Final Updated Environmental and Social Impact Assessment Report for the Mwinilunga to Jimbe Road

SEPTEMBER 2025

DETAILS:	
COMPANY/ LIS CODE	Road Development Agency (RDA)
NAME OF FACILITY	Upgrading of 102Km of the T2 road from Mwinilunga to Jimbe
TYPE OF FACILITY	Road
LOCATION	Mwinilunga to Jimbe in Ikelenge
PROVINCE	North Western
DISTRICTS	Mwinilunga and Ikelenge
ADDRESS OF DEVELOPER	Road Development Agency, P.O. Box 50003, Lusaka.
CONTACT PERSON	Gershom Kalumba Chilukusha
DESIGNATION	Principal Environmentalist
FAX	0211 253404
TELEPHONE	0211 253088/253801/253002
E-MAIL	gchilukusha@roads.gov.zm

EXECUTIVE SUMMARY

Background

The Government of the Republic of Zambia (GRZ), through the Road Development Agency (RDA), intends to rehabilitate/upgrade the road from Mwinilunga to Jimbe border in Ikelenge district as part of the development of the Lobito Corridor.

The EIA Regulations under Part II Clause 7 (2) (a) indicates that an Environmental Impact Statement (EIS) is required to be prepared for any project specified in the Second Schedule of the Regulations, or (b) for any alterations or extensions of any existing project specified in the Second Schedule. The Second Schedule of the Regulations, under Item 2 Transportation (a) specifies that "*All major roads outside urban areas, the construction of new roads and major improvements over 10 Km in length and over 1 Km in length if the road passes through a national park or Game Management Area*". Therefore, an ESIA is required for the upgrading/rehabilitation of the 102Km T5 road from Mwinilunga to Jimbe in Ikelenge.

Justification of the Project

The road project is within the context of Zambia's National Development Plans which is a fulfillment of the Government's sector goal to provide a safe and sufficient road transport system capable of supporting the productive sectors and the social and economic transformation of the country. The project from Mwinilunga to Jimbe will support the regional integration and cross border trade with Angola through the Jimbe border. It will reduce the road maintenance costs, vehicle operating costs and travel times.

Need for the ESIA

The ESIA has been prepared in fulfilment of the requirements of the 1997 Zambian Environmental Impact Assessment Regulations and the updated African Development Bank 2023 Integrated Safeguards System (ISS) safeguards policies.

The Bank's ISS safeguards policies that would be triggered by the project due to its nature include OS 1 - Assessment and Management of Environmental and Social Risks and Impacts; OS 2 - Labour and Working conditions; OS 3 – Resources Efficiency and Pollution prevention Management; OS 4 – Community Health, Safety and Security; OS 5 – Land Acquisition, Restrictions on Access to Land and Land Use, and Involuntary Resettlement; OS 6 – Habitat and Biodiversity Conservation and Sustainable Management of Living Natural Resources, OS 8 Cultural Heritage and OS 10 – Stakeholder Engagement and Disclosure of Information

Particulars of Shareholders/Directors

Road Development Agency (RDA) is wholly owned by the Government of the Republic of Zambia.

Track Record

RDA is the executing arm of Government on all primary and secondary road projects.

Total Project Cost/Investments

The expected project cost is approximately US$54,315,333.00

Project Life Span

The proposed upgrading/rehabilitation of the Mwinilunga to Jimbe Road is designed to have a lifespan of 20 years. Thereafter, RDA will evaluate whether to conduct periodic maintenance or to have the road reconstructed.

Project Commencement Date

The project will commence as soon as the ESIA and the RAP have been approved and the road designs have been finalized. As an AfDB-financed project, commencement of works is also subject to the fulfilment of various Financing Agreement requirements.

The Project

Location

The T005 Mwinilunga to Jimbe road comprises a surfaced 2-lane carriageway for 10.29 km. The road then reverts to a single-lane earth/gravel track of varying width until it reaches the project termination point at the Jimbe River bridge, which also forms the international border between Zambia and Angola (centre of bridge deck). The two large towns along the road corridor are Mwinilunga located at Km 0.00 and Ikelenge at km 56.6. There is also Kalene Hills at km 72.6 as a major settlement. The route also has a number of smaller villages and settlements interspersed.

The width of the road varies between 3.2m and 6.2m (4.9m m average). This indicates that the original road was most probably constructed to Class III or IV standard.

Major Road Defects

The main defects are severe potholing in areas where the road is relatively flat and erosion on the steeper sections. This is caused by inadequate drainage due to inadequate maintenance and shaping/blading of the road, which leads to water ponding on the road and the subsequent traffic induced formation of potholes.

Similarly, the longitudinal erosion of the road on steeper sections is also caused by inadequate drainage, where water cannot drain off the road and this causes the formation of erosion channels.

The section of the T005 between km 57 and km 92.5 from Ikelenge to Jimbe is in a particularly severe state and becomes almost impassable when it rains.

Proposed Road Upgrading

The project involves upgrading the road from the current gravel/earth road to paved standard and demarcation of the road reserve of 100m (i.e. 50m on both sides of the existing centreline for the T005 road from Mwinilunga to Jimbe

The selected technical solutions shall include:

- Road Categorization;
- Road Geometrics;
- Junction Design;
- Road Safety Design;
- Road Furniture; and
- Utilities Designs.

For a road such as this one it is not thought to come completely to an end and thus decommissioning might not take place. On the other hand, the technical estimation for the proposed road life is 20 years, after that period the reconstructed carriageway road would need to be strengthened or re-constructed.

The design concept is to provide a high-speed road that allows safe and efficient movement of traffic with fully controlled access. Although the road will be designed for vehicles, the movement of pedestrians and bicycles along the road will be considered in the overall design.

The geometric design standard adopted for this road almost conforms to the Class I paved standard of the Zambian specification. Depending upon the selection criteria, various typical cross sections have been developed and adopted suitably for different segments of road (i.e. urban or rural areas).

Overall the cross section of the upgrading of the T2 road from Mwinilunga to Jimbe will largely depend upon the road categorization. Bearing in mind that 80% of the project road length is rural; a typical Type 1-Rural cross section will apply to most of the road length. It has been agreed that standardized lane and shoulder widths should be provided for a total roadway width of 11m made up of a 2 x 3.50m = 7.00m wide 2-lane single travelled way and shoulders 2.0m wide each.

Project Alternatives

The road ear-marked for upgrading is an existing road and therefore there are no alternatives to the route for the road. No realignments are anticipated, so no alternatives were available to discuss realignment options either.

This section therefore compares the environmental and social impacts of various widths within which road construction activities could be carried out. These alternatives are as follows:

- Alternative mode of Transportation;
- The "No Project Option";
- Adopting a 100m road reserve width for the T005 road from Mwinilunga to Jimbe and paying necessary compensation to the affected people;
- Adopting a construction corridor that covers the construction width plus a verge either side of the road, and
- Pavement Alternatives.

Project Activities

The project will involve mainly three activities, that is, pre-construction phase, the construction phase and post construction phase.

- ***Pre-construction Phase***-These include mainly feasibility and detailed engineering studies including the environmental and social impact assessment and resettlement action plans.
- ***Construction Phase***-This consists of civil works (construction of the road pavement and bridges/ culverts, etc) and consultancy services. The component of consultancy services consists of design review and construction supervision of civil works.
- ***Post-construction phase***-This phase involves inspection and technical audits in addition to operation and maintenance of the road. Post-construction audit can be taken up with the Contractor prior to expiry of the defects liability period. Sensitization of the

road users and installation of other accident intervention measures may also take place during this phase.

Baseline Information

- ***The bio-physical environment-***The biophysical environment in the area of influence of the Mwinilunga to Jimbe road is a modified one where human activity has essentially altered the area's primary ecological functions.
- ***Climatic conditions –***Overall, the climate of the road project area is controlled largely by the north-south migration of the Inter Tropical Convergence Zone (ITCZ), producing seasons. The road project area of influence has annual average temperature of 19.8 °C, experiencing warm to hot summers, reaching 30 °C and more in September and October and warm winter days, but cold at night. It receives an average of nearly 1,300 mm rain annually, with rainfall exceeding 0.1 mm on an average of 116 days a year.
- ***Topology***- The project road lies on a plateau which is orientated north of north-east – south of southwest. The plateau is incised by streams and rivers, which form gently sloping, shallow valleys. The height of the plateau is between 1200-1400 a.m.s.l. (above mean sea level).
- ***Geology-*** Overall, the project road is located in a structure described as a rigid bloc of pre-cambrian bedrock. This block is divided by Lufilian Arc of folded Katanga sediments crossing the DRC and Northern Zambia through to Angola. The zone is apparently stable but it is cut by several small faults which can produce land sliding whose intensity is weak. The road corridor has never had seismic movement.
- ***Soils-*** The Mwinilunga to Jimbe soils are mainly light sandy clays, orange brown in colour where they overlie lower Roan, with less fertile paler clay sands on flatter grounds. Outcrops of laterite gravel exist along the route, which have been used as sub-base and stabilised base course for the existing road.
- ***Hydrology-*** The river system of the Mwinilunga to Jimbe Road corridor is considered to be part of the Zambezi Watershed and its tributary system. Most of the rivers and streams crossed by the project road flows towards the east north draining into the Lunga River.
- ***Air Quality and Noise Levels-*** The results obtained for all communities show that the ambient concentration of dust over the sampling period is within the given limit, and the ambient noise levels are low. However, dust levels along the road corridor tend to be higher when there is movement of vehicles. The results samples conducted along road corridor means that although during the dry season the project road corridor is characterized by very dry and dusty conditions with large quantities of windblown dust visible in the atmosphere, the major source of dust along the road corridor is movements of vehicles and trucks, resulting from the re-suspension of dust from the dirt road surfaces.
- ***Flora-*** Generally the Mwinilunga to Jimbe road corridor is predominantly characterized by Miombo woodlands with primary vegetation and 2 storey canopies that has dense with ground cover of short grasses. The road corridor is characterized by 16-22 m tree height with common tree species such as Anisophyllea bohemii, Brachystegia boehmii, Brachystegia floribunda, Brachystegia speciformis, Isoberlinia angolensis, pterocarpus angolensis, Diplorhynchus condilocarpon, Uapaca nitida and Faurea saligna.

  The forest inventory in the project area revealed great tree species diversity. From the 84 sample plots, 29 tree species were found within the road reserve the road corridor in the proposed way leave. The results of some of the 13 common tree species per hectare along the sampled way leave area indicated the following number of stems per hectare.

Brachystegia floribunda 38 and ficus species recorded the highest number of stems per hectare followed by brachystegia boemii (22), Anisophylea boemii (21), Brachystegia longifolia (18), Diplorhynchus condylocapon (17), uapaca nitida (14), Pterocarpus angolensis (14), Strychnos coculoides (13), parinari curaterifolia (11), Sysgium cordatum (9),Brachystegia speciformis (9) combretum molle had 7 stems /hectare.The area along the road reserve had a great potential for timber such as pricopsis angolensis and Faurea saligna. The presence of Maquesia and Brachystegia species was an indication of good flora for beekeeping activities.

The flora study has provided useful insight into the uniqueness in terms of high conservation value of the vegetation along the project road corridor from Mwinilunga to Jimbe and the need for sustainable management of forest resources to ensure that the major drainage systems in the area are not disrupted by anthropogenic activities. The area already has experienced a number of vegetation changes including a high dominance of Miombo woodland and a gradual change-over to Chipya due to high incidences of forest fire, and over dependence on agricultural practices which are largely temporal with very low input arrangements.

- ***Fauna*** - In terms of animal life the project road corridor is poor with most of the big game decimated from the area. There are however reports of common duikers, and scrub hares and other smaller animals being present in the area. There is average bird life in the area with guinea fowls and pigeons and most woodland birds as the most common, though not much of birdlife was seen during the assessment.

  It is worth noting that on a wider scale human threats to mammalian life continue to increase with continued growth of human population which seeks more land for food production, more space for settlement and even greater development to improve quality of life. The threat on the area is on the modification of the ecosystem by removal of certain habitats which are perceived to be of lower value compared to the envisaged developments. These threats are eminent for all-natural resources- inclusive of the above listed mammal species. Snaring of small animals like bush babies and rodents is common in the area. Most of the mammal species listed in this discussion are still under the threat of poaching by local people, principally for game meat.

- ***Administrative Set Up***- The project road from Mwinilunga to Jimbe is located in North-western Province. It traverses through two districts namely Mwinilunga and Ikelenge. In terms of traditional administration, the Mwinilunga to Jimbe road passes through two chiefdoms for Chief Kanongesha and Chief Nyakaseya.
- ***Land ownership along the proposed road project*** -Land along the project road is held in customary ownership.
- ***Settlement Patterns***-The settlement pattern along the Mwinilunga to Jimbe Road Project is greatly influenced by livelihood systems and population growth dynamics. Overall however, the settlement pattern is linear along the project road. Other pull factors that have influence on settlement patterns along the road corridor include location of social institutions and streams.
- ***Population Estimates-***The overall goal and benefits of road infrastructure, together with other development pillars, is to contribute towards improved livelihoods; improved public transport; improved access to health and public service delivery; enhanced opportunity for employment and incomes; and achievement of millennium development goals. Special attention has been given on the investment in communities with high

incidences of poverty, unemployed youth, women and vulnerable groups.[1] The population to be directly affected by the project road was taken to include a 200m radius throughout the road corridor as an area of influence.

- ***Gender Based Roles and Responsibilities***-The issue of gender inequality along the project road corridor, just like is the case elsewhere in the country has remained rooted in traditional values and has been exacerbated by limited education, training and skill development; employment opportunities for women and men and; disparities in incomes. Thus, the traditional role of a woman is still perceived as being a mother and taking care of household duties.
- ***Age***-One of the demographic indictors captured and which has relevance to the project is the age of the population along road corridor. Age will be a very important variable during the construction phase of the project because employment opportunities during construction phase will be affected by age. Analysis of the characteristics of household members indicate that majority of people (74%) along the road corridor are below the age of 35 years. During the construction phase of the road the contractor needs to be aware of this young age group to avoid engaging young people below the recommended age (i.e. limiting employment to above 15). One way in which the contractor would avoid child labor, is by ensuring that all those recruited have National Registration Cards.
- ***Gender and Roles***-Another demographic variable considered is gender and roles. The results of the household survey revealed that women and men along the project road have different travel needs and patterns, though the mode of transport largely is the same. Along the road project, out of the 86 women who were interviewed along the road corridor, 73% tend to engage more in non-work, off-peak travel, visiting a more diverse set of locations, using more complex trip patterns or engage in trip chain. This means that when they travel, they tend to have multiple purposes and multiple destinations within one trip, such as shops, market, schools, and health centers. Hence, unlike men, women tend to value flexibility over time savings in their travel choices. On the other hand, out of 104 men who responded to the household questionnaire, the majority (69 percent) reported that their travels are centered on economic aspects (i.e. going to sources of income) and therefore they tend to value speed, reliability, and road safety in that order of importance. The household survey results have further shown that women along the road corridor are more affected by the current state of the road than men in as far as use of bicycles as a means of transport is concerned, with more men (71 percent) using a bicycle twice a week compared to 34 percent of women. When this question is probed further, the results show that one of the reasons for this outcome is that the current road is more geared to motor vehicles and lack provision of cycle lanes or safe areas for cycling. The foregoing results of the household survey therefore means that the upgrading of the road would need to be done in a gender-responsive manner, through the availability of areas for walking and intermediate modes of transport in addition to areas for motorized vehicles. This will enable women to perform their multiple roles and, therefore, satisfy their practical gender needs.
- ***Poverty Levels***-In terms of poverty levels, majority of households along the road corridor fall within the "poor category" (60%) and over half of these poor households have income far below the poverty line (ZMW517.6 per adult per month). Only 7% of the households interviewed indicated that their incomes were above ZMW500 per month, while 38% indicated that their income per month is less than ZMW5000 and

therefore fall under the lower poverty line. Another economic indicator used to determine the poverty level along the road corridor was household size. Poor households along the road corridor tend to be large. The household survey revealed that majority of households (38.9%) have between 5-8 members. In terms of household headship, female headed households are more likely to be below the poverty line. Although the results of the household survey indicate that only 23% of the respondent were female headed households, the number of these female headed households living below the lower poverty line is significant (73%) compared to 29% of male headed households living below the lower poverty line. Finally, ownership of consumer durables among households along the project roads was generally low, and there was little difference in asset ownership among poverty groups. Only 60% of households owned an average of two consumer durable items. Nearly 60% owned a radio, and 40% owned a bicycle, but only small number of households owned such other items as sewing machines, televisions, refrigerators and other items.

- ***Income Composition***-Although there are no trend data on the composition of household income along the road corridor, the baseline survey requested the actual household income per month. People generally tend to under report their incomes, and it is likely that the reported figures for the baseline survey is even further under reported, given that many of these households produce some food for household consumption. Despite these limitations, results of the baseline survey showed that the majority of households in the project area earn less than ZMW500 per month, with a significant number of these households earning less than ZMW300 per month. The main sources of income are: (a) own livelihood or economic activity; (b) income from employment paid in cash; (c) unpaid income; (d) other cash income; and (e) income from employment paid in kind. Respondents were asked to identify their main and second source of income. It appears that own livelihood or economic activities play an important role in day-to-day living of households along the road corridor with more than 80% dependent on it. This pattern could change when the roads are completed, although it is with optimism that such change is in favor of a higher proportion for the combined own livelihood and employment income sources.
- ***Livelihoods Activities and Strategies*** -Making ends meet for the households along the road corridor is a daily struggle and this is not just a case for the road corridor but it is a common feature among Zambian Rural Households. The baseline information obtained along the road corridor indicated that households typically pursue diverse livelihood portfolios, not because they have plenty of economic opportunities, but as a response to a range of constraints and risks. Much of the road corridor's population is dependent on slash-and-burn, rain-fed agriculture for its subsistence. Maize still dominates the crop production along the road corridor, although it is declining because of diversification away from maize due to the resurgence in the production of traditional crops. The factors observed throughout the country, and which are responsible for the decline in maize, also hold for the observed decline in maize production along the road corridor. These are (i) Reduced subsidies have made small scale farmers intensify crops that rely less on modern farm inputs-fertiliser and seeds. (ii) These crops have become increasingly marketable both domestically and through cross border trade.

Positive Impacts of the project-all phases

- ***Employment opportunities-*** Upgrading of the proposed road presents income opportunity for contractors and tax revenue for government. About 300 people might be directly hired by the contractor during road construction. The majority of this number will be low-skilled labour from local communities. This presents a positive but short-term

economic benefit especially for youths. However, it is common for the largest proportion if not all of this labour to comprise male workers only but for equitable benefit and gender equity, able women should also be hired wherever they meet job requirements. The likelihood of the impact occurring is high but the benefit (severity) to wider local communities would only be moderate (hence medium severity). Therefore, impact significance is *moderate.*

- ***Income from construction materials***-Road construction will require 900,000m^3 of gravel and 60,000m^3 of aggregate. Other materials are lime, bitumen, water, cement and steel especially for bridges. Procurement of these resources connotes income to suppliers and owners of land where quarry sites will be located. This is a positive but short-term and reversible impact. The likelihood of the impact occurring is high but benefits will be to a small section of community (business owners/ material suppliers) hence medium severity. Therefore, impact significance is *moderate*.
- ***Opportunity to Improve Drainage***- The road is an existing road, hence the impact of the existing road as a barrier to natural drainage can be observed especially on low lying areas. It is intended that the present effects of the road will be studied, as part of the overall design process, to improve drainage in general. Therefore, impact significance is *major*.
- ***An improved road*** -Improvement of the road will have positive, significant and long-term local, national and regional socio-economic impacts. These include: Reduced vehicle wear/ tear; Reduced travel time; Safer journeys with reduced accident risk. Accident rates change following improvement in road geometry and pavement. Upgrading the project road will improve visibility, reduce braking distances and have road signs installed where none existed. Although speeds are expected to increase, there is evidence that overall, upgrading of the project road will reduce accident rates and fatalities. The duration of this impact will be long-term and the likelihood of occurring is high after road improvement. Benefits to every road user will be of local and regional spatial extent hence high severity. Therefore, impact significance is *major*.
- ***Increased economic activity*** -A good road will enhance access to cross border trading, improving local and regional economies. Road improvement will also stimulate development of businesses along the road, for example, roadside markets and secondary job opportunities from new businesses. This is a positive and long-term impact. Secondary benefits such as jobs created as a result of increased economic activity will also be long-term. The duration of this impact will be long-term and the likelihood of occurring is high after road improvement. Increased economic activity in local economies would benefit all communities along the road hence high severity. Therefore, impact significance is *major*.

Negative Impacts of the project- all phases

- **Increased hazard and no hazard waste** - Camp and equipment yard will require land to develop, temporarily altering land use. Their operation will generate domestic and hazardous waste (waste oil) which if improperly managed will contaminate local environmental resources (soil, water) and pose public health risks. Livestock could die from feeding on camp waste such as peelings commingled with plastic carrier bags. Lack of medical facilities at camp would pose a considerable risk to workers' health. Unrestored camp and yard sites are an aesthetic blight and contamination from fuel, oil or unused bitumen degrade the environment. Duration of impacts is short-term; extent is local but likelihood high. Due to the small footprint, impact severity on receptor community will be moderate (medium) if sites are left contaminated rendering overall impact significance to be *moderate*.
- ***Loss of Vegetation***-Although much of the road section is modified and the species' composition in the area is poor in terms of diversity due to the disturbance of natural habitats by anthropogenic activities, there are some sections of the road corridor with good standing miombo woodlands, which will be affected by the proposed road upgrade. This will be more severe along the two protected forests where the land is maintained in its pristine state. Loss of vegetation could impact fauna, accelerate soil erosion, siltation of streams, swamps, and rivers due to sediment transport. The *likelihood* of the impact occurring is high while its duration will be medium-term since land-take would be permanent. Without mitigation, severity of this impact would be moderate high resulting into a *moderate* overall significance level.
- ***Increased Sediment Load*** - During road upgrade, bridges will be constructed at several river crossings. Construction of bridges will have the potential impact of increasing sediment load in rivers. Increase in sediment load in watercourses would impair water quality and impact magnitude would depend on size (flow of river), construction methodology and preventive strategies or precautions instituted. Impact is negative but temporary and reversible. Likelihood of this impact occurring is moderate hence severity is medium (Contractor and supervisors will be competent to construct bridges/culverts in such areas). Impact significance is thus *minor-moderate*.
- ***Gully erosion and land degradation -*** Drainage is an important provision to the road to avoid deterioration by stormwater. Drains will be designed and constructed to divert runoff from the carriageway discharging it onto adjoining land. This should be done at non-erosive velocities to avoid gully erosion. Erosive stormwater discharged onto land/ property adjoining the road would lead to gullies and land degradation; siltation of streams, swamps and rivers due to sediment deposition; and modification of natural drainage patterns. Gully erosion and land degradation impacts would be long-term (prevailing for as long as road life) if not controlled. Likelihood of impact occurrence is medium (with good road drainage design) but severity high when farmlands are destroyed. Impact significance is therefore *major*.
- **Delays in transportation of goods and passengers, traffic congestion or accidents** -Road construction will necessitate diversion of traffic from sections being worked on to allow fast and safe road works or continued use of the route. Diversions will cause temporary delays in transportation of goods and passengers, traffic congestions or accidents (especially for heavily laden trucks and trailers) along detour roads that may not have been constructed properly. Impact is negative but temporary and reversible (note that effects of accidents such as loss of life are irreversible). *Likelihood* of this impact occurring is high; however, it will be short-term ceasing with end of construction hence medium severity. Additionally, not all road sections will

necessitate diversions hence impact severity is medium. Overall impact significance is therefore *moderate*.

- ***Increased noise, vibrations and dust*** -The road project will utilize 900,000m³ of gravel and 60,000m³ of aggregate. Direct and secondary effects (noise, vibrations, dust, fly rock injuries, etc) associated with stone/ rock quarrying and excavation of gravel can pose negative and sometimes irreversible social impacts. Gaping excavations due to unrestored pits cause visual blight and scarring of landscapes besides posing public health and safety risks. Some secondary impacts of stone blasting and quarrying such as injury or death caused by fly rock are irreversible. Damage to dwellings near quarries would be a considerable social impact in rural poor communities. Unless a firm contractual commitment is made by the contractor, leaving unrestored quarry sites is a common practice in Zambia and likelihood of this impact occurring is high. Impact severity is medium (or even low) except when quarries are located close to communities, an unlikely situation unless alternative sites cannot be found. Impact significance is therefore *moderate*.
- ***Staining of households and goods -*** Road construction will necessitate transportation of materials from sources to worksites. Haulage of gravel and crushed stone (aggregate) from sources to road construction work sites will be associated with the following impacts: Staining of households and goods in roadside shops by dust, Traffic accidents involving people, wildlife and livestock, Haulage traffic noise. Although never compensated, staining of trade commodities in shops (especially foodstuffs: salt, sugar, flour, etc) with dust translates into a financial loss for local business owners. Excessive dust in dwellings poses a short-term health impact. Unless speeds are controlled, material haulage poses a risk of road accidents especially near school crossings, livestock crossings and in trading centres. Haulage traffic noise is not expected to be a significant impact except near schools and health centres. Risk of this *potential* impact actually occurring is highest in trading centres or through settlements with considerable population but largely impact extent is along entire length of the road. Material haulage will be short-term ceasing with completion of construction activities but secondary effects (if they occurred) such as accidents (hence disability or death) have negative, long-term and possibly irreversible socio-economic impacts. If mitigation recommendations are implemented, the likelihood of the impact occurring is medium but impact severity high especially when accidents involve loss of lives. Significance of road dust will be comparatively highest through trading centres where goods and foodstuff in shops could be contaminated. Overall impact significance is therefore predicted to be *major*.
- ***Pollution of land and watercourses*** -During the construction period, there will be a need to stockpile and store assorted materials at or near the construction site so as to ensure easy and uninterrupted access to supplies. This will lead to pollution of land and watercourses by spilling and wash away of materials. Additionally, material losses are a financial loss to the contractor. There is a potential pollution risk if construction materials (fuel, lubricants, and gravel) are not stored or handled properly. Spill accidents may cause contamination of watercourses or kill off vegetation and fauna. Inadequate management of storage areas can also result in material loss through spillages or washing away of stockpiles. This impact is negative with a medium likelihood of occurrence but will be short-term in temporal extent, only occurring during the construction period and local in extent, mostly localised to areas near storage sites. However, spills in watercourses can impact remote/ distant downstream communities.

Severity is therefore assessed as medium resulting in an overall significance level of *minor-moderate*.

- ***Loss of vegetation and littering due to asphalt plant operation*** -Surfacing a 102km road will require considerable quantities of bitumen. Its preparation, storage and application could have socio-environmental impacts. If firewood is used in heating bitumen, considerable cords of wood would be necessary representing a significant loss of vegetation for the entire road length. Littering due to poor housekeeping at the asphalt plant or improper disposal of unused bitumen and aggregates or bitumen spills would have the localised impact of contaminating environmental resources (soil and water). The impact is negative, temporary and reversible but the likelihood of this impact occurring is low since ingredients of asphalt (bitumen and aggregate) represent a financial cost to the contractor and waste is unlikely. Although high in organic contaminants, bitumen is biodegradable. Since contamination impact would often be localised, spatial extent is small and severity is *medium*. For the foregoing reasons and the fact that alternative heating fuel other than wood is possible, impact significance is *moderate*.
- ***Social ills of construction labour including crime & HIV/AIDS*** -In local communities, construction workers will be idolized as richer with ready income to spend. This and influx of workers, typically young males seeking road construction job opportunities could lead to an increase in social pathologies such as alcohol or illicit drug abuse and prostitution. The risks include contraction of communicable diseases including HIV/AIDS. Vices such as drug abuse and prostitution would affect social coherence and security in project communities maligning the image and intent of an otherwise good project. Unless adequate sensitization of all workers is undertaken by the contractor, the likelihood of the impact occurring is medium (considering some level of awareness among the general populace). The duration of the above-mentioned social ills will be short-term ending with completion of road construction but associated social and health effects are long-term and irreversible. The risk of HIV/AIDS makes this impact of high severity resulting in an overall significance level of *major*.
- ***Demolition of structures within the road reserve of the proposed road*** -During road upgrading, structures within the road reserve will be demolished, but it is anticipated that this will not happen until every affected person is duly compensated as per the Bank Safeguard policies and commensurate advance notices to vacate the affected properties has been provided. Although there will be loss of structures during road upgrade, every affected person will be compensated by Government, therefore this impact will not be critically adverse if people are compensated at replacement value and given adequate notice to vacate affected structures before construction commences. The *likelihood* of the impact occurring is high. Since compensation will be provided to replace affected structures, severity of this impact will be medium resulting in a *moderate* overall significance level.
- ***Occupational health and safety risks for workers*** -Road works will have the following occupational health and safety risks with potential to cause serious injuries to workers: Burns (handling hot bitumen, welding/hot works, etc); Falls from working at heights or wet surfaces; Electrocution; Noise and body vibration from equipment; Injury from fly rock e.g. at quarry sites or debris when demolishing affected buildings and accidents from construction vehicles. Lack of hand wash water and mobile toilet facilities at work sites could also pose considerable health risks to workers (and the local communities traversed). OHS impacts will potentially occur at any point during road construction and while some accidents could be minor, others might be grave leading to permanent disability or loss of lives of construction workers. Duration of the impact will

be short-term, occurring only during the construction phase. Extent of the impact will be local or national depending on origin of construction workers. Likelihood of the impact occurring is high considering the usually low level of safety at construction sites in Zambia. Significance of this impact is therefore predicted to be *major*.

- ***Increase traffic accidents -*** Drivers on a newly improved road will always excitedly drive faster than is often safe: a phenomenon referred to as "*new road effect*". This usually happens in the first months of commissioning a new road and is associated with frequent road accidents. Likely effects will be human and livestock accidents. Driving at unsafe speeds on a newly completed road would pose accident risks with possible loss of lives and goods. Impact is negative but reversible with safe road use sensitization campaigns for 1-2 months before road commissioning. The impact would be short-term but resultant effect long-term if no concerted effort is expended in sensitization of road users and local communities. Likelihood of impact occurrence is medium but severity high where accidents lead to loss of life. Impact significance is therefore *major*.
- **Climate change risks** – The project implementation is unlikely to lead to any climate change risks as vegetation clearance will be restricted to areas where civil works will be implemented and furthermore the road project will be undertaken in an area that is already developed. The recommended complementary activities of tree planting are expected to minimize any possible climate change risks.

Environmental Hazard Management

The upgrading of the Mwinilunga to Jimbe road could entail occupational hazards/ risks and accidents especially involving motorised road construction equipment, asphalt plant and stone quarries. The following measures are proposed to control this risk:

(a) ***Accidents from equipment***: Only trained/ certified operators will operate motorised equipment.

(b) ***Blasting explosives safety:*** During road construction, the contractor will ensure the following:
- Stone blasting is only done by licensed blasters.
- All explosives are delivered to quarry sites (under security escort as Zambia's security requirements demand) on the day of blasting and any remnants returned into security custody after blasting. After each blast, site inspection will be conducted for un-detonated explosives.
- Advance warning is given to local communities near quarry sites before a blasting episode.
- After each blasting incident, inspection is conducted in communities around quarry sites to identify any offsite damage to private property, which should be duly and equitably compensated.
- All workers should be adequately protected from risk of fly rock and blasting noise.

(c) ***Risk of burns/ scald at asphalt plant:*** This risk will be averted by contractors using only licensed operators following stringent safety guidelines and operation procedures. Operations involving hot bitumen shall be limited to daytime in adequate natural light.

(d) ***Fire safety:*** Fire safety equipment and personnel will be provided in workers' camp. Warning signs will be provided at areas of potential fire sources, e.g. at fuel storage areas.

(e) ***Medical emergency response:*** The contractor will have a medical clinic and a standby vehicle to immediately transport any accident victims to a nearby hospital in Mwinilunga and Ikelenge. *First Aid* facilities will be provided at construction sites, equipment yards and in camps.

(f) ***Oil/ fuel spills***: Accidental oil and/ or fuel spills would occur when contractor's trucks or vehicles are involved in road accidents or negligence of staff while on duty. Accidents may be caused by improper use of equipment, mechanical faults in equipment or vehicles among others. Spills or leakages would result in contamination of soils and water resources with hydrocarbons. Hydrocarbons and particulate matter if released into the soil will affect its productivity and pose a health risk to the community, animals and plants around. In water resources, it would affect the aquatic vegetation and fauna in addition to disrupting water supply to the communities that rely on them.

No vehicle or equipment shall be allowed to be used if any oil or fuel leak is observed. The contractor shall have spill control equipment on standby both at the workers camp and road construction site to ensure that any leakage or spill is contained and cleaned on time.

Monitoring and Reporting

Institutional Arrangements- The primary oversight to ensure that mitigation actions are implemented will rest with the RDA's Directorate of Construction and Rehabilitation working with the Environmental and Social Management Unit (ESMU) under the Directorate of Planning and Design. The Zambia Environmental Management Agency (ZEMA) has regulatory supervisory and monitoring roles. The RDA shall require contractors to comply with this ESMP and assign a fulltime staff (Environmental Officer) to undertake environmental supervision during construction. The RDA confers full mandate to the supervising engineering consultant (SEC) to supervise the road project on a day-to-day basis. The SEC will oversee the contractors work through a full-time environmental specialist. This specialist should guide the contractor's fulltime Environmental Officer in undertaking their own responsibilities, including reporting.

Monitoring will be undertaken by the RDA's ESMU. Monitoring by ZEMA is "third party monitoring" but this is its regulatory mandate according to the Environmental Management Act of 2011, and no funding is expected from the RDA. Another government agency that may undertake "third party monitoring" is the Occupational Health & Safety Department in the Ministry of Labour & Social Security. This unit has authority to inspect any facility for compliance with national requirements on safety in workplaces. The project shall make no funding to the Ministry since this is provided for in its annual budget. Monitoring will be done through site inspection, review of grievances logged by stakeholders and *ad hoc* discussions with potentially affected persons.

Environmental and Social Management Plan

Below is a table presenting a summary of the Environmental and Social Management Plan (ESMP) of the project.

