To Provide Better Vertical Alignment (Not Too Steep Slope Applied)
- 5) To Secure Road Reserve to Accommodate Proper Number of Lanes, Verges, Utility Spaces as well as Space for Future Developments (including NMT & Service Road Installations)

Mombasa City Road Development Project

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2nd Stakeholder Meeting Handout



Resettlement Impacts of the Project (1/2)

Category	Unit	Original Alignment	Proposed Alignment (Draft)	Difference
Land Owner	Persons	597	350 + α	-247 + α (-41% + α)
House, Hut & Shed	No.	336	157	-179 (-53%)
School	No.	2	0	-2 (-100%)
Mosque	No.	2	0	-2 (-100%)
Church	No.	1	0	-1 (-100%)
Economic Tree	No.	21,949	8,011	-13,938 (-64%)

⚠ The inventory of Land Parcel for Pungu is yet to be completed as of 15th Sep, 2011.

Mombasa City Road Development Project

Resettlement Impacts of the Project (2/2)

District	Village	Unit	Land Owner	House, Hut & Shed
Changamwe	Mabanda ya Ngombe	No.	19	7
	Miritini	No.	94	7
	Port Reitz	No.	44	11
Kinango	Tsunza	No.	99	37
	Mwandudu	No.	19	11
Likoni	Mtongwe	No.	49	10
Kwale	Kiteje	No.	26	9
	Pungu	No.	Not known yet	65
Total		No.	350 + α	157

Mombasa City Road Development Project

2nd Stakeholder Meeting Handout

Number of Livelihood Affected Persons (1/2)

Category	No.	Type of Loss Anticipated
Boat Owners	3	Temporary loss of income and employment
Boat Operators	6	
Canoe Owners	4	
Canoe Operators	11	
Fishermen	250	Short-term interference during road and bridge construction
Fish Traders	248	Short-term loss of income from fish trading during road and bridge construction
Fish Farmers	21	Short-term loss of income from fish farming

Mumbai City Road Development Project

Number of Livelihood Affected Persons (2/2)

Category	No.	Type of Loss Anticipated
Farmers	323	Loss of income and food from farming
Conservation Groups	30	Short-term loss of income from mangrove seeding plant
Bodaboda Owners	6	Short-term interference with transport business during road construction
Bodaboda Operators	38	
Small Scale Traders	5	Short-term loss of income from business

Mumbai City Road Development Project

Entitlement Matrix (Draft) (1/4)

Type of Loss	Unit of Entitlement	Compensatory Measures (Draft)
Loss of Agricultural Land	Title Holders	<ul style="list-style-type: none"> 100% cash compensation at replacement cost for affected portion 15% cash top-up in compulsory acquisition
	Tenants	<ul style="list-style-type: none"> Compensation for remaining value of lease
Loss of Residential/Commercial/Industrial Land	Title Holders	<ul style="list-style-type: none"> 100% cash compensation at replacement cost for affected portion Compensation for standing assets such as well 15% cash top-up in compulsory acquisition
	Tenant/Lease Holder	<ul style="list-style-type: none"> Compensation for standing assets such as well Compensation for remaining value of lease
	Informal Settler	<ul style="list-style-type: none"> Possibility of land grant

Note: The Cut-off Date for eligibility for compensation was set on 15th July 2011.

Mumbai City Road Development Project

Entitlement Matrix (Draft) (2/4)

Type of Loss	Unit of Entitlement	Compensatory Measures (Draft)
Loss of Structure		
1	Partial loss but residual viable	<ul style="list-style-type: none"> 100% cash compensation at replacement cost for affected portion based on market value Repair cost for unaffected structure at 25% of compensation
	Fully affected/partially affected and remaining structure is non-viable	<ul style="list-style-type: none"> Cash compensation at replacement cost for entire structure based on market value plus house re-building allowance at 25% of compensation

Mumbai City Road Development Project

Entitlement Matrix (Draft) (3/4)

Type of Loss	Unit of Entitlement	Compensatory Measures (Draft)
Loss of Economic Tree & Crop	All PAPs including Farmers	<ul style="list-style-type: none"> Cash compensation based on income for entire life-cycle in case of economic trees Cash compensation as gross yield value for crops such as cassava for 3 years Right to salvage for wood products
Assistance to Vulnerable Group	All Vulnerable Groups	<ul style="list-style-type: none"> KaMHA to consider assistance over and above compensation package to cushion them against impact.
Loss of Livelihood	Boat Owners	3 months cash handout calculated at gross income
	Boat Operators	3 months cash handout worth of wages earned
	Canoe Owners	3 months cash handout calculated at gross income
	Canoe Operators	3 months cash handout worth of wages earned
	Small Scale Trader	3 months cash handout worth of gross daily profit

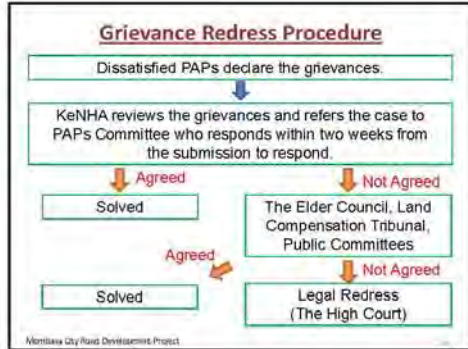
Mumbai City Road Development Project

Entitlement Matrix (Draft) (4/4)