Environmental and Social Monitoring Plan

Aspect	Mitigation measures	Monitoring Indicators	Responsibility	Implementation	Cost Estimates	Monitoring Oversight
Land and Soil	• Direct road runoff away from the road by installing side drains and mitre drains; • Embankment side slopes should be planted with shrubs and grasses to stabilise them and prevent erosion; • Replant sections already completed immediately; • Topsoil and overburden should be stored in separate piles; • The spoil heaps should be covered to reduce the amount of soil washing/blowing away. • On areas where the risk of erosion is evident, stabilize the areas and prevent erosion. These may include, but not limited to; ✓ Confining construction activities; ✓ Using cut off drains; ✓ Using mechanical cover or packing structures such as geo-fabric to stabilize steep slopes or hessian, gabions, mattress and retaining walls; ✓ Mulch or chip cover; ✓ Constructing anti-erosion berms	• Excavated materials and excess earth will be kept at appropriate sites approved by the Supervising Engineer; • The earth dumping sites will be designed in such a manner as to facilitate natural water discharge; • The erosion prevention measures must be implemented to the satisfaction of the RE; • Where erosion does occur on any completed work/working areas, the Contractor shall reinstate such areas and areas	• RDA – ESMU • Supervising Engineer	During Construction Phase	Cost not applicable as this is part of the construction cost included in the BOQ and Tender Documents/Contract	• ZEMA • AfDB Missions

		damaged by the erosion at his own cost and to the satisfaction of the RE and ESO.				
	• Maintenance of machinery, bunding the garage, and directing spills to an oil sump which should be emptied into a designated final disposal site; • Bulk oil storage tanks must be contained in a concrete bund and the bunded area must have a concrete floor, with no drain outlet; and • The workshop should be entirely surrounded by a drain leading to an interceptor.	• Monitoring at specified stations affected; and • Record of Analysis • Reports on site.	• RDA – ESMU • Supervising Engineer	During Construction Phase	• 200,000.00	• ZEMA • AfDB Missions
Vegetation	• Conduct training on ecological conservation measures for all construction workers. • Encourage re-vegetation after construction activities are finished • Limit clearing of vegetation to what is absolutely necessary; • Keep construction width to a minimum • No use of herbicides; and • Provide workforce with alternatives to fuelwood and charcoal.	• Number of trainings conducted on ecological conservation • Number of places re-vegetated	• RDA – ESMU • Supervising Engineer	During Construction Phase and Operation Phase	• 300,000.00	• ZEMA • Forestry Department • AfDB Missions

Sedimentation	• Erosion control measures must be implemented to prevent introduction of sediment-laden runoff into surface waters (e.g. gabions, hay bales, silt screens, settling basins, sediment traps) • Sides of drainage channels shall be planted with grass or stone pitched	• Number of places re-vegetated • Number of erosion control measures put in place	• RDA – ESMU • Supervising Engineer	During Construction Phase and Operation Phase	300,000.00	• ZEMA • WARMA • AfDB Missions
Protected Areas	• Limit clearing of vegetation to what is absolutely necessary; • Provide workforce with alternatives to fuelwood and charcoal.	• Hectarage of the Forest Reserves	• RDA – ESMU • Supervising Engineer	During Construction Phase	N/A	• ZEMA • AfDB Missions • Forestry Department • NHCC
Surface and Underground water	• Control the amount of material that is required to be laid onto the crossings, and ensure that this material is applied carefully, and immediately compacted; • Rehabilitation of the culverts and swamp crossings should be done during the dry season, wherever possible; • Ensure that construction debris is disposed of in a sensible manner and not thrown into the swamps and rivers, or along the roadside; • Wastewater and sewage from the contractor's yard must also be disposed of properly; and • Construct a septic tank at	• Water quality	• RDA – ESMU • Supervising Engineer	During Construction Phase and Operational Phase	350,000.00	• ZEMA • AfDB Missions • WARMA

	construction yard and at the workmen's camp where all wastewater and sewage should be disposed of.					
	• Design drains and culverts to capture and slow down runoff water and settle sediment; and • Stores oil and fuels at contained locations away from drains.	• Visual assessment of suspended solids; • Record of Analysis reports on site.	• RDA – ESMU • Supervising Engineer	During Construction Phase	150,000.00	• ZEMA • AfDB Missions
Air Quality	• Suppress dust through water sprinkling by using a water bowser or the application of molasses or other palliatives on the road surfaces; • Wet quarry loads being transported in open trucks; • All workers should wear dust masks at all times when at the sites of high dust generation; • Warn the neighbourhood of possible generation of dust beyond normal levels; and • Construction machinery should be well maintained and low sulphur diesel should be used.	• No of complaints received from stakeholders	• RDA – ESMU • Supervising Engineer	During Construction Phase	400,000.00	• ZEMA • Ministry of Labour • AfDB Missions
Aspect	**Mitigation Measures**	**Monitoring Indicators**	**Responsibility**	**Implementation**	**Cost Estimates**	**Monitoring Oversight**
Noise	• Special care should be taken when construction is taking place near sensitive	• No. of complaints received from	• RDA – ESMU • Supervising Engineer	During Construction Phase	300,000.00	• ZEMA • Ministry of

	receptors such as schools and clinics; • To the extent possible, heavy vehicles should not be used at night across populated areas; • Ensure that construction equipment is operating optimally and with operational noise mufflers where possible. • Controlled blasting shall be used to just weaken the rock for excavation with earth moving machines. • Protective clothes for ear protection shall be provided to all the workers and inductions shall be conducted • Operations shall be conducted with observation by safety officers and all activities shall be conducted during the normal working hours of the day to avoid noise disturbance at night • Periodic noise monitoring shall be conducted to ensure that the noise emitted is below the international threshold limit value of 85dBA outside the plant • The crushing plant shall be frequently serviced to ensure operations are within the manufacturer's specifications. • Notify the community about works due to take place in any particular road section at least 5 days before	the surrounding communities				Mines – Mines Safety Department • AfDB Missions

	construction is due to commence in their vicinity; • Establishment of signboards near sensitive receptors like schools, places of worship etc.					
Solid and Hazardous wastes	• Store construction waste, garbage, and domestic and human waste in designated places only and remove and dispose regularly. • Ensure that waste materials are properly disposed of at suitable locations. • Inspect waste storage areas and facilities periodically. • The contractor should develop a waste management plan; • All personnel shall be instructed to dispose of all waste in a proper manner • Contractor shall provide litter collection facilities; • The final disposal of the site waste shall be done by approved waste disposal agents;	• Waste disposal Registers	• RDA – ESMU • Supervising Engineer	During Construction Phase	300,000.00	• ZEMA • Local Authorities • AfDB Missions
Properties in the Road Reserve area	• It is estimated that about 1,497 PAPs will lose their houses/kitchens or trading shops. The owners of these structures will however be compensated at current market value in accordance with the AfDB guidelines.	• Number of property owners compensated • Valuation Report	• RDA – ESMU • Supervising Engineer	During Construction Phase	44,410,898.40	• ZEMA • AfDB Missions

Archeology and Cultural Heritage	• Construction activities to be confined to approved site areas • Chance finds to be reported to National Heritage Conservation Commission	• Number of finds	• RDA – ESMU • Supervising Engineer	During Construction Phase	100,000.00	• ZEMA • NHCC • AfDB Missions
Road Traffic and Safety	• Control of dust emissions from the roads • Limiting construction activity during day time working hours • Install speed humps at schools and settlements to slow down traffic • Install road signage e.g. speed limits • Hold regular sensitization meetings with the surrounding communities • Hold regular toolbox talks with drivers and equipment operators	• No of accidents • No of toolbox talks • No. of community sensitization meetings	• RDA – ESMU • Supervising Engineer	During Construction Phase and Operation Phase	200,000.00	• ZEMA • RTSA • AfDB Missions
Occupational Health and Safety	• The Contractor shall comply with all standard and legally required health and safety regulations as promulgated by Factories and Other Places of Work Act and also the ILO Guidelines on Safety and Public Health in the construction activities; • The Contractor shall provide a standard first aid kit at the site office; • There should be a Safety Officer on site who has first aid training and knowledge of safety procedures; • Speed limits appropriate to the vehicles driven are to be observed at all times on access and haul roads; • No unauthorized firearms are	• Number of first aid kit provided on site. • Number of PPE issued to workers • Numbers of accidents recorded	• RDA – ESMU • Supervising Engineer	During Construction Phase	350,000.00	• ZEMA • AfDB Missions • Ministry of Labour

	permitted on site; • The Contractor shall provide the appropriate Personal Protective Equipment for staff. • Limiting construction activity during day time working hours • Install speed humps at schools and settlements to slow down traffic • Install road signage e.g. speed limits					
Community Health and Safety	• The Contractor shall be responsible for the protection of the public and public property from any dangers associated with construction activities, and for the safe and easy passage of pedestrians and traffic in areas affected by the construction activities; • All works which may pose a hazard to humans and domestic animals are to be protected, fenced, demarcated or cordoned off as instructed by the RE. If appropriate, symbolic warning signs must be erected; • The HIV/AIDS prevention campaigns should be conducted at the camps as well as in the trading / market centres. The contractor shall take an active role in civic and public health education to his employees. The campaign shall include the training of facilitators within the workers, information posters in more frequented areas in the campsite and public areas,	Implement STD and HIV/Aids awareness programme to the construction workers and the community	• RDA – ESMU • Supervising Engineer	During Construction Phase	900,000.00	• ZEMA • AfDB Missions • National AIDs Council of Zambia

	availability of promotional material (T-shirts and caps), availability of condoms (free), and theatre groups. • The contractor will provide condoms at appropriate places in the work camps. The campaigns will be continuously done by the relevant Government organization even during operation phase of the road. • Train peer educators • Work with schools to target the youth					
Vulnerable Groups	• Provide equal employment opportunities to the vulnerable groups • Reserve 15% jobs to the women • Children below the age of 18 should not be employed on the project	• Number of women and disabled people employed on the project	• RDA – ESMU • Supervising Engineer	During Construction Phase	50,000.00	• ZEMA • AfDB Missions • Ministry of Community Development and Social Welfare
Discrimination On employment opportunities	• To avoid conflicts with the local people on employment is it proposed and important that the Contractor employs the locals in liaison with local leaders and administration in unskilled and semi-skilled duties; • To promote the livelihood of vulnerable groups such as women, there will be a need to undertake sensitization and awareness campaigns to the local community to promote gender equity in employment during the road construction works. • Contractor to make deliberate	• Employment of local people • Specific jobs will be exclusive for women	• RDA – ESMU • Supervising Engineer	During Construction Phase	50,000.00	• AfDB missions • Ministry of Labour

	efforts to include and retain women in construction					
Local Economy	• For unskilled workers priority will be given to local people • Construction materials and food items to be obtained locally	• Number of local people employed	• RDA – ESMU • Supervising Engineer	During Construction Phase	N/A	• AfDB Missions • Ministry of Labour
				Total cost	**48,360,898.40**	

Public consultations

Public consultations were undertaken at various levels to enlist the perceptions of the different stakeholders on the impacts of the road project. During the period March to April 2025, discussions were held with district officials in the project area at Mwinilunga and Ikelenge and with the affected people at Jimbe on 2 April 2025, Kalene Trading centre on 2 April 2025 and at Lwakela Trading centre on 3 April 2025. The meetings were used to disseminate information about the road rehabilitation project and the anticipated relocation of properties from the road reserve areas along the road corridor. Project risks such as dust pollution, transmission of sexual diseases, loss of vegetation and water pollution.

Among other issues and concerns that were raised during stakeholders' consultations were suggested strategies on how negative impacts can be mitigated. From the FGD and interviews the respondents made the following strategies for addressing the negative impact.

- Create awareness among the community about the positive and negative impacts of the proposed road upgrade;
- Local people be given job opportunities in employment;
- Enhance awareness on health issues such as HIV&AIDS, drug/alcohol abuse;
- Establish counselling centres of HIV&AIDS;
- During construction, the road should be watered constantly to reduce dust;
- Compensation for demolished structures;
- Notices should be given in good time (12 months) to allow those affected to shift;
- Any loss of property/business should be compensated;
- Compensation should be done in a very transparent manner;
- Parents should sensitise their youth on dangers of drug/alcohol abuse and immoral acts;
- Involvement of the affected persons at all levels of the process so that they are psychologically prepared; and
- Have drivers adhere to traffic laws.

The above outlined strategies formed part of the basis for the formulation of project mitigation measures in the ESMP and informed the RAP process.

Most of the respondents in the project area have a positive outlook towards the rehabilitation of the project road. The youth are looking forward to employment opportunities during the construction phase while the Project Affected Persons were mainly concerned about compensation aspects. Though these findings and observations reveal that, the wider population and the PAPs are largely in favour of the project, efforts need to be made by RDA and the District administration to sensitize and mobilize the PAPS so that they can sustainably benefit from the road project. Of concern is the need to assist PAPs on strategies of managing and utilizing compensation packages for improvement of their livelihoods and replacement of lost assets.

Estimated Budget

The estimated overall budget for the implementation of the environmental and social measures is **ZMW 49,658,222.40 (USD 2,159,053.19).** This amount will cater for:

i. The cost of implementing the ESMP including environmental and social monitoring which is estimated to cost **ZMW 45,748,223.40** (**USD 1,989,053.19).** This cost will cover aspects such as the conduct of awareness and sensitization activities that include road safety, HIV/AIDs, gender awareness campaigns, air and water quality monitoring,

erosion and drainage control, environmental and social audits, compensation of project affected people, provision of PPE to workers.

ii. The cost of building the skills and capabilities of the institutions that will play key roles in the implementation of the ESIA which is estimated to be **ZMW 3,910,000.00** (**USD 170,000.00)**

The table below illustrates the budget details

	Mitigation Measures	Total Cost (ZMW)	Total Cost (USD)	Source of Funds
01	Compensation	44,410,898.40	1,930,908.63	Government of the Republic of Zambia
02	Conservation projects, awareness & sensitization	334,950	14,563.04	AfDB
02	Road safety awareness & sensitization	72,439	3,149.52	AfDB
04	Public traffic flow management during construction	35,975	1,564.13	AfDB
05	HIV/AIDS awareness and education including Gender awareness & Sensitization	300,000	13,043.48	AfDB
06	OHS provisions for workers	60,365	2,624.57	AfDB
07	Erosion and drainage control	73,780	3,207.83	AfDB
08	Air and water quality monitoring	49,329	2,144.74	AfDB
09	ESMP Management and Audits	182,926	7,953.30	AfDB
10	Institutional Collaboration and Monitoring of ESMP	300,000	13,043.48	AfDB
	Subtotal	**45,748,223.40**	**1,989,053.19**	
11	**Capacity Development of key institutions in the ESIA implementation process**	**3,910,000.00**	**170,000.00**	AfDB
	Subtotal		**170,000.00**	
	Grand total	**49,658,222.40**	**2,159,053.19**	

Conclusion and Recommendations

The findings from the Environmental and Social Impact Assessment show that although the proposed road upgrading of the project road from Mwinilunga to Jimbe is expected to have a number of negative impacts on the environment, most of these are anticipated to occur during the construction phase and are mitigated in the overall road design. The benefits that will accrue for the Zambian economy will be substantial.

There are some important potential environmental impacts that will accompany the project, both in the short and long term. During construction, potential negative impacts that are considered to be significantly high relate to impacts on demolition of structures, increased charcoal burning and trading, public health and soil degradation. These potential impacts are relatively easy to mitigate and their impacts are reversible.

The assessment shows that although the project will have adverse impacts on the environment, most are such that they are easily containable within acceptable limits provided that the

appropriate mitigation measures are adopted. The assessment also shows that there are many positive impacts of the project. All environmental and social concerns will be mitigated as detailed in the ESMP. A framework for the implementation and monitoring of the ESMP has been proposed and budgeted for. Compared to socio-economic benefits of the road project, many of the negative impacts will be insignificant as long as fair compensation and mitigation actions are implemented.

It is recommended that the project should go ahead with the implementation of the ESMP proposed in this report to mitigate the foreseen environmental and social impacts. In overall terms, Best Engineering Practices should be employed and proactive measures during O&M should be implemented and if achieved, the environmental and social impacts of the project should be easy to mitigate.

Contents

EXECUTIVE SUMMARY 1

LIST OF TABLES 8

LIST OF FIGURES 8

1.0 INTRODUCTION 9
1.1. BACKGROUND INFORMATION 9
1.2. ROAD DESIGN 10
1.3. JUSTIFICTION OF THE PROJECT 10
1.4. ESIA OBJECTIVES 11
1.5. GEOGRAPHICAL AND THEMATIC SCOPE OF THE ESIA 11
1.6. Contact Details of the Developer 12
1.7. Particulars of Shareholders/Directors 12
1.8. Track Record 12
1.9. Total Project Cost/Investments 12
1.10. Project Commencement Date 12
1.11. METHODOLOGY FOR PREPARATION OF THE ESIA 12
1.11.1. Introduction 12
1.11.2. The process followed in the EIA 13

CHAPTER TWO 11

2.0 POLICY, LEGAL AND ADMINISTRATIVE FRAMWORK 11
2.1 ZAMBIA POLICIES AND LEGAL FRAMEWOKS 11
2.1.1. Relevant Policy Framework 11
2.1.2. Legal Framework 12
2.2 Integrated Environmental and Social Impact Assessment Guidelines 20
2.3 RELEVANT INTERNATIONAL AGREEMENTS 23
2.4 INSTITUTIONAL FRAMEWORK 27
2.4.1 Ministry of Infrastructure Housing and Urban Development 27
2.4.2 Road Development Agency (RDA) 27
2.4.3 District Councils and Traditional Leadership 27
2.4.4 Zambia Environmental Management Agency (ZEMA) 27
2.4.5 National Road Fund Agency (NRFA) 27
2.4.6 Road Transport Safety Agency (RTSA) 27
2.4.7 Contractors and Supervising Engineers 28
2.4.8 Communities 28

CHAPTER THREE 29

3.0 PROJECT DESCRIPTION 29
3.1 PROJECT LOCATION 29
3.2 EXPECTED AREA OF INFLUENCE (AoI) 30
3.3 CONSTRUCTION EQUIPMENT AND MATERIALS 31
3.4 SOCIAL IMPACTS IN THE DESIGN 31
3.5 CURRENT CONDITION OF THE EXISITNG ROAD 31
3.5.1 Existing Road Width 31
3.5.2 Major Road Defects 32
3.5.3 Drainage Structures 33
3.6 PROPOSED ROAD UPGRADING 34

3.6.1 Overall 34
3.6.2 Project lifespan (estimate) 35
3.6.3 Road Categorisation 35
3.7 ROAD DESIGN 35
3.7.1 Design Concept 35
3.7.2 Design Standard 35
3.7.3 Access Control 36
3.7.4 Road Reserve Width 36
3.7.5 Design Speed 36
3.7.6 Geometric Design 36
3.7.7 Earthworks 38
3.7.8 Structural Design 38
3.7.9 Bus Bay / Bus Stop 47
3.7.10 Proposed Road Safety Improvements 47
3.7.11 Road Furniture 48

CHAPTER FOUR 50

4.0 PROJECT LIFE CYCLE 50
4.1 INTRODUCTION 50
4.2 MOBILIZATION PHASE 50
4.3 ROAD DESIGN AND CAMP SITE ERECTION 50
4.4 CONSTRUCTION PHASE 52
4.4.1 Introduction 52
4.4.2 Construction Overview 52
4.4.3 Associated activities 52
4.5 OPERATION AND MAINTENANCE PHASE 61
4.5.1 Activities during Pre-Commissioning 62
4.6 DECOMMISSIONING AND ABANDONMENT PHASE 64
4.6.1 Decommissioning 64
4.6.2 Demobilization of the project 64

CHAPTER FIVE 66

5.0 PROJECT ALTERNATIVES 66
5.1. PROJECT ALTERNATIVES 66
5.1.1. Alternative mode of Transportation-Option 1 66
5.1.2. The "NO" project option-Option 2 66
5.1.3. Adopting 100m for T005 road reserves width-Option 3 67
5.1.4. Pavement Alternatives-option 4 67

CHAPTER SIX 69

6.0 ENVIRONMENTAL AND SOCIAL BASELINE CONDITIONS 69
6.1. INTRODUCTION 69
6.2. THE BIO-PHYSICAL ENVIRONMENT 69
6.2.1. Climatic conditions 69
6.2.2. Topography 72
6.2.3. Geology and Hydro-Geology 72
6.2.4. Soils 73
6.2.5. Hydrology and Water Resources 74
6.2.6. Ambient Air Quality and Noise 78
6.2.7. Flora 81
6.2.8. Terrestrial Fauna 90

6.2.9. Cultural and heritage Sites 93
6.3. SOCIO-ECONOMIC BASELINE 94
6.3.1. Administrative Set Up 94
6.3.2. Land ownership along the proposed road project 94
6.3.3. Settlement Patterns, Culture and Tradition 95
6.3.4. Gender and the Proposed Road Upgrade 100
6.3.5. Population Dynamics 103
6.3.6. Economic Profiles of households along Project Road 105
6.3.7. Livelihoods Activities and Strategies 106
6.3.8. Social Aspects of the Project Road 109
6.3.9. Demolition of Structures, Land Take and Compensation 113

CHAPTER SEVEN 115

7.0 POTENTIAL ENVIRONMENTAL AND SOCIAL RISKS AND IMPACTS 115
7.1 INTRODUCTION 115
7.2 MAIN ENVIRONMENTAL AND SOCIAL RISKS 115
7.3 IMPACTS DURING CONSTRUCTION PHASE 117
7.3.1 Biophysical 118
7.3.2 Socio-economic Environment 127
7.4 OPERATIONAL PHASE RISKS AND IMPACTS 137
7.4.1 Positive Road Use Risks and Impacts 137
7.4.2 Negative Road Use Risks and Impacts 139
7.5 CLIMATE CHANGE IMPACTS 142
7.5.1 Road Impact on Climate Change 142
7.5.2 Impacts of Climate Change on the Road 143
7.6 GENDER IMPACTS 145
7.6.1 Construction-phase Risks and impacts: 145
7.6.2 Gender Risks and impacts during Operation: 145

8.0 ENVIRONMENTAL AND SOCIAL MONITORING & MANAGEMENT PLAN 147
8.1. INTRODUCTION 147
8.2. ENVIRONMENTAL MANAGEMENT PLAN 147
8.3. OBJECTIVES OF THE ESMP 147
8.4. RISK AND IMPACT MITIGATION PLAN 148
8.5. RESPONSIBILITIES 148
8.5.1. Ministry of Infrastructure Housing and Urban Development 149
8.5.2. Road Development Agency (RDA) 149
8.5.3. Road Transport and Safety Agency (RTSA) 149
8.5.4. Zambia Environmental Management Agency (ZEMA) 149
8.5.5. Resident Engineer and Environment / Social Officer 150
8.5.6. Contractor 150
8.5.7. Local Authorities 150
8.5.8. Community 151
8.5.9. Compensation 151
8.5.10. Monitoring and Reporting Arrangements 151
8.6. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN 151
8.7. ESMP Implementation and Monitoring budget 190
8.8. ENVIRONMENTAL HAZARD MANAGEMENT 190
8.9. ACTION PLAN FOR INCIDENTS & ACCIDENTS 191
8.9.1. Introduction 191
8.9.2. Objective 191
8.9.3. Scope 191

8.9.4. Procedures 192
8.9.5. Dissemination 192
8.9.6. Institutional Arrangements: 192
8.9.7. General Procedure Requirements 192
8.9.8. Specific Action Plans 193

CHAPTER NINE 202

9.0 CONSULTATIONS 202
9.1 Public consultations 202
9.2 Public Disclosure 203
9.3 Stakeholder Engagement Plan 203

CHAPTER TEN 204

10.0 CAPACITY DEVELOPMENT & TRAINING PLAN 204

CHAPTER ELEVEN 206

11.0 CONCLUSION AND RECOMMENDATIONS 206
11.1 CONCLUSION 206
11.2 RECOMMENDATION 206

CHAPTER TWELVE 207

12.0 APPENDICES 207
Appendix 1: Minutes of Public Consultations 207
Appendix 2: Pictures of Scoping Meetings Held in 2025 211
Appendix 3: Some Indicator Species in Ikelenge area 213

LIST OF TABLES

Table 3-1:Proposed Design Speed for the proposed upgrading of the Mwinilunga to Jimbe road 36
Table 3-2: Proposed Safety Improvements for the proposed carriageway 47
Table 4-1: Material Requirements (Road Layerworks) 54
Table 4-2: List of potential hard rock quarries 55
Table 4-3: Characteristics of Potential Project Waste 56
Table 6-1: Surface water analysis results 75
Table 6-2: Ground water analysis results 77
Table 6-3: WHO Noise Levels Guideline Values 80
Table 6-4: Stems Per HA of Trees Species along Road Reserve 86
Table 6-5: Tree Species Diameter Distribution 87
Table 6-6: Mean bole and Tree heights of the tree species in the sampled three areas 88
Table 6-7: Mammals still in existence within road project corridor 91
Table 6-8: Involvement in Road Construction by Sex 101
Table 6-9: Challenges in getting involved in the road Improvement 103
Table 7-7-1: Requisite protective gear to be provided by contractors for workers 136
Table 8-1: Environmental and Social Monitoring Plan (ESMP) 153
Table 8-2: Environmental mitigation, management and monitoring cost estimates 190

LIST OF FIGURES

Figure 1-1: Overview of stakeholder consultation.....10
Figure 4-1: Major waste and their treatment/Disposal Method 60
Figure 6-1: Mean monthly maximum and minimum temperatures at Solwezi including average monthly rainfall and rain days.....70
Figure 6-2: Average Relative Humidity.....71
Figure 6-3: Soil Profile along the road corridor 73
Figure 6-4: Concentration of particulate matter in Malanga communities.....79
Figure 6-5: Concentration of particulate matter in Nyakaseya community.....80
Figure 6-6: Ambient noise levels monitored around Nyakaseya area along road corridor during movement of vehicles.....81
Figure 0-7: Typical Kneria Species common in the Northern Kafue River and its Tributaries.....92
Figure 8-1: Waste Management Hierarchy 194
Figure 8-0-2: Typical Bin Liners to be provided 197

CHAPTER ONE

1.0 INTRODUCTION

The Government of the Republic of Zambia (GRZ), through the Road Development Agency (RDA), intends to rehabilitate/upgrade the road from Mwinilunga to Jimbe border in Ikelenge district as part of the development of the Lobito Corridor.

The EIA Regulations under Part II Clause 7 (2) (a) indicates that an Environmental Impact Statement (EIS) is required to be prepared for any project specified in the Second Schedule of the Regulations, or (b) for any alterations or extensions of any existing project specified in the Second Schedule. The Second Schedule of the Regulations, under Item 2 Transportation (a) specifies that "*All major roads outside urban areas, the construction of new roads and major improvements over 10 Km in length and over 1 Km in length if the road passes through a national park or Game Management Area*". Therefore, an EIS is required for the upgrading/rehabilitation of the 102Km T5 road from Mwinilunga to Jimbe in Ikelenge.

The ESIA has been prepared in fulfilment of the requirements of the 1997 Zambian Environmental Impact Assessment Regulations and the updated African Development Bank 2023 Integrated Safeguards System (ISS) safeguards policies. The Bank's ISS safeguards policies that would be triggered by the project due to its nature include Operating Safeguard (OS) 1 - Assessment and Management of Environmental and Social Risks and Impacts; OS 2 - Labour and Working conditions; OS 3 – Resources Efficiency and Pollution prevention Management; OS 4 – Community Health, Safety and Security; OS 5 – Land Acquisition, Restrictions on Access to Land and Land Use, and Involuntary Resettlement; OP 6 – Habitat and Biodiversity Conservation and Sustainable Management of Living Natural Resources and OS 10 – Stakeholder Engagement and Disclosure of Information

1.1. BACKGROUND INFORMATION

The Government of the Republic of Zambia's focus as stipulated in its National Development Plans is "Sustained economic growth and poverty reduction to be achieved through accelerated infrastructure and human development, enhanced economic growth and diversification, and promotion of rural development". Recognizing that transport is fundamental to spurring economic growth and social development, the Plan's vision is "a well-developed and maintained socio-economic infrastructure by 2030". With regard to roads, the Plan's focus is on maintenance of feeder roads, tourist access and urban roads within the core road network.

The first phase of the Road Sector Investment Programme (ROADSIP) was initiated in 1998. The main objectives of ROADSIP I were to (a) bring the road core network to maintainable condition (b) improve road conditions (c) build capacity of road authorities (d) create employment to address poverty alleviation (e) improve road safety (f) improve environmental management (g) improve rural transport services and (h) manage community roads. Phase II of ROADSIP commenced in 2004 and came to an end in 2013. This phase of the programme further refined the Programme objectives to include poverty in rural areas and gender imbalance through the use of labour based methods and packaging of contracts, maximum involvement of road users, transparency and accountability in tenders, and needs based management and budgets (http://www.nrfa.org.zm/index.php). However, the basic concept of ROADSIP remains the upgrading of all roads to maintainable standards and thereafter to sustain these standards through budgeted periodic maintenance systems.

In Northwestern Province, one of the project roads earmarked for upgrading covers 102Km road from Mwinilunga to Jimbe. The rehabilitation of the road is meant to improve the wellbeing of the people who depend on the project roads. This is so because socio-economic and cultural growth mainly depends on a speedy, safe, economical, comfortable and efficient transport system, particularly a road transport system. Absence of a well-developed road network has caused lack of basic facilities in sectors such as education, health, banking, recreation, and has led to reduction of employment potential, limited inter –regional transport of agricultural inputs and consumer goods, reduced outward transportation of agricultural and forestry produce, livestock and their products for most of the rural population.

Once the project road is upgraded, it will shorten transit times, reduce vehicle operating costs, and therefore make transportation of goods easier. The project road will also support the regional integration and cross border trade with Angola through the Jimbe border.

Better roads are intended to result in improved transportation services to the main centres along the road (the implication being that transport becomes cheaper, although this benefit is rarely passed on to the service user). This in turn will result in better access to health centres, improved delivery of social services by the Government (particularly in the health, education and agriculture sectors), and improved educational indicators such as school enrolment rates and dropout rates. These socio-economic benefits are expected to contribute to improving household income levels and standards of living.

In March/April 2025, RDA through its internal capacity updated the ESIA and RAP reports that had been prepared in 2016 for the 327Km Manyinga to Jimbe via Mwinilunga (D286/T005) road. The update focused on the road section between Mwinilunga and Jimbe which is part of the development of the Lobito Corridor and was prepared in accordance with the Zambia Environmental Management Agency's (ZEMA) requirements, as stipulated in the Environmental Management Act of 2011 and Statutory Instrument No. 28 of 1997 (The Environmental Protection and Pollution Control (Environmental Impact Assessment) Regulations, 1997), – the latter hereinafter referred to as the EIA Regulations.

1.2. ROAD DESIGN

In 2016 the Road Development Agency (RDA) coordinated the preparation of the road designs and surveys through Jeffers & Green, in association with Zenith Consulting Company. The updated ESIA is based on the 2016 designs. The designs will be subjected to a review process beginning the 4th quarter of 2025, as currently procurement processes for a consultant are underway. Any material changes to the design will trigger a revision or addendum to the ESIA to reassess environmental and social risks, mitigation measures, and RAP provisions.

1.3. JUSTIFICTION OF THE PROJECT

The overall goal and benefits of upgrading the Mwinilunga to Jimbe road, is to contribute towards improved livelihoods; improved public transport; improved access to health and public service delivery; enhanced opportunity for employment and incomes; and achievement of sustainable development goals. The upgrading and rehabilitation of the road is considered to be of national and regional importance, in terms of facilitating trade which includes cross border trade with Angola through the Jimbe border.

A better road is intended to result in improved transportation services to the main centres along the road (the implication being that transport becomes cheaper, although this benefit is rarely passed on to the service user). This in turn will result in better access to health centres,

improved delivery of social services by the Government (particularly in the health, education and agriculture sectors), and increased secondary school enrolment rates. These socio-economic benefits are expected to contribute to improving household income levels and standards of living.

Socially, upgrading and construction of the road project will increase mobility, accessibility of basic services (e.g., clinics and hospitals, market, schools, employment, etc.), and safety (i.e., prevention of accidents). This will address basic human needs of both male and female road users, especially the pregnant and lactating women, children, persons with disabilities and senior citizens. A road infrastructure project that is designed to promote equal access of women and men to employment and basic services, and equal opportunity to participate in governance structures will help women address their strategic gender interests. These interests refer to needs that if addressed will liberate women from their subordinate role and inferior status to men, and lead to the achievement of gender equality.

From an environmental point of view, the upgrading of the road from gravel to paved standard will save the country the much-needed resources spent on periodic maintenance of gravel roads which usually happens after 3-5 years. The maintenance of gravel roads such as the project road also leads to environmental degradation as huge amounts of gravel are needed and usually leaves open pits that are hazard to communities around them.

It is anticipated that improved transportation along the project road will also lead to benefits in the provision of basic social services such as access to health facilities and educational institutions, as well as markets and administrative centres – aspects which are difficult to quantify but are clearly linked to the cost and ease of access to the area.

1.4. ESIA OBJECTIVES

The main objectives of this ESIA study were to:

- Establish a detailed documentation of the prevailing baseline conditions before the road rehabilitation project construction commences.
- Identify the anticipated environmental impacts of the project and the scale of the impacts.
- Propose mitigation measures to be taken during and after the implementation of the project.
- Document the consultation process undertaken to inform potential project stakeholders as well as the attitude of the stakeholders towards the project.
- consider different alternatives to the project to meet the intended objectives and discuss alternative methods for developing the project to ensure that the project is justified from a broader environmental, social and economic perspective.
- Develop an environmental and social management plan with mechanisms for monitoring and evaluating compliance and environmental and social performance, which shall include the cost of mitigation measures and the time frame of implementing the measures.

1.5. GEOGRAPHICAL AND THEMATIC SCOPE OF THE ESIA

The geographical scope of the study area is in North Western province of Zambia covering the road corridor from Mwinilunga to Jimbe via Ikelenge. Jimbe is the border area between Zambia and Angola. The thematic scope covered by the ESIA study are as follows:

- Description of the project area, activities, processes, and operations.
- Identification of the anticipated environmental and social impacts of the project.
- Identification and analysis of the alternatives to the proposed project.
- Mitigation measures to be implemented during and after project implementation
- Development of an environmental and social management plan (ESMP) and the
- Development of mechanisms for monitoring and evaluating the compliance and environmental performance of the project.

1.6. Contact Details of the Developer

The Director and Chief Executive Officer
Road Development Agency
Government/Fairley Road
P.O. BOX 50003
Ridgeway, Lusaka, Zambia
Tel: (260)-211-253088/253002/253801
Fax + (260)-211-253404/251420
Email: rda_hq@roads.gov.zm

Contact Person
Mr Gershom Kalumba Chilukusha - Principal Environmentalist
gchilukusha@roads.gov.zm

1.7. Particulars of Shareholders/Directors

Road Development Agency (RDA) is wholly owned by the Government of the Republic of Zambia.

1.8. Track Record

RDA is the executing arm of Government on all primary and secondary road projects.

1.9. Total Project Cost/Investments

The expected project cost is approximately US$54,315,333.00

1.10. Project Commencement Date

The project will commence as soon as the ESIA and the RAP and road designs have been approved. As an AfDB-financed project, commencement of works is also subject to the fulfilment of various Financing Agreement requirements.

1.11. METHODOLOGY FOR PREPARATION OF THE ESIA

1.11.1. Introduction

The screening process is the first step in the EIA process, where a proposed project is examined, to determine whether it qualifies for an EIA process or not. According to the ZEMA EIA Regulations under Part II Clause 7 (2) (a) indicates that an Environmental Impact Statement (EIS) is required to be prepared for any project specified in the Second Schedule of the Regulations, or (b) for any alterations or extensions of any existing project specified in the Second Schedule. The Mwinilunga to Jimbe Road is longer than 10 Km in length and therefore qualifies for a full EIA according to the Zambian EIA Regulations (1997). The second step is to conduct a scoping exercise with the participation of stakeholders, in order to agree on issues to include in the EIA study, and hence the preparation of the Terms of Reference. Upon approval

of the TOR by ZEMA, baseline studies are conducted with full stakeholder consultations which include the ZEMA, the RDA, GRZ departments and the community and other interested parties in the project area. Preparation of the EIS and its review by the ZEMA completes the EIA process.

1.11.2. The process followed in the EIA

1.11.2.1. The Scoping Phase

A scoping study was conducted in March to April 2025 to identify the significant issues relating to the proposed road upgrading, and to determine the scope of the issues to be addressed in the ESIA study. Three scoping meetings were held at Jimbe, Kalene and Lwakela Trading centres. These were complimented by the one-on-one discussions that were held with the Project Affected People during the enumeration of the affected structures in the road reserve areas that were conducted from 20th March, 2025 to 9th April, 2025 by RDA staff as part of updating the ESIA and RAP reports. The outcomes of these meetings are in the minutes that have been attached as part of appendix 1.

1.11.2.2. Stakeholder Consultation & Expert Assessment

During the period 20 March 2025 to 9 April 2025 the baseline data on the fauna, flora and social aspects were re-assessed/confirmed through literature review, discussions with key informants in the project area such as the District Commissioners of Mwinilunga and Ikelenge and Chief Nyakasenya, the one-on- one discussions that were held with the 1, 497 Project Affected People along the road corridor and three scoping meetings that were held at Jimbe, Kalene Trading centre and Lwakela Trading centre at which the community members were sensitized about the upcoming road project and the conduct of the asset inventory in the road reserve. The group meetings that were held did not disaggregate the attendees by gender and level of vulnerability. The only level of disaggregation was done during the one-on-one discussions when affected properties in the road reserve area were being identified and marked for relocation.

Some of the documents that were reviewed are:

- GRZ, 1997: EIA Regulations
- GRZ, 2011: Environmental Management Act
- The 2016 Project Design Report
- EIA Procedures Manual, ZEMA (1998);
- Environmental Guidelines for Road Upgrading and Maintenance Work, RDA (1997);
- Environmental Management Act No 12 (2011).
- The AfDB ISS AfDB's updated Integrated Safeguard Standard (ISS) of 2023
- Mwinilunga District Integrated Development Plan (2022 – 2031)
- Ikelenge District Integrated Development Plan (2022 – 2031)

During the field visit, the team conducted ground inspection surveys of the project road corridor. The following methods were employed in data collection:

1. *Geology and Geomorphology*-The Geological and Geomorphologic information presented in this report were taken primarily from existing documents done on the project area of influence. The approach of collecting information from existing documents was chosen because it was less costly and presented readily available information. Further the geology and geomorphology of an area takes many years to change.

2. *Flora*-The assessment of the vegetation in the vicinity of the proposed Mwinilunga to Jimbe road corridor was undertaken using the floral transect survey by traversing the areas that will be affected by the proposed project alignment, and making observation and listing down the plant species encountered using transect lines. A transect survey was chosen as it is less costly and does provide standardized observations along the landscape.
3. *Fauna (including Avifauna)*-Faunal transect survey was undertaken simultaneously with the floral species assessment. The assessment of animal species was done by making observations and listing down of species encountered along the way with the help of local guides. A transect survey was chosen as it is less costly and does provide standardized observations along the landscape.

The sampling strategy was based on the density of locations in terms of population. The sampled areas where the consultations were held are among the densely populated sites along the proposed project road. Evidence of consultations through minutes and photographs have been attached in Appendix 1 and Appendix 3 respectively.

One on one discussions were held with about 1,497 household owners regarding their affected structures and the proposed road project. From the one on one individual PAP engagements that were conducted during this period, 979 were men, 516 were women; 484 were youths and 162 were elderly individuals. Details of the consultations are highlighted in the table below;

Table 1: Disaggregated data of one-on-one stakeholder consultations

Category of participants	**Number of participants**	**Key Feedback received**
Men	979	• They expressed happiness that the road was finally going to be worked on • They stressed the need for timely compensation
Women	516	
Religious group representatives	17	
Youths	484 (F – 148; M – 336)	• They requested that they should be prioritized when it comes to jobs during the construction phase owing to the high unemployment levels in the project areas • Need for business opportunities for youths who are pineapple farmers
Elderly	162 (F – 83; M – 79)	• Need for timely compensation and whether they could be assisted in the relocation and construction of their properties

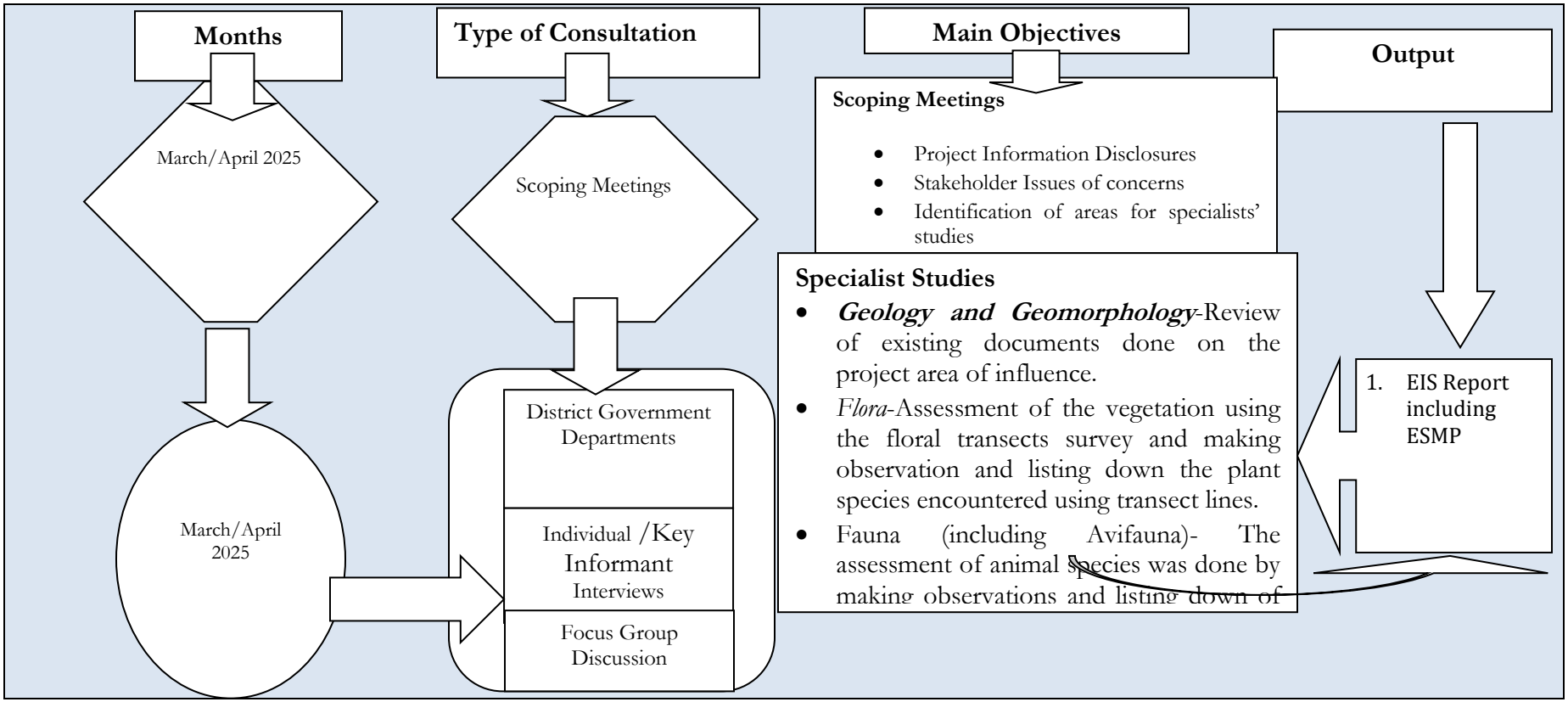


Figure 1-1: Overview of stakeholder consultation

CHAPTER TWO

2.0 POLICY, LEGAL AND ADMINISTRATIVE FRAMWORK

2.1 ZAMBIA POLICIES AND LEGAL FRAMEWOKS

2.1.1. Relevant Policy Framework

2.1.1.1. Guidelines for Road Upgrading Environmental and Maintenance Work 1997.

In August 1997, the former Ministry of Transport and Communications (MOTC) published guidelines to be used by those involved in the planning, designing, implementation and monitoring of road works, to ensure that environmental concerns are addressed. In addition to providing guidelines on how to integrate environmental concerns into the road design, contract documents or construction activities, it also outlines the national legal and policy framework for the management of natural resources relevant to road works.

Relevance: *These guidelines are relevant to the current project in that the activities to be carried out during construction may affect the environment if careful planning and implementation of the project is not followed.*

Compliance: *During the detailed study for the proposed upgrade of the Mwinilunga to Jimbe Road project (T005), the consultant made these guidelines part of the literature review in order to ensure that the concerns of these guidelines are integrated into the ESMP for the project road.*

2.1.1.2. National Resettlement Policy of 2015

The National Resettlement Policy of 2015 whose theme is, "THE HOPE FOR THE FUTURE", was formulated to guide the implementation of the resettlement programme which empowers citizens who may not have the capacity to purchase land on the open market. The policy aims to contribute to Government's efforts in reducing poverty as well as uplifting the standards of living of the resettled people and populations.

The National Resettlement Policy will assist Government in creating stable and sustainable human settlements on the principles of equity and growth by facilitating the creation of human settlements which are economically productive, socially just and environmentally sustainable.

The policy recognises that in addition to voluntary resettlement, Zambia has witnessed an increased number of involuntary displacements and resettlements due to the following factors:
(i) Natural and Human induced disasters;
(ii) Land disputes;
(iii) Development projects;
(iv) Encroachment of populations on land meant for other activities;
(v) Conflicts along national boarder areas; and
(vi) Difference in social/religious affiliations.

Among other things the policy aims to ensure security, stability and sustained development and improved livelihoods of resettled persons.

Relevance: The policy is relevant to the current project in that over 1,500 structures are likely to be demolished as they are found in the road reserve of 100m for the T005 road from Mwinilunga to Jimbe.

Compliance: A Resettlement Action Plan (RAP) has been prepared in line with standard practice and guidelines.

2.1.2. Legal Framework

2.1.2.1. The Environmental Management Act (EMA), No. 12 of 2011;

This Act is the principal environmental law in Zambia and provides for integrated environmental management and the protection and conservation of the environment and the sustainable management and use of natural resources etc. This law is the primary legal basis for undertaking environmental assessment for the proposed road upgrading project.

Relevance: The Relevance of this Act lies in the fact that it empowers stakeholders to take legal actions against the developer (RDA) for any negative environmental and social consequences that may result from the implementation of the current project.

Compliance: The EMA and other laws were reviewed to identify all the negative environmental and social impacts likely to result from the project and mitigation measures have been proposed in order to minimize the impacts in line with the requirements of this Act.

Permit Required: An approval Decision Letter that has to be applied for by the Road Development Agency as the Developer of the Mwinilunga Jimbe road rehabilitation project.

2.1.2.2. The Environmental Impact Assessment (EIA) Regulations, Statutory Instrument No. 28 of 1997

These Regulations state that: "A developer shall not implement a project for which a project brief or an environmental impact statement is required under these Regulations, unless the project brief or an environmental impact assessment has been concluded in accordance with these Regulations, and the Agency has issued a decision letter."

Relevance: These Regulations are relevant to the current project since the length of the project road is more than 10Km, and therefore, would require to be subjected to a full EIA.

Compliance: Scoping meetings were held along the road corridor, and produced a Scoping Report and Terms of Reference (TOR) for the upgrading of the project. The TORs were consequently approved by the Zambia Environmental Management Agency (ZEMA) on 20th October 2014. After the approval of the TOR, baseline studies were undertaken by different specialists and in line with the approved TOR.

Permit Required: An approval Decision Letter that has to be applied for by the Road Development Agency as the Developer of the Mwinilunga Jimbe road rehabilitation project.

2.1.2.3. The Environmental Management (Licensing) Regulations, 2013

The Environmental Management (Licensing) Regulations, 2013, were enacted in 2013 and are a consolidation of the following Regulations:

- Air and Water Pollution
- Waste Management
- Hazardous Waste
- Pesticide and Toxic Substances; and
- Ozone Depleting Substances.

Relevance: The Environmental Management (Licensing) Regulations are relevant to the upgrading of the Mwinilunga to Jimbe Road in that:

- *During construction, the contractor will generate a lot of used oils and petroleum waste which will need to be disposed off;*
- *The project will generate a lot of waste from construction activities, and in the construction camps by construction workers, which will need to be disposed; and*
- *The project will involve abstraction of water from various water sources for various construction activities and therefore, this Act is relevant to the current project.*

Compliance: *This EIS has proposed mitigation measures and has recommended that the RDA and the contractors should comply with the requirement of these regulations, by using services of a licensed company to dispose of used oils and petroleum waste and this will apply to the project area in total. In addition, measures have proposed that the RDA contractors, through the risk assessment, environmental, health and safety guidelines, shall use to manage all wastes generated during project implementation.*

Permit Required: The Service Providers that the Contractors will engage to transport hazardous materials from the project are to the disposal sites will be required to have a licence from ZEMA for the transportation of hazardous materials. The Contractors will also be expected to obtain a hazardous waste generation and storage licence from ZEMA.

2.1.2.4. The Water Resources Management Act, No.21 of 2011

This Act provides for the management, development, conservation, protection and preservation of the water resources and its ecosystems.

Relevance: *During construction works, large quantities of water will be abstracted from these water bodies. These water bodies are a main source of water for communities found in the project area.*

Compliance: *The EIS has proposed measures that the RDA and its contractors shall comply with during the abstraction, handling and storage of water from the water bodies. These measures provide for the equitable, reasonable and sustainable utilization of the water resource, as well as equitable and sustainable utilization of the shared water resources. Necessary steps that will be required to abstract water from these water bodies in line with the Act have been recommended.*

Permit Required: The Contractors will be expected to obtain water abstraction permits from the Water Resources Management Authority (WARMA) for the abstraction of construction water from water bodies and for the sinking of boreholes for domestic water.

2.1.2.5. The Tourism Act, CAP 155

This Act provides for the preservation of the country's natural endowments e.g. National Heritage sites and waterfalls etc, as assets of tourist attraction.

Relevance: *The project road has a number of tourist attraction sites such as the Zambezi Source National Monument, the Nchila Wildlife Reserve, the Jimbe Drainage and the Chitunta Bird Sanctuaries,* Kahoshaná rock in Nyakaseya area.

In addition, guesthouses and accommodation facilities, which have shown a significant growth in the project section in recent years represent a growing tourism niche and the road project will further facilitate this development.

Compliance: *During the detailed study, various stakeholders were engaged to understand how the upgrading of the road might help to boost tourism in the project area of influence. RDA and its contractors are expected to make deliberate efforts to act in a manner consistent with the principles enshrined in this Act and where necessary to implement appropriate measures to promote and enhance the conservations along the road corridor.*

2.1.2.6. The Zambia Wildlife Act, CAP. 12 of 1998

This Act states that: "….to provide for the establishment, control and management of Game Management Areas; to provide for the sustainable use of wildlife and the effective management of wildlife habitat in Game Management Areas; to enhance the benefits of Game Management Areas to both local communities and wildlife; to involve local communities in the management of Game Management Areas; to provide for the development and implementation of management plans"

Relevance: *The project corridor is close to the West Lunga National Park* (1684Km^2) *and two Game Management areas;* Chibwika Ntambo ((1550 Km^2) and Musele-Matebo (3700 Km^2). *In addition, poachers from the GMA may easily find market from construction workers.*

Action: *During the detailed study, various stakeholders were engaged to understand how the upgrading of the road might help to boost wildlife conservation in the project area. In addition, recommendations have been made on how RDA and the contractors can implement appropriate measures to promote and enhance conservation aims in general.*

2.1.2.7. The Forest Act No. 4 of 2015

An Act to provide for the establishment and declaration of National Forests, Local Forests, joint forest management areas, botanical reserves, private forests and community forests; provide for the participation of local communities, local authorities, traditional institutions, non-governmental organizations and other stake-holders in sustainable forest management; provide for the conservation and use of forests and trees for the sustainable management of forest ecosystems and biological diversity; establish the Forest Development Fund; provide for the implementation of the United Nations Framework Convention on Climate Change, Convention on International Trade in Endangered Species of Wild Flora and Fauna, the Convention on Wetlands of International Importance, especially as Waterfowl Habitat, the Convention on Biological Diversity, the Convention to Combat Desertification in those countries experiencing Serious Drought and/or Desertification, particularly in Africa and any other

relevant international agreement to which Zambia is a party; repeal and replace the Forests Act, 1999; and provide for matters connected with, or incidental to, the foregoing.

The Act also provides for the protection of 6 tree species nationally whether in a protected area or outside. These are shown in the table below.

Species Scientific Name	English Name
Entandrophragmacaudatum	Mountain Mahogany
Khayanyasica	Red Mahogany
Pterocarpusangolensis	African Teak
Afzeliaquanzensis	Pod Mahogany
Faureasaligna	Beechwood
Baikiaeaplurijuga	Teak

Relevance: *The Mwinilunga to Jimbe road project passes near two protected forests namely: (i) Luekera River National Forest N0.35 along T005 Road between Km2.6 to Km17.1; and (iv) Nkomba Protected Forest Are No. 75 along T005 Road between Km78.6 to Km84.6. The project may involve the felling down of trees and other vegetation resources as part of site preparation and having access to the project site and as such the Forest Act will be adhered to especially in the event that protected tree species are found within the project area.*

Compliance: *The ESIA has made recommendations to RDA on how the agency can implement appropriate measures to promote and enhance the conservation aims enshrined in this Act and that clearing of vegetation shall only be confined to the road Reserve, while planting of trees shall be encouraged during project implementation.*

2.1.2.8. The National Heritage and Conservation Commission Act

The objectives of the National Heritage and Conservation Commission Act apply to development activities in game parks as augmented by section 22 of the Zambia Wildlife Act that prohibits removal or damage of any objects of prehistoric, historic or archaeological interest that exist in these protected areas.

Relevance: *This Act is relevant to the project in that the activities of the project during construction will involve digging which may in the process lead to discovery of artefacts or objects of archaeological significance.*

Compliance: *During the ESIA, particular attention was paid to establish the presence of any artefacts or objects of archaeological significance along the project road.*

2.1.2.9. The Town and Country Planning Act, Cap 285

This Act provides for the control, use and change of land use zones and reservations for various purposes e.g. sitting of work sites. It also provides for the compensation of those affected by planning decisions and regulated development subdivisions.

Relevance: *This Act is relevant to the current project in that the project requires establishing the boundaries with council planning boundaries so that the 100m road reserve required for the project road is not applied in areas that fall under the jurisdiction of the two local councils.*

Compliance: *Recommendations to the RDA have been made in this EIS on how the agency should comply with this law during the construction of the proposed project by consulting with the relevant Provincial and District Planning Authorities throughout the implementation of the project.*

2.1.2.10. The Public Roads Act, CAP 12 of 2002

The Public Roads Act provides for the establishment of the Road Development Agency responsible for the planning, management and coordination of the road network in Zambia. Part III of this law prohibits road infringement by stipulating dimensions of road reserves within which no construction of any structures is allowed.

Relevance: *Although the project road is an existing road, very few people along the road corridor are aware of the road requirement for the project road. The project plans to relocate all structures found within the proposed road reserve (i.e 50m on both side of the existing centerline for rural section of the road and 18m for the built areas).*

Compliance: *A Resettlement Action Plan has been prepared for the relocation of structures found in both the road reserve and the construction width.*

2.1.2.11. The Road Traffic Act

The Road Traffic Act No. 11 of 2002 provides for the establishment of the Road Transport and Safety Agency (RTSA) and defines its functions. It also provides for a system of road safety and traffic management in Zambia.

Relevance: *The traffic during transportation of construction materials has potential to cause accidents hence traffic control measures have to be observed and roads must comply with provisions of the Act.*

Compliance: *The EIS developed traffic safety measures, which the RDA and its contractors shall implement during both construction and operation of the road project.*

2.1.2.12. The Petroleum Act, CAP 424

This Act, among other things, regulates the conveyance and storage of petroleum, inflammable oils and liquids.

Relevance: *During construction of the project road, the contractor will transport and store petroleum and inflammable oils and liquids and therefore, this Act is relevant to the project.*

Compliance: *The ESIA has proposed measures of how the RDA and its contractors shall comply with regulations under this law during the transportation of fuel for construction equipment and generators. Where labour camps are located, the handling of refuelling activities will require adherence to environmental, health and safety practices.*

2.1.2.13. The Energy Regulation Act, CAP 436

The Act provides for the establishment of procedures for the transportation, handling and storage of fuels to minimize negative environmental impacts.

Relevance: *During construction of the project road, the contractor will transport and store petroleum and inflammable oils and liquids and therefore, this Act is relevant to the project.*

Compliance: *The ESIA has proposed measures of how the RDA and its contractors shall comply with regulations under this law during transportation of fuel and will adhere to environmental, health and safety practices.*

2.1.2.14. The Factories Act, 1967

The essence of the Act is to provide for the control of matters pertaining to Occupational Health and Safety Regulations and the operation of factories (implemented by the Ministry of Labour).

Relevance: *The contractor to work on the Mwinilunga to Jimbe Road will have crushing plants and mixing plants and this regulation will be applicable during the construction stage.*

Compliance*: The ESIA has proposed measures of how the RDA and its contractors shall comply with regulations under this law.*

2.1.2.15. Occupational Health and Safety Act of 2010

The Act establishes the Occupational Health and Safety Institute and provides for its functions; provides for the establishment of health and safety committees at workplaces and for the health, safety and welfare of persons at work. Most important is the provision regarding the protection of persons, other than persons at work, against risks to health or safety arising from, or in connection with, the activities of persons at work. The Act states that an engineer shall carry out his duties in such a manner as to ensure the occupational health and safety of persons at, or near, a workplace. The road, together with borrow pits and quarries, as construction sites will be associated with occupational hazards such as excessive emissions and noise. The contractor will be obliged to provide his workers with Personal Protection Equipment (PPEs) and overall, the construction will be carried out in accordance with the provisions of this Act.

Relevance: *Section 16(1) declares that Notwithstanding any other written law, an employer shall (a) ensure, so far as is reasonably practicable, the health, safety and welfare of the employees of the employer at a workplace; and (b) place and maintain an employee in an occupational environment adapted to the employee's physical, physiological and psychological ability. Section 26 (2) reaffirms that Without prejudice to the generality of subsection (1), an employer shall (a) provide plant and systems of work that are, so far as is reasonably practicable, safe and without any risks to human health and maintain them in that condition; (b) ensure, so far as is reasonably practicable, that articles, devices, items and substances provided for the use of the employees at a workplace are used, handled, stored and transported in a manner that is safe and without any risk to the health and safety of the employees at the workplace; (c) provide such information, instruction, training and supervision as is necessary to ensure, so far as is reasonably practicable, the health and safety of the employees at their workplace; (d) so far as is reasonably practicable, maintain a workplace under the employer's control, in a condition that is safe and without any risk to the health and safety of employees at their workplace; (e) so far as is reasonably practicable, provide and maintain the means of access to, or exit from, a workplace that are safe and without any risk to the health and safety of the employees using it; (f) provide and maintain a working environment for the employees that is, so far as is reasonably practicable, safe and without any risks to their health and safety, and which is adequate as regards facilities and arrangements for their welfare at the workplace. (h) provide for measures to deal with emergencies and*

accidents, including adequate first-aid arrangements; (i) provide at the employer's expense all appropriate protective clothing or equipment to be used in the workplace by employees, who in the course of employment, are likely to be exposed to the risk of bodily injuries, and adequate instructions in the use of such protective clothing or equipment. Construction activities shall expose workers to occupational risks to their health and safety due to factors such as operation of equipment, handling of materials and exposure to construction site hazards

Compliance: *The project will enforce measures indicated in the Environmental and Social Management Plan by appointing a construction environmental officer who will be a competent person mandated to implement among other things the recommended mitigation measures addressing occupational risks to workers.*

2.1.2.16. Anti-Gender Based Violence Act (2011)

The Anti Gender Based Violence Act of 2011 is a major step towards the fight against gender-based violence (GBV) in Zambia. It is one of the most comprehensive laws on GBV in SADC. The Act gives hope to many women and children who have been subjected to GBV without adequate recourse. GBV is defined as a hindrance to the attainment of gender equality and the realisation of the social and economic goals of Zambia, as it erodes the confidence of the survivors that they can contribute to development efforts. Gender-based violence (GBV) in Zambia takes the form of physical, mental, social or economic abuse against a person because of that person's gender and includes violence that may result in physical, sexual or psychological harm and suffering to the victim. It may also include threats or coercion, or the arbitrary deprivation of liberty, whether in public or private life.

Compliance: The project will enforce the provisions of the GBV act to ensure that issues of GBV are adequately addressed at road construction sites among the workers and between the workers and the communities that they are serving during the civil works.

2.1.2.17. Workers Compensation Act, No. 10 of 1999.

This Act makes provisions for the establishment and administration of a fund for the compensation of workers disabled by accidents to, or diseases contracted by such workers in the course of their employment, and for the payment of compensation to dependants of workers who die as a result of such accidents or diseases.

Relevance: - During the construction and operation of the Mwinilunga Jimbe road project, accidents may occur that may incapacitate affected workers either short or long term, workers so affected will require to be compensated.

Compliance: - The contractor should ensure that workers are registered with Workers Compensation by way of fulfilling the provisions of the Act.

2.1.2.18. The National HIV/AIDS/STI/TB Council Act No. 10 of 2002.

The Act provides for the establishment of the HIV/AIDS/STI/TB council, whose functions include the coordination and provision of support to development, monitoring and evaluation of multi-sectoral response for the prevention and combating of the spread of HIV/AIDS/STI/TB in order to reduce the personal, social and economic impacts of HIV/AIDS/STI/TB.

Relevance: - This Act is relevant to the current project in that the work-force may indulge in casual sex with risks of contracting STI/STDs leading to HIV/AIDS in some cases.

Compliance: - The contractor to liaise with Ministry of Health for backstopping activities regarding HIV/AIDS/STI sensitization to the workforce. The contractor should in addition engage a Service Provider to carry out this activity as part of the road project.

2.1.2.19. The Employment Code Act, No. 15 of 2019

This Act provides legislation relating to, the employment of persons; to make provision for the engagement of persons on contracts of service and to provide for the form of and enforcement of contracts of service. According to this law, it is illegal for any employer to engage an employee on casual basis for any job that is of a permanent nature. The Act also bans unjustified termination of employment by employers.

Relevance: The construction and operation phases of the project will involve the employment of skilled and unskilled manpower and their engagement should follow the provisions of this Act.

Compliance: RDA shall ensure that individuals employed at the project are above years 18 years of age and are provided with conditions of service that meet or exceed the minimum conditions of service. Employees will not be subjected to exploitation and abuse of their rights through casualization.

2.1.2.20. National Council for Construction Act No.10 of 2020

The National Council for Construction Act No.10 of 2020 was established to provide for the promotion and development of the construction industry in Zambia; provide for the registration of contractors; provide for the affiliation to the Council of professional bodies or organizations whose members are engaged in activities related to the construction industry; provide for the regulation of the construction industry; provide for the establishment of the construction school; provide for the training of persons engaged in construction or in activities related to construction; and to provide for matters connected with or incidental to the fore-going.

Relevance: -The contractor is expected to be registered with the NCC. The Act has oversight regarding activities undertaken by the contractor.

Compliance: -The contractor will ensure guidelines of the Act are followed in the implementation of the Mwinilunga Jimbe road project.

Permit Required: The Contractors will be expected to have in their possession valid National Council for Construction (NCC) certificates.

2.2 Integrated Environmental and Social Impact Assessment Guidelines

The AfDB's updated Integrated Safeguard Standard (ISS) of 2023 evolved as a result of new procedures for environmental and gender assessment that aim to integrate the Bank's new vision and emerging priorities, particularly cross cutting themes of poverty, environment, population, health, gender and stakeholder participation. The underlying approach for implementing AfDB funded projects is the mitigation approach, which targets preventative actions related to project design, location, and implementation, rather than curative interventions. The guidelines indicate that compensation measures should be the last resort action. The construction of the Mwinilunga Jimbe road is expected to trigger the following Operational Safeguards

Operational Safeguards 1: Assessment and Management of Environmental and Social Risk and Impact. This OS has been met through the preparation of this ESIA report since the project has been classified as a high-risk project.

Operational Safeguards 2: Labour and Working Conditions; The project will involve the hiring of workers who will work during the duration of the Mwinilunga Jimbe road project.

Operational Safeguards 3: Resources Efficiency and Pollution Prevention and Management. This OS will be met through the implementation of the ESMP and the C-ESMP and the adherence to disposal of hazardous materials.

Operational Safeguards 4: Community Health, Safety and Security. This OS will be met through the adherence to the provisions of the Employment Code Act No. 3 of 2019 and the preparation and implementation of the Occupational Health and Safety Plan, Community Health, Safety and Security Management Plan and the Emergency Response Plan

Operational Safeguards 5: Land Acquisition, Restrictions on Access to Land and Land Use, and Involuntary Resettlement. The project will result in the displacement of people that have constructed within the 100m radius of the road reserve. This OS will be met through the preparation of a Resettlement Action Plan (RAP) and the payment of compensation to the affected property owners.

Operational Safeguards 6: Habitat and Biodiversity, Conservation, and Sustainable Management of Living Natural Resources. The proposed road project will be near the Luakera River National Forest No. 35 which is located at approximately 11°35′S, 24°25′E**,** about 20 km from T5 north of Mwinilunga town; and the Nkomba Protected Forest Area No. 75 located at approximately 11°8′38″S, 24°6′16″E, about 40 Km from T5 northeast of Mwinilunga Town and about 50 Km from T5 in Ikelenge District**.**

Operational Safeguards 7: Vulnerable Groups. The road project will be implemented in a rural province of Zambia and will impact some vulnerable groups such as children, widows and the differently abled persons.

Operational Safeguards 8: Cultural Heritage**.** The project area is endowed with a contemporary culture which is a blend of values, norms, material and spiritual traditions of two major tribes, namely the Lunda and Luchazi.

Operational Safeguards 9: Financial Intermediaries. This is not likely to be triggered for the Mwinilunga Jimbe road.

Operational Safeguards 10 – Stakeholder Engagement and Information Disclosure. The project will involve the disclosure of information to various stakeholders.

Table: Alignment of Study with AfDB ISS 2023 (10 Operational Standards)

ISS 2023 Operational Standard	Relevance to Study
OS1: Assessment and Management of Environmental and Social Risk and Impact	Central to both Zambian legislation and AfDB guidelines
OS2: Labour and Working Conditions	The project site will have workers who will need to work in a safe environment and in accordance with labour laws
OS3: Resources Efficiency and Pollution Prevention and Management.	Applies to environmental impact during design and implementation
OS4: Community Health, Safety and Security	The project will be implemented in an area that has surrounding communities.
OS5: Land Acquisition, Restrictions on Access to Land and Land Use, and Involuntary Resettlement	The project may result in the relocation of people who have properties within the road reserve area.
OS6: Habitat and Biodiversity, Conservation, and Sustainable Management of Living Natural Resources	Is of significance as the road project is located near the Luakera River National Forest No. 35 and the Nkomba Protected Forest Area No. 75
OS7: Vulnerable Groups	The road project will be implemented in a rural province of Zambia and will impact some vulnerable groups such as children, widows and the differently abled persons.
OS8: Cultural Heritage	Influences site planning and resettlement. The project area is endowed with a contemporary culture which is a blend of values, norms, material and spiritual traditions of two major tribes, namely the Lunda and Luchazi.
OS9: Financial Intermediaries	Is not likely to be relevant unless working through a financial institution
OS10: Stakeholder Engagement and Information Disclosure	The need for stakeholder engagements and information disclosure is cardinal to the success of the project.

Comparison between the Zambian Legislation and AfDB Environmental and Social Safe-Guards Policies.

Table: Gap Analysis Matrix: Zambian Legislation vs AfDB Environmental and Social Safeguards

Aspect	Zambian Legislation	AfDB Environmental and Social Safeguards	Gap Identified	Recommendation
Compensation	Recognizes the need for compensation for affected persons (e.g., land, crops, structures)	Covers compensation and provides additional support for resettlement and livelihood restoration	Focus is on compensation only; no structured livelihood restoration plan	Align with AfDB standards to include livelihood restoration and support post-compensation
Resettlement	Largely silent or absent in legislation	Comprehensive resettlement policy ensuring assistance at relocation sites	Lack of legal backing for resettlement in national law	Incorporate formal resettlement provisions into Zambian legislation or project-specific frameworks
Valuation Approach	Based on current/depreciated market value	Based on full replacement cost	Possible under-valuation of lost assets under national law	Adopt AfDB standard for full replacement cost during valuation
Livelihood Restoration	Not mandated; focus is on asset replacement	Emphasizes restoration or improvement of pre-displacement livelihood levels	No livelihood restoration required under national framework	Design livelihood support measures in line with AfDB safeguards
Customary Tenure	Recognizes customary land rights	Recognizes both customary and informal land rights	Generally aligned, but AfDB is broader in recognizing informal occupancy	Expand recognition of informal tenure rights in practice, especially for vulnerable groups
Squatters/Informal Occupants	Often excluded from compensation unless under customary arrangements	Entitled to compensation if occupancy established before cut-off date	National law may exclude some vulnerable populations	Include eligibility provisions for informal occupants in line with AfDB standards
Standard to Apply in Conflicts	Not clearly stated; default is national	Higher standard prevails when in		

Aspect	Zambian Legislation	AfDB Environmental and Social Safeguards	Gap Identified	Recommendation
	law	conflict with national law		

Whenever the international guidelines such as those provided by the African Development Bank and Zambian national legislation are at variance, the higher of the two standards will apply because by so doing; the lesser standard is consequently already met.

2.3 RELEVANT INTERNATIONAL AGREEMENTS

Zambia is a signatory to a number of international conventions. Conventions of significance to the proposed project are briefly described below:

1. ***African Convention on the Conservation of Nature and Natural Resources (Algiers,1968), (Maputo, 2003):*** The objective of the convention is to encourage individual and joint actions for the conservation, utilization and development of soil, water, flora and fauna for the present and future welfare of mankind. This must be done from an economic, nutritional, scientific, educational, cultural and aesthetic point of view.

   Relevance to the Project: Soil protection, water protection and protection of flora and fauna is an obvious positive impact to the project. This explains the relevance of the convention to the project.

2. ***Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES):*** The objective of this agreement is to ensure that international trade of wild flora and fauna does not endanger their existence. The convention is customized through the Zambia Wild Life Act No. 12 of 1998 and the implementing body is Zambia Wildlife Authority.

   Relevance to the Project: The project area may be home to endangered flora and fauna species that require protection hence the relevance. The project will enhance the flora and fauna species.

3. ***Kyoto Protocol to the United Nations Framework Convention on Climate Change:*** The aim is to further reduce greenhouse gases by enhancing the national programs of developed countries aimed at this goal and by establishing percentage reduction targets for the developed countries.

   Relevance to the Project: Greenhouse gases lead to climate change and there are worldwide campaigns especially for major investments to reduce emissions of green-house gases. Some measures include carbon foot print calculation and sequestration. Petroleum fuels shall be used at the proposed project during construction and land shall be cleared. These activities contribute to the overall carbon foot print for the area. This entails the relationship to the project.

4. ***Convention on Biological Diversity (CBD):*** The major aim of the CBD is to effect international cooperation in the conservation of biological diversity and to promote sustainable use of living natural resources worldwide. It also aims at bringing about sharing of the benefits arising from utilization of natural resources. A number of plans in this convention fall under the Department of Agriculture, Forestry, Fisheries and ZAWA.

   Relevance to the Project: The proposed wildlife conservation measures in this report are also aimed at attaining requirements of the CBD hence the relationship.

5. ***Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal:*** The objective is to control import and export of hazardous wastes. It also aims at ensuring that any transboundary movement and disposal of hazardous waste, when allowed, is strictly controlled and takes place in an environmentally sound and responsible manner.

   Relevance to the Project: Used hydrocarbons shall be generated and disposed of and this shall be done in accordance with best environmental management practices. Through already customized laws such as the Hazardous Waste Management Regulations, provisions of the convention are applicable.

6. ***Convention on Migratory Species and the African –Eurasian Water Bird Agreement:*** Just like other migratory species, water birds cross several international borders during their migration, facing a wide range of threats. Without international cooperation, conservation efforts by one country can be meaningless if these birds are not protected in another country. Under this convention, a 'flyway approach' means that all threats water birds face during their journey are identified and addressed. Major threats include habitat destruction. To conserve these species efforts such as the "African Eurasian Migratory Water bird Flyways" have been implemented.

   Relevance to the Project: As already stated, the project area is in a green field area with possibilities of these protected birds flying to the site. Therefore, taking note of the provisions of this agreement is necessary.

7. ***The United Nations Framework Convention on Climate Change (UNFCCC):*** It was signed by Zambia in 1992. The objective is to achieve stabilization of greenhouse gas concentrations in the atmosphere. Zambia recognizes that the largest source of one of the main greenhouse gases, carbon dioxide, is from burning wood fuel and the use of coal and oil.

   Relevance to the Project: The proposed project shall contribute to greenhouse gases although at a minimal rate. Observing best practices in reducing greenhouse gases is necessary to the project hence the relationship.

8. ***Stockholm Convention on Persistent Organic Pollutants, 2004***
   The Stockholm Convention on Persistent Organic Pollutants is an international environmental treaty, signed in 2001 and effective from May 2004, that aims to eliminate or restrict the production and use of persistent organic pollutants (POPs). POPs are defined as "chemical substances that persist in the environment, bio-accumulate through the food web, and pose a risk of causing adverse effects to human health and the environment". Key elements provided for in Articles 1, 3, 5, 6, and 11 of the Convention

include the requirement that developed countries provide new and additional financial resources and measures to eliminate the production and use of intentionally produced POPs, eliminate unintentionally produced POPs where feasible, and manage and dispose of POPs wastes in an environmentally sound manner.

Relevance to the Project: Because of the laboratory activities that will be going on during operation chances are high that POPs related chemical substance may be used.

9. **The World Heritage Convention**

The most significant feature of the 1972 World Heritage Convention is that it links together in a single document the concepts of nature conservation and the preservation of cultural properties. The Convention recognizes the way in which people interact with nature, and the fundamental need to preserve the balance between the two.

The Convention stipulates the obligation of States Parties to report regularly to the World Heritage Committee on the state of conservation of their World Heritage properties. These reports are crucial to the work of the Committee as they enable it to assess the conditions of the sites, decide on specific programme needs and resolve recurrent problems. It also encourages States Parties to strengthen the appreciation of the public for World Heritage properties and to enhance their protection through educational and information programmes. The Convention encourages States Parties to integrate the protection of the cultural and natural heritage into regional planning programmes, set up staff and services at their sites, undertake scientific and technical conservation research and adopt measures which give this heritage a function in the day-to-day life of the community.

Relevance to the Project: The project area is rich in cultural and natural heritage which will be protected in accordance with the National Heritage Laws and the provisions of the World Heritage Convention.

10. **IUCN Guidelines for Reintroductions and Other Conservation Translocations**

The IUCN guidelines deal with conservation translocation which is a deliberate movement of organisms from one site for release in another site. It must be intended to yield a measurable conservation benefit at the levels of a population, species or ecosystem, and not only provide benefit to translocated individuals. Translocation is an effective conservation tool but its use either on its own or in conjunction with other conservation solutions needs rigorous justification. Feasibility assessment should include a balance of the conservation benefits against the costs and risks of both the translocation and alternative conservation actions. Risks in a translocation are multiple, affecting in many ways the focal species, their associated communities and ecosystem functions in both source and destination areas; there are also risks around human concerns. Any proposed translocation should have a comprehensive risk assessment with a level of effort appropriate to the situation. Where risk is high and/or uncertainty remains about risks and their impacts, a translocation should not proceed.

Translocations of organisms outside of their indigenous range are considered to be especially high risk given the numerous examples of species released outside their indigenous ranges subsequently becoming invasive, often with massively adverse impacts. Any translocation will impact and be impacted by human interests. Social, economic and

political factors must be integral to translocation feasibility and design. These factors will also influence implementation and often require an effective, multi-disciplinary team, with technical and social expertise representing all interests.

Relevance to the Project: The possibility of the movements/translocating of species from other sites into the project area and vice versa is high given that the project area will attract a number of people/workers from other regions who will come for work and other business opportunities.

11. **World Health Organisation (WHO) Guidelines**

A WHO guideline is defined broadly as any information product developed by WHO that contains recommendations for clinical practice or public health policy. Recommendations are statements designed to help end-users make informed decisions on whether, when and how to undertake specific actions such as clinical interventions, diagnostic tests or public health measures, with the aim of achieving the best possible individual or collective health outcomes.

Relevance to the Project: The guidelines will be relevant to guide the treatment of various ailments that may arise in the project area.

12. **Ramsar Convention**

The 1971 Ramsar Convention on Wetlands of International Importance Especially as Waterfowl Habitat is an international treaty for the conservation and sustainable use of Ramsar sites (wetlands). It is also known as the Convention on Wetlands. The Convention provides a framework for the conservation and wise use of wetlands and their resources. Since 1991 Zambia has listed 8 Ramsar Sites covering a surface area of 4030,500 hectares.

Wetlands are vital for human survival. They are among the world's most productive environments; cradles of biological diversity that provide the water and productivity upon which countless species of plants and animals depend for survival. Wetlands are indispensable for the countless benefits or "ecosystem services" that they provide humanity, ranging from freshwater supply, food and building materials, and biodiversity, to flood control, groundwater recharge, and climate change mitigation. The Convention uses a broad definition of wetlands. This includes all lakes and rivers, underground aquifers, swamps and marshes, wet grasslands, peatlands, oases, estuaries, deltas and tidal flats, mangroves and other coastal areas, coral reefs, and all human-made sites such as fish ponds, rice paddies, reservoirs and salt pans.

Relevance to the Project: The project area has a number of water bodies and is the source of the Zambezi river which is a major river in Zambia.

The above environmental laws, policy and regulations, as well as conventions and protocols, together provide the environmental legal framework which the consultant has reviewed in detail in order to advise the RDA on compliance requirements during project implementation.

2.4 INSTITUTIONAL FRAMEWORK

The institutions that will play key roles in implementing the ESIA are as follows:

2.4.1 Ministry of Infrastructure Housing and Urban Development

The Ministry of Infrastructure, Housing and Urban Development (MIHUD) is responsible for overall policy formulation and monitoring of the road infrastructure developments. The Ministry oversees the construction and civil engineering activities to the extent that they should not adversely affect the environment.

2.4.2 Road Development Agency (RDA)

The Road Development Agency has the overall mandate to provide for the care, maintenance and construction of public roads in Zambia and to regulate maximum weights permissible for transmission on roads. RDA will engage the contractors and supervising engineers who will superintend upon the day to day activities of the road works that also include the implementation of the ESIA.

2.4.3 District Councils and Traditional Leadership

Local Councils and Traditional leadership are responsible for local policy matters, economic development, resolution of local conflicts and the provision of leadership in their respective areas.

2.4.4 Zambia Environmental Management Agency (ZEMA)

ZEMA is empowered under the Environmental Management Act (EMA), No. 12 of 2011 to ensure that major developmental activities in Zambia adhere to the provisions of the Environmental Impact Assessment (EIA) Regulations of 1997. It is a requirement under the EIA regulations that any road rehabilitation/construction project exceeding 10Km should undergo an EIA process before the commencement of civil works. Upon the successful conclusion of the EIA, ZEMA issues a Decision Letter to either approve or disapprove such a project.

2.4.5 National Road Fund Agency (NRFA)

In order to co-ordinate all funding to the road sector, Government has established a National Road Fund Agency (NRFA). All resources meant for the road sector from the Government, co-operating partners or private sector, are channelled to the National Road Fund Agency. The Agency is responsible for collection, disbursement, management and accounting of the National Road Fund, reporting through the Ministry of Finance and National Planning, to the Committee of Ministers on Road Maintenance Initiative. The National Road Fund comprises fuel levy, road user charges, Government funding to the Road and Road Transport Sector, donor funding and credits secured for the Road and Road Transport Sector.

2.4.6 Road Transport Safety Agency (RTSA)

The Road Transport and Safety Agency which is under the Ministry of Transport and Logistics is responsible for the implementation of policy on road transport and traffic management, road safety and enforcement of laws regulating road transport and safety in the country. In addition, this Agency is responsible for programming, procurement, monitoring and evaluation of road transport regulations and safety programmes approved by the Committee of Ministers on Road Maintenance Initiative.

2.4.7 Contractors and Supervising Engineers

The Contractors and the Supervising Engineers who will be appointed by the Road Development Agency will have the responsibility of ensuring that the road works are implemented in accordance with the ESIA and other environmental best practices.

2.4.8 Communities

The local people through which the road project will be implemented are expected to provide cooperation to the contractors to enable the smooth implementation of the road project.

CHAPTER THREE

3.0 PROJECT DESCRIPTION

3.1 PROJECT LOCATION

The Mwinilunga to Jimbe comprises a surfaced 2-lane carriageway for 10.29 km. The road then reverts to a single-lane earth/gravel track of varying width – this location shall constitute the start point of T005 at km 0.0 until it reaches the project termination point after 102.00 km at the Jimbe River Bridge whose coordinates are S=1106586; E=02401405), which also forms the international border between Zambia and Angola (centre of bridge deck). The two large towns along the road corridor are Mwinilunga located at Km 0.00 and Ikelenge at km 56.6. There is also Kalene Hills at km 72.6 as a major settlement. The route also has a number of smaller villages and settlements interspersed.

The road corridor is generally flat land. The road project will be near the Luakera River National Forest No. 35 which is located at approximately 11°35′S, 24°25′E**,** about 20 km from T5 north of Mwinilunga town; and the Nkomba Protected Forest Area No. 75 located at approximately 11° 8′ 38″ S, 24° 6′ 16″ E, about 40 Km from T5 northeast of Mwinilunga Town and about 50 Km from T5 in Ikelenge District**.** The corridor is endowed with a contemporary culture which is a blend of values, norms, material and spiritual traditions of two major tribes, namely the Lunda and Luchazi people. The river system of the road corridor is considered to be part of the Zambezi watershed and its tributary system. Most of the rivers and streams crossed by the project road from Mwinilunga to Jimbe flows towards the east-north draining into the Lunga River while the Kalamui Stream and Kamafumbu Stream, discharge their waters into the Zambezi River. The source of the Zambezi river is located between Mwinilunga and Ikelenge districts. Most of the rivers and streams crossed by the project road are perennial.

Figure 3-1 shows the end point of the project road at Jimbe Bridge in Jimbe (Ch327+400).