Type of Loss	Unit of Entitlement	Compensatory Measures (Draft)
Loss of Livelihood	Fishermen	<ul style="list-style-type: none"> Provision of alternative and new fisheries with full access from the new road Capacity building including equipment and skills up for deep sea fishing Income compensation for any day of work lost due to road and bridge construction
	Fish Traders	<ul style="list-style-type: none"> Provision of new fish market Income compensation for any day of work lost due to road and bridge construction
	Fish Farmers	<ul style="list-style-type: none"> Income compensation for any day of work lost due to road and bridge construction
	Bodaboda Owner, Operators	<ul style="list-style-type: none"> One month worth of income replaced before identification of other routes
	Conservation Groups	<ul style="list-style-type: none"> Capacity building for fish farming Income compensation for lost assets and anticipated income

Mumbai City Road Development Project

2nd Stakeholder Meeting Handout



Implementation Schedule (Draft)

Activity	2011				2012				2013				2014			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Approval of PAP by GOK and other agencies	■															
Set up PAP Implementation Team				■												
Confirmation of PAPs and notification of PAP Unit Establishment				■	■											
Distribution of Info cards				■	■	■										
Design and Procurement of Resettlement Site, if applicable					■	■	■	■	■							
Issuance of Clearance					■	■	■	■	■	■	■	■	■	■	■	■
Payment of Compensation to PAPs								■	■							
Relocation to PAPs												■	■	■	■	■

Mombasa City Road Development Project

Monitoring and Evaluation

Type	Purpose	Responsibility
Internal Monitoring and Evaluation	Mainly assess adherence of resettlement implementation on schedule to approved plans and time-frame.	<ul style="list-style-type: none"> KeNHA Steering Committee RAP Implementation Committee
External Monitoring and Evaluation	Mainly assess the overall effectiveness and compliance of PAPs resettlement to JBIC/WB/GoK Policy.	<ul style="list-style-type: none"> Resettlement Specialist of Management Consultant Team (MCT) JICA
Propose remedial measures where necessary		All of above

Note: As the resettlement is KeNHA's undertaking, compensation will be paid by KeNHA. JICA will monitor the resettlement process.

Mombasa City Road Development Project

Mombasa City Road Development Project

Environmental Considerations

Mombasa City Road Development Project

Environmental Impact Assessment (EIA)

- In accordance with Kenya's law (EMCA, 1999), KeNHA submitted the EIA Report to NEMA in March 2011.
- Under its reviewing process, NEMA noticed to the public to submit comments on the EIA report in May 2011.
- NEMA is now reviewing the EIA report according to the comments from the public and relevant agencies.

Mombasa City Road Development Project

Supplemental EIA Surveys

- In order to predict and assess the impacts, and consider the mitigation measures, the following supplemental EIA surveys were conducted.
 - 1) Ambient air quality
 - 2) Noise level
 - 3) Flora and fauna
 - 4) Sediment quality (under analysis)

Mombasa City Road Development Project


2nd Stakeholder Meeting Handout

Impact on Ambient Air Quality

- The ambient air quality around the proposed road might deteriorate with the expected traffic increase.
- The future air quality along the proposed road was predicted based on:
 - ❑ Present levels of pollutants (PM₁₀, SO₂, NO₂, CO)
 - ❑ Estimated emission from the projected traffic volume in 2025.
 - ✓ Kipevu Link Road: 4-lane
 - ✓ Mombasa Southern Bypass: 2-lane

Mombasa City Road Development Project 10

Ambient Air Quality Survey



(µg/m ³)	Present levels	Tolerance limits **
PM ₁₀	11-17	100 (day) 50 (annual)
NOx (NO ₂)	**ND-26	80 (day) 60 (annual)
SOx (SO ₂)	ND-18	80 (day) 60 (annual)
CO	379-510	2,000 (8 hours)

*1: (Dir) The Environmental Management and Coordination (Air Quality) Regulations, 2009, the Schedule: Table 1 Ambient Air Quality Tolerance Limits.
*2: ND = Not Detected

Mombasa City Road Development Project 11

Impact on Ambient Air Quality

Estimated increase of pollutant levels in 2025

- The estimated increases of pollutants (PM₁₀, NO₂, SO₂, CO) are about 10-20 µg/m³.
(@ the 55m point from the road center: 4-lane & 2-lane)

Assessment

- The present air quality in the project area is in good condition. The future air quality may not significantly deteriorated with the future traffic increase. Under the tolerance limits.

Monitoring Plan

- Regular monitoring of ambient air quality is indispensable.