End of project road (Ch327+400) at Jimbe Bridge in Jimbe-Ikelenge District

Pillars at the Jimbe Bridge that act as International Boundary between Zambia

Figure 3-1: End of Project Road in Jimbe at Jimbe Bridge

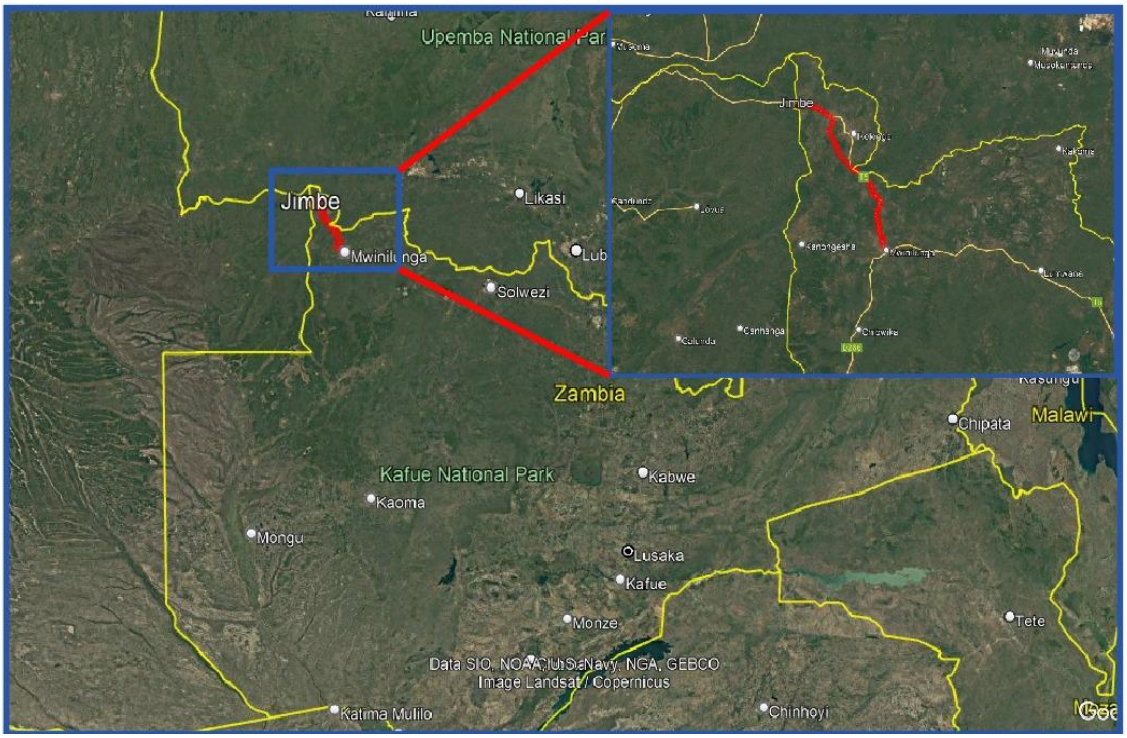


Figure 3-2: Location Map of the Mwinilunga to Jimbe Project Road

3.2 EXPECTED AREA OF INFLUENCE (AoI)

Although there are various ways of identifying the Area of Influence (AoI), the ESIA study used the least data intensive methods, which involved using population data. Given that the 2022 census estimates that about 74.6% of the population in North Western Province is involved in agricultural activities, it was considered that this method would represent a good proxy for data intensive methods. With this assumption, the expected areas of influence were identified in three bands as follows:

- Areas of full influence to include those areas served directly by the road;
- Areas of partial influence to include those areas served indirectly by the road;
- Areas of no influence to include those areas not served by the road.

Thus, the number of total beneficiaries directly served by the road was estimated by applying the population density of the two districts where the project road is located, to the size of each project road's AOI. A project road's AOI has been defined to be 200 meters i.e 100 meters from the centerline on either side of the carriageway.

The area within 100m on both sides of the project road is considered a direct impact area/ zone of influence for primary impacts. However, secondary impacts could take on a wider spatial local, national or even regional extent. The 200m zone of influence was considered for this project based on most probable extent of direct impacts of especially the construction phase, namely: accidents, dust plumes, borrow areas, stone quarry operations, noise, sources of construction labour and social effects e.g. prostitution. The route and its zone of influence are shown in Figure 3.3.

3.3 CONSTRUCTION EQUIPMENT AND MATERIALS

The contract will specify the minimum construction equipment that the Contractor (s) are expected to have on site for the smooth execution of the civil works. The sourcing of construction materials such as gravel, stone aggregates, water, fuel and cement will be the responsibilities of the Contractor (s). The Contractors will be expected to adhere to the regulations pertaining to the sourcing and utilisation of these materials.

3.4 SOCIAL IMPACTS IN THE DESIGN

The design that will be adopted for the road project is one that minimises the displacement of people by maintaining the existing road alignment. The design will provide for road access points to homestands. The designs will include for example details of road signs, markings, intersection layouts, access restrictions, bus stops, crossings, footpaths etc. The road designs must be environmentally safe enough and compatible with the natural surrounding environment

3.5 CURRENT CONDITION OF THE EXISITNG ROAD

3.5.1 Existing Road Width

The Mwinilunga to Jimbe comprises a surfaced 2-lane carriageway for 10.29 km then reverts to single-lane earth/gravel track of varying width. The location that constitutes the start point of the proposed road upgrade of the Mwinilunga to Jimbe stretch on T005 is km 0.0 whose coordinates are S = 1139592 E = 2428015- until it reaches the project termination point after 102.00 km at the Jimbe River Bridge whose coordinates are S=1106586; E=02401405, which also forms the international border between Zambia and Angola (centre of bridge deck). The two large towns along the road corridor are Mwinilunga located at Km 0.00 and Ikelenge at km 56.6. There is also Kalene Hills at km 72.6 as a major settlement. The route also has a number of smaller villages and settlements interspersed.

The road corridor is generally flat land. The road passes near the Luakera River National Forest No. 35 and the Nkomba Protected Forest Area No. 75. The corridor is endowed with a contemporary culture which is a blend of values, norms, material and spiritual traditions of two major tribes, namely the Lunda and Luchazi people. The river system of the road corridor is considered to be part of the Zambezi watershed and its tributary system. Most of the rivers and streams crossed by the project road from Mwinilunga to Jimbe flows towards the east-north draining into the Lunga River while the Kalamui Stream and Kamafumbu Stream, discharge their waters into the Zambezi River. The source of the Zambezi river is located between Mwinilunga and Ikelenge districts. Most of the rivers and streams crossed by the project road are perennial.

Figure 3-3: Typical carriageway of the existing

3.5.2 Major Road Defects

The main defects are severe potholing in areas where the road is relatively flat and erosion on the steeper sections. This is caused by inadequate drainage due to inadequate maintenance and shaping/blading of the road, which leads to water ponding on the road and the subsequent traffic induced formation of potholes.

Similarly, the longitudinal erosion of the road on steeper sections is also caused by inadequate drainage, where water cannot drain off the road and this causes the formation of erosion channels. The section of the T005 between km 57 and km 92.5 from Ikelenge to Jimbe is in a particularly severe state and becomes almost impassable when it rains.

The last 550m from the Jimbe border post to the Jimbe River Bridge traverses a clayey subgrade with deep ruts. Interviews with border officials revealed that trucks transporting goods across the border can take days to cross this relatively short section of road.

It must be noted that the road generally follows the surrounding natural ground level (NGL) and is in many cases below the NGL and can therefore not drain adequately. The inlets of the existing minor pipe culverts are below the NGL and are sunk into the ground (i.e. drop inlet scenario). Side drains leading up to the inlets are generally overgrown and cannot drain into the inlets and therefore water drains onto the road.

The outlets of the minor pipe culverts are similarly below the NGL and trenches leading away from the outlets until they "daylight" are present in many instances. These trenches are heavily overgrown in most cases and impede their proper functioning. Mitre drains are evident along the road but are in many cases non-functional due to inadequate maintenance (i.e. overgrown and blocked).

3.5.3 Drainage Structures

3.5.3.1 Minor culverts

184 minor culverts were recorded, comprising of 173 No. 600mm dia. concrete pipes and 11 No. 900 dia. concrete pipes.

The inlets of the existing minor pipe culverts are below the NGL and are sunk into the ground (i.e. drop inlet scenario). Side drains leading up to the inlets are generally overgrown and cannot drain into the inlets and therefore water drains on to the road. The outlets of the minor pipe culverts are similarly below the NGL and trenches leading away from the outlets until they "daylight" are present in many instances. These trenches are heavily overgrown in most cases and impede their proper functioning.

Mitre drains are evident along the road but are in many cases non-functional due to inadequate maintenance (i.e. overgrown and blocked).

The distance between headwalls is inadequate to accommodate a Class II or Class IC road and it is recommended that the existing minor pipe culverts be replaced with minimum 900mm diameter pipe culverts or as required. Inlet and outlet structures (i.e. wingwalls, headwalls, apron slabs) are to be cast in-situ reinforced concrete and the culverts shall be delineated using hazard plates at road level.

3.5.3.2 Major Culverts

The existing major culverts generally cross formal rivers and in most instances consist of Armco pipe culverts with a diameter of 1.5m or greater. A few major culverts consist of 900mm diameter concrete pipe culverts. There are 29 major culverts and an inventory of major culverts and their rivers is tabled below. The major culverts appear structurally and hydraulically adequate and are generally in a fair condition with relatively minor defects.

An exception to this is the Zambezi River culvert where water is seeping through the bottom of the abutments. The downstream outlets of the culverts do not appear hydraulically efficient and prone to possible long-term erosion problems (rocky substrate). The upstream side (inlets) appears to accumulate debris such as tree trunks.

No handrails or balustrades are visible on most of the longer major culverts. The local inhabitants living in close vicinity of the major culvert structures were interviewed by the consultant's site staff to ascertain whether any of the culverts were prone to flooding during the rainy season (i.e. historical information).

It was established that only the culvert crossing the Luakela River (T005, km 17.2) has been overtopped in a particularly heavy rainy season in 2007/2008 – by 150mm according to eyewitness accounts. Culverts no's 4, 5, 14, 20, 21, 22, 23, 24 and 26 were noted as the water level coming very close to the pipe soffit but not overtopping whilst all other remaining culverts appear to function appropriately during normal rainfall events. The hydraulic study conducted in section of this report summarizes the findings in this regard.

All major culverts are too narrow to accommodate a Class II or Class IC road and appropriate replacements will have to be made. This has been determined as part of the hydrological study.

It is envisaged that most major culverts will be replaced with cast in-situ reinforced concrete box culverts.

Inlet and outlet structures (i.e. wingwalls, headwalls, apron slabs) are to be cast in-situ reinforced concrete and the culverts shall be delineated using hazard plates at road level. Appropriate erosion/scour protection at inlets and outlets will be provided.

3.5.3.3 Bridge Survey

There is one bridge at Jimbe River Bridge along T005 at Km92.3. It is a reinforced concrete bridge with multiple spans and was inspected for signs of structural distress and/or hydraulic deficiencies in order to assess its overall condition and the need for repairs and/or upgrading work.

The bridge has a deck, piers and abutments constructed in reinforced concrete. Structurally the decks, abutments and piers are all in good condition except for missing or about failing bearings. The loading standard for the concrete bridge is not known. The bridge location has visible signs of some erosion of channels/stream beds and embankments as well as some scouring around piers and abutments/wing walls, but the overall picture is that the bridge was functioning well with no signs of high-water levels being too close to the bridge deck or other hydraulic deficiencies.

The clear width of bridge deck was measured 9.10m comprising of a 2 x 3.65m = 7.30m wide travelled way and 0.90m wide kerbed sidewalk/pedestrian walkway on both sides.

The hydraulic design of the existing bridge is not available. With regards to the waterway inspection where no signs of excessive high-water levels were found as well as information collected on history of floods lead to the conclusion that the bridge have adequate discharge capacity.

3.5.3.4 Road Furniture Survey

No road side amenities in the form of lay byes or rest areas currently exist along the route. There are equally no public transport facilities (i.e. bus stops) along the route.

No road signage and markings were observed during the site visit and appropriate road markings and signage in accordance with the SADC Road Traffic Signs Manual will be provided as part of the design.

3.5.3.5 Utility Services Survey

Very little utility services were observed, with the exception of overhead electricity lines running parallel to the road between km 53.6 and km 75.6 in the Ikelenge area. Mobile phone towers were observed in Jimbe.

3.6 PROPOSED ROAD UPGRADING

3.6.1 Overall

The project involves a full construction of the existing carriageway and demarcation of the road reserve of 100m (i.e. 50m on both sides of the existing centreline). The selected technical solutions shall include:

- Road Categorization;
- Road Geometrics;
- Junction Design;
- Road Safety Design;
- Road Furniture; and
- Utilities Designs.

3.6.2 Project lifespan (estimate)

The life span of the road will depend on a number of factors:

- Regular maintenances will sustain the road for many years, short of which it will be rendered useless within a couple of years; and
- At a certain stage the Government can decide to:
  - ✓ Abandon or divert the whole road otherwise a section of it. In such case the need for preliminary environmental assessment (PEA) will be called for; and
  - ✓ Expand the road and therefore calling for one of the studies: PEA, EIA or environmental audit.

For a road such as this one it is not thought to come completely to an end and thus decommissioning might not take place. On the other hand, the technical estimation for the proposed road life is 20 years, after that period the constructed carriageway road would need to be strengthened or re-constructed.

3.6.3 Road Categorisation

The section road from Mwinilunga to Jimbe road is an international trunk road designated as class T. Class T roads are the highest class of road in Zambia. The major function of Class T roads is to provide mobility (as opposed to access).

For purposes of the road design, the entire length of the project road has been divided into various categories on the basis of volume/type of traffic, number of lanes, terrain/topography. This is in terms of Rural and Semi urban. Most of the length along the project road is rural category (80%) and also most of this length is available in longer stretches (20.5km, 27km, 43.5km and 50km). This indicates the carriageway proposal would be uniform continuously for majority of its length.

3.7 ROAD DESIGN

3.7.1 Design Concept

The design concept is to provide a high-speed road that allows safe and efficient movement of traffic with fully controlled access. Although the road will be designed for vehicles, the movement of pedestrians and bicycles along the road will be considered in the overall design.

3.7.2 Design Standard

The design follows SATCC standard code of design for the Geometric Design of Trunk Roads (Ed. Sept 1998) together with Recommendations on Road Design Standards – Geometric Design of Rural Roads (Ed. Dec. 1994) issued by Roads Department, Zambia. The design standards for the project road have been adopted after reviewing the relevant latest Manuals, specifications and design guidelines (SATCC, AASHTO and Zambia Specifications).

3.7.3 Access Control

In consideration of the Class A category of the project road, full access control should ideally be exercised. However, the nature of development along the project road, is such that to restrict access in a major way would entail the demolition of many houses and other properties in order to provide the service roads which would be necessary to channel traffic to a reduced number of main junctions.

It is reasoned that a more appropriate solution would be to adopt a reduced level of control especially in-built areas such as Mwinilunga, Ikelenge and Kalene areas. Therefore, partial access control, as defined by the Road Design Manual, will be adopted. In effect access will be kept to the minimum consistent with optimal cost effectiveness and safety.

3.7.4 Road Reserve Width

The desirable road reserve width applicable for a Class T road is 100m according to the Public Roads Act. Therefore, 100m will be adopted for the T005 road section from Mwinilunga to Jimbe. However, the construction width is at maximum 28m from the existing centerline with an exception of a few locations of bridge approaches, Lay bys where the width is more.

3.7.5 Design Speed

Most of the elements of roadway alignment and facilities will be largely influenced by the design speed. Based on the initial studies and understanding the preset route characteristics, the proposed design speed had been arrived and summarized below in Table 3-1.

Table 3-1:Proposed Design Speed for the proposed upgrading of the Mwinilunga to Jimbe road

Category of Road	Desirable Minimum Rural	Minimum
Rural	120 km/hr	80/60 km/hr
Semi Urban	100 km/hr	80/60 km/hr
Urban		60/40 km/hr

3.7.6 Geometric Design

The geometric design standard adopted for this road almost conforms to the Class I paved standard of the Zambian specification. Depending upon the selection criteria, various typical cross sections have been developed and adopted suitably for different segments of road.

The design concept is to provide the shortest route and a high-speed road that allows safe and efficient movement of traffic. Although the road will be designed for vehicles, the movement of pedestrians and bicycles along the road will be considered in the overall design.

The level of service for this road is set to be Minor Arterial System which has the following characteristics:

- Connection between local centers of population.
- Linkage between districts, local centers of population and developed areas with the principal arterial system.

The geometric design standard adopted for this road almost conforms to the Class IIC paved standard of the SATCC specification. The proposed cross-section of the road consists of:

- 100m road reserve for T005;
- 10.8 m carriageway width (2 x 3.4m lanes with 2 x 1.5m surfaced shoulders and 2 x 0.5m gravel roundings);
- 2,5% cross-fall/camber for straights;
- 7% maximum cross-fall for fully developed super-elevations;
- Camber and cross-fall < maximum of 4%; and
- Cut and fill batter slopes of 1:2 maximum.

The cross-section standard is dictated by safety issues more than anything else and safety must be the over-riding parameter. In general, the design speed of 100 km/hr was selected but the speed will have to be reduced to 60 or 40 km/hr for sharper curves or along settlements or other similar sections. Rumble strips are provided in populated areas. The urban roads will follow existing alignments due to the built-up nature of the site. Regular speed humps at key locations such as schools; etc will provide traffic calming measures and serve as pedestrian crossing points.

The vertical alignment has been chosen to balance the cut to fill and minimize the spoil.

The stopping sight distance for the main road is set to be 150m according to flat terrain, increased to 215 m for the maximum grade of 5%. This combination allows for the most economical design with due attention to the safety of the road users.

Other details of the horizontal and vertical alignment are presented below, as well as in the construction drawings.

- Barrier sight distance 320 m
- Decision sight distance 300 m
- Passing sight distance 670 m
- Intersection sight distance 150 m
- Minimum horizontal curve radius 250 m – At times this had to be reduced to accommodate existing settlements and sharp curves
- Minimum Horizontal Curve length 200 m –At times this had to be reduced in order to create space for the existing settlements-
- Super elevation 4% Max due to sharp corners at 100 km/hr unless otherwise indicated
- Minimum length of vertical curve 180 m
- Maximum vertical gradient 6%

As the total ADT on this road is well below the limit for 60% passing opportunity along the entire road length, no allowance is made for the provision of passing lanes or climbing lanes.

The cross-sectional properties of the road are as follows:

- Camber 2.5%
- Maximum super elevation 4%
- Carriage way width 6.5 m
- Shoulder 1.2 m shoulder sealed and 0.3 m un sealed
- Side drain slopes 1:2 (1:3 when embankment is higher than 1m)

- Side batter slopes 1:2 in stable material

A severity index of 4.8 is used in order to determine the justification for crash barriers. In this case, crash barriers are set when the fill is more than 2 m, with fill side slopes of 1:3.

All intersections are treated as simple junctions with at least 150m of visibility on any side or approaches.

3.7.7 Earthworks

The subgrade condition is poor to fair, but water drainage is poor. Therefore, most of the road needs to be raised above the natural ground by minimum 400 and preferably 600 mm so that the pavement structure remains above wet zone of the ground. In addition, the relief and cross culverts are 900 mm diameter, which need at least 400 mm cover, bringing their invert to 1300mm below finished road levels. In light of the above, most of the road is made of imported fill, except in few places where cut to fill from sides is possible.

Terrain Model is being developed which considers the earthworks required for this project. At preliminary stage, the following quantities of earthworks are estimated for this project:

- Remove top soil 300,000 m^3
- Cut from borrow to Fill 550,000 m^3

3.7.8 Structural Design

The pavement structure has been decided based on minimum practicable thicknesses, which will create a balanced pavement structure. The direction split was not considered as the pavement structure for both ways is at a minimum design level and the traffic load one way or the other would not change the layer thickness designs.

The strength of the sub grade was determined using DCP, down to minimum depth of structural influence of sub grade, as well as laboratory verification of CBR values. The main road was divided into two sections where the sub grade material was investigated. There is a lack of good quality stone in the area; therefore, the most cost-effective pavement would consist of cement stabilized base on top of layers of earthwork which at the same time raise the road above the general surrounding terrain by 600 mm, which is preferred in order to keep the pavement layers as dry as possible. Similar approach will be taken to the urban roads.

The traffic analysis for this project revealed that the estimated traffic projection for the 20-year design life of the road is not in excess of 2 million ESA, falling within the T3 traffic class. Therefore, SATCC / AASHTO design procedure was used for the road.

3.7.8.1 Bridges

The following considerations were analysed in determining the bridge form.

1) **Foundations**

Road over river bridges must generally be founded on rock. If the rock level is shallow, the bridge can be founded on spread footings with the footings fixed into the bedrock by means of dowel bars. If the rock level is deeper, a pile or caisson foundation should be utilised. Geo-technical investigations at the sites are ongoing.

2) Hydraulic information

The hydraulic information for the bridges is summarized below:

Bridge	Effective catchment area (km2)	Design flood volume (m3/s)	Design flood level (m)
Kifubwa	430	25	1358.41
Mushindamo	256	30	1321.57
Kafue	440	40	1313.87

3) Bridge width

Each bridge cross-section consists of 2 lanes of 3.25m, a 0.5m edge strip/shoulder outside the yellow line to make the carriageway 7.5m wide. On either side of the shoulder is a 1.2m raised sidewalk. A 0.315m wide plinth on the outside of each sidewalk is required to fix the 0.475m wide concrete barrier. This gives a total bridge width of 10.85m. The approach road for 20 m each side of the bridges will form a transition between the bridge cross section and the road cross section.

4) Bridge height and length

Bridge height and length are mainly determined by the river hydraulics and vertical alignment standards. A minimum freeboard of 1.5m has been used with the given high-water level for each bridge. The bridge height also depends on the vertical road alignment.

The minimum deck soffit levels and road surface levels for each of the design options can be seen in Section 5.3 below. The bridge lengths are recommended to be 12 m and 18m. A single span bridge is proposed at each location.

5) Design loading

The bridges are designed for the NA, NB36 and NC30-5-18 loads according to the SATCC: Code of practice for the design of road bridges and culverts.

The geographical area in which the bridge will be constructed is in an active earthquake area. Therefore, earthquake action will be designed according to the SATCC: Code of practice for the design of road bridges and culverts. Reinforcement detailing shall be done according to BS EN 1998-2*: Design of structures for earthquake resistance*. The structure shall be designed for an Earthquake Intensity according to the Modified Mercalli Scale of VII. This relates to a ground acceleration of 0,1g for a probability of 20 percent that the degree of intensity will be exceeded in 50 years. Refer to Appendix B: Earth quake risk in Africa: Modified Mercalli Scale (OCHA Regional Office for Central and East Africa Issued December 2007).

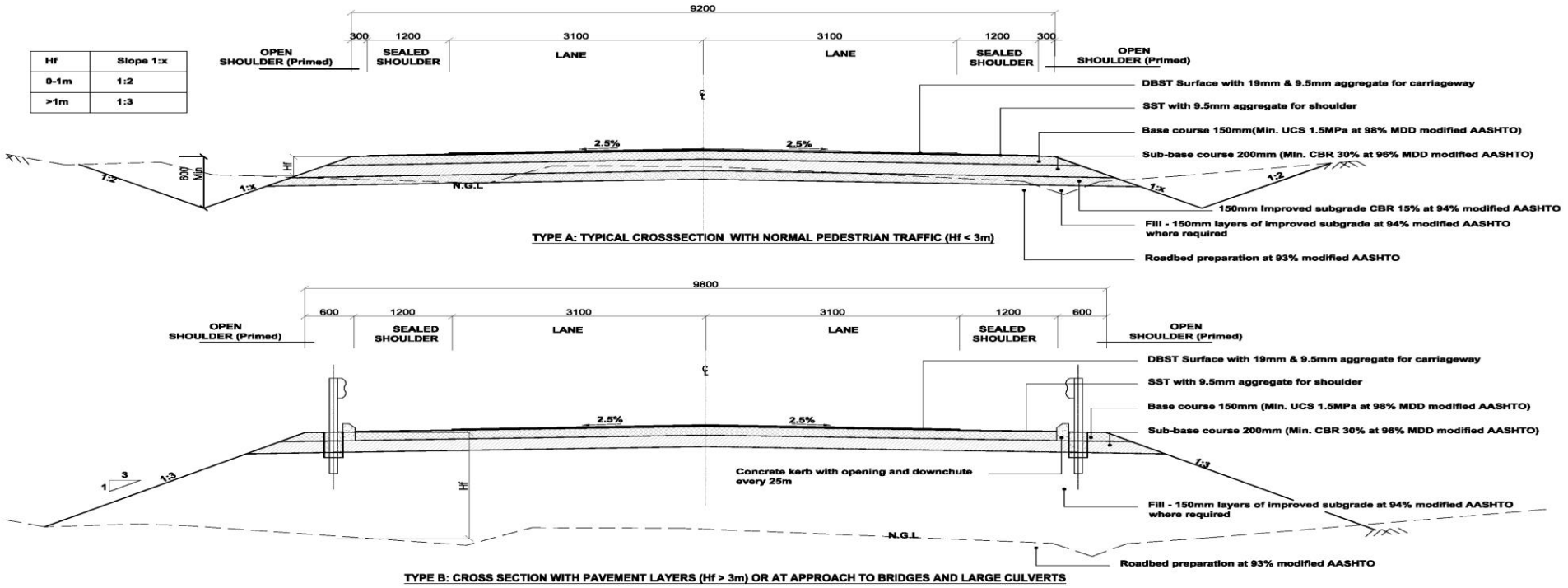


Figure 3-9: Typical Cross Section for the proposed Manyinga to Jimbe Road Upgrade

3.7.9 Bus Bay / Bus Stop

A standard design has been prepared for bus bays according to SATCC_GDTR as well as following RDA's instruction to segregate bus bays from the main traffic with raised island.

The layout of the bus bay comprises the following main features:

- 35m long entry and merging/exit tapers (lead-in and lead-out sections), positioning the bus bay 3.0m from the edge of the travelled way to accommodate the standard 2.0m wide shoulder and a 1.0m wide kerbed traffic island (raised/semi-mountable kerb type no. 7 with visibility painting/kerbface marking).
- 3.5m wide and 15m long bus bay (stopping area).
- 1.5m wide kerbed sidewalk (raised/semi-mountable kerb type no. 7 with visibility painting/kerbface marking) with 60mm thick concrete block paving.
- Passenger platform behind the sidewalk and with open-fronted shelter (approximate 4.5m x 1.8m plan dimensions and 2.5m height, of brick, stone or cement block walls, with side wall ventilation openings, corrugated iron roof and concrete bench).
- Pavement/surfacing of the bus bay is the same as for the Project Road.

3.7.10 Proposed Road Safety Improvements

In the detailed design stage care has been taken to incorporate the findings of the safety audit within the Scope of the Design study and the following aspects have been incorporated into the design. The road should be provided with appropriate and sufficient traffic signs and markings as per the requirements of specific locations. The summary of Improvement's incorporated in the design is briefed **Error! Reference source not found.**4.

Table 3-2: Proposed Safety Improvements for the proposed carriageway

Safety Aspect	Improvements incorporated in Design
Geometric alignment	The scope of upgrading design did not allow for major realignments but the following provision has been made: • Vertical realignment of severe vertical crest and sag curves; • Vertical realignment of sag curves at dangerous bridge sites; • Horizontal realignment where appropriate;
Junction Layout	• Junctions have been designed to the appropriate standards. • Bus layby's and other layby's will be retained but improved to the required standard for width, length and safe exit and entry points.
Roads Signs	• All road signs will be replaced.
Road Markings	• All road markings will be to the required standard and the construction contract makes provision for the installation of road studs.
Guard Rails	• Guard rails will be installed where required.
Drainage and Bridge Structures	• All narrow structures will be widened and where required, bridges will be raised to accommodate the new vertical alignment.
Safety of non-motorised road users	• Separate footways will be constructed in the high density pedestrian areas of Ikelenge areas. No provision is made for pedestrians in the rural environment.

Safety Aspect	Improvements incorporated in Design
Traffic Accidents and "Black Spots"	"Black spots" identified are as a result of either steep grades and urban areas and have been addressed as follows: • Separate pedestrian facilities in urban areas; • Speed bumps large settlement areas.
Road safety features	Road safety features to be installed include but are not limited to concrete safety barriers, kerbs, road signs, road markings, rumble strips, road humps and guardrails

3.7.11 Road Furniture

The condition of the existing road furniture was recorded during the visual assessment of the road and the subsequent safety measures are summarized below, together with recommendations for any improvements required.

3.7.11.1 Road signs and Markings

Road markings and signs perform the important function of guiding and controlling traffic on a highway. The markings serve as psychological barriers and signify the delineation of traffic paths and their lateral clearance from traffic hazards for safe movement of traffic. Road markings are therefore essential to ensure smooth and orderly flow of traffic and to promote road safety. RDA standard Practice for Road Markings and SATCC Specifications was used in the study as the design basis.

3.7.11.2 Speed Zoning

In large settlement areas such as Mwinilunga and Ikelenge, a local speed limit of 60 km/h has been proposed, due to high pedestrian, cycle movements and Sub-standard horizontal geometry.

3.7.11.3 Fencing

Fencing of road reserve to prevent encroaching into the road reserve is a new concept which is yet to be considered by RDA. Currently, there are no measures in place to protect road reserve for the project road. Road boundary fencing is therefore desirable and the provision of fencing along the road reserve could be included in the final design drawings and documentation after discussion with RDA. This will significantly help to reduce the number of people encroaching the proposed road reserve.

3.7.11.4 Guardrails, Safety Barriers, Handrails

All the existing guardrails at the bridge approaches have fallen down as most of the wooden support posts are rotten or the guardrails have been damaged in accidents. The guard rails are mostly badly rusted and all of them need to be replaced with new galvanized railings.

For the Road Upgrading Project galvanised steel safety barriers (metal guardrails) with steel guardrail posts driven in the ground are included to replace guardrails at high fill sections and at bridge approaches. Safety barrier/guardrail terminals with concrete anchor block are provided at the start and end of a guardrail section.

The safety barriers will be provided at outer edges of roadways wherever the embankment height is more than 2m in plain terrain and at bridge approaches.

3.7.11.5 Kilometer and Marker/Guide Posts

The details of kilometer posts are in accordance with RDA standard drawings. Kilometer posts are provided on both sides of the road i.e., independently for each direction of travel. Kilometer posts are located on the left-hand side of the road as one proceeds from the station from which the Kilometer count starts. The posts shall be fixed at right angles to the center line of the carriageway.

Marker Posts are intended to mark the edges of the roadway so as to guide drivers for the alignment ahead. Object markers are used to indicate hazards and obstructions within the vehicle flow path, for example, channeling islands close to the intersections. Posts shall be provided as per the details given in the drawings in accordance with the provisions of RDA Standard.

Marker posts are provided for all curves having lesser radius and posts are proposed on embankments of height more than 1.0m, bridge approaches before start of the guard rails.

CHAPTER FOUR

4.0 PROJECT LIFE CYCLE

4.1 INTRODUCTION

Throughout the course of constructing the road engineers and others with relevant specialties such as surveyors, economists, environmentalists and sociologists will be required. These will be charged with technical issues at the onset of the project and subsequent activities. Other staff who will be required are casual and manual labour with or without skills who will serve as handymen throughout road construction. About 30 experts and 200 handymen will be employed during the three-year road construction.

4.2 MOBILIZATION PHASE

The time taken for the duration of mobilization phase will be about three months. For road construction the mobilization phase will include a number of activities including:

- Clearing sites all along the RoW;
- Identifying appropriate camping site(s) either as recommended by the EIS or others depending on the bidder's preference[2];
- Constructing and using an apt camp;
- Purchasing equipment (otherwise owned by the construction company) including vehicles, bulldozers, excavators, vibrating rollers, concrete vibrators, generators and others;
- Movement of construction materials e.g. sand, gravel, cement, stones, timber, iron bars, and others;
- Undertaking the initial works such as crushing of aggregates, locating site posts and disposal sites for waste materials.

4.3 ROAD DESIGN AND CAMP SITE ERECTION

The horizontal and vertical alignment determined at intervals of 25m along centreline, tangent points and other critical points as required. The vertical alignment is designed to consider the hydraulic and soil conditions and the needs to raise the embankment.

The earthworks and pavement design are designed to carry traffic over a period of 20 years and in accordance with the Pavement and Materials Design Manual, 1999 and the overseas Road Note 31, 2023 by the Transport Research Laboratory. Other parameters to be considered during pavement design shall include: results of the pavement evaluation, soils and materials tests and other engineering treatments dictated by the available natural materials. Access roads joining the project road shall be paved up to the end of the road reserve taking cognizant of the environmental requirements.

The design of drainage structures involves all existing data and results of the field investigations for soils, foundations, hydrology, and others parameters. It is assessed and used as a basis for the

[2]The sites taken other than those identified by the EIS will require the preparation of EPBs

design of drainage structures. Detailed hydraulic computation and structural designs are carried out and fully documented in the reports.

The Geometric design is devised bearing the following considerations:

- Based on the topographic survey and the design pavements, to improve the horizontal and vertical alignments as necessary and complying with the approved design standards appropriate to the traffic and engineering characteristics of the road;
- All possible accident black spots are identified and their design incorporated. Measures to improve dangerous locations are also identified. Improved layout and visibility at junctions, proper separation of pedestrians and cyclists from the vehicular traffic and the provision of pedestrian crossings, bus bays and parking areas are included in the design, where possible. Other measures include provision of wide shoulders in towns/villages and climbing lane on steep grades.

The traffic design is considered to:

- Determine appropriate growth rates per category of vehicles (i.e. light and heavy) using apt methods that are acceptable. Moreover, for each determined category the future traffic forecast for the next 10 to 20 years is provided;
- Detailed engineering design is carried out to specify necessary traffic control features. The design includes detailed traffic analysis as well as, where appropriate, design traffic forecasts for major intersections. Based on the traffic analysis, the intersection capacity and related traffic studies are conducted to determine the location of signs, signals as necessary, pavement markings, facilities for pedestrians and non-motorized traffic around populated areas and other control features;
- A detailed scheme for the management of the traffic flow is developed to ensure that vehicle and pedestrian movement is properly handled during the construction period. This plan includes details of the location and design of bypass lanes; temporary structures, barriers, signs, signals and other physical features necessary to accommodate traffic flow during construction. In addition to the design plan, a traffic operations plan detailing the construction sequencing, public information announcements, use of traffic control devices and other activities are designed to minimize traffic disruption.

Campsite Erection

The erection of campsite will be the sole responsibility of the Contractors that will be awarded the contracts to rehabilitate the Mwinilunga-Jimbe road. The Contractors working in conjunction with the district authorities in Mwinilunga and Ikelenge will choose the appropriate sites for the erection of campsites which will be done during the contractors' mobilization phase. This may include land acquisition from the appropriate land owners. The campsites are expected to consist of offices, laboratory, workshops, housing quarters for both the contractors and the supervising engineers. The contractors will be expected to obtain an environmental approval permit (Decision Letter) from the Zambia Environmental Management Agency (ZEMA), and a water abstraction permit from the Water Resources Management Authority (WARMA) prior to the start of constructing the campsites and utilization of any water resource respectively.

4.4 CONSTRUCTION PHASE

4.4.1 Introduction

With the purpose of carrying out road reconstruction effectively the agreements embedded in the contract together with the capability of the company awarded the contract should be observed. Worth mentioning the changes in the weather and sometimes local politics are likely to affect the speed and quality of construction.

4.4.2 Construction Overview

A pre-qualified contractor capable of carrying out road construction will undertake construction of the road, and associated works. The construction will require a number of temporary facilities such as equipment & workshop yard, labour camp and site offices.

The Construction contract will be based on RDA conditions which stipulate that the Contractor must provide a performance bond as well as the following insurances: -

- Insurance of Works and Contractors Equipment; and
- Third Party Insurance.

4.4.3 Associated activities

Many activities will be done during construction of the road. These will comprise of:

4.4.3.1 Ground Investigations

Prior to actual construction works, the Contractor will undertake additional ground investigations over and above the one done by the Consultant. These additional ground investigations will be more elaborate. Samples from test pits will be subjected to both visual observations and laboratory tests.

4.4.3.2 Demolition and Site Clearance

This will include general site clearance of vegetation including their disposal. Where necessary, trees may be cut, their stumps removed and resulting holes backfilled. Where the road requires slight realignment, or there is need to clear the entire width of the road reserve, existing structures, which are in the way of the construction, will be demolished and disposed. This is likely to be intense in large settlement areas and especially at market places. The demolished elements will include brickwork, concrete, masonry blocks, metal (largely steel) and timber. The mitigation measures for the affected households have been proposed in the Resettlement Action Plan (RAP).

4.4.3.3 Concrete Works

There will be concrete works at certain sections of the road that require reinforcement. In addition, bridges and box culverts maintenance and replacement of all the 600 pipe culverts other drainage structures will be required.

4.4.3.4 Earthworks

Earthworks operations will be for preparation of road sub grade and drainage, in addition to auxiliary works within the road corridor. Earthworks will include: -

- Site Survey and Setting out;
- Excavation by cutting into topsoil, normal soil, rock or artificial material. Trimming some excavated surfaces and disposing of excavated material(s);
- Filling to Embankment and General Filling with imported natural material other than topsoil. These natural materials include rock; sand and other approved naturally occurring materials;
- Scarifying, watering and compaction of fill layers or in situ road formation level; and
- Providing, placing and lapping geo textile materials.

4.4.3.5 Road Paving

The Roads Pavement comprises of the following: -

- Construction of the carriageway;
- Precast Concrete Kerbs and Channels to act as restraint to road edges;
- Non-Illuminated Traffic Signs;
- Reflective Road Studs along centre line of carriageway; and
- Road Markings to designate carriageway from shoulders.

4.4.3.6 Duration of construction phase

The time for the construction phase will be in the region of three (3) years.

4.4.3.7 Materials: Sources, types and amounts for construction

The materials to be used will be more or less those obtained during mobilization. The major ones will be sand, gravel, stones and others from borrow pits, and others like cement, timber and steel reinforcement bars from commercial dealers. Utilities such as water, energy and communication gadgets will be essential together with reflectors for slowing down speeding vehicles. Moreover, more materials will be required such as grass and seeds or seedlings for containing soil erosion as well as iron or wood boards and iron bars for signposts.

Materials investigations and characterization was done and have covered the following important aspects: -

- Assessment of in-situ alignment soils for the purpose of carrying out pavement design based on traffic loading, base course type, and climate and subgrade strength as recommended by PMDM-1999 and overseas Road Note 31-2023;
- Investigations on existing and potential new borrow areas for the purpose of obtaining suitable materials for pavement layers which will be utilized for fill, subbase and base course lying;
- Investigations of potential existing and new quarry/stone sites which for obtaining suitable materials for surfacing and granular pavement layers including crushed stone road base and aggregates for concrete works; and
- Evaluation of potential sand and water sources in order to understand their physical and chemical suitability for concreting, mortar and pavement works.

The following are estimated quantities of materials to be used for the upgrading works of the road from Mwinilunga to Jimbe.

Table 4-1: Material Requirements (Road Layerworks)

19mm surfacing stone (m^3)	13 000
6.7mm surfacing stone (m^3)	4 600
Bitumen tack coat (70/100 penetration grade) (litres)	1 600 000
Fogspray (65% cationic emulsion) (litres)	750 000
Precoat (litres)	230 000
Crushed-stone base (m3)	178 000
Subbase (m^3)	210 000
Upper selected layer (m^3)	160 000
Cut to fill (m^3)	205 000
Borrow to fill (m^3)	2 195 000

4.4.3.7.1 Borrow Pit Sites for Pavement Layers

Potential borrow pit sites were identified and had gravel samples collected for testing in the laboratory for compliance with the specifications given in the SATCC Standard Specification in accordance with their proposed use. Forty (40) existing borrow pits were located for possible extension and a further 26 new/potential borrow pit sites were identified for further investigation and separate Environmental Project Briefs (EPBs) will be prepared for the borrow pits that shall be opened up in accordance with the National Environmental Impact Assessment Regulations.

The EPBs will be prepared by the Contractors that will be awarded the civil works contracts since it is the responsibility of contractors to source for road construction materials. The EPBs for the borrow pit sites are expected to be prepared during the mobilisation phase. The identified borrow pits will only be utilised once approvals have been obtained from ZEMA.

Additional points of concern are as follows:

- Numerous existing borrow pits are close to settlements and villages and have been substantially mined.
- Extension potential may therefore be limited by the close proximity of dwellings.
- The existing borrow pits have been extensively mined and no overburden material has been retained for their rehabilitation. If these borrow pits are to be extended, their rehabilitation would only cater for the extended area, unless sufficient excess overburden material can be sourced from the extended area.
- The thickness of overburden material is limited in many instances and would results in inadequate amounts of material being available for the rehabilitation of the borrow pits.
- The thickness of good quality gravel appears thin in many instances with the gravel being underlain by inferior quality material (i.e. clays). This would result in an extensive borrow pit area to source the required amounts of material. Alternatively, the distance between borrow pits would have to be reduced to contain the borrow pit extent.

- Protected and undisturbed forest areas may also hamper the opening of new borrow pits but this will have to be confirmed with the relevant authorities.
- The sourcing of sand for use in concrete may prove difficult and could be constrained to alluvial deposits at river crossing, which may not be desirable from an environmental standpoint. The thick sandy overburden material in the southern section of the project (km 0 to km 100) may prove more suitable in this instance.

4.4.3.7.2 Fill Materials

Fill material will origin from cut in the existing road prism where the new road level will be lower than the existing road due to improvement of the vertical alignment required for compliance with the applicable design standard.

Further fill material will origin from cut in the existing road prism where existing cuts need to be widened due to the new width of the Project Road.

4.4.3.7.3 Sand

It is assumed that the requirement for natural sand for the Project will be relatively small, mainly for blinding material, mortar and some concrete. Normally the aggregate production produces excessive amounts of quarry dust, which may be used in lieu of natural sands.

The sand found at various borrow pits was found to be suitable for use as fine aggregate for concrete and can be blended with fine aggregate derived from the mechanical crushing of rocks in the quarries if required. All the existing borrow pits will be assessed by the Contractors for their suitability in terms of material extraction.

4.4.3.7.4 Crushed Rock

There are four potential hard rock quarries as tabulated below.

Table 4-2: List of potential hard rock quarries

No	Road No	Stake Value (Km)	Material Type
1	T005	Mwinilunga, prison property	Dolomite
2	T005	43.2	Sandstone
3	T005	66.2	Sandstone
4	T005	71.6	Granite

These sites were not assessed during the 2025 study. The contractors that will be appointed are expected to undertake their own assessments and studies since the sourcing of construction materials is their responsibility. The Contractors will be expected to prepare environmental assessment reports and obtain the necessary environmental approvals from the Zambia Environmental Management Agency before starting quarry operations at the selected sites.

4.4.3.7.5 Sources of manufactured materials for road construction.

- **Cement-** Cement is easily available in the mainland, packed in 50kg bags and sourced from the factories by Lafarge Cement and Chilanga cement works in Ndola is the sources for supply of cement for the entire project requirements.
- **Reinforcement Steel-** M/S Good Time Steel (Zambia) Ltd and M/s UMCIL, Lusaka is the major source of steel for the entire project requirements. Strength and other properties of reinforcing steel to be confirmed by testing of samples in approved testing laboratories.
- **Bitumen-** Bitumen for road works is generally readily available from either Indeni Oil Refinery in Ndola or external suppliers. Supply at Indeni Oil Refinery is limited capacity 400t/day. Therefore, continuous supply to the project may be delayed or inadequate to meet the target progress. In such case option of importing bitumen and emulsion direct sources from South Africa and Zimbabwe. Bitumen properties need to be checked by testing representative samples in approved laboratories.

4.4.3.7.6 Transportation and handling of construction materials

Transportation and handling of materials will basically be done manually. Machinery will be operated manually while feeding and controlling them will involve human realization and keenness. Materials will either be moved from borrow pits or obtained from the camp and then sent to the site under construction.

4.4.3.8 Construction Waste and Emission Inventories

4.4.3.8.1 Construction and Commissioning Waste Management

The Table below presents indicative characteristics of wastes that will be generated by the Proposed Project.

Table 4-3: Characteristics of Potential Project Waste

1. SOLIDS • Bituminous material; • Cement (Dust); • Paper and Cards; and • Plastic bottles, cans, drums & packaging bags (both polythene and biodegradable)	1. **METALS** • Welding Rods • Isolated Steel Piles Wasted Lengths • Copper (Electrical Wires etc) • Reinforcement steel
2. Aggregates • Vehicle parts; • Glass; • Rags and Oil Adsorbents;	2. **SLUDGES** • Grease; • Paint; and • Oil.

• Light bulbs and tubes; • Paint cans and brushes; • Stone and Rocks; • Tyres; • Cleared Trees & Branches; • Cleared undergrowth, shrubs etc; • Waste Timber; and • Concrete Shuttering.	**3. LIQUIDS** • Wash down water and drum water; • Leakage of fuels and bitumen • Oily water. **4. DOMESTIC** • Food

It is expected that the special specifications in the Tender Documents will obligate the contractor to dispose of different categories of waste appropriately.

In general, the contractor will be required to develop construction specific Waste Management Plans prior to the start of construction work. At the start of the construction contract, the contractor will undertake a waste minimization/treatment/disposal study, guided by the project waste management strategy. The study will identify and quantify the expected wastes and describe: -

- Proposals for reduction, treatment processing;
- Third parties to whom waste will be transferred for re-use;
- Liaisons with the local Councils to identify and document suitable council disposal sites, ground, landfill and incineration facilities;
- Other locations of landfills or waste storage sites to be adopted if local Council facilities are inadequate; and
- On site incineration facilities to be adopted if local Council facilities are inadequate.

The findings of the study will be used in the development of the construction waste management plans which must adhere to the Environmental Management (Licensing) Regulations, 2013-Waste Management. At a minimum, these plans will include: -

- A consolidated summary of the applicable regulations and restrictions governing the generation, handling, treatment and disposal of wastes generated during the construction/commissioning phases of the Project;
- Any permitting requirements for waste treatment or disposal;
- Detailed method statement for each element of the waste management handling, treatment and disposal process; and
- Any third-party agreements for waste handling, transfer or disposal.

After the construction of the road, the waste handling/disposal facilities established by the contractor under the construction program will be closed.

If a waste handling/disposal facility procured by the contractor is closed, the contractors will be required to ensure that it is appropriately de-commissioned (i.e. including capping of any disposal sites) and the surface will be re-instated according to the Project Reinstatement Strategy. If the facility is retained, it will be transferred to the proponent.

4.4.3.8.2 Release to the Atmosphere

Atmospheric emissions will be generated by the proposed roads project activities principally, during construction of road works. It is anticipated that the most significant components of such emissions will be combustion gases, specifically: -

- Nitrogen Oxides (NOx);
- Carbon monoxide (CO);
- Sulphur Dioxide (SO2);
- Particulate matter (PM);
- Volatile Organic Compounds;
- Aldehydes; and
- Secondary pollutants.

4.4.3.8.3 General Wastewater Disposal

Wastewater includes all water flows from the temporary site office, work sites and subsidiary operations such as vehicle and equipment washing. Wastewater from temporary site office should be treated in a septic tank and related soak-a-ways.

Wastewater from the works will generally be from the roadside drains and during curing of concrete works. These wastewaters are not hazardous but should be monitored to ensure that they do not cause adverse effects.

4.4.3.8.4 Quantification of water demand

The major use of water will be for domestic purposes (drinking, washing clothes etc.) at the camp and watering of the road for dust reduction.

- **Domestic Demand**
  - ✓ Assumptions
    1. Number of employees = 300people
    2. Average water consumption = 45litres/capita.day
    3. Duration of road construction (all phases) = 3years

  Domestic Water demand = 45 x 300 x 3 x 365 =**14,782,500litres**

- **Road watering demand**
  - ✓ Assumptions
    1. 10,000 litres tanker will water 2.5km of the road
    2. 10km of the road will be watered once per day, therefore 40,000l will be required per day.
    3. Duration of road construction (all phases) = 3years

Water demand = 40,000Lx 365days x 3yrs **=43,800,000litres**

- **Other water demand**

  These include water required for dust control in the quarries, borrow pits and to bring fill soil to optimum water content. This can be taken as 20% of the sum of domestic and road watering demand.

  Other demands = (14,782,500+43,800,000) x 0.2= ***11,716,500litres***

- **Total Water Demand**

  The total water needed is the sum of the demands above which is ***75,299,000 litres***

4.4.3.8.5 Quantification of wastes

- **Liquid waste**

  Sewage will be the dominant liquid waste which will be treated by Septic tank – Soak Away system. Oil and greese will be produced but to a very small extent since the maintenance of the trucks and machines will be done in proper garages. Some of the oil produced will be used in the asphalt process to coat the aggregate

- **Sewage quantification**

  ✓ Assumption

  1. 80% of the domestic water demand will become wastewater

  *Total Sewage will be = 0.8 x 14,782,500=****11,826,000 litres***

- **Solid waste**

  In road construction projects the solid waste is mainly contributed by domestic wastes (camp site) such as food waste, papers, tins, glasses etc.

- **Domestic waste quantification**

  ✓ Assumption

  1. Average Generation rate = 0.35kg/capita per day
  2. Number of employees = 300people
  3. Duration of road construction = 3years

*Total domestic solid waste = 0.35x 300 x 3 x 365 = 114,975kg =****115 tons.***

4.4.3.8.6 Construction waste quantification

Major wastes generation associated with the project construction and their treatment/ disposal methods are described in the table below:

Figure 4-1: Major waste and their treatment/Disposal Method

Activity	Waste type	Amount	Treatment/ Disposal Method(s)
Domestic activities at the campsite	food waste, papers, tins, glasses, cloths, woods, metals	114,975tons	Collected and disposed at the Dumpsite. Other option include burial and Burning as directed in Table 6 below
Site Clearance (1 to two meters on both sides of the road.	Trees and Shrubs	Not Significant	Sell or give to villagers to be used as source of energy
	Vegetable soil (top Soil)	Not Significant	This organic soil is full of manure, will be stockpiled to be used during planting of vegetation
Excavation of drains and foundation (Where applicable)	Spoil Soil	Not Significant	This soil shall be stock piled along the foundation trenches. The soils shall be used to reinstatement site at the end of the project
Actual Construction	Rubbles	Not Significant	Will be crushed and used to fill the pot holes at nearby areas
	Scrap metals	Not Significant	Sell to recyclers
	Timber	Not Significant	Sell to recyclers
	Cement bags	Not Significant	Sell to recyclers
Use of oil/fuel in construction vehicles and vehicle servicing	Used oil	Not significant	The used oil will be stock piled in drums and will be disposed of through a certified hazardous waste disposal company/firm

Waste Type	Burial	Approved Dump
Food waste	Allowed	Allowed
Paper	Allowed	Allowed
Cloth	Allowed	Allowed
Wood	Allowed	Allowed
Metal1	Allowed	Allowed
Plastics2	Not allowed since there is an approved dumpsite	Allowed
Tins	Allowed	Allowed
Glasses	Allowed	Allowed

4.4.3.8.7 Best practices in Waste Handling

Waste for Burial- Only inert materials or readily decomposable materials may be disposed by burial. Inert materials include materials such as brick or concrete debris. Readily decomposable materials include materials such as paper, cloth, wood, and vegetative waste. Best practices for burial include the following:

- No liquids or material containing liquids may be buried;
- No waste shall be buried below the water table or less than 1 meter above the water table;
- If the water table has seasonal fluctuations, this restriction applies to the highest seasonal water level;
- No waste shall be buried within 100 meters of a surface water body or water well;
- No waste shall be buried within 300 meters upgradient of a surface water body or water well;
- No waste burial site shall have a surface slope greater than 4:1 (horizontal to vertical);
- Waste burial sites shall be protected against future erosion;
- Local and district authorities (Mwinilunga and Ikelenge) must be notified of the locations of any waste burial sites;
- The locations should be identified with GPS coordinates. If appropriate, the chainages and offsets of the waste burial sites should be listed;
- All waste burial sites must be clearly marked around the perimeter indicating that the cover soil within the perimeter should not be disturbed;
- At the end of the project, the Contractor shall mark all of the waste burial sites on the As Built drawings. The Contractor shall also produce a single drawing with all of the waste burial sites marked, and with the coordinates listed in a table shown in the drawing; and
- The Contractor shall produce a record of the types and volumes of wastes buried at each site and the dates of operation for each site.

Waste for Removal-All waste that is to be removed from site of production will be taken to the various dump sites approved by the local authorities. RDA and the contractor shall ensure that there are no surface water bodies within 5km of the boundaries of the dump. RDA and the Contractor shall further maintain a record of all wastes disposed in an approved dump. The record shall include the types and volumes of wastes disposed and the disposal location.

4.5 OPERATION AND MAINTENANCE PHASE

The actual usage of the road is expected to commence after the construction works. The project road is under "trunk road" category and therefore will be directly managed by RDA. The design period is 20 years, after which re-surfacing will be needed. During this time, RDA will carry out routine maintenance by attending to pot holes, clearance of vegetation within the ROW (road reserve area) and monitoring.

The contractor will undertake pre-commissioning activities before the project road from Mwinilunga to Jimbe is opened to traffic and the public in general. Examples of pre-commissioning activities

include road inspection for roughness and stability. Thereafter, the Regional Engineers office of the RDA will draw up a maintenance programme to ensure that the project road does not deteriorate.

4.5.1 Activities during Pre-Commissioning

4.5.1.1 Structural and Civil Engineering Works

These types of works are usually ready for use after construction and construction testing. These works will be commissioned if and when, their functionality can be substantially achieved.

As a part of the commissioning activity, the Consultant will prepare and finalize built drawings for the entire structural and civil engineering works.

4.5.1.2 Site Reinstatement

Prior to the commencement of the reinstatement program, the contractor will be required to develop a project specific reinstatement plan.
The reinstatement of the Project will be based on the following principles: -

- Disturbed areas which are not permanent works, will be reinstated to pre-construction conditions to the greatest practicable extent;
- Disturbed areas will be stabilized to protect the integrity of permanent works;
- Disturbed areas will be re-vegetated to achieve good and natural landscape ambience;
- Regular monitoring of reinstated areas will be undertaken until environmental requirements and goals have been achieved.

4.5.1.3 Timing of Reinstatement

Reinstatement of the Project area will be undertaken on a sequential basis dependent on the completion of construction and testing in each area. The site will be cleared of residual construction debris, construction signs and equipment as part of activities associated with reinstatement.

4.5.1.4 Site Clean Up

Prior to de-mobilization of construction personnel and equipment, cleanup activities will be carried out in accordance with environmental standards and industry best practice. Cleanup activities will consist of the removal and/or disposal of temporary structures, equipment, tools and excess material brought on site or generated during the construction and commissioning program.

4.5.1.5 Permanent Reinstatement

Permanent reinstatement will be undertaken in all the areas that have been subjected to disturbance by the roads and viaduct bridge construction.

To facilitate natural re-vegetation of disturbed areas, the separately stockpiled excavated material land topsoil will be spread back in the reverse order in which they were excavated.
The key reinstatement principles are summarized below: -

- Minimize reduction in soil quality and structure during construction;
- Reinstate all third-party assets affected by project activities in accordance with the construction contract documents and other pre-entry agreements;

- Carry out site landscape on the basis of a landscape plan prepared by a landscape
- Professional;
- A target minimum cover of pre-existing ground vegetation established within one year of final reinstatement will be set;
- An aftercare monitoring and corrective action program will be developed and implemented based on examining the bio-restoration process periodically after reinstatement; and

Any fences, services, structures or other facility affected by the construction works will be repaired or replaced to a condition that is at least as good as that found prior to construction.

4.5.1.6 Duration of operation phase

A surfaced road is expected to last for many years so long as it is regularly maintained and the vehicles using the road carrying permissible weights. Nonetheless the *design period is expected to be 20 years*. In this regard the road should adopt a well-planned upgrading and maintenance program. Everyone expects such conditions to prevail for many years and RDA is expected to observe that.

On the other hand, because of a number of reasons the Government may wish to do one or several of the following:

- abandon a portion of the road and create another one or an alternative portion;
- divert the original course (long or short distances) and substitute it with a new one;
- expand the road because of increased number of traffic; and
- if worse comes to worse close the road completely in which case the decommissioning process will be carried out.

In whatever case any change done on the road or its neighborhood the environment can be affected. Therefore, what is important is to carry out a quick environmental and social assessment before undertaking further action to gauge the degree of mitigation measures so far done and their secondary consequences. Similarly, the new location of the road should be subjected to environmental and social assessment to predict the possible impacts. By doing such assessments the environment will minimally and negatively be affected. In order to be reliable, the EIAs will be done taking cognizant of all the environmental dimensions and parameters. The scope of the study will bear environmental, the biophysical, social, economic and cultural components.

4.5.1.7 Materials: Sources, types and amounts

The materials to be used during operation will be fewer than those collected during construction. Even so, depending on the nature of the use, the care that will be put in it, and the prevailing weather, the required materials may change from time to time or remain constant. The key ones will be sand, gravel, stones and others from borrow pits, as well as others like cement, timber and iron bars from commercial dealers. Utilities such as water, energy and communication gadgets will be essential together with reflectors for slowing down speeding vehicles.

Moreover, more materials will be required such as grass and seeds or seedlings for containing soil erosion as well as iron or wood boards and iron bars for signposts. Trucks, bulldozers, motor graders, excavators, crushers, mixers and other equipment will be required.

4.5.1.8 Labour and Water

The envisaged activities during operational phase will be done by three categories of workers. Category one will be RDA's engineers who will be monitoring the technical problems associated with the road, the type of vehicles using the road and where necessary weighing them, and collecting information pertaining to the road's performance. In the same group will be the scheduled environmental and social management of the entire road project.

Another group is the casual labourers who will be doing activities as directed by the technical group of experts. This group will also maintain the road's good looks by cutting vegetation, clearing channels and doing other non-technical everyday jobs. Group three will be road inspectors including environmental monitors and auditors who will be coming once in a while to monitor and assess the status of the road and give recommendations and advices.

During the operational stage there will be less water that will be required for the road's activities. By the same token water will be required at whatever time there are road maintenances or upgrading. Even so, water from the running streams will be used during the road checks and balances and for domestic upkeep.

4.5.1.9 Solid waste: types and amount

The solid waste to be produced during the operational phase does not differ significantly from that of the construction period. The only exception will be reduced cutting of the vegetative materials but other wastes will be increased. More shops will be built and market places established and thus contributing to more wastes particularly plastics, paper and small containers.

4.5.1.10 Liquid waste: types and amount

The liquid waste will continue to be produced albeit completion of the road because there will be more influx of people using the road. These will need toilet facilities at various centres, and they will increase consumption of water. Construction of latrine facilities along the road will cut down thoughtlessness.

4.6 DECOMMISSIONING AND ABANDONMENT PHASE

4.6.1 Decommissioning

Decommissioning of the road is not foreseen, however, decommissioning of related facilities especially contractor's camps and workshops are inevitable. Further, decommissioning of quarries and borrow sites will be done upon completion of construction works.

4.6.2 Demobilization of the project

4.6.2.1 Introduction

Upon completion of the contracted work, the contractor shall remove all of its tools, materials and other articles from the construction area. Should the contractor fail to take prompt action to this end, the RDA, at its option and without waiver of such other rights as it may have, upon sixty (60) calendar days' notice, may treat such items as abandoned property. The contractor shall also clean areas where he worked, remove foreign materials and debris resulting from the contracted work and shall maintain the site in a clean, orderly and safe condition.

Materials and equipment shall be removed from the site as soon as they are no longer necessary to minimize the demobilization work after completion of the project. Before the final inspection, the site shall be cleared of equipment, unused materials and rubbish so as to present a satisfactory clean and neat appearance.

All the camp sites will be built as temporary structures and these will also include the use of movable structures such as movable containers. All the temporary structures that can be beneficial to the community should be left to the local government for other uses in the area.

4.6.2.2 Duration of demobilization phase

Demobilization phase will take a minimum of six (6) months to complete the most pressing issues. Consequently, whatever is done will need monitoring and environmental audit. These will be done as scheduled or planned in the Environmental Management and Monitoring Plan.

There will be two phases during demobilization including disbanding of the camp and decommissioning. During closure of the camp the solid wastes likely to be produced will include rubble, iron sheets, wooden materials (as roofing woods, door frames and panels). Unless it has been decided for the camp to be used for another purpose like school or dispensary, the produced wastes will still be used for building other houses. There will be racked vehicles which will need to be moved from that place. Contracts will be made between the Construction Company and collectors of scrapes for recycling. Otherwise, the materials will be treated as per Environmental Management and Monitoring Plan.

Unless the Government decides otherwise or there is a necessity for diverting the road or sealing off (closing) a portion of the road, it is unlikely to demobilize it. After the completion of the civil works the only probable solid waste to be encountered will be dug out materials from wrecked portions that require maintenance or upgrading.

4.6.2.3 Liquid waste: types and amount

Liquid waste to be realized during demobilization will more or less be like that during operation. The toilet facilities along the road will be used by commuters and during demobilization there will not be any effect.

4.6.2.4 Legal Basis

For the components that will require decommissioning, the proponent (RDA) will prepare a written abandonment plan within 30 days of determining decommissioning. The Plan will detail how the decommissioning will be carried out.

The abandonment plan will be subject to approval by ZEMA. An Environment Project Report (EPR) will be prepared prior to implementation of this plan, to assess and minimize potential environmental and social impacts arising from the abandonment operations. This abandonment EPR Study will be submitted to ZEMA for consideration.

4.6.2.5 Technical Solutions for Abandonment

The exact details of how facilities will be abandoned will be determined prior to abandonment and agreed with the relevant authorities including ZEMA. Therefore, it is not possible to determine at this stage exactly what techniques will be used. However, this will be in accordance with recognized international standards.

CHAPTER FIVE

5.0 PROJECT ALTERNATIVES

5.1. PROJECT ALTERNATIVES

The road ear-marked for upgrading is an existing road and therefore there are no alternatives to the route for the road. No alternative routes were investigated for the project since the existing road will be upgraded/rehabilitated. No realignments are anticipated, so no alternatives were available to discuss realignment options either.

This section therefore compares the environmental and social impacts of various widths within which road construction activities could be carried out. These alternatives are as follows:

- Alternative mode of Transportation;
- The "No Project Option";
- Adopting 36m and 100m road reserves width;
- Adopting a construction corridor that covers the construction width plus a verge either side of the road, and
- Pavement Alternatives.

5.1.1. Alternative mode of Transportation-Option 1

There are no alternatives to this road that fulfill the functions of providing relatively fast, cheap land transportation within the road corridor and beyond. The only other alternative is by air, which is unlikely to either complement or to substitute for road transport in this region. Although there are three airstrips; at Kawiko (Government owned), Kaleni and Sakeji (CMML Mission owned) which can be used by light aircraft for those who wish to travel by air, transportation of goods and passengers by air is not likely to be a possibility for the foreseeable future in this region.

It can be argued that alternative transport modes such as rail can be considered instead of upgrading the proposed road. However, this option would entail far higher capital cost compared to paving an existing gravel road. A railway line in a new corridor would also be associated with hitherto unknown social and environmental impacts.

For the foregoing reasons, this option is not tenable.

5.1.2. The "NO" project option-Option 2

The "NO" Project Option, or the "do nothing" alternative, is the current road which is associated with a number of adverse environmental and social impacts. One of the most significant impacts is the increase in road traffic accidents which have occurred as a result of congestion. Transit times will remain as is, and over time would become worse as the road deteriorate further.

Generally, there would be no change with regard to impacts on water quality, vegetation, forests/trees, wetlands, visual impacts. No households would be affected as there will be no loss of land, property or crops. Infrastructure along the road would not be affected.

5.1.3. Adopting 100m for T005 road reserves width-Option 3

The Public Roads Act of 2002 provides for a road reserve width of 100m for the T005. This road reserve extends 50m on either side of the centreline of the Mwinilunga to Jimbe road. Owners of all the structures that will require to be relocated from the road reserve area will receive compensation based on the Resettlement Action Plan.

In this case, it is estimated that approximately over 1,500 structures (owning structures, property and crops) within 50m of the centreline on both sides of the road for the T005 roads will be affected and there will still be a substantial amount of vegetation and trees affected. The application of this road reserve width makes it relatively easy to control the Contractor's activities when it comes to clearing the area for construction works.

5.1.4. Pavement Alternatives-option 4

The road sections were evaluated in terms of the following project alternatives:

Alternative 0:

Do minimum option, which involves routine maintenance in the form of periodic light blading, spot re-gravelling and re-gravelling of the existing road with a 125mm thick gravel wearing course (GWC) once the existing GWC reaches a minimum thickness of 25 mm. No changes/improvements to the existing alignment or drainage structures are made.

Alternative 1:

Upgrading of the road sections to a modified All-Weather Class II gravel standard. This entails widening the carriageway to 10.8m and replacing and lengthening all drainage structures. Changes to the existing alignment are made were warranted in terms of the required geometric design standards. The existing bridge structures are to remain as is.

Alternative 2:

Upgrading the road sections to a modified Class IC bitumen standard using a modified Class W1 pavement structure (i.e. granular base / granular subbase). This entails widening the carriageway to 10.8m and providing 2x 3.5m wide surfaced lanes and 2 x 1.5m wide surfaced shoulders (bituminous double seal surfacing). Changes to the alignment are made were warranted in terms of the required geometric design standards and are to comply with a 100 km/h design speed. All drainage structures are to be replaced and sized in accordance with the hydraulic requirements. The existing bridge structures are to be replaced and are to be sized in accordance with the hydraulic requirements.

Alternative 3:

Upgrading the road sections to a modified Class IC bitumen standard using a modified Class W2 pavement structure (i.e. granular base / cemented subbase). This entails widening the carriageway to 10.8m and providing 2x 3.5m wide surfaced lanes and 2 x 1.5m wide surfaced shoulders (bituminous double seal surfacing).

Changes to the alignment are made were warranted in terms of the required geometric design standards and are to comply with a 100km/h design speed. All drainage structures are to be replaced and sized in accordance with the hydraulic requirements. The existing bridge structures are to be replaced and are to be sized in accordance with the hydraulic requirements.

Alternative 4:

Upgrading the road sections to a modified Class IC bitumen standard using a modified Class W3 pavement structure (i.e. cemented base / cemented subbase). This entails widening the carriageway to 10.8m and providing 2x 3.5m wide surfaced lanes and 2 x 1.5m wide surfaced shoulders (bituminous double seal surfacing). Changes to the alignment are made were warranted in terms of the required geometric design standards and are to comply with a 100 km/h design speed. All drainage structures are to be replaced and sized in accordance with the hydraulic requirements. The existing bridge structures are to be replaced and are to be sized in accordance with the hydraulic requirements.

The economic analysis reveals that Alternative no. 2 yields the highest economic benefit in terms of NPV and IRR for the base analysis and all six sensitivity scenarios.

This option entails upgrading the road sections to a modified Class IC bitumen standard using a modified Class W1 pavement structure (i.e. crushed stone base / crushed stone or granular subbase with CBR > 45%). This means widening the carriageway to 10.8m and providing 2x 3.5m wide surfaced lanes and 2 x 1.5m wide surfaced shoulders using a bituminous double seal surfacing. Changes to the alignment are made were warranted in terms of the required geometric design standards and are to comply with a 100 km/h design speed. All drainage structures are to be replaced and sized in accordance with the hydraulic requirements. The existing bridge structures are to be replaced and are to be sized in accordance with the hydraulic requirements.

The results indicate that upgrading the road sections to a bitumen surfaced standard is economically justified by yielding a positive NPV and an IRR greater than the discount rate.

The only exception occurs when the expected GDP growth is reduced by 50% and results in both a negative NPV and an IRR below the discount rate for all alternatives. This would make the upgrade alternatives not viable in economic terms but it is however expected that the surfacing of the roads will indeed generate greater economic activity in the region and result in higher than expected GDP growth.

Upgrading the roads will results in an increase in initial construction or client costs but will have a long-term benefit by substantially reducing maintenance and road user costs during the 20-year analysis period.

It is therefore recommended that the road be upgraded to surfaced standard. All alternatives will require periodic and routine maintenance during the 20-year analysis period. This will include routine items such as patching and crack sealing and periodic maintenance such as reseal/resurfacing and rehabilitation.

CHAPTER SIX

6.0 ENVIRONMENTAL AND SOCIAL BASELINE CONDITIONS

6.1. INTRODUCTION

This section outlines the findings of an environmental and social baseline study (ESBS) that was conducted in March/April 2025. Different methods of assessments were used to obtain data on the physical and social environment of the project area. Among these methods were:

- Desktop study on all the available information on the project area;
- Visits to government departments, non-government organizations, local authorities and other relevant authorities;
- Field works. These were investigations of environmental baseline conditions using various instruments to including to assess: -
    i. Topography;
    ii. Geology;
    iii. Soils;
    iv. Noise and vibration;
    v. Climate;
    vi. Air quality;
    vii. Hydrology;
    viii. Flora and Fauna; and
    ix. Socio-economic aspects including infrastructure and communications.

There will be need to prepare a Biodiversity Management Plan prior to the commencement of the civil works.

6.2. THE BIO-PHYSICAL ENVIRONMENT

The biophysical environment in the area of influence of the project road from Mwinilunga to Jimbe is a modified one where human activity has essentially altered the area's primary ecological functions.

6.2.1. Climatic conditions

Due to inconsistences in data compilation at the Mwinilunga Meteorological Station, Meteorological Station in Solwezi, the Headquarters of the North-western Province was used for climatic conditions in the project area.

Overall, the climate of the road project area is controlled largely by the north-south migration of the Inter Tropical Convergence Zone (ITCZ) with seasons. The ITCZ migrates between the equator and the Tropic of Capricorn (23º S) between November and February. In winter, it is

located over the northern tropics. The summer rains are brought by the southward migration of the ITCZ, and are characterized by thunderstorms, which are occasionally severe, with excessive lightning and sometimes hail.

The climatic conditions of the areas along the project road have been accurately described as a tropical continental highland climate[3]. Due to the combined effect of low latitude (15 S), continental position and high elevation above sea level, the climate shows the combination of a clear division into a dry and a rainy season, the predominance of the diurnal cycle over the seasonal, and large daily ranges of temperature.

Commonly three seasons are distinguished:

- Rainy season – a warm wet season from November to April;
- Cold season – a mild to cool, dry season from April to August; and
- Hot season – a hot and dry season from September to November.

6.2.1.1. Rainfall and Temperature

Temperatures along the project road corridor are defined by the two seasons (cool and dry – May to September and warm and wet – October to April).

The road project area of influence has annual average temperature of 19.8 °C, experiencing warm to hot summers, reaching 30 °C and more in September and October (Figure 6-1), and warm winter days, but cold at night. It receives an average of nearly 1,300 mm rain annually, with rainfall exceeding 0.1 mm on an average of 116 days a year. Summer rains start in late October and the bulk of the rainfall occurs between November and March when more than 90% of the annual rainfall is measured.

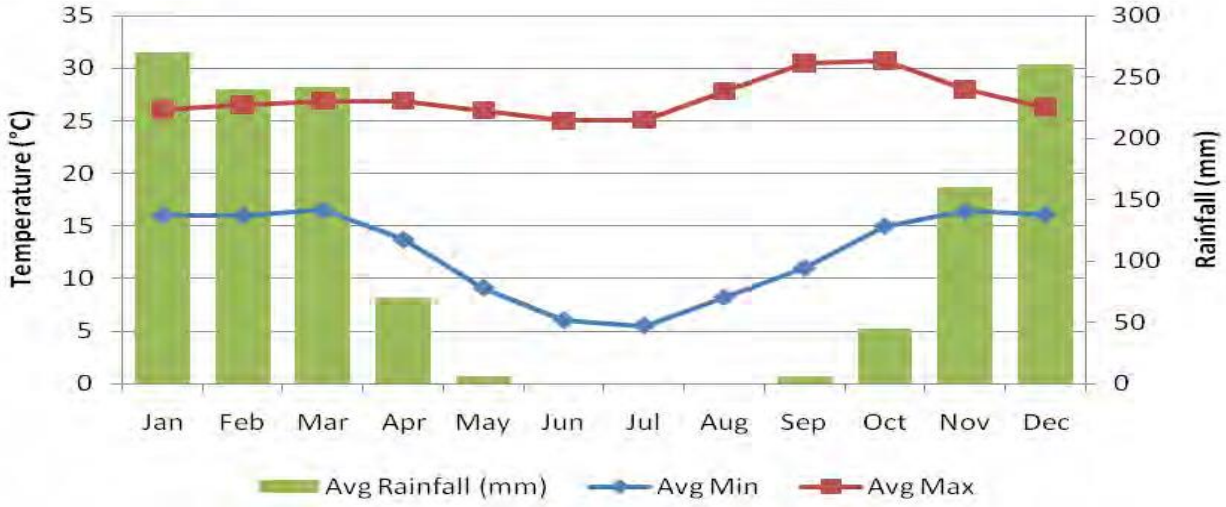


Figure 6-1: Mean monthly maximum and minimum temperatures at Solwezi including average monthly rainfall and rain days

[3] Nieuwolt S. (1971): Climatic variability and weather types in Lusaka, Zambia. - Arch. Met. Geoph. Biokl., Ser. B, (19, Heft 4): 345-366; reprinted in: Theoretical and Applied Climatology; Springer, Wien.

6.2.1.2. Evaporation

Evaporation generally exceeds precipitation for most of the year. Potential evaporation is highest in the driest months and during the beginning of the summer (September to the beginning of November). Annual mean evaporation exceeds annual mean precipitation by approximately 850mm. The daily evaporation rate in the area ranges from 3mm to 10mm. In hot months (September and October), it reaches a peak of 13mm. The lowest evaporation rates occur in the month of February towards the end of the wet season.

6.2.1.3. Humidity

For the past three years, the average annual relative humidity has been 60% (Figure 4-3). Mean monthly humidity levels vary from a minimum of 43% in the cool season (June-August) to a maximum of 76% during the rainy season (November-March). The average dew point for the whole year is usually 12ºC[4].

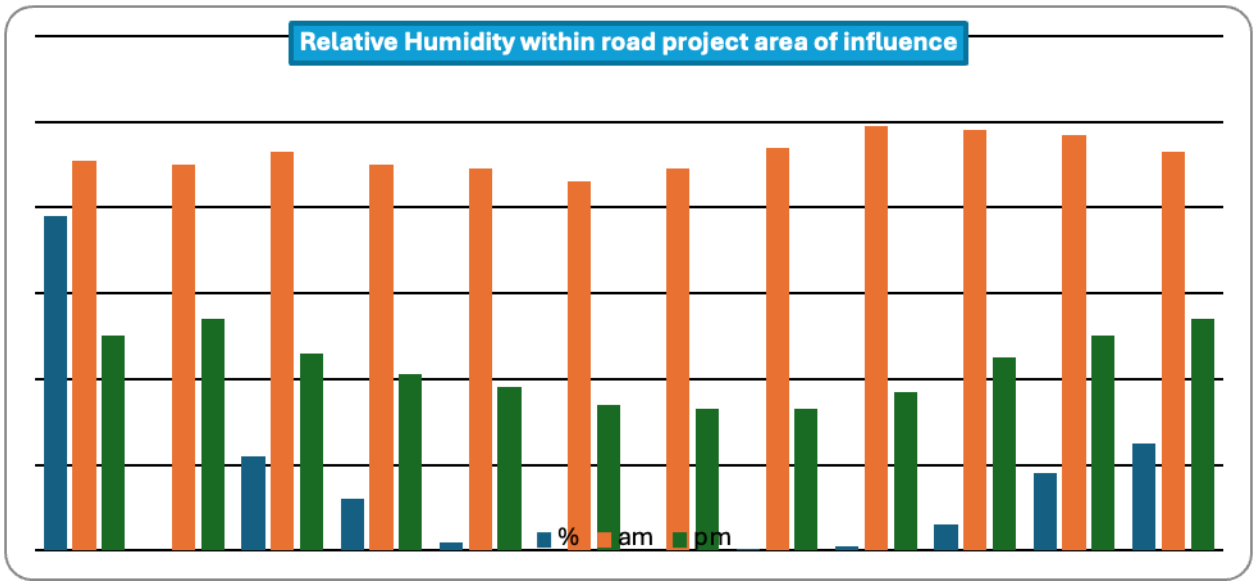


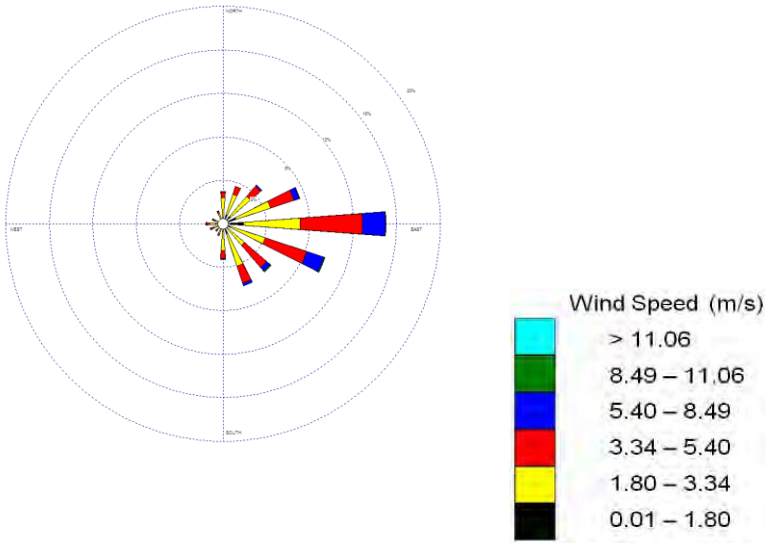
Figure 6-2: Average Relative Humidity

6.2.1.4. Wind

The wind field for an area is an important parameter with respect to air quality and dust control. Whilst rainfall and temperature attenuate the behaviour and concentration of a pollution plume after the release of a pollutant into the atmosphere, wind can generate dust emissions and thereafter control the dispersion of a pollution plume. The degree to which the winds have an influence on dispersion depends on wind speed, with higher winds speeds resulting in longer travel distance and dilution of the pollutants. Lower more stable wind conditions result in shorter travel distance and build-up of pollutant levels (especially gases) over a smaller area.