Mombasa City Road Development Project 12

Impact on Noise level

- The noise levels around the proposed road might increase with the expected traffic increase.
- In order to understand the present noise level, the survey was carried out.
- The future noise level is predicted based on the projected traffic volume in 2025.
 - ✓ Kipevu Link Road: 4-lane
 - ✓ Mombasa Southern Bypass: 2-lane

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Noise Survey



dB(A)	Average (min – max)	
	Day (6am – 5pm)	Night (8pm – 6am)
P1	61 (49 – 75)	47 (44 – 51)
P2	49 (45 – 60)	47 (45 – 50)
P3	45 (42 – 53)	43 (40 – 51)
P4	57 (48 – 64)	45 (42 – 51)
P5	56 (48 – 75)	46 (44 – 54)
Kenya	50 residence 60 commercial	35 residence 35 commercial
IFC	55 residence 70 industrial	45 residence 70 industrial

*1: The Environmental Management and Coordination (Noise and Vibration/Pollution Control) Regulations, 2009
*2: IFC: General EHD Guidelines: Environmental Noise Management, 2007. (From: IFC and World Bank Group)

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Noise Impact

Estimated noise levels in 2025
(@the 55m point from the road center: 4-lane & 2-lane: peak time)

- Day: 60 - 70 dB(A)
- Night: 50 - 60 dB(A)

Assessment

- The future noise levels may increase with the future traffic volume compared with the present levels.

Mitigation measures

- Installation of noise barrier and noise absorber (plants), where required, especially schools, hospitals and religious facilities.


Monitoring Plan

- Regular monitoring of noise levels is indispensable.

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2nd Stakeholder Meeting Handout

Impact on Flora and Fauna



Flora and Fauna Survey

- Mangroves and terrestrial vegetation
- Marine and terrestrial fauna
- Mammals, Birds, Reptiles, Amphibians, Insect;
- Fish, Crustaceans and Mollusks

Survey sites

Mombasa City Road Development Project 36

Impact on Flora and Fauna

Present status: main result

- There are no protected and threatened species in the project area.
- Locally significant biota, mangroves and Kaya, are now threatened by human activities.

Impacts due to construction and operation

- Habitat destruction & separation, barrier of migration, loss of breeding ground ➔ Loss of biodiversity
- Loss of local resources: fishery, timber and medicines

➔ Mitigation measures

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Impact on Flora and Fauna

Mitigation measures

- To avoid and minimize the direct destruction of mangroves and Kaya: ➔ **Alternative alignment, Jetty**
- To restore mangroves: ➔ **Mangrove replanting**
- To minimize the degradation of mangroves and marine species: ➔ **Oil separator (grit chamber)**
- To secure migration path for small animals: ➔ **Underpass culvert**

➔

Monitoring Plan

- The progress shall be regularly monitored, such as growth of mangroves, as well as fish catch.

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Asante sana!

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Discussion

Comments / suggestions will be much appreciated

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Appendix A3-4 Minutes of the Second Stakeholder Meeting

MOMBASA CITY ROAD DEVELOPMENT PROJECT – PUBLIC CONSULTATION MEETING

Venue: Young Men Christian Association (YMCA) Social Hall, Likoni District and at St. Mary's Catholic Church Hall, Changamwe District and

Dates: Thursday 15th September 2011 and Thursday 16th September 2011

Both meetings started at about 10.30 a.m. with introduction and welcoming remarks. The meetings were chaired by the host District commissioners. The Coast Regional Commissioner attended the meeting at Likoni. A total of 454-participants attended the two meetings.

The Changamwe meeting was chaired by the Changamwe District Commissioner Mr. Douglas Mutai. The meeting was attended by 238 participants from two (2) districts; Changamwe and Kinango. The villages represented in this meeting were Port Reitz, Miritini, Changamwe, MabandayaNgombe, Jomvu, and Tsunza.

The stakeholder's meeting in Likoni District was also chaired by Likoni District Commissioner Mr. Kinyua. A total of 216 participants attended the meeting. The villages represented were Mwangala, Murongondoni, ShikaAdabu, Mbuta, MajengoMapya, Mwamdudu, Kiteje, Kibundani, Pungu, Likoni, Mtongwe and Bububu.

KeNHA was represented by the Environment and Social Interest Section within the Planning and Environment Department and the KeNHA Coast Regional Office. The public consultation meeting was also attended by the JICA consultants; Katahira & Engineers both meetings and gave feedback on the supplementary RAP survey findings. Other stakeholders represented included Kenya Airport Authority, Kenya Ports Authority, Kenya Wildlife Services, Coast Development Authority, National Environmental and Management Authority, Kenya Pipeline Company, Kenya Association of Tour Operators, Kenya Fisheries, Ministry of Lands, National Museum and Ministry of Information.

The objective of the stakeholders' meeting was:-

- To explain an outline of the Preparatory Survey conducted by the JICA Team
- To explain the proposed road alignments
- To comply with the JBIC Guidelines because Government of Japan intends to provide ODA Loan
- To obtain comments/suggestion of stakeholders on the project and Environmental and Social considerations.