4

The average wind speed at the project road corridor is 2.6 m/s (Figure6-3). A significantly high frequency of light and calm winds occurs along road corridor, with 66% of all winds less than 3.4 m/s. The winds are almost exclusively from the sector east to southeast, with 25% of all winds from the east. The strongest winds occur in this sector and reach 8.5 m/s, but only occur on less than 1% of occasions. A relatively high frequency of very light winds occurs along road corridor, with more than 38% of winds less than 3.4 m/s[5].



6.2.2. Topography

The project road lies on a plateau which is orientated north of north-east – south of southwest. The plateau is incised by streams and rivers, which form gently sloping, shallow valleys. The height of the plateau is between 1200-1400 a.m.s.l. (above mean sea level).

6.2.3. Geology and Hydro-Geology

The Project Road is located in a structure described as a rigid bloc of Precambrian bedrock. This block is divided by Lufilian Arc of folded Katanga sediments crossing the DRC and Northern Zambia through to Angola. The zone is apparently stable but it is cut by several small faults which can produce land sliding whose intensity is weak. The road corridor has never had seismic movement.

The project road is underlined by gneiss and schists of the Precambrian Basement complex. Boreholes completed in the rocks of this Basement complex vary in depths from 36m to 81m yields from 17 to 360m3/d. Transmissivities are relatively low ranging from 0.2 to 0.8m2/d.0.

It is expected that the geological formations having the highest potential for exploitation are granites or granitic gneisses.

[5] Ibid

6.2.4. Soils

The Mwinilunga to Jimbe soils are mainly light sandy clays, orange brown in colour where they overlie lower Roan, with less fertile paler clay sands on flatter grounds. Outcrops of laterite gravel exist along the route, which have been used as sub-base and stabilised base course for the existing road.

The geological formation of the road corridor area is characterized by granites with Gneiss and Schists in some places while the soil is characterized by reddish-brown silty clays. The soil transforms into sandy soils dotted with rock fragments deep into the profile. (See Plates A/B and C/D below) in Figure 6-4.

Granite and sandstones are also found interspaced in varied proportions across the horizon. Heavily weathered sandstone is encountered below 2 m in the soil profile. The soils provide good anchorage for deep rooted trees due to its deep profile (more than 3m deep).

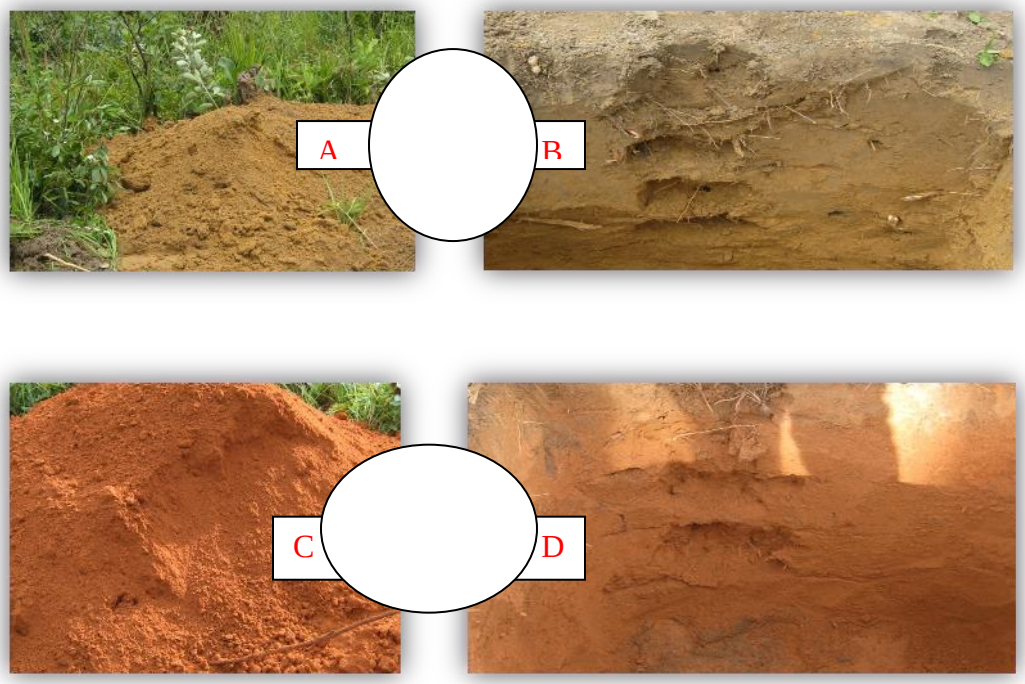


Figure 6-3: Soil Profile along the road corridor

The soils in the project area were generally identified as belonging to the following two types:

- C1 – well-drained, deep to very deep yellowish red to strong brown friable, fine loamy to clayey soil having a clear clay. Increase with depth, with inclusions (20%) of moderately well drained, deep to moderately shallow, gravely clay.
- C2 – Fine loamy to clayey soils.

These findings are in conformity with the soils in the study area as provided in the Exploratory Soil Map of Zambia, scale 1: 1 million a broad description.[6]

Soils close to the surface up to about 20cm deep are characterized by grayish clayey loams, apparently due to the presence of humus from plant material deposition. Close to the river channels and on river valleys the soils turn light to yellowish grey fine sands with isolated clayey sand formations.

Soils found in the Mwinilunga/Jimbe of the road corridor are generally shallow, slightly acid, structureless fine textured pale or pallid, poor in humus, frequently underlain by quartz rubble or laterite developed under conditions of peneplanation. Deeper pockets of younger soil are found in colluvial sites and on the flanks of river valleys.[7]

6.2.5. Hydrology and Water Resources

Surface water and groundwater in Zambia is regulated under the Water Resources Management Act in 2011 which is enforced by the Water Resources Management Authority (WARMA). WARMA is responsible for the issuance of permits for water abstractions for various activities such as construction works.

6.2.5.1. Surface Water

The river system of the road corridor is considered to be part of the Zambezi Watershed and its tributary system. Most of the rivers and streams crossed by the project road from Mwinilunga to Jimbe flows towards the east-north draining into the Lunga River while the Kalamui Stream and Kamafumbu Stream, discharge their waters into the Zambezi River.

The rivers and streams crossed by the project road are perennial, and all were flowing during the time of the field observation. The water quality is said to be good, as the water is mostly clear and fast flowing with no visible source of contamination.

The communities downstream of each of these stream and rivers crossed by the project road use the water for various agro-businesses such as farming and animal husbandry. Therefore, the quality and quantity of the water in these streams remains critical to the sustainability of their livelihood. However, the proposed project is perceived to have manageable impacts which will not significantly alter downstream water uses.

As a general observation, it is noted that rivers/streams crossed by the project road carry vegetative debris that will require local routine maintenance regime to ensure a clear waterway during heavy storms. Most of the silted pipe culverts are a result of vegetative debris and overgrown vegetation choking the inlets and outlets of the structures.

[6] Zambia Soil Survey, 1991
[7] Bingham, M.; 2005

6.2.5.2. Analysis of Surface Water Results

All the run-off from the project area will eventually be discharged into either the Lunga River or into the Zambezi River. As mentioned earlier, the communities downstream of each of these rivers use the water for various agro-businesses such as farming. Therefore, the quality and quantity of the water in these streams remains critical to the sustainability of their livelihood. Water Samples from However, the proposed project is perceived to have manageable impacts which will not alter downstream water uses.

The baseline values for the sampled water in the watercourses are shown in Table 6-1. These values have been compared to the World Health Organization (WHO) Drinking Standards. Water samples were collected from the Mwoji, Lwamakanyi, Mudyanyama and Zambezi Rivers at locations for the proposed construction of bridges. The samples were analysed by UNZA Laboratory, and showed that the pH in all the water bodies was within the permissible value for drinking water. Heavy metals such as Lead, Mercury and Cobalt do not pose a danger to the surrounding communities, as they were within permissible limits for drinking water.

The Mwoji and Lwamakanyi Rivers showed a high turbidity, thus having loss of transparency, as turbidity leads to oxygen depletion. Solids tend to absorb most of the light from the sun, hence, water appears cloudy.

Lwamakanyi River showed high levels of Manganese beyond the permissible value for drinking water. Manganese is a very common compound that can be found everywhere on earth. It is one out of three toxic essential trace elements, which means that it is not only necessary for humans to survive, but it is also toxic when high concentrations are present in the human body. Uptake of Manganese by humans is mainly through food, such as spinach and herbs. Manganese effects occur mainly in the respiratory tract and in the brain.

The presence of coliforms signals health related dangers to the surrounding communities, especially that some of the communities depend on these water bodies for domestic use. Faecal coliforms were shown to be present in the water, and they were beyond permissible values.

Table 6-1 shows surface water analysis results for the water bodies along the project road corridor.

Table 6-1: Surface water analysis results

Sample name	Mwoji River	Lwamakanyi River	Mudyanyama stream	Zambezi River	WHO guidelines
Parameter					Maximum permissible value for drinking water
pH	6.61	7.67	7.76	7.69	6.2-8.5
Total Dissolved Solids (mg/l)	163	257	141	162	1000
Conductivity (µS/cm)	329	514	284	324	1500
Total Suspended Solids (mg/l)	2.2	5.6	3.2	2.9	-
Turbidity (NTU)	4.08	18.70	7.06	5.70	1-5

Calcium Hardness (as mg $CaCO_3$/l)	76	100	76	82	-
Calcium (mg/l)	30.4	40.0	30.4	32.8	-
Chlorides (mg/l)	10.0	7.0	10.0	8.0	250
Sulphates (mg/l)	<0.01	<0.01	<0.01	<0.01	250
Total Phosphates (mg/l)	<0.01	<0.01	<0.01	<0.01	-
Lead (mg/l)	<0.01	<0.01	<0.01	<0.01	0.01
Nitrates (as mg NO_3 –N mg/l)	<0.01	<0.01	<0.01	<0.01	50
Ammonia (as mg NH_4-N mg/l)	<0.01	<0.01	<0.01	<0.01	-
Biochemical Oxygen Demand (as mg O_2 mg/l)	10.0	10.0	9	8	-
Chemical Oxygen Demand (as mg O_2 mg/l)	19	21	18	18	-
Copper (mg/l)	<0.003	<0.003	<0.003	<0.003	2
Cobalt (mg/l)	<0.005	<0.005	<0.005	<0.005	-
Potassium (mg/l)	2.02	1.52	2.22	1.53	-
Sodium (mg/l)	6.60	4.72	6.62	5.02	-
Manganese (mg/l)	<0.01	2.17	2.02	1.52	0.5
Mercury (mg/l)	<0.002	<0.002	<0.002	<0.002	0.006/0.001
Magnesium (mg/l)	29.76	36.98	21.60	13.92	-
Zinc (mg/l)	<0.001	<0.001	<0.001	<0.001	3
BACTERIOLOGICAL RESULTS					-
Total coliforms (#100ml)	40	55	48	54	0
Feacal coliforms (#100ml)	21	24	15	15	0

Source: Environmental Engineering Laboratory- UNZA

6.2.5.3. Ground water and Sanitation

The project area has an aquifer with the water table in most of the selected sites ranging between 8m and 20m - depending on the time of the year. In the months of August to October, most of the artesian wells dry up as the water table gets very low leaving only wells that are situated close to dambo[8] areas and rivers.

According to the World Bank[9], 89% of the population living in urban areas have access to safe drinking/improved water while the coverage in rural areas is at 51%. Customers in peri-urban

[8] Dambo is a word used for a class of complex shallow wetlands specifically in Zambia and Zimbabwe. They are generally found in higher rainfall flat plateau areas, and have river-like branching forms which may be nowhere very large, but common enough to add up to a large area. Dambos have been estimated to comprise 12.5% of the area of Zambia, and are particularly prevalent around Miombo Woodland (Chidumayo, E N, 1992; The utilisation and status of dambos in southern Africa: a Zambian case study)

[9] World Bank: Zambia Water Supply and Sanitation Sector Diagnostic report, 2020

areas complain most frequently about the fact that not enough water is available and that it can only be accessed at certain times when the tap attendant is present.

Along the project road corridor, water supplied from groundwater is mostly provided by bore-holes with hand-pumps or hand-dug wells that are usually equipped with a bucket and windlass or a hand pump. Common depths of boreholes are in the range of 30 to 100 meters. Hand-dug wells are shallow with depths ranging from a few meters to seldom above 15 meters.

Sanitation coverage in rural sections of the project road corridor stands at 38% whereas 54% of the population in urban areas of the project road corridor have access to sanitation facilities, which are considered "acceptable". The facilities considered acceptable are those with connec-tions to the sewer network and septic tanks. Owner of septic tanks often resort to using tanks and soakaways which are constructed to leak. This way groundwater contamination is highly likely to occur. This is further aggravated by lack of enforcement of building regulations by the Local Authorities.

Unsafe forms of water supply: unprotected shallow well and open groundwater surface used as dumpsite and for water supply.

6.2.5.4. Sources of Groundwater Contamination

Groundwater is the main source of drinking water for most of the population along the project road. Much of this ground water is contaminated to a limited and not unhealthy extent, as is evident by the ground water analysis. Contaminants include organic chemicals, nitrates, fluorides, salts and pesticides. The sources of contaminants include poorly designed pit latrines, leaking underground storage tanks, soaps and detergents, fertilizers and pesticide residue on vegetables.

The results of the collected water samples were compared to both the WHO Drinking Water Guidelines. The results show that sulphates were slightly above WHO limits for drinking water in both samples. The high levels of sulphates can be attributed to contamination caused by the use of soaps and detergents. However, this does not pose a danger to the local population. Levels of faecal coliforms were high in both samples, but slightly higher in sample 2, implying that the water needs to be treated before human consumption. Levels of all other parameters were within the WHO limits for drinking water.

Table 6-2: Ground water analysis results

Sample name	Sampling Point 1	Sampling Point 2	WHO guidelines
Parameter			Maximum permissible value for drinking water
pH	6.68	6.94	6.5-8.5
Total Dissolved Solids (mg/l)	185	312	1000
Conductivity (µS/cm)	369	622	1500
Total Suspended Solids (mg/l)	<1.0	<1.0	-
Turbidity (NTU)	1.06	0.14	1-5
Calcium Hardness (as mg $CaCO_3$/l)	116	108	500

Calcium (mg/l)	46.4	50.0	-
Chlorides (mg/l)	14.0	50.0	250
Sulphates (mg/l)	<0.01	<0.01	250
Total Phosphates (mg/l)	5.64	6.29	5.0
Acidity (as mg $CaCo_3$ /l)	Nil	Nil	500
Total hardness (as mg $CaCo_3$)	237	217	500
Lead (mg/l)	<0.01	<0.01	0.01
Nitrates (as mg NO_3 –N mg/l)	<0.01	10.14	50
Ammonia (as mg NH_4- N mg/l)	0.67	1.48	1.50
Biochemical Oxygen Demand (as mg O_2 mg/l)	24	49	-
Chemical Oxygen Demand (as mg O_2 mg/l)	62	78	-
Copper (mg/l)	<0.003	<0.003	2
Cobalt (mg/l)	<0.005	<0.005	-
Potassium (mg/l)	2.96	10.52	-
Sodium (mg/l)	9.14	36.98	200
Magnesium (mg/l)	29.04	26.16	-
Manganese (mg/l)	<0.01	<0.01	0.50
Zinc (mg/l)	<0.001	<0.001	3
BACTERIOLOGICAL RESULTS			-
Total coliforms (#100ml)	60	90	0
Faecal coliforms (#100ml)	56	82	0

6.2.6. Ambient Air Quality and Noise

Although the proposed road upgrade is not expected to release major pollutants, the determination of baseline air quality (i.e. especially dust) of the proposed project is still essential to just ensure that the proposed project operates within the set guidelines. This section provides the baseline for ambient air quality and noise levels in the project area.

6.2.6.1. Air quality

Air quality varies with the season, reflecting variations in temperature, humidity and rainfall. During the dry season any smoke and dust which arises, lingers in the near-ground air layers and causes frequent, but not significant, haze and reduced visibility. However, during the wet season, heavy rainfall quickly disperses smoke and dust, and maintains good air quality.

For the proposed road upgrade, particulate matter with PM10 (particles with a diameter of 10µm or less) was considered for baseline. These are particles that are able to reach the lower regions of the human respiratory tract and are therefore, responsible for most of the adverse health effects associated with suspended particulate pollution. Major concerns to human health are effects on breathing and the respiratory system, damage to lung tissue, cancer, premature death and loss of visibility.

The approach to air quality impacts was to evaluate the baseline in terms of ambient concentrations of pollutants that could be affected by the proposed road project and determine impacts in terms of compliance with ambient air quality standards. The method of sampling employed the use of a Microdust Pro (Casella 712k) in selected locations along the project area.

These settlement areas included Malanga and Nyakaseya. The sampling process included time intervals ranging from thirty minutes (00:30 min) to one hour (01:00 hour).

The results obtained for all communities show that the ambient concentration of dust over the sampling period is within the given limit, and the ambient noise levels are low as demonstrated in Figures from 6-6 to 6-9. The yellow lines in the figures indicate the dust levels while the green line indicates the acceptable dust levels. It can be seen from the graphs that most times the dust levels are within acceptable standards (i.e. below or very close to the green line). However, dust levels along the road corridor tend to be higher when there is movement of vehicles as demonstrated by the Figure 6-6 where the yellow line was observed to go above the green line.

The results therefore mean that although during the dry season the project road corridor is characterized by very dry and dusty conditions with large quantities of windblown dust visible in the atmosphere, the major source of dust along the road corridor is movements of vehicles and trucks, resulting from the re-suspension of dust from the dirt road surfaces.

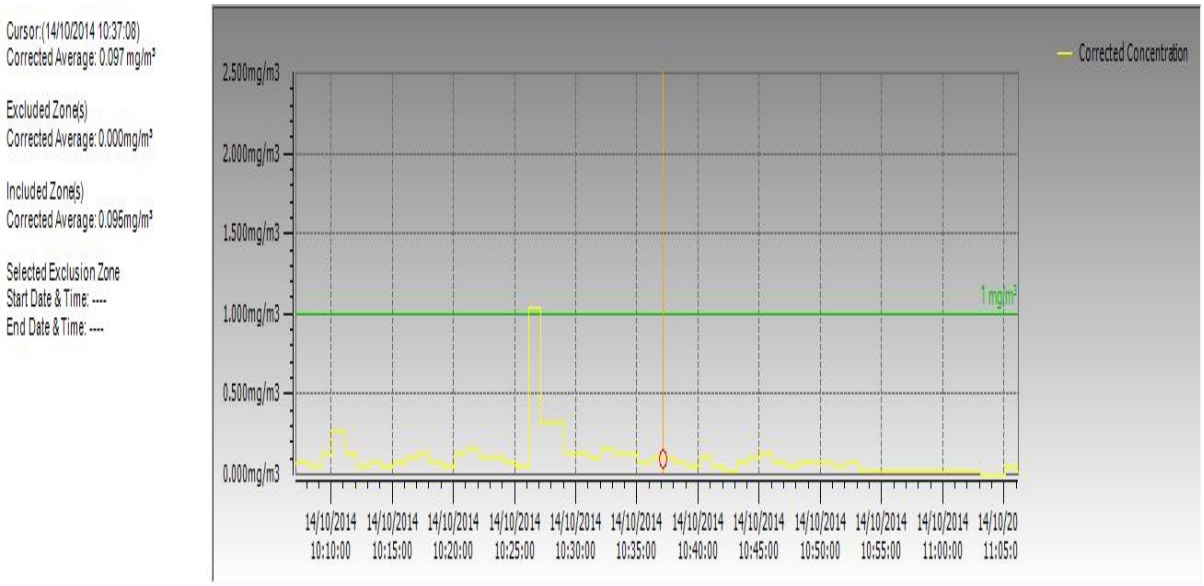


Figure 6-4: Concentration of particulate matter in Malanga communities.

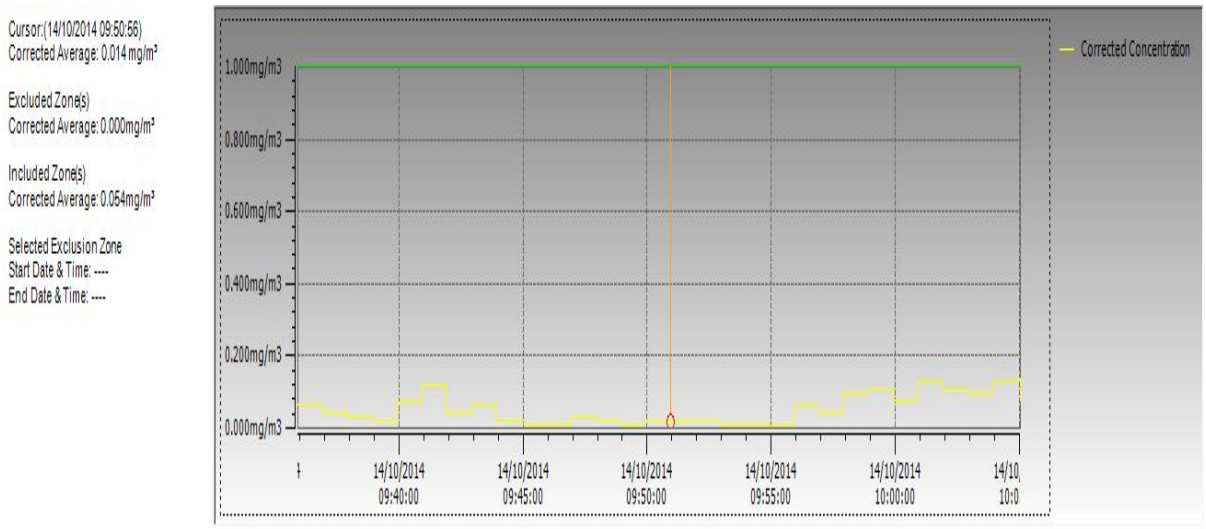


Figure 6-5: Concentration of particulate matter in Nyakaseya community.

6.2.6.2. Noise

The Zambian regulations do not currently provide for the noise guidelines. The international guidelines, specifically the World Health Organization Guideline Values have been used (see Table 6-3).

Table 6-3: WHO Noise Levels Guideline Values

	One Hour LAeq	
Receptor	**Daytime**	**Nighttime**
	07:00 hrs - 22:00hrs	22:00hrs - 07:00hrs
Residential; institutional; educational	55	45
Industrial; commercial	70	70

As was the case with monitoring air quality, the approach to noise monitoring was to also evaluate the baseline in terms of ambient noise levels. The method employed was the use of a sound level meter (Casella 63x) in selected locations along the project area. Noise was monitored approximately 50m from the road corridor.

The results indicate variations in noise levels depending on whether there is movement of tucks or not. During low vehicular movement along the road corridor, noise results indicated LAeq values below 37.6dB, less than the World Health Organization (WHO) residential guideline values (55).

During the movement of vehicles along the road corridor, the level levels tend to be higher than the WHO recommended levels. For example, the noise levels monitored during vehicular movement indicated LAeq values above 55 (i.e.69.8dB).

It can therefore be concluded that the movements of vehicles (i.e mainly heavy trucks) along the road corridor, is the major source of noise. Other noise sources along the road corridor include community activities, wind gusts and birds chirping.

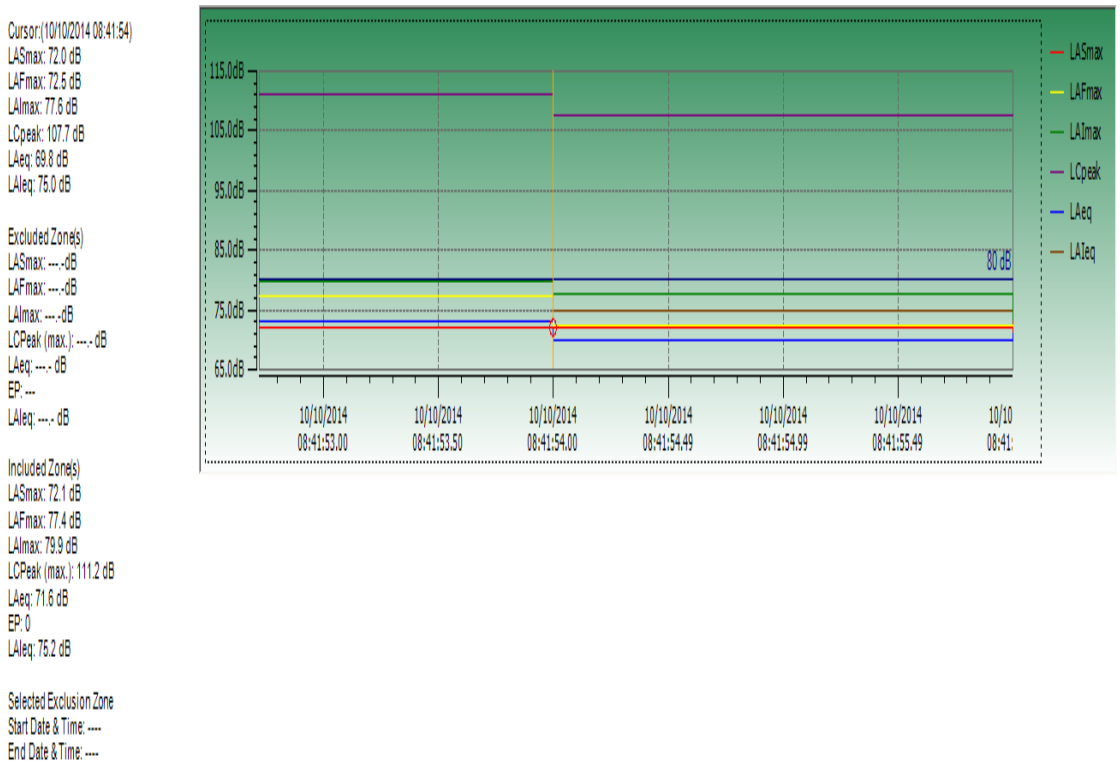


Figure 6-6: Ambient noise levels monitored around Nyakaseya area along road corridor during movement of vehicles.

6.2.7. Flora

The vegetation found along the road corridor falls in two major categories which are classified according to the District Situational Analysis Reports and enhanced by professional, visual assessment and methodologies contained in publications which are highlighted in the Bibiliography. These categories are primarily Miombo woodland and Chipya grasslands.

6.2.7.1. Miombo Woodlands

Overall however, the project road from Mwinilunga to Jimbe lies in the miombo woodland area which is dominated by broad-leaved trees of the *Brachystegia spiciformis* (musasa) and *Julbernardia globiflora* (mutondo) vegetation. The medium high trees that form this habitat are spaced such that their canopies do not interlock and sunlight can penetrate, encouraging

growth of a good grassy cover in most areas. In the miombo woodland, the major tree species include Muombo (*Brachystegia boehmii*), Muputu (*Brachystegia spiciformis*), Mpasa (*Julbernardia globiflora*), Mutondo (*Julbernardia paniculata*) Mutobo (*Isoberlinia angolensis*) Mupundu (*Parinari curatellifolia*) Museshi (*Marquesia macroura*), Mufungo (*Anisophyllea boehmii*), and thickets of herbaceous under-storey flora.

6.2.7.2. Chipya Woodland

Chipya woodland is also conspicuous in several stretches along the road. Here one finds fire induced grass savannahs with scattered fire tolerant trees such as *Pterocarpus angolensis* (Mulombwa). It is mainly derived from the Dry Evergreen or associated with Lake Basin areas. Evergreen groundwater relic forest (Mushitu) occurs in the perennially moist parts of the dambos which are found in depressions. These patches were observed along the road, particularly along the rivers/streams, evidence of the high rainfall zone characterising this part of the country. Tree species associated with Chipya woodland in the area are: *Albizia adianthifolia, Brachystegia glaberrina, B. spiciformis, B. utilis, Burkea africana, Erythrophleum africanum*, (the woodland types species), the *Combretums* (*C. celatroides, C. psidioides,* and *C. zeyheri*), *Diplorhynchus condylocarpon, Ochna pulchra, Oldfieldia dactylophylla, Pseudolachnostylis maprouneifolia, Syzygium guineense* subspecies *macrocarpum, Terminalia brachystemma* and *T. mollis* and the *Uapacas.*

6.2.7.3. Protected Forests

The proposed road project will be near the Luakera River National Forest No. 35 which is located at approximately 11°35′S, 24°25′E**,** about 20 km from T5 north of Mwinilunga town; and the Nkomba Protected Forest Area No. 75 located at approximately 11° 8′ 38″ S, 24° 6′ 16″ E, about 40 Km from T5 northeast of Mwinilunga Town and about 50 Km from T5 in Ikelenge District**.**

The source of the Zambezi River – also a protected forest area – is located at T005/km 39.6, approximately 4.3 km east of the T005 on the border with the Democratic Republic of Congo (DRC).

6.2.7.4. Forest Assessment

6.2.7.4.1. Methodology

The inventory and assessment of forest resources was carried out in areas approved for the road reserve (i.e. 100m for the Mwinilunga to Jimbe). The methods used in data collection was based on systematic sampling with predetermined sampling points at the interval of 3. km. Satellite images were used for easy accessibility of the area and this enhanced accurate data collection. Systematic sampling was used as opposed to random sampling.

6.2.7.4.2. Sampling design

The inventory was carried out in 84 main circular sample plots of 0.04 hectares each and within each main sample plot at the middle; a sub-plot (regeneration plot) measuring 5m by 5m was also fixed. Systematic sampling design was employed to achieve the inventory objectives and was adopted because of the following reasons:

- Yielding more accurate estimates for the same number of samples because sample areas are better distributed.
- Sampling bias is ordinarily negligible if when strips are run across the forest.

6.2.7.4.3. Field tools, Materials and Equipment

A number of forest inventory tools, materials and equipment were used during the data collection and the following were the tools used:

- The GPS (Global Positioning System) device for capturing geographical locations and positions,
- Suunto hypsometers for measuring tree and bole heights,
- Diameter tapes for measuring tree diameters,
- Linear tapes for measuring lengths and sizes of sample plots,
- Ranging rods for establishing visible boundaries of sampled areas and marking straight lines and ranging out.
- The forest field manual book, "Know Your Trees" was extensively consulted as a reference book in identifying most of the trees.
- Topographic maps as references for locating the required sites on the ground;
- Field forms and pencils which were designed for this purpose were used by enumerators to record field data collected during the forest way leave assessment.

6.2.7.4.4. Data Collection

The data for the forest field inventory was collected by the field crew who comprised two (2) technical officers and two (2) community members who were incorporated in the team.

Field Observations/reconnaissance-Forest reconnaissance was the initial stage that was undertaken in order to compare the protocols developed before the reconnaissance is undertaken and the field situation. This was undertaken in order to assess the forest that will be affected along the way leave and the effect of forest utilization on the ecosystem and community. These included observations on vegetation changes, fire prevalence, access rails, obstacles, land use and the likely impact of deforestation along the proposed Rail way leave.

Main Sample plot Data-From the main sample plot, the following parameters were collected and recorded:

- Coordinates
- Elevation above sea level
- Name of tree species
- Diameter at breast height (dbh) at 1.3m in cm for every tree greater than 5cm.
- Bole height
- Total Tree height
- Vegetation type and under growth
- Forest condition
- Occurrence of fires, disease observation and etc

Regeneration Plot Data-Regeneration plot (5m radius) was a sub plot of the main plot and data collected from these plots was only on all tree species measuring less than 5cm in diameter.

Sampling Intensity-The sampling intensity used was 0.036% with the main square sample plot being 0.04ha in size, bearing in mind that the probability level was 90% while 10% was to cover for sampling errors which was considered as low. Systematic sampling was done along the road reserve at 3km interval. One hundred and two (102) kilometers with a width of 100 meters for the T005 road was covered during the assessment.

Observation from satellite images indicate that, the proposed route was passing through an area which is predominantly semi evergreen Miombo with an average volume of slightly 40m^3 /hectare and fairly disturbed and also indicate some disturbed pastures which is an indication of some settlements and agriculture fields along the proposed road reserve.

6.2.7.4.5. Data Analysis

The data from the inventory of the forest was computed and analysed using Microsoft excel and forest calc software. The form factor used to compute the tree and bole volume was 0.74 for non-merchantable tree species and 0.68 for merchantable tree species respectively. The formulae to compute the calculations were as follows:

Gross tree stem volume calculation

Formula $V= Dbh^2/4 * \pi * H * \pi * F$

Where

- V = volume of tree in m^3
- DBH = diameter of tree at breast height in cm
- H = tree total height
- π = 3.1416
- F = 0.74

Commercial tree stem volume calculation

Formula $V= Dbh^2/4 * \pi * H * \pi * F$ Where

- V = volume of tree in m^3
- DBH = diameter of tree at breast height in cm
- H = tree total height
- π = 3.1416
- F = 0.68

Basal area calculation

$g = Dbh^2/4 * \pi$ Where

- π =3.1416
- g = cross sectional area or basal area of the trees/ha
- Dbh = diameter of tree at breast height in cm

The volume was calculated for each tree species by considering diameter at breast height (DBH), bole height and total height of a tree in a plot.

6.2.7.4.6. Findings of the Forest Inventory

The data collected from the forest inventory was entered and analyzed in order to determine the following characteristics of tree species per hectare:

- Species distribution,
- Diameter distribution,
- Height distribution,
- Basal area distribution,
- Volume distribution, and;
- Regeneration potential.

6.2.7.4.7. Status along the Road Corridor

Generally, the road corridor is predominantly characterized by Miombo woodlands with primary vegetation and 2 storey canopies that has dense with ground cover of short grasses. The road corridor is characterized by 16-22 m tree height with common tree species such as Anisophyllea bohemii, Brachystegia boehmii, Brachystegia floribunda, Brachystegia speciformis, Isoberlinia angolensis, pterocarpus angolensis, Diplorhynchus condilocarpon, Uapaca nitida and Faurea saligna.

The area was observed with pockets of some agricultural fields (abandoned and existing) with some traces of secondary vegetation and dambos. Also observed were beekeeping activities.

Some of the trees were observed with scars due to late burning that have been occurring in the area. These fires have been affecting flora thus affecting honey production.

6.2.7.4.8. Tree Species Distribution

The forest inventory that was carried out revealed great tree species diversity. From the 84 sample plots, 29 tree species were found within the road reserve of the road corridor in the proposed way leave. The results of some of the 13 common tree species per hectare along the sampled way leave area indicated the following number of stems per hectare. Brachystegia floribunda (38) and ficus species recorded the highest number of stems per hectare followed by brachystegia boemii (22). Anisophylea boemii (21), Brachystegia longifolia (18), Diplorhynchus condylocapon (17), uapaca nitida (14), Pterocarpus angolensis (14), Strychnos coculoides (13), parinari curaterifolia (11), Sysgium cordatum (9), Branchiostegal speciformis (9) combretum molle had 7 stems /hectare.

The area along the road reserve had a great potential for timber such as pericopsis angolensis and Faurea saligna. The presence of Maquesia and Brachystegia species was an indication of good flora for beekeeping activities.

Table 6-4: Stems Per HA of Trees Species along Road Reserve

APPENDIX V: SUMMARY OF BOLE VOLUME, TREE VOLUME AND BASAL AREA BY SPECIES PER HECTARE IN THE PROPOSED RAILLINE .								
			MEAN					HECTARE
NO.	**SPECIES**	**FREQ**	**DBH/cm**	**TREE HT(m)**	**Tree volume**	**stems/plot**	**Vol/plot**	**Stems/Ha**
1	Acacia spp	3	18	12	0.67756176	0.04918033	0.0111076	1.2295082
2	Albizia antuneziana	17	26	14	9.34598392	0.27868852	0.1532129	6.9672131
3	Anisophyllea boehmii	51	7.5	9	1.499811188	0.83606557	0.0245871	20.901639
4	Baphia bequaertti	1	12	8	0.06691968	0.01639344	0.001097	0.4098361
5	Brachystegia boehmii	56	29	14	38.30129296	0.91803279	0.62789	22.95082
6	Brachystegia floribunda	93	32	21	116.1725645	1.52459016	1.9044683	38.114754
7	Brachystegia longifolia	44	26	20	34.5565792	0.72131148	0.5665013	18.032787
8	Brachystegia spiciformis	23	19	12	5.78785524	0.37704918	0.0948829	9.4262295
9	Combretum molle	18	21	18	8.30013156	0.29508197	0.1360677	7.3770492
10	Diplorhynchus condylocarpon	43	28	22	43.08326176	0.70491803	0.706283	17.622951
11	Erythrina abissinica	5	16	15	1.115328	0.08196721	0.0182841	2.0491803
12	Erythrophleum africanum	15	9	12	0.8469522	0.24590164	0.0138845	6.147541
13	Fauria saligna	14	30	19	13.906746	0.2295082	0.2279794	5.7377049
14	Ficus spp	93	25	23	77.65906875	1.52459016	1.2730995	38.114754
15	Isoberlinia angolensis	15	28	16	10.9302144	0.24590164	0.1791838	6.147541
16	Julbernadia paniculata	16	18	13	3.91480128	0.26229508	0.0641771	6.557377
17	Marquesia macroura	12	42	18	22.13368416	0.19672131	0.3628473	4.9180328
18	Monotes africanus	17	7	9	0.43550073	0.27868852	0.0071394	6.9672131
19	Parinari curatellifolia	28	12	10	2.3421888	0.45901639	0.0383965	11.47541
20	Pericopsis angolensis	8	32	22	10.46921216	0.13114754	0.1716264	3.2786885
21	Pseudolachynostylis maprouneifolia	10	16	16	2.3793664	0.16393443	0.039006	4.0983607
22	Pterocarpus angolensis	34	16	17	8.59546112	0.55737705	0.1409092	13.934426
23	Strychnos cocculoides	34	16	15	7.5842304	0.55737705	0.1243316	13.934426
24	Swartzia madagascarienrsis	10	8	7	0.2602432	0.16393443	0.0042663	4.0983607
25	Syzygium cordatum	23	9	5.3	0.573574851	0.37704918	0.0094029	9.4262295
26	Syzygium guienese	14	8	8	0.41638912	0.2295082	0.0068261	5.7377049
27	Uapaca kirkiana	19	6	7	0.27813492	0.31147541	0.0045596	7.7868852
28	Uapaca nitida	35	6	5.6	0.40988304	0.57377049	0.0067194	14.344262
29	Uapaca sansiberica	14	8	5	0.2602432	0.2295082	0.0042663	5.7377049
	TOTAL	**765**			**422.3031845**	**12.5409836**	**35.191932**	**313.52459**

6.2.7.4.9. Tree Species Diameter Distribution

The mean tree diameters of most tree species that were sampled in this forest ranged from 6cm to 42cm. Table 6-5 below shows tree species diameters along road reserve for the road corridor.

Maquesia macroura had the highest mean diameter distribution of 42 cm, followed by brachystegia floribunda and pericopsis angolensis with 32 cm respectively and faurea saligna had a mean diameter of 30 cm. These are the species that had potential for timber exploitation whose diameter was 30 and slightly above 30 cm in diameter.

Table 6-5: Tree Species Diameter Distribution

			MEAN
NO.	**SPECIES**	**FREQ**	**DBH/cm**
1	Acacia spp	3	18
2	Albizia antuneziana	17	26
3	Anisophyllea boehmii	51	7.5
4	Baphia bequaertti	1	12
5	Brachystegia boehmii	56	29
6	Brachystegia floribunda	93	32
7	Brachystegia longifolia	44	26
8	Brachystegia spiciformis	23	19
9	Combretum molle	18	21
10	Diplorhynchus condylocarpon	43	28
11	Erythrina abissinica	5	16
12	Erythrophleum africanum	15	9
13	Fauria saligna	14	30
14	Ficus spp	93	25
15	Isoberlinia angolensis	15	28
16	Julbernadia paniculata	16	18
17	Marquesia macroura	12	42
18	Monotes africanus	17	7
19	Parinari curatellifolia	28	12
20	Pericopsis angolensis	8	32
21	Pseudolachynostylis maprouneifolia	10	16
22	Pterocarpus angolensis	34	16
23	Strychnos cocculoides	34	16
24	Swartzia madagascarienrsis	10	8
25	Syzygium cordatum	23	9
26	Syzygium guienese	14	8
27	Uapaca kirkiana	19	6
28	Uapaca nitida	35	6
29	Uapaca sansiberica	14	8

6.2.7.4.10. Tree Height Distribution

The heights of most tree species in the selected three forest areas are dominated by the common Miombo tree species and this ranged from 5 to 23 meters. A sample of trees with the mean highest heights that occupy the upper and the lower storey is as shown in table 4 below. The table indicates that ficus species had the highest height height of 23m followed by pericopsis angolensis with 22 meters, Brachystegia floribunda with 21 meters, brachystegia longifolia with 20m and the lowest mean height being Uapaca sansibarica.

Table 6-6: Mean bole and Tree heights of the tree species in the sampled three areas

NO.	SPECIES	FREQ	DBH/cm	BOLE HT(m)	TREE HT(m)
1	*Acacia spp*	3	18	6	12
2	*Albizia antuneziana*	17	26	7.5	14
3	*Anisophyllea boehmii*	51	7.5	6.9	9
4	*Baphia bequaertti*	1	12	2.5	8
5	*Brachystegia boehmii*	56	29	8	14
6	*Brachystegia floribunda*	93	32	8.2	21
7	*Brachystegia longifolia*	44	26	12	20
8	*Brachystegia spiciformis*	23	19	5.6	12
9	*Combretum molle*	18	21	8.9	18
10	*Diplorhynchus condylocarpon*	43	28	13	22
11	*Erythrina abissinica*	5	16	6.5	15
12	*Erythrophleum africanum*	15	9	4.6	12
13	*Fauria saligna*	14	30	13	19
14	*Ficus spp*	93	25	12	23
15	*Isoberlinia angolensis*	15	28	13.4	16
16	*Julbernadia paniculata*	16	18	9	13
17	*Marquesia macroura*	12	42	14	18
18	*Monotes africanus*	17	7	3.6	9
19	*Parinari curatellifolia*	28	12	5	10
20	*Pericopsis angolensis*	8	32	14	22
21	*Pseudolachynostylis maprouneifolia*	10	16	7	16
22	*Pterocarpus angolensis*	34	16	8.4	17
23	*Strychnos cocculoides*	34	16	8.4	15
24	*Swartzia madagascarienrsis*	10	8	1.4	7
25	*Syzygium cordatum*	23	9	2	5.3
26	*Syzygium guienese*	14	8	1.5	8
27	*Uapaca kirkiana*	19	6	1.2	7
28	*Uapaca nitida*	35	6	0.5	5.6
29	*Uapaca sansiberica*	14	8	0.8	5
	TOTAL	**765**			

6.2.7.4.11. Volume Distribution by Species per Hectare

The results of the inventory analysis for sampled areas show that Brachystegia floribunda had the highest volume of 116.1726 m3 for all the species along the way leave followed by ficus species with the volume of 77.65 M3 and the lowest being Baphia barquaetti with 0.0669 M^3.

6.2.7.4.12. Regeneration Potential

Generally, regeneration was good in secondary succession areas than those that were not disturbed by cutting down trees and fires regeneration rate was higher rate of regeneration than in those areas where the forests were relatively intact.

6.2.7.4.13. Current Practices of Vegetation along Road Corridor

 	Beekeeping is a major rural livelihood activity on which a good number of people in the area are dependent. The good part of it is that it promotes sound management practices in the area where it is practiced. The downside is the cutting of trees for bark hives. The practice affects mainly the definitive Miombo tree species such as Brachystegia. These are also the major honey trees from which nectar and pollen are collected.
	Thatch grass such as Loudetia is commonly harvested for use to thatch village houses or for sale to those building Chalets for tourist purposes. Harvesting of grass for thatching, fencing or other purposes has a positive impact on the environment since it reduces flammable material or biomass and increases regeneration potential.

	Making of ornate furniture and decorative baskets is also a major economic activity in the survey area. These articles are made from reeds, rattan and small wooden poles and almost every household possesses a number of these items. It is not uncommon to find a number of these items being sold in curio shops in urban areas. Management of source areas is not a formalized cultural practice despite the obvious economic benefits
	The picture is showing a typical pit or frame sawing practiced by a lot of indigenous Zambians living in timber rich resources areas of the country. Typical timber species available in the study area include: Afzelia quanzensis, Faurea saligna, Guibourtia coleosperma, Mitragyna stipulosa, Pericopsis angolensis and Pterocarpus angolensis. Over-exploitation of timber species is common across Zambia with little hope of future sustainability

The flora study has provided useful insight into the uniqueness in terms of high conservation value of the vegetation along the project road corridor and the need for sustainable management of forest resources to ensure that the major drainage systems in the area are not disrupted by anthropogenic activities. The area already has experienced a number of vegetation changes including a high dominance of Miombo woodland and a gradual change-over to Chipya due to high incidences of forest fire, and over dependence on agricultural practices which are largely temporal with very low input arrangements.

6.2.8. Terrestrial Fauna

Anthropogenic activities and degradation of habitats have led to lower numbers of animal species in the project area. Data concerning fauna in the project area was obtained from visual observation and interviews with the locals.

6.2.8.1. Mammals

In terms of animal life the project road corridor is poor with most of the big game decimated from the area. There are however reports of common duikers, and scrub hares and other smaller animals being present in the area. There is average bird life in the area with guinea fowls and pigeons and most woodland birds as the most common, though not much of birdlife was seen during the assessment.

The most common reason cited for the loss of the animal species along the road corridor is hunting using dogs, hand-made guns, dug-pits armed with sharp sticks (Amaswau), traps and wire snares. The latter two are non- selective.

None the less, interviews with some community members along road corridor reviewed that not all large mammals have gone into extinction in the project area. A number of large mammal species still exist in the area; although poaching continues to be the major threat to their survival and existence. The ESIA team could not however encounter any mammals during the assessment.

According to the local people, the following mammals are still in existence within the road project areas of influence, though their numbers may be low.

Table 6-7: Mammals still in existence within road project corridor

Item	Local Name	Common Name	Scientific Name	Local Status	IUCN Status
1	Musongo/Kote	African Civet	Civettictis civetta	Common	Least Concern
2	Nkaka	Ant Bear	Orycteropus afer	Rare	Least Concern
3	Mpombu	Baboon chacma	Papio ursinus jubileaer	Abundant	Least Concern
4	Changa	Bush baby	Galago crassiaudatus	Abundant	Least Concern
5	Insengele	Bush Squirrel	Paraxerus cepapi	Abundant	Least Concern
6	Cisongo	Bushbuck	Tragelaphus scriptus	Rare: locally threatened	Least Concern
7	Kapoli	Bushpig	Potamochoerus porcus	Rare	Least Concern
8	Nkai	Common Duiker	Sylvicapra grimmia	Rare	Least Concern

6.2.8.2. Reptiles and Amphibians

The topography of the project road corridor area provides for the formation of a wide variety of habitats. As has been said before, the area traversed by the project road has extensive network of river systems and aquatic environments which provide for the existence of reptiles and amphibians. Time of study was not sufficient to cover all the habitats; river systems, wetlands, evergreen forests, grasslands and woodlands as all these 'house' *snakes, lizards, Skinks, Geckos, Agamas, Chameleons, Tortoises* and *frogs* of different species; in varying numbers in different seasons and habitats. However, given the limited time, lizards, snakes and frogs were

seen. This is in conformity with the Biodiversity Foundation for Africa (BFA)[10] which classifies the area (Ikelenge pedicle) as an area of High Reptile/Amphibian Species Diversity having a rich herpetofauna (57 reptiles, 35 amphibians) due to the mosaic of different habitats. BFA further reports that the Congo Basin forest reptiles that reach their southern limit here include a lacertid lizard (*Adolfus africanus*), the Forest Night-adder (*Causus lichtensteinii*), Jackson's Bold-eyed Tree Snake (*Thrasops jacksonii*), the Splendid Dagger-tooth Tree Snake (*Rhamnophis aethiopissa*) and the Forest Vine Snake (*Thelotornis kirtlandii*).

6.2.8.3. Aquatic Ecosystem Classification

The ecological ecosystem of the project road comprises a network of perennial streams and rivers, and some seasonal dambo areas, which at the time of the visit were all flowing. The streams and rivers were mostly remote and healthy looking except for sites that were near sites of domestic, farming and fishing activities.

The fish species observed in some of the streams crossed by the project road during the survey are typical of the northen Kafue tributaries. The species encountered during this visit were; *Pseudocrenilabrus philander, Tilapia sparmani, Clarias ngamensis, Clarias gariepinus, Barbus trimaculatus, Barbus annecterns, Barbus multilineatus, Barbus afrovernayi, Hippopotamyrus ansorgi, Microctenopoma intermedium, Aplocheilichthys species, Petrocephalus catostoma and Kneria species.*

According to the Fisheries Department in Solwezi, majority of the fish species in northern Zambian tributaries of the Upper Kafue River are currently classed as "Least Concern" in the on-line IUCN Red Data List (2009). These tributaries, however, contain many fish species that do not occur elsewhere in the system and several are very poorly known and are thus classed as "Data Deficient". Several of these are shared with Congo tributaries that share (or recently shared) watersheds with the Kafue tributaries, e.g. the Kneria species that are shared between northern Kafue region and the southern Congo basin.

Figure shows species captured at Mushindamo village from Mushindamo River.

Figure 0-7: Typical Kneria Species common in the Northern Kafue River and its Tributaries

6.2.8.4. Identification of Rare or Endangered Species

It is worth noting that on a wider scale human threats to mammalian life continue to increase with continued growth of human population which seeks more land for food production, more

[10] BFA report, 2018

space for settlement and even greater development to improve quality of life. The threat on the area is on the modification of the ecosystem by removal of certain habitats which are perceived to be of lower value compared to the envisaged developments. These threats are eminent for all-natural resources- inclusive of the above listed mammal species. Snaring of small animals like bush babies and rodents is common in the area. Most of the mammal species listed in this discussion are still under the threat of poaching by local people, principally for game meat.

Ikelenge District is also home to endangered Butterfly Species namely, *Euptera freyja, Anthene sp., Lepidochrysops sp., Spindasis pinheyi.*

The BFA[11] confirms the study findings suggesting that large mammals have been extirpated with the exception of some private lands, such that biodiversity, including small mammals, is threatened by destruction of gallery forests exists along the Mwinilunga – Ikelenge pedicle. This situation has been attributed to local bushmeat consumption threatens all mammals.

6.2.8.4 Endemic Species

Even though the field assessments could not locate species endemic to the project area, extant literature reveals that endemic species do exist along the Ikelenge pedicle. The global importance of the Ikelenge pedicle is underwritten by the occurrence of endemics, whilst the biodiversity of the forest-savanna mosaic is of regional significance[12]. Some indicator species of the biodiversity that are either endemic (E) or marginally (M) occur in the project area are as outlined under Appendix 3.

6.2.9. Cultural and heritage Sites

The study for cultural and heritage sites for this report considered both cultural and natural heritage. Cultural Heritage falls into five types as follows:

- Anthropological;
- Historical Heritage;
- Historical engineering and Structural site;
- Archeological heritage and
- Rock ward-old traditional paintings

Natural Heritage includes:

- Water falls;
- Hot springs; and
- Fossils.

6.2.9.1. Anthropological Heritage

The project area is endowed with a contemporary culture which is a blend of values, norms, material and spiritual traditions of two major tribes, namely the Lunda and Luchazi. These tribes

[11] BFA report, 2018
[12] Cotterill, 2002

moved into these areas in a series of migratory waves a few centuries ago. They grew in numbers and established chiefdoms.

Historically, these two tribes are one and the same people and all migrated at the same time from Kola Kingdom as one group. These tribes have a lot in common such as marital systems (i.e. adopt matrilineal lines) and the culture of respecting the dead is also common among the two tribes, which is why graveyards are important cultural heritage sites in the road project corridor. The use of different in languages is perhaps the most common difference between the two tribes along the road corridor.

The Lunda tribe who occupies much of the road corridor also celebrates a traditional ceremony called "Chisemwa Cha Lunda".

Ikelenge District also houses the Kalene Hills which is a historical site. Kalene Hill is a sandstone ridge rising about 1,460 m (4,800 ft) above sea level, located approximately 3 km southeast of the Kalene Hill community. The proposed road project traverses west of this hill around the community named after the hill.

6.2.9.2. Natural Heritage

In terms of natural heritage, the road corridor is home to Zambezi rapids on the Zambezi River, the Zambezi Source and its hinterland in Mukangala Ward and the Kahoshaná rock in Nyakaseya ward. The Zambezi River source which is a recognized national monument is situated approximately 15 Km from the proposed road project (T005) in Ikelenge District.

The Mwinilunga Cultural Museum serves as a vital repository of the region's rich cultural heritage. Established to showcase the diverse traditions and customs of the local communities, the museum promotes understanding and appreciation of Zambian cultural identities. Mwinilunga has four (04) waterfalls namely Kakumbi, Nchanga, Chikuni and Kashikishi falls. There is also the Kafinda Hot spring.

6.3. SOCIO-ECONOMIC BASELINE

6.3.1. Administrative Set Up

The project road is located in North-western Province. It traverses through two districts namely Mwinilunga and Ikelenge. In terms of traditional administration, the Mwinilunga to Jimbe passes through two chiefdoms for Chief Kanongesha and Chief Nyakaseya. The functions of these Traditional Chiefs have been legalised.

6.3.2. Land ownership along the proposed road project

The concept of 'land use planning' is still new and only practiced to a limited extent in townships (as is the case within the Ikelenge Township) where specific areas are assigned for industries, commercial building and dwelling. However, most of the structures including some structures within areas where local authorities have planning jurisdiction have no titles.

Outside the local authorities' jurisdiction, land along the road corridor is held in customary ownership and is administered by the Traditional Leaders. No title deeds are issued for land

under customary tenure system because this type of land is basically under communal ownership and as such property rights and security is dependent on the traditional leader's goodwill. The advantage of this system compared to leasehold is that everyone belonging to a particular chiefdom has shared ownership rights and cannot be declared landless. User rights on a given piece of land are thus passed on through inheritance or as a gift from the chief or his representatives (headmen or clan leaders).

There are several ways in which community members along the project road corridor gain access to land. It is basically based on the important traditional principle that all residents of the village are entitled to land for their personal or household use. This means that as far as virgin land is concerned any member of the related community can select a field for growing crops within the village territory. The headman, rather than anyone else, deals with strangers on land issues. The individual owns the land for as long as he or she cultivates it or has built a house or other functional structure. However, traditionally it is held that no one man can own land and that land belongs to the villagers as a group. Individual land ownership of land is thus subject to corporate interests of the village community. Transfer to another person through gifts inheritance, sale or abandonment terminates an individual's land rights.

The chief and village headmen merely represent the village communities and exercise jurisdiction over land in case of conflict or disputes. Despite this conception of land tenure, the Government of Zambia enacted the Lands Act No. 29 of 1995 to recognise the title of individuals holding land under customary tenure. The law also provides for the conversion of tenure of such holding from traditional to leasehold tenure. Consequently, this has set in motion a dynamic of change of tenure with some individuals, especially cash crop farmers, starting the process of converting their customary use and occupation rights into state leasehold tenure. Thus, a mixed form of land holding consisting of statutory leasehold and customary tenure has emerged and is operating at some of the sites surveyed.

6.3.3. Settlement Patterns, Culture and Tradition

6.3.3.1. Settlement Patterns

The settlement pattern along the project road corridor is greatly influenced by livelihood systems and population growth dynamics. Overall however, the settlement pattern is linear along the road corridor. Other pull factors that have influence on settlement patterns along the road corridor include location of social institutions and streams.

The names of the key settlements along the Mwinilunga Ikelenge road section are Nswana, Muchanga, Kazhima, Nsanganyi, Lukama, Kashinakazhi, Mwanauti, Kalusa, Lwakela, Kayepa, Kakunga, Pulumani, Chitambala, Kapwaya, Mundongo, Mundungu, Kalezu, Sakuwaha, Mukangala, Samuheba, Chamakimba, Mashata, Kankawami, Kasayanga, Sapilinya, Kelondu, Sokasoka, Nswana Kabunda and Mungwayanga.

The names of the key settlements along the Ikelenge Jimbe road section are Lundungu, Safwalanga, Ngandwe, Chapwi, Sahando, Nyakaseya, Chapepi, Kalichi, Kemba, Yanga Yanga, Mwakama, Sandumba, Kawangu, Kambilima, Muliyemba, Kalombi, Ichiya, Mbuya, Mwatalunda, Kalwaji, Jimbe, Chisasa, Kachiza and Waseheli.

Some of the houses in the above-mentioned settlements/villages are within the 100 meters road reserve of the Mwinilunga Jimbe road and have therefore been captured in the Resettlement Action Plan report for relocation. According to the census of population and housing of 2022 the population density of Mwinilunga is 7.3 persons per square kilometre with an average annual population growth rate of 2.3 percent while the population density of Ikelenge is 20.2 persons per square kilometre with an average annual population growth rate of 2.6 percent. Overall, the population density of North Western Province is 10.2 persons per square kilometre. The census report of 2022 indicates that North Western Province has an average household size of 5.2 which is the highest in Zambia.

6.3.3.2. Culture and Tradition

The culture of the two major tribes namely Lunda and Luchazi along the road corridor varies and is highly influenced and governed by complex lineage systems including matrilineal and patrilineal systems, each having their own customary law. In a matrilineal community and this especially common among the Lunda people only persons related to the deceased through the deceased's mother or more remote female ancestor are eligible to share in the estate. However, inter-marriage is much more common than in the past and is having a profound impact on kinship (lineage) structures and inheritance practices.

Generally, under the customary land tenure system, community members receive one plot for houses, one or more plots for crops, and another for livestock. Grazing land is shared, while homestead and crop lands are used exclusively by individual households. Crop lands often revert to communal grazing lands between harvests. Customary land is predominantly occupied by subsistence and small-scale emergent commercial farmers. Traditionally, the right to use the land was provided to both men and women. The user-rights, like inheritance, followed the line of descent. Crop land remains with the family and usufruct right is passed on for generations. Usufruct rights rest with the extended family, which is also determined by lineage.

In both matrilineal and patrilineal societies, adult males have usufructuary rights in land through their membership of a village community. In a matrilineal society, women have held equal rights in land as men in their natal villages. Virilocally, married women (where the wife settles in the husband's village) would not forfeit these rights and could exercise them upon divorce, widowhood or if distance allowed while resident at their husband's village. But they have not held independent rights at their husband's villages, rather access has been through the husband. In marriages where the husband settles in the wife's village, women would exercise their usufructuary rights, through which their husbands would have access to land.

The traditional governance structures of the Lunda and Luchazi will be helpful in community mobilisation as the Headmen in each specific village are key entry points for community mobilisation, information dissemination and resolution of conflicts. The traditional leadership will be handy in providing information regarding property ownership for compensation purposes. They will also be major players in the allocation of alternative land for people that will require land after having been relocated from the road reserve areas. The Headmen will also act as a useful link to the Royal Highness of Kanongesha of the Luchazi people and Nyakaseya of the Lunda people.

6.3.3.3. Religious Practices and Beliefs

From a general survey of the area, it is estimated that over 90% of local people embrace the Christian faith. A number of churches have been established, sometimes located less than 1km apart along the main project road. It is quite evident that religion is an important aspect of peoples' lives and therefore, the Church is a very important institution in these communities. Christian religions and traditional philosophies co-exist, and witchcraft is a common belief.

A survey of churches in the project area revealed twelve denominations: United Methodist, Evangelical Church of Zambia; Roman Catholic Church; Open Church; Covenant Church; Christian Community Church; Christian Brethren (CMML); New Apostolic Church; New Covenant Church; Baptist; Seventh Day Adventist Church; Jehovah's Witnesses; and Pentecostal Assemblies of God.

6.3.3.4. Gender Based Roles and Responsibilities

The World Bank[13] highlight that gender imbalances permeate several aspects of society and women continue to have fewer opportunities to participate in key decision-making positions, to have low levels of representation in formal employment, and experience high levels of teen pregnancy, child marriage, and intimate partner violence (IPV). This scenario is not different from the issue of gender inequality along the project road corridor where historically rooted in traditional values and has been exacerbated by limited education, training and skill development; employment opportunities for women and men and; disparities in income. Thus, the traditional role of a woman is still perceived as being a mother and taking care of household duties. [14]

According to the National educational statistics[15], north-western province has the highest female primary education level (grades 1-7) dropout rate of 3 percent and second highest rate in terms of girl child pregnancies in primary level education national wide. This was confirmed during consultations where it was highlighted that most women along the road corridor discontinue their formal education at primary level, and traditional division of labour, prevent them from gaining participation in the formal sector (i.e. although there is little source of formal employment other than the occasional construction activities of schools and other social institutions)[16].

Another finding from interviews with Chiefs Representatives (i.e. counsellors) is that culturally, male heads of households make decisions over family assets such as land and highly valued household items – that is the higher the value of an asset the more likely it is to be owned by the male head who solely makes decision over them. It is therefore important to know that, women in male headed households have lesser decision-making power than in the female-headed households.

[13] World Bank: Zambia gender assessment report (2023)
[14] Personal Interviews with Mrs Muzyamba-Chibwika Rural Health Center
[15] Ministry of Education: National educational statistics bulletin, 2023
[16] Personal Interviews with Head teachers from Nyakaseya and Malanga Primary Schools

During focus group discussion, it was discovered that, the major activity for women remains caring for the family and performing household activities while; most men do businesses and are the main providers (food, school fees) for their families. It was also discovered that, men own higher valued assets in the family and make all the major decisions over them. Many youths remain dependants on parents, running family errands but they have no decision – power over family assets.

Activity Profile	Access and Control of Resources	Overall Decision-Making Power
Women • Trade in the Local Market • Household care work and chores (cleaning house, preparing food and caring for the children) • Providing food, clothing, school fees etc. to the family • Participating in community meetings	**Women** • Lack Financial Capital • Access local markets to trade and buy household needs • Do not own means of transport i.e. bicycle • General walk on foot carrying out tasks or use public means i.e. • Limited access to information	**Women** • Married women generally do not have decision-making power. • Women make decisions over matters of the household – food, utensils etc. • Single women, widows make decisions with adult children
Men • **Self-employment** • Trading – Carrying out businesses • Unemployed • Participating in community meetings – • Providing food, house, clothing, school fees etc. to the family	**Men** • Access to Financial Capital through asset – based collaterals • Own Businesses (i.e. Tembas) • Access both local and urban markets • Own means of transport with high mobility using – bicycles. • Access information – radio • Higher literacy levels	**Men** • Make overall decision on family assets. on incomes or capital investment
Youth • Trading • Self Employed • Sent by parents for errands • Unemployed	**Youth** • Generally, are unemployed do not own assets	**Youth** • Generally, dependants on parents • No say over family assets

6.3.4. Gender and the Proposed Road Upgrade

Transport planning models in the past; have not considered women specific travel patterns particularly differences in relation to trip purposes, frequencies and distance of travel, mode of transportation used, mobility constraints to access other services such as health. Transport is a part of a larger structure of activities and studies have revealed that there are significant differences in travel patterns of men and women particularly those married with children.

6.3.4.1. Use of Current Road System

During focus group discussions at Malanga village, participants were asked to identify the most common use of the current road even if it is in a deplorable state. The top most listed uses are: - community members use the current road to access businesses (mainly tembas and a few shops) situated along the road; transportation of goods and services and access to district towns. The others include access to medical health care services and; easy access to schools by the children. The findings from these discussions show that there is need to sensitize the community on the importance of the proposed road project, which will go a long way in improving their transport arrangements.

From these findings, it was observed that women's travel patterns typically derive from the tasks that, they must handle for their households and communities and this varies according to where they live. Women reported that they have to fulfil their roles as workers; they must take care of children and handle household responsibilities and are often responsible for maintaining community and social networks. Due to the bad state of the project road, women generally find it prohibitive to use even the cheapest available means of transport such as bicycles. In addition, and related to the bad state of the road, women tend to spend a higher share of their income transport (i.e. hire of motorbikes) on average than men. Mobility patterns of women along the project road thus relate to domestic, economic and social tasks.

6.3.4.2. Mobility Constraints

The baseline data from qualitative findings have shown that the most common mobility constraints facing the community along the project road corridor include: The road is in a bad state with big potholes, very narrow and it gets worse, and low level of incomes and livelihood and high poverty levels. The other mentioned constraints include: Accidents of heavy tracks, available transport is mainly motorbiking which are dangerous and expensive and the bad state of the road has led to low profits and low returns from the businesses.

Many of the informants especially the women reported that the road in its current state is bad and travel is difficult. It is also worse when children have to be taken to hospitals and dangerous for the sick and elderly. Most of the time, the motor transport fairs are exorbitant and many people cannot afford and therefore, are forced to walk. The men reported that the poor state of the road has led to low profits and returns from their businesses since, only customers living along the road may buy from them and not others from surrounding centres.

From the findings, it is clear and essential that the gender differences in transport systems are linked to the different roles women and men play in society that need to be understood and recognized in order to adequately plan and design the spatial and temporal characteristics of transport modes that both women and men depend on for their travel to undertake social, domestic and economic activities. Overall this study has shown that including women in stakeholder consultations in the planning of the proposed improved road provides practical

insights that can improve transport access for all, and safety for other vulnerable users such as children and the elderly.

6.3.4.3. Expected Impact of the Road Improvement

FGDs with the respondents show that members of the communities throughout the road corridor have greater positive expectations with regards to the upgrading of the road in terms of better livelihoods, businesses and employment opportunities.

The negative impacts were perceived to include displacement and demolition of structures, loss of income, business, livelihoods, employment, and increase in immorality leading to increase in sex commercial workers, the number of HIV infections and alcoholism. The other listed impacts include environmental hazards such as pollution and insufficient compensation, resettlement and loss of livelihood.

Although this data captures the perceived negative impacts, it is noted that the positive impacts outweigh the negative and therefore the need to support the upgrading of the Mwinilunga to Jimbe Road.

6.3.4.4. User Friendly Roads for Women and Vulnerable Groups

In addressing the constraints, the road should be gender responsive to the different needs and priorities. The respondents suggested that the design should ensure proper walking paths and cycle tracks especially in large settlement areas; Putting bumps and zebra crossing; Provision of bus stops and designated places for vendors and providing shelters at proposed bus stops; and adequate compensation for those who might lose their properties.

6.3.4.5. Involvement of Women, Men & Youth in the Road Construction

Table 6-8 shows various ways of involvement of women, men and youths that will benefit them in the process of upgrading the troad. The data shows that there are several ways of involvement of women, men and youths and therefore there is need to sensitise them before construction begins.

Table 6-8: Involvement in Road Construction by Sex

Category	Suggested type of Involvement
Women	Cooking and selling of foods and beverages to the workers
	Selling of household goods including vegetables and cereals
	Supervising the labourers
	Planting of grass by the side of the roads
Men	Supply of materials for construction
	Operate the machinery
	Carrying construction materials to the site
	Driving
	Sensitising the community about the importance of the roads
	Cut down trees and shrubs for construction

Youth	Employment as manual labourers
	Being involved in awareness creation to peers on HIV&AIDS, alcohol/drug abuse
	Attachment to a job training for experience
	Selling of household goods to the workers
	Clerical officers/record keeping/store keeping

6.3.4.6. Challenges - Getting Involved in the Construction of Roads

In the discussions, men, women and the youths gave the reasons why in the past, they have not been involved and highlighted obstacles faced in the construction of roads. The most common obstacles discussed were; the contractors bring in labour from outside the community and lack of transparency in employment. The women in particular ascertained that prior commitments in the home greatly hinder them from working in the road construction even though they need the money. Other factors include pregnancy and other health issues, which make their spouses, or relatives stop them from taking the jobs; and also fear and possibility of sexual harassment and insecurity hinder them from getting engaged.

Discrimination is also common in the construction site and many women fear that they may not get employment due to inadequate skills and sex discrimination as the jobs are seen as 'manly'. Women reported that most of the time they lack information; male dominance in the construction sites; low remunerations; negative attitudes towards construction work as being manual; cultural limitation; husbands refusing their wives from working and; taking care of children/house responsibilities. Table 6-7 shows the major challenges for women are: - Lack of opportunities and stiff competition, lack of qualifications/skills and discrimination against women; harsh working conditions and the issue of bringing labourers from other places.

The youth stated that they are mainly discouraged from working in the construction of the road because of poor working standards such as long hours, little pay, lack of safety measures and negative attitude of the contractors. The major challenges experienced by the youth are: - Lack of qualifications/skills, limited opportunities for employment and discrimination against youth especially the female youth; alcohol/drug abuse and sexual harassment. The other listed challenges are: - corruption and importing labourers from other places. This data shows that the youth will benefit from the construction of the proposed road upgrade and therefore there is need to create awareness to the youth about the project and to encourage them to apply when advertised.

The men on the other hand stated that they are mostly disheartened by lack of awareness about the opportunities in the road construction and how they can be engaged; They also reported lack of opportunities and stiff competition, Lack of qualifications/skills and Harsh working conditions, Low pay/wages, Negative attitudes of the contractors; ill health and age factor.

According to the local administration the negative factors that can hinder the community members from participating in the construction of the road are: negative political involvement in the area; lack of consultations and/or agreements between the local administration and the contractors; lack of adequate and effective communication between the community members and the local administration; and corruption and nepotism which will hinder the local administration from getting involved or playing the aforementioned roles in the construction of the road.

Table 6-9: Challenges in getting involved in the road Improvement

Category	Challenges
Women	Harsh working conditions
	Lack of opportunities and stiff competition
	Discrimination against women
	Negative politics such as ethnicity
	Bringing labourers from other places
	Lack of qualifications/skills
Men	Harsh working conditions
	Low pay/wages
	Lack of opportunities and stiff competition
	Negative attitudes of the contractors
	Lack of qualifications/skills
Youth	Lack of opportunities and capital
	Discrimination against youth especially the female
	Lack of qualifications/skills such as low levels of education
	Bringing in labour from other places

6.3.5. Population Dynamics

6.3.5.1. Demographics Project's AOI in relation to the current state of the Road

In this EIS report, the Project Area of Influence (AOI) is being defined as 200 meters which is 100 meters from the centerline on either side of the carriageway. Areas within 200m radius are therefore been adopted in this report as catchments areas likely to have full project influence while those outside 200m but within 500m radius are treated as catchments areas with partial influence of the project.

Within this project AOI, a household questionnaire was administered to 190 households sampled along the road corridor. In the following section, a summary of the major demographic indicators is described.

According to the 2022 census Zambia has an estimated population of 20,720,000 persons and has been growing at an average annual growth rate of 2.8 percent. North-western Province, where the project is located has an estimated population of 1,278,000. Mwinilunga and Ikelenge Districts, in which districts the project road is located, have estimated population of 136,770 and 44,777 respectively[17].

6.3.5.2. Population by Age

Age is an important demographic variable and is one of the primary bases of demographic classification. In as far as the upgrading of the road is concerned; age will be a very important variable during the construction phase of the project because employment opportunities during construction phase will be affected by age.

[17] ZamStats: Census of Population and Housing of Zambia; 2022

The household data results for the project road indicate that the road corridor has a greater number of younger people than older people. Analysis of the characteristics of household members indicate that majority of people (74%) along the road corridor are below the age of 35 years. This finding is consistent with the 2022 census of population and housing which indicated that Zambia's youth population is at 26.1 percentage. Overall, the household survey results for the proposed project indicate that proportions decline as age increases, which create a population pyramid.

During the construction phase, the contractor needs to be aware of this young age along the road corridor in order to avoid engaging young people below the recommended age (i.e. limiting employment to above 15). One way in which the contractor would avoid child labor, is by ensuring that all those recruited have National Registration Cards.

6.3.5.3. Population by Gender and Roles

Another important demographic variable which has relevance to the upgrading of the road is Gender. Gender refers to socially-constructed characteristics and entitlements of men and women. They are thus ascribed by the society based on perceived capabilities and roles of women and men.

During the baseline surveys for this EIS, a questionnaire was administered to determine the roles of women and men in relation to road infrastructure such as the upgrading of the project road. The results of the household survey reveal that women and men along the project road have different travel needs and patterns, though the mode of transport largely is the same.

Along the road project, out of the 86 women who were interviewed along the road corridor, 73% tend to engage more in non-work, off-peak travel, visiting a more diverse set of locations, using more complex trip patterns or engage in trip chain. This means that when they travel, they tend to have multiple purposes and multiple destinations within one trip, such as shops, market, schools, and health centers. Hence, unlike men, women tend to value flexibility over time savings in their travel choices.

On the other hand, out of 104 men who responded to the household questionnaire, the majority (69 percent) reported that their travels are centered on economic aspects (i.e. going to sources of income) and therefore they tend to value speed, reliability, and road safety in that order of importance.

The household survey results have further shown that women along the road corridor are more affected by the current state of the road than men in as far as use of bicycles as a means of transport is concerned, with more men (71 percent) using a bicycle twice a week compared to 34 percent of women. When this question is probed further, the results show that one of the reasons for this outcome is that the current road is more geared to motor vehicles and lack provision of cycle lanes or safe areas for cycling.

The foregoing results of the household survey therefore means that the upgrading of the road would need to be done in a gender- responsive manner, through the availability of areas for walking and intermediate modes of transport in addition to areas for motorized vehicles. This will enable women to perform their multiple roles and, therefore, satisfy their practical gender needs.

Women are the principal providers of subsistence labour, whose duties include cultivating the fields, cooking, milking, fetching water and firewood, gathering wild vegetables and fruits, and also caring for the children at home. Children, both boys and girls, help in cultivating, herding and miscellaneous tasks such as gathering sticks and timber for building the house.

6.3.6. Economic Profiles of households along Project Road

6.3.6.1. Average per capita income

According to the 2022 Living conditions monitoring survey monthly average income for households in rural areas was K2,112.2 while that of households in urban areas was K5,546.6. The report further states that in rural areas, households spent 56.4 percent of their incomes on food and 43.6 percent on non-food expenditure items, while in urban areas expenditure on food amounted to 34.7 percent of household incomes and non-food expenditure amounted to 65.3 percent. Further survey results show that 60 percent of the population in Zambia was living below the national poverty line (78.8 percent in rural areas and 31.9 percent in urban areas) with 48.0 percent of the population being extremely poor. Overall results show that 588 out of every 1000 male-headed households compared to 634 out of every 1000 female-headed households were poor at national level. This implies that out of every 100 households, female-headed households were more likely to be poorer than households headed by their male counterparts.

6.3.6.2. Income and Expenditure

Income is defined as receipts from economic activities including interest income, and non-economic activities such as gifts and donations. It includes cash and in-kind receipts as well as unpaid income of household members involved in a family business or activity including farming.

Although there are no trend data on the composition of household income along the road corridor, the baseline survey requested the actual household income per month. People generally tend to underreport their incomes, and it is likely that the reported figures for the baseline survey is even further underreported, given that many of these households produce some food for household consumption.

The main sources of income are: (a) own livelihood or economic activity; (b) income from employment paid in cash; (c) unpaid income; (d) other cash income; and (e) income from employment paid in kind. Respondents were asked to identify their main and second source of income.

It appears that own livelihood or economic activities play an important role in day-to-day living of households along the road corridor with more than 80% dependent on it. This pattern could change when the roads are completed, although it is with optimism that such change is in favor of a higher proportion for the combined own livelihood and employment income sources.

Within the agriculture, forestry and trading sectors, the sources of income ranked according to importance are agriculture, trading and forestry subsectors. Within the services sector, trading ranks first as a sub-sector source, followed by others including the banking, transport and storage sub-sectors.

Perception data from the households suggest however that regardless of the source of income, there is a trend of declining household income in the communities along the road corridor. Perceptions are strongly influenced by rising expectations and cannot accurately quantify patterns; nevertheless, it is significant that only 11% of the respondents thought their household income had remained fairly stable, while over 85% of households thought it had decreased.

Households cope with changes in income in a variety of ways. The basic mechanism is to change household expenditure patterns. These "expenditure strategies", the primary responsibility of women in their reproductive role, relate to changing consumption patterns of food and non-food items. Based on perception data from the household survey results, households along the road corridor adopt a broad threefold tactic for which women are primarily responsible. This tactic involves cutbacks in overall consumption levels, changes in dietary habits and types of food consumed, and reduction in the purchase on nonessential goods.

6.3.7. Livelihoods Activities and Strategies

Making ends meet for the households along the road corridor is a daily struggle and this is not just a case for the road project but it is a common feature among Zambian Rural Households. The baseline information obtained along the road corridor indicates that households typically pursue diverse livelihood portfolios, not because they have plenty of economic opportunities, but as a response to a range of constraints and risks.

Among the foremost factors identified by the project affected people include the often marginal agro-ecological conditions for most forms of agriculture, low levels of asset endowment, and a generally unfavorable external environment, a declining forest resource base, lack of access to credit, difficulties in accessing vibrant markets for most products, and the deplorable state of most infrastructure and services.

The interaction of all these factors over time has resulted in unacceptably high incidences of poverty among households along the road corridor. The Zambia Statistics Agency[18] revealed that poverty levels in Zambia had risen from 54.4 percent in 2015 to 60 percent in 2022. Even more concerning was that extreme poverty was measured to have increased to 48 per cent in 2022 from 40 per cent in 2015, and urban poverty has risen from 23.4 per cent in 2015 to 31.9 per cent in 2022 while rural poverty has risen from 76.6 percent in 2015 to 78.8 percent in 2022. The report further reveals that Extreme poverty in North Western province has also risen from 48.4 percent in 2015 to 50.6 percent in 2022. Not only are the populations falling under the poverty bracket deprived materially, they are also severely disempowered by low levels of education, poor health, and a lack of adequate information and space to participate in making decisions that affect their lives.