The agenda of the meeting included:--

1. Opening of the meeting
2. Presentation of JICA Preparatory Survey on Mombasa City Road Development Project
 - a. Outline of Preparatory Survey
 - b. Social Considerations
 - c. Environmental considerations
3. Discussion
 - d. Comments and suggestions by stakeholders
4. Closing of the meeting

The JICA consultants in conjunction with KeNHA continued to sensitize the participants on their role through sharing:-

5. An outline of JICA preparatory survey
6. Schedule of the project Implementation
7. Justification for the revised alignment
8. Presentation of the proposed road alignment
9. Presentation of the proposed social consideration for involuntary resettlement following the supplementary RAP survey
10. Presentation of the results of the supplementary EIA survey and proposed mitigation measures.

Following the presentation, it emerged that about 400 household would be affected. Pungu village had not been enumerated at the time of the meeting as they wanted the project to be moved further from their community to reduce the impact on their clan/village. The proposed alignment did not affect any community structures and investments including schools, mosques and churches and was widely accepted. Concerns were raised on the proposed implementation schedule of the project and urged the Government of Kenya to speed the process in order for the project to start earlier than year 2014.

Generally, the public welcomed the project. The Local Administration office also supported the project and encouraged the people to continue to cooperate and freely give their information during the verification stage that will be conducted in the future. They continued to discourage the local residents from selling off their land at this project phase. They also informed the stakeholders to note the project implementation timelines as indicated to avoid misinformation. Pungu village was also urged to cooperate in order for the process to be finalised in time.

The questions/comments and answers during discussion are summarized below:

#	Questions Asked	Response Given
1.	Which plots will be affected by the road?	It was indicated that an aerial photography was undertaken however a detailed survey will be concluded to determine the actual plots that will be affected.
2.	What Mechanisms will be put in place to enhance accountability?	The project will be funded by an independent financier who will monitor the implementation of the Resettlement Action Plan (RAP) and ensure that all conditions of the RAP are met.
3.	What will be done to the Kayas and burial sites that will be affected?	It was indicated that the RAP survey is still on going and a team of the consultants are expected to hold discussions with the community's village elders for an amicable solution on how to address or compensate for these sites.
5.	Pungu residents asked for the alignment to be moved from their community.	It was agreed that a team comprising of KeNHA, the Provincial Administration and the Consultant will engage the community to agree on a way forward.
6.	Do the beacons mounted on the ground show the road corridor and the land that will be affected? And if not can they be removed?	The participants were informed that the beacons on the ground are control points for survey. The road corridor boundary beacons will be put up during the detailed survey process.
7.	How will compensation for business affected by the road be undertaken especially for those who use the boat for transport to sell their palm wine?	It was indicated that all people whose livelihoods will be affected by the project will be compensated. The Palm wine business is under the small scale category of livelihoods that will be affected and the compensation will be three (3) months cash handout worth of gross daily profit.
8.	What will be done to ensure that all the affected persons are compensated and not other people?	Verification will be undertaken to establish the rightful owners and the list will be made public.
9.	Will there be other consultative meetings in the future?	The consultation meetings will be ongoing until the road is implemented as per the schedule. The meetings will continue until the end of the project.
10.	How will the project benefit the residents of Likoni?	The bypass road will serve everyone and is important for the development of this country.
11.	What traffic measures will be put to ensure safety of the school going children, churches and other pedestrians? and also to put up bumps	It was indicated that road safety measures will definitely form part of the entire project and take care of all the categories of people. It was however indicated that it is not the policy of the Government to erect bumps on highways but on assessment of the safety needs of the road,

#	Questions Asked	Response Given
		bumps may be erected on case by case.
12.	What will be done to ensure that the noise pollution is minimised	Noise pollution will be included in the environmental monitoring and management plan and the survey has suggested planting of trees near schools, hospitals and churches to minimize the noise levels
13.	Will land with no title be compensated the same as land with title	The participants were informed that all land will be compensated
14.	Will compensation for cashew nuts and coconuts be considered	It was indicated that all trees including the cashew nuts and coconuts that will be affected were taken into consideration for compensation.
15.	What measures will be put for the boreholes and community assets that will be affected during the road construction	They were informed that all properties and development on the proposed alignment will be compensated.

APPENDIX A4 Terms of Reference for Mangrove Reforesting Plan

Appendix 4: Terms of Reference for Mangrove Reforesting Plan

1. Introduction

These terms of reference (TOR) describes the consultancy services required to prepare the Mangrove Reforesting Plan (MFP) in respect of the Mombasa City Roads Development Project (the Project) which is an initiative of the Government of Kenya with support from the Japan International Cooperation Agency (JICA).

The implementation agency of the Project is Kenya Highway Authority (KeNHA) under the Ministry of Road. KeNHA intends to engage a consulting company (the Consultant) for preparation of the MFP, and the TOR sets out the scope of services to be provided by the Consultant.

2. Background

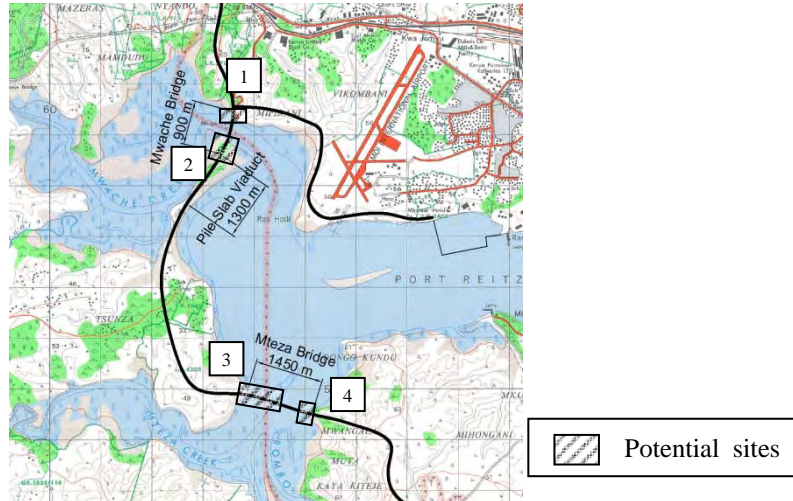
The project consists of the following components:

- Mombasa Southern Bypass (the Bypass): From Miritini Jct. at A104 through Mwache Jct. and Tsunza to Kibundani Jct. at A14. The length is 20.0km. The section from Miritini Jct. to Mwache Jct. is 4-lane and from Mwache to Kibundani Jct. is 2-lane.
- Kipevu Link Road (the Link Road): From Mwache Jct. to New Container Terminal is 5.7km with 4-lane.
- Long bridges, namely Mwache Bridge (900m), Mteza Bridge (1450m) and a pile-slab type viaduct (1300m) are proposed along the Bypass.
- Grade separated junctions at Miritini, Mwache and Kibundani along the road.
- Grade separated U-turn bay at 5 points along the road.
- Other necessary road facilities such as drainage, slope protection and road safety as proposed in the Preparatory Survey Report.

3. Mangroves to Be Cleared

The potential mangroves cutting sites are the costal swamps of Mwache and Mteza Creeks, where the bridges and roads are constructed as shown in Figure A-1. The rough estimate of mangrove area to be cleared is presented in Table A-1. The total area or the number of mangroves to be cleared at each site shall be clarified at the detail design stage.

Mangrove species: *Rhizophora mucronata*, *Bruguiera gymnorrhiza*, *Ceriops tagal*, *Avicennia marina*, *Xylocarpus granatum*, *X. moluccensis*, *Heritiera littoralis*, *Lumnitzera racemosa* and *Sonneratia alba*, were recorded in Mwache, Tsunza and Mteza along the proposed road alignments.



Source: JICA Survey Team

Figure A-1 Potential Mangrove Cutting Area along the Long Bridges

Table A-1 Area of Potential Mangrove Cutting

No	Site	Estimated Area *1 (m ²)	Estimation Method
1	Mwache Bridge (Mkupe side)	1,500	15.0*100=1,500
2	Mwache Bridge (Tsunza side)	4,500	15.0*300=4,500
3	Mteza Bridge (Tsunza side)	10,500	15.0*700=10,500
4	Mteza Bridge (Mwangala side)	1,500	15.0*100=1,500
Total		18,000	-

4. Objectives of Consultancy Services

To implement the Project, the Consultant shall prepare the MFP, tendering assistance and supervision of implementation of the MFP. The selection of the Consultant shall be in accordance with the Guidelines for the Employment of Consultant under Japanese ODA Loans and the regulations of the Government of Kenya.

The objectives of the Consultancy services are:

- To prepare the MFP to replant, restore and conserve the mangrove forests cleared by the Project;
- To ensure the MFP implementation with the efficient and timely manner in accordance with the planned implementation schedule; and
- To render proper technical supervision and execution of the MFP and ensure restoration and conservation of mangrove forests.

5. Scope of Work

Scope of work of the MFP will include the following tasks:

- 1) To review the potential sites of mangrove cutting based on the detail design of the bridges and roads.
- 2) To confirm the potential areas at the sites and identify the species and number of mangroves to be cleared.
- 3) To prepare the MFP cooperated with Kenya Forest Service (KFS) and Kenya Marine and Fisheries Research Institute (KMFRI) who have rich experience in mangrove replanting.
- 4) To identify the suitable species and locations for replanting with consultation with the experts of KFS and KMFRI.
- 5) To confirm the permission and agreement of land use for replanting with relevant authorities and land owners/residents (land will not be planned for industry, port or residential development).
- 6) To obtain the cooperation of NGOs for replanting and maintenance, such as the Mbuta Mazingira Conservators of Mwangala and the Tsunza Mangrove Conservation Group through KFS and KMFRI.
- 7) To prepare the maintenance and monitoring plan of replanted mangroves.
- 8) To estimate the replanting cost, maintenance and monitoring cost.
- 9) To prepare the MFP prior to commencement of construction since MFP will be executed during the construction phase by the contractor.
- 10) To prepare the report format. During the construction phase, the monthly maintenance and monitoring shall be carried out. The report shall be quarterly submitted to JICA. During the operation phase, biannual monitoring report shall be submitted to KeNHA and JICA.

6. Contents of MFP

The contents specified in MFP include:

- 1) Objective;
- 2) Main species of mangroves found in Mwache, Tsunza and Mteza;
- 3) Criteria for selection of species to replant:
 - To grow well at the local conditions of soil, topology, water quality tide and climate;

- To have high ecological and or economic values;
 - Easy and low cost in replanting;
- 4) Criteria for site selection:
- Former area of mangrove forests, but now the mangrove trees have low density;
 - Not far from the Project site;
 - To have suitable natural conditions for mangrove replanting (topography, soil, water, tide, sediment etc);
 - Land may be agreed by local residents or authorities for mangrove replanting;
- 5) Scheme of cooperation with local agencies (KFS, KFMRI) and mangrove conservation NGOs;
- 6) Methods and procedure of site preparation, seed provision and planting;
- 7) Methods and procedure of monitoring and trimming;
- 8) Time schedule of site preparation, seed provision, planting, maintenance and monitoring.
- 9) Reporting: frequency and report form

7. Schedule

The working period shall be less than 90 days from the date of the contract. The MFP shall be submitted prior to commencement of construction.

8. Work plan

The Consultant will provide proposal with an elaborated work plan citing critical milestones towards achievement of the consultancy. The client will consider any proposal made on possibility of improving on the TOR.

9. Competency/Expertise

The Consultants, NGOs and University Departments must able to demonstrate;

- 1) Post graduate specialization in the field of botany and aquatic biology.
- 2) Experience of similar work, including evidence of satisfactory delivery of at least two similar projects in the past 10 years. This should include at least twenty years experience of environmental planning of conservation and restoration of forests, especially mangroves.

- 3) Experience of working with donor, government and NGO partners, including familiarity with JICA and World Bank procedures.
- 4) Experience of strategic policy, institutional strengthening and capacity building programmes.
- 5) Adherence to the TOR and quality of the proposed methodology, to deliver the project outputs.

10. Cost proposal

The consultant should prepare comprehensive cost quotations as indicated in the Bills of quantities. However, quality and costs will influence selection of the winner with the best technical proposal and lowest financial proposal being declared responsive.

APPENDIX A5
Environmental Management Plan Monitoring Form
for Submitting to JICA

- Appendix A5-1 Environmental Management Plan Monitoring Form for Submitting to JICA
– Construction Phase
- Appendix A5-2 Environmental Management Plan Monitoring Form for Submitting to JICA
– Operation Phase

Appendix A5-1 Environmental Management Plan Monitoring Form for Submitting to JICA -Construction Phase

Project Activity	Potential Environmental Impact	Mitigation Measures (Proposed/Implemented)	Parameters to be Monitored	Location	Methods, equipment and frequency of Measurement (Date and/or time of Measurement)	Measured Value (Average/ Max/ Total, etc)	Kenyan standard/ Standard for Contract/Referred International Value	Input (e.g. cost, M/M)	Implementing Institution	Responsible Institution	Reporting
Construction of bridges and roads	Loss of mangrove trees	Mangrove replanting should be implemented Regular monitoring of replanted mangroves	Extent of cleared area and progress of replanting	Mwache and Mteza	(Refer to the Mangrove Reforesting Plan)				Contractor / Consultant	KeNHA/ Kenya Forest Service	<ul style="list-style-type: none"> • Monthly report submitted to KeNHA. • Quarterly Monitoring Report submitted to KeNHA and JICA.
Construction of bridges and roads	Aquatic habitat loss/ fragmentation; migration/feeding corridor restrictions. Loss and disturbance of benthic fauna	Oil separator (grit chamber) with drainage facilities When the abutments of the bridges are installed, turbidity in the creeks should be monitored.	Benthos species composition and density	2 sites	2 times/year		Compare with the baseline conditions		Contractor / Consultant	KeNHA/ Ministry of Fisheries department	<ul style="list-style-type: none"> • Quarterly Monitoring Report submitted to KeNHA and JICA.
			Seawater quality Turbidity (or SS)	2 bridges and ripraps along the coasts	Every work days		Increment of SS < 10 mg/L		Contractor / Consultant		<ul style="list-style-type: none"> • Monthly report submitted to KeNHA. • Quarterly Monitoring Report submitted to KeNHA and JICA.
Construction of roads	Terrestrial flora: loss of vegetation cover	Planting of trees and grass in road rights of way and adjacent areas (seedlings and saplings of indigenous trees and other important plant species before clearing of vegetation)	Extent of cleared area and progress of revegetation	All construction sites	Visual inspection				Contractor / Consultant	KeNHA/ National Museums of Kenya/ Kenya Wildlife Service	<ul style="list-style-type: none"> • Monthly report submitted to KeNHA. • Quarterly Monitoring Report submitted to KeNHA and JICA.
Construction of bridges and roads	Terrestrial and avian fauna: Habitat loss / damage Loss of migratory / feeding corridors	Underpass culvert to secure migration path for small animals	Bird Species and count	4 sites	2 times/year				Contractor / Consultant	KeNHA/ Kenya Wildlife Service/ Ministry of Fisheries Development	<ul style="list-style-type: none"> • Quarterly Monitoring Report submitted to KeNHA and JICA.
			Fish/Prawn: species, size, count	4 sites	2 times/year				Contractor / Consultant		
Construction of roads	Soil erosion/ land slides	Design of drainage facilities to avoid soil erosion and slope stabilization measures	Changes in vegetation, scouring and siltation.	All construction sites	Visual inspection				Contractor / Consultant	KeNHA	<ul style="list-style-type: none"> • Monthly report submitted to KeNHA. • Quarterly Monitoring Report submitted to KeNHA and JICA.
Construction of roads	Groundwater contamination	Protection measures: construction of culverts and retaining walls, soil erosion control, oil spillage prevention and monitoring.	pH, Suspended solids, Nitrate, Ammonia, Nitrite, TDS, E.coli, Fluoride, Phenols, Arsenic, Cadmium, Lead, Selenium, Copper, Zinc ABS Permanganate value	2 sites	Methods specified by the Environmental Management and Coordination, (Water Quality) Regulations 2006 2 times/year		Environmental Management and Coordination, (Water Quality) Regulations 2006 First Schedule : Quality Standards for Sources of Domestic Water		Contractor / Consultant	KeNHA/ NEMA/ Ministry of Public Health and Sanitation	<ul style="list-style-type: none"> • Quarterly Monitoring Report submitted to KeNHA and JICA.
Construction of bridges and roads	Air pollution	Dust control measures: sprinkling of water; covers of the trucked material during transportation	Ambient air quality PM ₁₀ ,	5 sites	Methods specified by (Draft) The Environmental Management and		(Draft) The Environmental Management and Coordination (Air		Contractor / Consultant	KeNHA/ NEMA	<ul style="list-style-type: none"> • Quarterly Monitoring Report submitted to KeNHA and JICA.

Project Activity	Potential Environmental Impact	Mitigation Measures (Proposed/Implemented)	Parameters to be Monitored	Location	Methods, equipment and frequency of Measurement (Date and/or time of Measurement)	Measured Value (Average/ Max/ Total, etc)	Kenyan standard/ Standard for Contract/Referred International Value	Input (e.g. cost, M/M)	Implementing Institution	Responsible Institution	Reporting
		Pollutant emission control measures: low emission construction vehicles, maintenance and inspection.	NO ₂ /NO _x , SO ₂ /SO _x , CO		Coordination (Air Quality) Regulations, 2008 2times per year		Quality) Regulations, 2008 WHO Air Quality Guidelines for Particulate Matter, Ozone, Nitrogen Dioxide and Sulfur Dioxide, Global Update 2005				
Construction of bridges and roads	Seawater pollution	Oil separator (grit chamber) with drainage facilities Establish an oil spill monitoring system and a rapid response unit in the contractor's team.	pH, Temperature, Salinity BOD COD T- Nitrogen T- Phosphorus Oil & Grease, Cyanides, Phenols, Sulphide, TSS E.coli, Arsenic Lead, Cadmium, Nickel, Chromium, Mercury, ABS Total pesticide residues	4 sites	Methods specified by the Environmental Management and Coordination, (Water Quality) Regulations 2006 2times per year		Environmental Management and Coordination, (Water Quality) Regulations 2006 Third Schedule : Standards for Effluent Discharge into the Environment		Contractor / Consultant	KeNHA/ NEMA	• Quarterly Monitoring Report submitted to KeNHA and JICA.
Construction of bridges and roads	Noise and vibrations	Proper service of equipment; installation of sound barriers for pile driving activity; construction activities to be restricted during day time hours only. Plant trees in environmental facility zones.	Noise level: L _{Aeq} (day and night) Vibrations: velocity or acceleration	5 sites	Methods specified by The Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009.		The Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009. General EHS Guidelines; Environmental Noise Management, International Finance Corporation: IFC 2007.		Contractor / Consultant	KeNHA/ NEMA	• Quarterly Monitoring Report submitted to KeNHA and JICA.
Construction of bridges and roads	Waste generation	Project Waste Management Plan (PWMP) To promote segregation and recycling (3R: Reduce, Re-use and Recycle)	Site conditions and cleanliness	All construction sites and labor camp	(Refer to the Project Waste Management Plan)				Contractor / Consultant	KeNHA/ NEMA/ Mombasa Municipal Council	• Monthly report submitted to KeNHA. • Quarterly Monitoring Report submitted to KeNHA and JICA.
Construction of bridges and roads	Community Health and Safety	Public Meetings	Opinions, grievance	2 locations per year	For a construction period of each package				Contractor / Consultant	KeNHA/ District Offices	• Quarterly Monitoring Report submitted to KeNHA and JICA.

Project Activity	Potential Environmental Impact	Mitigation Measures (Proposed/Implemented)	Parameters to be Monitored	Location	Methods, equipment and frequency of Measurement (Date and/or time of Measurement)	Measured Value (Average/ Max/ Total, etc)	Kenyan standard/ Standard for Contract/Referred International Value	Input (e.g. cost, M/M)	Implementing Institution	Responsible Institution	Reporting
Labor Camp	Occupational Health and Safety	Supply the works: -clean water and safe food -toilets/sewage treatment facilities -domestic solid waste management	Camp conditions	All camps	Weekly inspection		the Occupational Safety and Health Act, 2007		Contractor / Consultant	KeNHA/ Directorate of Occupational Health and Safety	<ul style="list-style-type: none"> • Monthly report submitted to KeNHA. • Quarterly Monitoring Report submitted to KeNHA and JICA.

Appendix A5-2 Environmental Management Plan Monitoring Form for Submitting to JICA - Operation Phase

Project Activity	Potential Environmental Impact	Mitigation Measures (Proposed/Implemented)	Parameters to be Monitored	Location	Methods, equipment and frequency of Measurement (Date and/or time of Measurement)	Measured Value (Average/Max/Total, etc)	Kenyan standard/ Standard for Contract/Referred International Value	Input (e.g. cost, M/M)	Responsible Institution	Reporting
Construction of bridges and roads Road traffic	Loss of mangrove trees	Monitor the growth of replanting mangroves	Mangroves: density, height and diameter	Mwache and Mteza	(Refer to the Mangrove Reforesting Plan)				KeNHA/ Kenya Forest Service	<ul style="list-style-type: none"> • Annual Monitoring Report submitted to JICA.
	Aquatic habitat loss/ fragmentation; migration/feeding corridor restrictions. Loss and disturbance of benthic fauna	Oil separator (grit chamber) with drainage facilities Regularly monitoring of fish catch and benthos	Benthos species composition and density	2 sites	2 times/year		Compare with the baseline conditions		KeNHA/ Ministry of Fisheries department	<ul style="list-style-type: none"> • Biannual Monitoring Report submitted to JICA.
Road traffic	Terrestrial and avian fauna: Habitat loss / damage Loss of migratory / feeding corridors	Conduct regular maintenance of the grit chambers and underpass culvert	Bird Species and count Fish/Prawn: species, size, count	4 sites 4 sites	2 times/year 2 times/year				KeNHA/ Kenya Wildlife Service/ Ministry of Fisheries Development	<ul style="list-style-type: none"> • Biannual Monitoring Report submitted to JICA.
Construction of roads	Soil erosion/ land slides	Soil erosion and slope stabilization measures	Changes in vegetation, scouring and siltation.	All construction sites	Visual inspection				KeNHA	<ul style="list-style-type: none"> • Biannual Monitoring Report submitted to JICA.
Road traffic	Air pollution	Pollutant emission control measures.	Ambient air quality PM ₁₀ , NO ₂ /NO _x , SO ₂ /SO _x , CO	5 sites	Methods specified by (Draft) The Environmental Management and Coordination (Air Quality) Regulations, 2008 2times per year		(Draft) The Environmental Management and Coordination (Air Quality) Regulations, 2008 WHO Air Quality Guidelines for Particulate Matter, Ozone, Nitrogen Dioxide and Sulfur Dioxide, Global Update 2005		KeNHA/ NEMA	<ul style="list-style-type: none"> • Biannual Monitoring Report submitted to JICA.

Project Activity	Potential Environmental Impact	Mitigation Measures (Proposed/Implemented)	Parameters to be Monitored	Location	Methods, equipment and frequency of Measurement (Date and/or time of Measurement)	Measured Value (Average/Max/Total, etc)	Kenyan standard/ Standard for Contract/Referred International Value	Input (e.g. cost, M/M)	Responsible Institution	Reporting
Road traffic	Seawater pollution	Regular maintenance of oil separator (grit chamber) with drainage facilities	pH, Temperature, Salinity BOD COD T- Nitrogen T- Phosphorus Oil & Grease, Cyanides, Phenols, Sulphide, TSS E.coli, Arsenic Lead, Cadmium, Nickel, Chromium, Mercury, ABS Total pesticide residues	4 sites	Methods specified by the Environmental Management and Coordination, (Water Quality) Regulations 2006 2times per year		Environmental Management and Coordination, (Water Quality) Regulations 2006 Third Schedule : Standards for Effluent Discharge into the Environment		KeNHA/ NEMA	• Biannual Monitoring Report submitted to JICA.
Road traffic	Noise and vibrations	Based on the monitoring results of noise levels, installation of noise barriers should be considered where necessary. Conduct regular monitoring of noise levels along the roadside. Install warning signs on road for horn ban, speed control and lane restriction. Regular maintenance on road to keep road surface good condition. Develop a mechanism to record and respond to monitoring results and complaints.	Noise level: L _{Aeq} (day and night) Vibrations: velocity or acceleration	5 sites	Methods specified by The Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009.		The Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009. General EHS Guidelines; Environmental Noise Management, International Finance Corporation: IFC 2007.		KeNHA/ NEMA	• Biannual Monitoring Report submitted to KeNHA and JICA.
Road traffic	Community Health and Safety	Public Meetings	Opinions, grievance	2 locations per year	2 times a year				KeNHA/ District Offices	• Biannual Monitoring Report submitted to JICA.