The communities cope or adapt to the poverty issue through a number of ways such as;

- **Income Diversification**: In addition to farming which is the main source of income for the majority of the people along the road corridor they do take up some job opportunities and the selling of merchandize in shops and makeshift stands as a means of raising additional income.

[18] ZSA: 2022 Poverty Assessment in Zambia

- **Social Cash Transfer**: Some people especially the vulnerable individuals have been enrolled under the Government social cash transfer program through which they receive a stipend to support their well-being. Social Cash Transfers are regular, non-contributory payments of money provided to incapacitated individuals and households. The beneficiaries receive K150 and are paid bimonthly. Persons with disabilities receive double (K300) transfers that other vulnerable persons receive. The scheme is now being implemented in all the 116 Districts across the country.
- **Crop Diversification**: People have now embarked upon the growing of various crops to boost their incomes and minimise their losses in case of crop failures.
- **Savings Groups**: The Savings Groups model also known as Village Banking is a strategy by various stakeholders to enhance financial inclusion in Zambia. It encourages individuals, often women, to form self-selecting groups of about 15-30 members within their communities. According the PMRC report of May 2020, Savings Group Model has helped balance gender-power dynamics by according women the opportunity to access credit and financing in order to be able to contribute to the household's income and influence how finances should be prioritised.

6.3.7.1. Agriculture

Much of the road corridor's population is dependent on slash-and-burn, rain-fed agriculture for its subsistence. Maize still dominates the crop production along the road corridor, although it is declining because of diversification away from maize due to the resurgence in the production of traditional crops. The factors observed throughout the country, and which are responsible for the decline in maize, also hold for the observed decline in maize production along the road corridor. These are (i) Reduced subsidies have made small scale farmers intensify crops that rely less on modern farm inputs-fertiliser and seeds. (ii) These crops have become increasingly marketable both domestically and through cross border trade.

The overall farming practice trends are that it is unsustainable and inefficient, and with little or no inputs, large areas of land are required as soil fertility is rapidly depleted. Disintegration of transport infrastructure and resulting geographical isolation has led to the collapse of the rural economy as farmers are unable to easily sell their produce, purchase inputs or receive support from agricultural extension services.

As women are responsible for close to 70 percent of agricultural production[19], there is a high-level of gender imbalance associated with these risks. The main issues identified along the project road are: food insecurity; unsustainable subsistence agriculture; deforestation, soil erosion and land degradation; and an under-utilized potential for agroforestry and conservation agriculture**.**

While agriculture still remains as a major source of income, traditional farming alone increasingly fails to secure sufficient income. Growth rate in the agricultural sector along the road corridor as a whole was only 0.4% in 2010/11 farming season and production of food crops increased by only 0.3%[11] . Structural limitations of agriculture in terms of income generation come from a number of facts including (1) deteriorating soil quality, (2) climate change, (3) lack of mechanisation, (4) lack of modern farming technologies and (5) unfavourable farm-gate price. This data represents a historical trend as recent district statistics are not readily available.

[19] MOA: Annual Report 2020, Mwinilunga Office

First of all, deteriorating and exhausted soil make it difficult to enhance productivity. Liberalization of agriculture has increased prices of agricultural inputs such as fertilizers beyond poor farmers' ability to afford. Farming techniques for better soil management have not been widespread along the road corridor with lack of extension services and training opportunities. Crop yields are generally low as little improved seed and virtually no fertilizers are used, resulting in less competitiveness in the international market.

Moreover, climate change makes it harder to predict weather variations and thus to plant crops accordingly. Patterns of rainy and dry seasons become unpredictable and crop failures are increasing. Moreover, extension and advisory service and early warning system have not yet reached many settlements along the road corridor.

Lastly, low farm-gate price that farmers get for their crops adds to inability of farming to secure sufficient livelihoods. Farmers only receive approximately 15 – 25 % of the final retail price, which is the most important urban market for majority of the people along the road corridor. The "lack of economies of scale at producer and retailer levels, marketing and transaction cost inefficiencies in transport, processing, and post-harvest handling" cause such problem. Most of all, lack of bargaining power of farmers because of poor organization and knowledge on price enables middlemen to exploit a greater margin.

Such challenges in agriculture make it difficult for farmers to generate cash income to support living standards, and thus many farmers are still locked into subsistence farming. Selling crops in a market is not profitable for many farmers because of low price that they get and less economy of scale due to small farm size and poor soil quality.

Thus, there are generally little cash circulating along the project road. Difficulties arising from lack of money income are compounded by an increasing need for cash such as expenditure on education and health. With the promotion of Universal Primary Education (UPE) by the Zambia government since 2006, education became more accessible to rural population. However, while school fees are free at public primary schools, education involves a lot of extra costs such as school uniforms, stationery and transportation. When participants to the FGDs were asked about an item of the biggest expenditure, the second most frequent answer was education after food.

Thus, pressures of income generation and limitations of agriculture to sufficient income generation are driving many households along the road corridor into livelihood diversification beyond traditional farming.

6.3.7.2. Non-Farm Diversification

Observations made along the road corridor and interviews with key informants point to the fact that non-farm activities have been increased along the road corridor. There have been new local trading centres which offer opportunities to open shops such as hair salons, kiosks, bars and bicycle repair shops. Moreover, with increasing demand for transportation, and vehicle taxis are on the increase. While such non-farm activities are still small in terms of number and scope, it reflects "a degree of dynamism and income growth along the road corridor that was not present in the past. These non-farm activities are likely to be enhanced with the coming of the upgrading of the project road.

As discussed above, diversification is increasing along the road corridor as an alternative or complementary livelihood stategy. However, close observation of its pattern raises some

concerns over an unequal access to diversification opportunities. The patterns of diversification reveals that livelihoods diversification often benefits the better off more than the poor, thus enhancing inequality. It is because more remunerative diversification requires initial capital and skills which are often not available to the poor.[20]

6.3.8. Social Aspects of the Project Road

The importance of road transport for the provisions of social services cannot be overemphasized and the delivery of social services cannot be alienated from the existence of road infrastructure.

6.3.8.1. Health Indictors along Project Road

The health indicators along the road corridor, (which were collected by the household survey, and triangulated with key informants' interviews results from health centers along the road corridor), have been estimated in various other household surveys in Zambia, whether at national, provincial, or district levels. Therefore, the estimates made in this baseline report are similar to those other household surveys in Zambia, except for allowance for the passage of time.

One source of national data for which several health indicators are found is the 2007 Demographic and Health Survey (DHS). On the whole, data from the road project area on health issues are comparable to national data.

Health services along the road corridor are delivered at the following three levels:

- Community level - Primary health care such as identification of health problems, health education, first aid treatment, deliveries and sensitization are provided at this level;
- Rural Health Care level - Activities carried out at this level include diagnosing and treating patients, health education, referring complicated cases to hospitals, providing maternal and child health services and providing environmental health services;
- Hospital level -Apart from the activities that take place in the other two levels, the district hospitals provide extra services such as laboratory services, X-ray services, Voluntary Counselling and Testing (VCT), surgical and obstetric services and mortuary services.

Most of the health facilities along the road corridor however fall short of the required standard as set by the Ministry of Health for a health facility. MOH's definition of a health facility refers to community health centers, clinics, rural health centers or any structure where people can access conventional health services. Furthermore, health facilities should have the necessary amenities such as water, electricity or solar, adequate infrastructure, communication facilities, transport and refrigerators for storage of drugs. Availability of amenities such as electricity or solar is important because it enables health facilities to provide services on 24 hours basis. Health facilities also need transport and communication facilities for them to be able to refer patients they cannot treat to the next level of care.

Transport in particular is a source of concern for all the health facilities along the road corridor as none of the health facilities has a vehicle and they all have to depend on transport from District Hospitals for referrals. This has had its own implications given the state of the road.

[20] (i.e. purchasing a bodaboda motorbike in Tundama cost almost ZMW3,500, which majority of the people along the road corridor cannot afford).

The proposed road upgrade will significantly help to improve the delivery of health services provided by the health centers within the road corridor especially for referral cases.

Another issue of concern, which has a bearing on the poor state of the proposed road, is to do with medical supplies and human resource. Medical supplies refer to drugs, vaccines and equipment used by personnel in health facilities. Human resource refers to people trained to provide health care services such as doctors, clinical officers, nurses, midwives, pharmacists and other staff trained to provide health services. To have effective delivery of primary health care, health facilities should be adequately staffed with trained health personnel who are motivated to provide health services to people in the community. Having adequate health personnel should be accompanied by availability of medical supplies because without these, health personnel cannot effectively provide health services. Health facilities also need financial resources for them to manage their day to day activities.

The baseline findings on medical supplies and human resources in the health facilities within the project area of influence show serious gaps to meet the required standards set by MOH. For example, with an exception of Kalene Hills Hospital which is a mission hospital, the other centers had no clinical officers and at best only a nurse was in charge and assisted by an Environmental Health Technician (EHT). Although the country as a whole has shortages of qualified medical personnel, the poor state of the road is largely seen as a major contributor to the state of affairs in the health centers since most qualified medical personnel tend to shun the area.

In terms of disease burden, the 5 top diseases responsible for morbidity and mortality in the project area include malaria, diarrhoea, respiratory infections (non-pneumonia), anaemia, and maternal complications. Further, due to inadequate public transport and ambulances in the district, women with maternal complications die on the way to referral district hospitals as there are delays in picking up patients from the remote RHCs.

6.3.8.2. HIV/AIDS

Recent data indicates that the incidence of HIV/AIDS is on the decline in Zambia. Currently about 13% of the adult population aged 15 to 49 are living with HIV. Generally, the incidence is about twice as high in urban areas than in rural areas. Prevalence is higher among women compared to men. People in the project area seem to have a good idea that the disease is transmitted sexually because the once popular practice of wife inheritance seems to be in decline.

Along the project road, HIV/AIDS/GBV and other health problems have become major development problems. They threaten economic development, social stability and security. They also neutralized the development gains that were achieved at great cost in the past.

All the two districts along the project road corridor (Mwinilunga and Ikelenge) are in the network and transit towns and prone to HIV/AIDS/GBV. The HIV/AIDS/GBV has great impact on many families which live in poverty and due to the fact that it has affected mainly the productive age group of 15 – 49 years. The loss in manpower due to HIV/AIDS/GBV can retard economic growth leading to deepening poverty levels.

According to the Provincial HIV/AIDS Task Force in Solwezi, the HIV epidemic along the project road corridor is driven by the following major factors:

- Multiple concurrent sexual partnerships,

- low condom use,
- mobility and labour migration fuelled by creation of new job opportunities,
- vulnerable and marginalized groups,
- vertical transmission from mother to child and
- Alcohol and drug abuse.

The mobile workforce includes Brief Case Traders, fishermen, charcoal burners, seasonal caterpillar harvesting, and migratory labourers on Road constructions, seasonal mushroom harvesters, traders and others. Stigma remains a barrier to individuals learning of their HIV infection early and accessing preventive services. Unreported cases of GBV also escalate the vice.

6.3.8.2.1. Factors promoting the spread of HIV/ AIDS

A large number of different factors are contributing directly or indirectly to the spread of HIV along the project road corridor and these include the following:[22]

- **Unemployment:** Most community members are subsistence farmers who grow maize, groundnuts, cassava, finger millet and beans for home use. Some practice seasonal fishing in swamps. There is poor food security among most community households. There is also increased number of OVC not going to school in the community.
- **Illiteracy:** A significant number of community members do not know how to read and write. Therefore, the community demands the media to use local language when they are making public awareness on critical issues that are of community concern.
- **Increased Poverty levels:** Most people have very low income as a result they fail to make good full meals in a day. Their children are not supported to school and have poor clothes. As a result of the above, some members of the community engage in illicit activities that lead to HIV infection such as sex work, alcoholism leading to unprotected sex etc.
- **Some cultural beliefs.** These include sexual cleansing and spouse inheritance. The most vulnerable groups are the widows and men who are involved in this practice as well as the orphans who are left without support after both parents pass away due to AIDS. Polygamous marriage practices among other extra marital unprotected sex contribute to the spread of HIV.
- **Sexual violence, rape, and child defilement** are some of the vices contributing to the spread of HIV as reported to the Police Victim Support Unit (VSU).
- **Gender inequality** and lack of deliberate policy to empower women economically. Women are mostly looked down upon and are not actively involved in decision-making; this increases their vulnerability to HIV infection due to unprotected sex as they have limited choice.
- **High levels of unemployment amongst communities.** Unemployment leads to low income, which in turn causes poverty especially among the youths. Poverty predisposes people to unprotected sex due to desperation. Sex is also used for recreation due to inadequate institutions/organizations providing employment or alternative recreation which would help people rechannelling their energies, especially the youths, to healthy recreational activities.

[22] Zambia Demographic Health Survey 2024

- **Negative attitude towards reproductive health issues and sexuality.** Apathy by most people towards issues of HIV/AIDS/STIs. There is also low condom use by most of the communities and parents are silent or unable to break /change the sex taboos.
- **Disrespect for human rights.** Human rights are not adequately promoted especially against such cases as child defilement and rape compounded by non-domestication of international laws related to gender-based violence.
- **High incidence of unprotected sex** amongst youth populations arising from the acquired cultures, norms, fashions, erosion of good family values, exposure to pornographic pictures, internet and the mushrooming nightclubs.
- **Alcoholism is also a major contributing factor of HIV.** Both the youths and adults/old under the influence of alcohol become vulnerable to HIV infection as they become reckless and involve themselves in unprotected sex.

6.3.8.2.2. HIV/AIDS awareness and prevention

At household level, data was gathered on the level of awareness on HIV/AIDs and human trafficking to assist RDA/Contractor in designing an awareness program for implementation during the construction period.

a) HIV/AIDS awareness in general

At least one member of over 90 percent of households has heard about HIV/AIDs; 71.1 percent had 'heard a little' and 20.7 percent had 'heard a lot'.

b) Knowledge about how HIV/AIDs is acquired

Although the majority of the respondents have heard about HIV/AIDS, the level of knowledge about how it is acquired is relatively low with 69.7 percent 'knowing a little', 27.0 percent 'knowing much' and 3.3 percent 'knowing nothing'.

c) Knowledge about the dangers of HIV/AIDS and how to avoid it

Among the information that people need to know about HIV/AIDS, the dangers of acquiring the disease appears to be known to most of the households. These are significant findings that could be of used in designing the HIV/AIDS awareness and prevention program.

d) How information on HIV/AIDS is acquired

Among households along the project road, RHCs and community health workers rank first (86.9%) as means of receiving information about HIV/AIDS. Radio (65.5%) ranks second and meetings conducted by national and local officials (63.6%) ranks third.

e) Organizations providing information on HIV/AIDS

Respondents identified the health centers, working with the National Aids Council, as major information providers (83.4%) and the others included World Vision and Corridors of Hope are unnamed organizations including foreign and local civic organizations.

6.3.8.2.3. Key vulnerabilities relevant to the project

The following are the key vulnerabilities that will be relevant to the Mwinilunga Jimbe road construction project.

- **Maternal Health Access**.

Zambia is committed to accelerating achievement of the United Nations Millennium Development Goals related to maternal and neonatal health outcomes. This commitment is expressed through increased human resource for health, infrastructure development, decentralisation, increased health financing and a multi-disciplinary approach in building consensus around interventions to improve maternal and and newborn outcomes. According to the Speech by the Zambian Minister of Health of July 2024 Maternal deaths occur during the following phases: 32 percent during pregnancy, 36 percent at delivery or in the first week and 33 percent from one week to one year. In terms of health facilities, the road corridor has hospitals in Mwinilunga, Ikelenge, Kalene Mission and Kanongesha and various clinics that are dotted along the corridor that provide maternal health access. The construction related influx especially of people seeking job opportunities along the Mwinilunga Jimbe road project is likely to have an impact on maternal health access.

- **Youth HIV risk**

In sub-Saharan Africa, young women are twice as likely to have HIV than young men. Young people who have relationships with older people are more likely to get HIV because of the greater likelihood that the older person has HIV. The young people are mostly at risk to acquiring HIV because of among others the lack of sexuality education among the young people, alcohol consumption, multiple sexual partners, early sexual onset and the low or inconsistent usage of condoms. The construction related influx especially of people seeking job opportunities along the Mwinilunga Jimbe road project is likely to exacerbate the HIV risk among the young people.

- **GBV hotspots**

In 2025, the Zambia Police Service released new statistics indicating a sharp increase in Gender-Based Violence (GBV) during the first quarter of 2025. A total of 11,177 cases were recorded across the country between January and March, representing a 15.2% rise compared to 9,700 cases reported during the same period in 2024. According to the Police Statement women and children are the most affected demographics and that in many cases, the perpetrators were intimate partners or close family members, reflecting the domestic nature of most GBV incidents. The gender Based Violence hotspots along the road corridor include workplace areas, family, churches and trading centres. The construction related influx especially of people seeking job opportunities along the Mwinilunga Jimbe road project is likely to exacerbate the problem of gender-based violence.

6.3.9. Demolition of Structures, Land Take and Compensation

During preparation of this EIS report, consideration was given to project components/ activities that would give rise to resettlement. These activities include the demarcation of road reserve being defined as 100m for the T005 road from Mwinilunga to Jimbe road. Other activities relate to the actual construction of the project road. The construction activities will be carried out with 36m (i.e. 18m on both side of the existing centerline), which will be enough space to accommodate all road furniture and creation of road detours.

The above consideration is in line with the Public Roads Act of 2002, which categories "trunk roads" to require a road reserve of 100m.

Most of the impacts related to demolition of structures will occur in the road reserve and few impacts are within the construction width.

The existing borrow pits will be used as sources for gravel material, but if some new sites will be identified as sources of construction materials, there is a need to be accessed through construction of temporary access roads. In case there is interference into private property, the requirements of the Public Roads Act of 2002 in relation to involuntary settlement will be applied.

Due to the proposed road reserve (i.e. 100m), a number of private properties will be affected. Impacted properties are defined in this report, as any property that is owned by the government, a community, private or encroachers/squatters, such as piece of land, infrastructure facilities, access, front walls of houses or business place, trees and any other natural or manmade features that would alter, rearrange of demolish to get required width for both the proposed road rehabilitation and road reserve.

CHAPTER SEVEN

7.0 POTENTIAL ENVIRONMENTAL AND SOCIAL RISKS AND IMPACTS

7.1 INTRODUCTION

Impact prediction and analysis utilized a project lifecycle approach: identifying and analysing impacts from *construction*, through *operation* (post-construction) phases. Impact analysis aimed at developing recommendations that maximize benefits and avoid/reduce/minimize adverse environmental and social impacts.

This section predicts and analyses possible positive and negative impacts of upgrading the existing gravel road ("the project"). Since the road has existed for many years, most socio-environmental impacts associated with this upgrading project will be direct in nature and mostly result from construction activities. Impact analysis also involved determination of magnitude, extent, duration of potential impacts and confirms that positive impacts outweigh potential negative impacts.

7.2 MAIN ENVIRONMENTAL AND SOCIAL RISKS

The major environmental and social risks anticipated as a result of the project include.

a. *Safety risks:* The road works will be undertaken while the road remains open to traffic which possess a number of safety risks to the road users and the workers. It is important that, works should be scheduled bearing in mind the need to ensure that the road remains open and safe to traffic.

b. *Disruption of roadside trade activities* which can arise through relocation of roadside makeshift kiosks at the growth centers such as at Kalene and at Lwakela Trading centres along the road corridor. This will impact on mainly women who are operators of such business enterprises, and this is to be mitigated through advance notification for project affected persons to relocate and there will be adequate, fair, and prompt compensation for such PAPs as provided in the RAP.

c. *Loss of water points* especially boreholes/wells that are located in the road reserve areas, some of which are public boreholes while others are owned by individuals. However, individual owners of such water points will be notified and compensated so that they can relocate their boreholes/wells while public boreholes will be relocated in consultations with the community leadership and local authorities.

d. *Increase in dust and air emissions* from earthworks and operating plant and equipment. This will be managed through routine sprinkling of water on cut and open surfaces during earthworks.

e. *Erosion and soil loss, loss of land and changes in land use, due to surface runoff* and general loss of vegetation. This will be mitigated. through the restriction of vegetation clearance to areas where civil works will be undertaken and will include greening the road by planting trees in some road sections. The project will work close with the Forestry Department to get guidance on the species selection for tree planting.

f. *Increase in Gender based violence and sexual exploitation and abuse (GBV/SEA).* In this regard, Grievance Mechanism Committee (GMC) members will be trained to refer these cases to relevant authorities such as police and probation officers, among others which can handle them using a survivor-centred approach). Further a Service Provider will be engaged to sensitize the workers and the surrounding community members and to also follow up on reported cases for their resolution.

g. *Increase in STDs/STIs including HIV/AIDS*. A potential influx in the population to the area for various jobs may result in risky behaviours among the people with increased risk of STDs/STIs including HIV/AIDS on both the workers and the communities. This is to be mitigated through engaging an HIV/AIDS service provider to supply condoms, sensitize the communities and the workers on both HIV/AIDS and associated illnesses such Tuberculosis (TB), use of Code of Conduct to regulate the behaviour and interaction of workers with the host community. This can further be mitigated by giving priority to the recruitment of workers from the neighbouring communities as opposed to importing labour from distant areas thereby increasing risks of HIV/AIDS infections in the workers and communities in the project areas; and requiring migrant (outside the project area) workers to stay in a Workers' Camp to minimise their direct interactions with the host communities.

h. *Loss of vegetation cover:* Asphalt plant operation impacts -re-surfacing of 102km road will require considerable quantities of bitumen. Its preparation, storage and application could have socio-environmental impacts. If firewood is used in heating bitumen, considerable cords of wood would be necessary representing a significant loss of vegetation for the entire road length. For the foregoing reasons and the fact that alternative heating fuel other than wood is highly recommended to be adopted in the project and this impact is of *moderate nature*.

i. *Occupational health and safety risks for workers:* Road works will have the occupational health and safety risks with potential to cause serious injuries to workers; burns (handling hot bitumen, welding/hot works, etc.); electrocution; noise and body vibration from equipment; injury from flying rock e.g. at quarry sites or debris when demolishing affected buildings and accidents from construction vehicles. Significance of this impact is deemed as major, and the workers will be trained in safety awareness, provision of safety infrastructure and procedures. While there are helpful and effective measures available to prevent risks, the project will firstly aim to either eliminate the risk by redesigning or make use of engineering controls, as long as it does not create further unnecessary risks to employee health and safety, before resorting to administrative controls once all possibilities are exhausted. In so doing the project will endeavour to install safety signage and work safety guidelines in all work places. Toolbox talks on health and safety will be delivered to all employees as well as a code of conduct specific to machine operators and drivers will be issued to emphasize employee well-being, injury prevention, and compliance with workplace safety regulations. The workers shall be provided with Personal Protection Equipment-PPEs in accordance with the National labour laws and the project Occupational Health and Safety Management Plan.

j. *Loss of properties from the Road Reserve areas:* it is estimated that about 1,497 Project Affected People will be affected in terms loss of residential structures, commercial buildings and residential structures.

k. *Dust emissions* -Road construction will necessitate transportation of materials from sources to worksites. Haulage of gravel and crushed stone (aggregate) from sources to road construction work sites will be associated with the following impacts: staining of households and goods in roadside shops by dust, excessive dust in dwellings which poses a short-term health impact. This should be mitigated through routine sprinkling of water on access routes and erecting speed control devices to check speed limits.

l. *Deterioration of access road conditions:* The transportation of construction materials by large trucks can lead to deterioration of access road conditions. Therefore, access roads will need to be regularly repaired, improved, and maintained in good condition

m. *Pollution of soil or water:* During the construction period, there will be a need to stockpile and store assorted materials at or near the construction site to ensure easy and uninterrupted access to supplies. This will lead to pollution of land and watercourses by spilling and wash away of materials. The storage shall be designed appropriately to prevent pollution of the soil or water. Because of space restrictions, bulky materials like sand and large stones will only be carried to the site as necessary. In order to prevent piling up a lot of materials on the site, the bulky materials, such sand, gravel, and stones, should be ordered by contractors from crusher and asphalt plants.

n. *Increase in road accidents*-It is likely that, once the road is rehabilitated, drivers on a newly improved road will be tempted to over-speed what is popularly referred to as "*new road effect*" which usually happens in the first months of commissioning a new road and is associated with frequent road accidents. It is noted that, the Road Transport and Safety Agency will step up vigilance on the rehabilitated road to ensure the road users observe the set speed limits in various sections of the road.

o. *Climate change risks* – The project implementation is unlikely to lead to any climate change risks as vegetation clearance will be restricted to areas where civil works will be implemented and furthermore the road project will be undertaken in an area that is already developed. The recommended complementary activities of tree planting are expected to minimize any possible climate change risks.

7.3 IMPACTS DURING CONSTRUCTION PHASE

The table below provides an overview of the expected impacts that will arise as a result of implementing the Mwinilunga Jimbe road project. These impacts have been derived from the information that has been presented under project description, project life cycle and baseline information.

Positive Impacts	1.	Employment creation
	2.	Drainage
	3.	Income generation
Negative Impacts	1.	Land and Soil
	2.	Vegetation
	3.	Sedimentation
	4.	Protected areas
	5.	Surface water
	6.	Groundwater
	7.	Air Quality
	8.	Noise
	9.	Solid and Hazardous Waste
	10.	Properties in the Road Reserve Areas
	11.	Archaeology and Cultural Heritage
	12.	Road Traffic and Safety
	13.	Occupational Health & Safety
	14.	Community Health and Safety
	15.	Vulnerable Groups
	16.	Employment (Child labour and discrimination)
	17.	Local Economy

7.3.1 Biophysical

7.3.1.1 Positive Impacts

7.3.1.1.1 Drainage

The road is an existing road, hence the impact of the existing road as a barrier to natural drainage can be observed especially on low lying areas and there are some spots along the project road where water sometimes flood. Most of the top soil along the road been eroded or crushed to fine powder, thus giving rise to drainage problems, as some sections of the road tend to be water logged in the rainy season. It is intended that the present effects of the road will be studied, as part of the overall design process, to improve drainage in general.

Impact Severity: Duration of this impact will be long-term (life span of the road) and likelihood of occurring is high. Therefore impact severity is high.

Impact significance: Major

+ (Positive)		Impact Likelihood			
		None	**Low**	**Medium**	**High**
Impact severity	**Negligible**	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Negligible-Minor	Minor
	Medium	Negligible	Minor	Minor-Moderate	Moderate
	High	Minor	Moderate	Major	**Major**

Enhancement Measures: In the road designs, provision has been made for bridges. In addition, box culverts and relief culverts have been provided for in the final design in order to improve drainage along the project road corridor.

7.3.1.2 Negative Impacts

7.3.1.2.1 Loss of Vegetation

Although much of the road is modified and the species' composition in the area is poor in terms of diversity due to the disturbance of natural habitats by anthropogenic activities, the project road will be near two protected forests with good standing miombo woodlands (i.e. Luakera River National Forest No. 35 from km 2.6 to km 17.1 and Nkomba Protected Forest Area No. 75: from km 78.6 to km 84.6 (0.5 km to 10.0 km LHS), which may be affected by the proposed road upgrade (i.e. creation of road detours). In addition, while much of the upgrading of the road will follow the existing alignment, there will be a need for road widening in some areas to meet road design specifications. Road widening will entail clearing vegetation adjoining existing road edges. For the most portion of the road this would not pose a significant impact on vegetation. Constructing access roads to borrow sites will also involve loss of vegetation.

The vegetation is unlikely to have any special conservation value, but some tree species have economic value (eg mango trees). In addition, trees have cultural importance, provide shade, and provide shelter for birds or small animals. Clearing of vegetation and trees may also encourage erosion.

Impact evaluation: Loss of vegetation could impact fauna, accelerate soil erosion, siltation of streams, swamps, and rivers due to sediment transport.

Impact severity: The *likelihood* of the impact occurring is high while its duration will be medium-term since land-take would be permanent. The impact will be direct and will however only be restricted to a few places (*i.e. on protected forests).* Without mitigation, severity of this impact would be high resulting into a *major* overall significance level.

Impact significance: Major

- (Negative)		Impact Likelihood			
		None	**Low**	**Medium**	**High**
Impact severit	**Negligible**	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Negligible-Minor	Minor
	Medium	Negligible	Minor	Minor-Moderate	Moderate
	High	Minor	Moderate	Major	**Major**

Impact receptors:

- Landowners with crops adjoining road; and
- Fauna using the areas as their habitats.

Impact mitigation: The following measures will be implemented to mitigate this impact:

- RDA will ensure that contractors prepare Biodiversity Restoration Plans to restore degraded areas arising from construction works.

- Clearing of vegetation and trees should be strictly controlled: it should be limited to what is absolutely necessary, and should not be done indiscriminately. Keeping the construction width to a minimum will substantially reduce the amount of vegetation and the number of trees that will have to be removed during construction.
- Clearing should be done manually or mechanically; the use of herbicides should be prohibited. Diligence on the part of the Contractor and proper supervision of the workforce is important in this respect.
- The workforce should be provided with alternatives to fuelwood and charcoal for cooking (e.g. by providing kerosene cookers), so that the pressure on fuelwood and charcoal will be reduced.
- After road improvement is complete, grass and trees must be replanted wherever vegetation has been inadvertently or unnecessarily destroyed. Trees should be planted along the roadside at the main trading centres and the local councils should be asked to look after them.

Residual Impact: Following mitigation, residual impact will be of ***low significance***.

7.3.1.2.2 Increased sediment load

During road upgrade, bridges and box culverts will be constructed at several river/stream crossings. Construction of bridges will have the potential impact of increasing sediment load in rivers.

Impact evaluation: Increase in sediment load in watercourses would impair water quality and impact magnitude would depend on size (flow of river), construction methodology and preventive strategies or precautions instituted.

Impact severity: Impact is direct, negative but temporary and reversible and extent is local. Likelihood of this impact occurring is moderate hence severity is medium (Contractor and supervisors will be competent to construct bridges in such areas). Impact significance is thus *minor-moderate*.

Impact significance: Minor-Moderate

- (Negative)		Impact Likelihood			
		None	**Low**	**Medium**	High
Impact severit	**Negligible**	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Negligible-Minor	Minor
	Medium	Negligible	Minor	**Minor-Moderate**	Moderate
	High	Minor	Moderate	Major	Major

Impact receptors: Receptors include aquatic fauna and flora in the watercourses and communities that depend on them for domestic use and watering livestock.

Impact mitigation:

- Bridge designs should provide for prevention of scouring using gabions, stone pitching or lining banks with concrete. Bridge location should be such as not to increase sediment load or significant changes in flow velocities in watercourses.

- Contractor should ensure that construction activities should be planned to minimize sediment transport, for example, constructing bridges in such places in the dry season.

Residual Impact: Following mitigation, residual impact will be of ***low significance***.

Impact management: Ensure proper construction supervision.

7.3.1.2.3 Soil erosion and land degradation

Drainage is an important provision to the road to avoid deterioration by stormwater. Drains will be designed and constructed to divert runoff from the carriageway discharging it onto adjoining land. This should be done at non-erosive velocities to avoid gully erosion.

Impact evaluation: Erosive stormwater discharged onto land/ property adjoining the road would lead to gullies and land degradation; siltation of streams, swamps and rivers due to sediment deposition; and modification of natural drainage patterns.

Impact severity: Soil erosion and land degradation impacts would be long-term (prevailing for as long as road life) if not controlled. Likelihood of impact occurrence is medium (with good road drainage design) but severity high when farmlands are destroyed. Impact significance is therefore *major*.

Impact significance: Major

- (Negative)		Impact Likelihood			
		None	**Low**	**Medium**	High
Impact severit	**Negligible**	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Negligible-Minor	Minor
	Medium	Negligible	Minor	Minor-Moderate	Moderate
	High	Minor	Moderate	**Major**	Major

Impact receptors:

- Communities adjacent to drainage sinks;
- Flora and fauna in areas where such stormwater is drained for example swamps, being subjected to shock loads; and
- Predominantly, this impact will be significant where some sections of the road go through rolling terrains.

Impact mitigation:

- RDA/Contactor should ensure that waterways leading into private property are grassed or similar provisions made to reduce erosive velocity of stormwater;
- RDA/Contactor should consider constructing stepped drainage systems in hilly areas to reduce stormwater velocities;
- Road design should, to the extent possible, utilize the natural drainage patterns; and
- Ensuring that storm/side drains do not discharge into housing and social areas.

Residual Impact: Following mitigation, residual impact will be of ***low significance***.

Impact management: Ensure proper construction supervision.

7.3.1.2.4 Increased noise, vibrations and dust

Construction of the road will require two types of earth materials:

- Sub-base material (natural gravel)
- Base course material (hard rock / "crushed rock"/ aggregate or "stones")

The road project will utilize about 250,000m³ of gravel and 15,000m³ of aggregate.

The base (crushed rock) is the load bearing layer laid directly beneath the bituminous surfacing. This layer will be 200 mm thick along the project road. The sub-base is the gravel layer that supports the road base and has a lower strength specification than the base. Road upgrade will require a sub-base of thickness 200 mm.

It will be the responsibility of the contractor to identify sources (location/ sites) of aforementioned earth materials that meet design specifications. Unless materials are obtained from existing quarries and borrow pits which need not be restored upon completion of the road, where these materials are obtained from, method of their extraction, haulage and state in which sites are left upon project completion all have potential for socio-environmental impacts below:

- Clearing of vegetation to create access to material sources,
- Excessive noise, vibrations and dust from stone blasting and crushing. Noise would affect local communities and quarry workers and vibrations will crack structures and health of especially elderly people. Commonly around stone quarries, local communities allege low milk and egg yields due to blasting noise and vibrations.
- Fly rock which damages crops, dwellings/ structures or injures people and livestock,
- Haulage impacts e.g. accident risks and road dust,
- Safety and public health risks of un-restored quarries and borrow pits.

Impact evaluation: Direct and secondary effects (noise, vibrations, dust, fly rock injuries, etc) associated with stone/ rock quarrying and excavation of gravel can pose negative and sometimes irreversible social impacts. Gaping pits due to unrestored pits cause visual blight and scarring of landscapes besides posing public health and safety risks.

Impact severity: Some secondary impacts of stone blasting and quarrying such as injury or death caused by fly rock are irreversible. Damage to dwellings near quarries would be a considerable social impact in rural poor communities. Unless a firm contractual commitment is made by the contractor, leaving unrestored quarry sites is a common practice in Zambia and likelihood of this impact occurring is high. Impact severity is medium (or even low) except when quarries are located close to communities, an unlikely situation unless alternative sites cannot be found. Impact significance is therefore *moderate*.

Impact significance: Moderate

- (Negative)		Impact Likelihood			
		None	**Low**	Medium	**High**
Impact severit	**Negligible**	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Negligible-Minor	Minor
	Medium	Negligible	Minor	Minor-Moderate	**Moderate**
	High	Minor	Moderate	Major	Major

Impact receptors:

- Quarry workers
- Local community (and their structures, crops, livestock, health and safety).
- Local communities near unrestored or improperly rehabilitated quarry or borrow sites which pond water and harbor disease vectors e.g. mosquitoes.

Impact mitigation: It should be a contractual requirement for the contractor to integrate quarry restoration plans in the general project implementation. To this effect, the contractor should ensure:

- Height and orientation of the quarry face need to be controlled if reinstatement is to be effective.
- Surplus soil materials (overburden) from the road excavations should be stockpiled at quarry sites to be sued during site restoration.
- Access roads to quarries if not needed by local communities should be scarified and revegetated. Site restoration should utilize native vegetation species and replanting undertaken during the rainy season to ensure high revegetation success.

Residual Impact: Following mitigation, residual impact will be of ***low significance***.

Impact management:

- Compensate any accidents to people or injurious damage to structures due to fly rock from stone/ rock blasting.
- Resident Engineer should not issue completion certificate to contractor or payments withheld until quarry sites are satisfactorily rehabilitated.
- Any unsuccessful vegetation regrowth should be replaced during the contractor's defect liability period.
- Existing gravel and stone quarries can be used to meet required material specifications to avoid opening new ones.
- Workers should be provided with protective gear (muffs, hard hats, overalls, foot protection).
- Control dust by good housekeeping practices and process control.

7.3.1.2.5 Staining of households and goods

Road construction will necessitate transportation of materials from sources to worksites. Haulage of gravel and crushed stone (aggregate) from sources to road construction work site will be associated with the following impacts:

- Staining of households and goods in roadside shops by dust,
- Traffic accidents involving people, wildlife and livestock,
- Haulage traffic noise.

Impact evaluation: Although never compensated, staining of trade commodities in shops (especially foodstuffs: salt, sugar, flour, etc) with dust translates into a financial loss for local business owners. Excessive dust in dwellings poses a short-term health impact. Unless speeds are controlled, material haulage poses a risk of road accidents especially near school crossings, livestock crossings and in trading centres. Haulage traffic noise is not expected to be a significant impact except near schools and health centres.

Impact severity: Risk of this *potential* impact actually occurring is highest in trading centres or through settlements with considerable population but largely impact extent is along entire length of the road. Material haulage will be short-term ceasing with completion of construction activities but secondary effects (if they occurred) such as accidents (hence disability or death) have negative, long-term and possibly irreversible socio-economic impacts. If mitigation recommendations are implemented, likelihood of impact occurring is medium but impact severity high especially when accidents involve loss of lives. Significance of road dust will be comparatively highest through trading centres where goods and foodstuff in shops could be contaminated. Overall impact significance is therefore predicted to be *major*.

Impact significance: Major

- (Negative)		Impact Likelihood			
		None	**Low**	**Medium**	High
Impact severit	**Negligible**	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Negligible-Minor	Minor
	Medium	Negligible	Minor	Minor-Moderate	Moderate
	High	Minor	Moderate	**Major**	Major

Impact receptors:
Disabled people, children, women and elderly people are especially at risk of road accidents.

Impact mitigation:

- The contractor should suppress dust by watering wherever necessary.
- Contractor should provide temporary road signage during construction and ensure drivers observe speed limits.
- Contractor should deploy traffic guides warning signs where necessary, such as on approach to trading centres and large settlements.
- Contractor should provide temporary and permanent speed reducing devices e.g. humps.
- Contractor should prohibit haulage activities at night to avoid accidents in high population settled areas.
- Contractor should erect temporary signs along routes used by haulage trucks.
- Construction crews should take care to watch out for and avoid domestic animals.
- The contractor should station traffic guides at potentially high accident risk locations to warn / guide road users.
- To avoid excessive haulage traffic noise at sensitive facilities, the contractor should not install temporary speed reduction features (humps) adjacent to schools or healthcare centres. This would avoid noise associated with high speed deceleration and acceleration at humps.

Residual Impact: Following mitigation, residual impact will be of low significance.

7.3.1.2.6 Pollution of land and watercourses

During the construction period, there will be need to stockpile and store assorted materials at or near the construction site so as to ensure easy and uninterrupted access to supplies. This will lead to pollution of land and watercourses by spilling and wash away of materials. Additionally, material losses are a financial loss to the contractor.

Impact evaluation: There is a potential pollution risk if construction materials (fuel, lubricants, and gravel) are not stored or handled properly. Spill accidents may cause contamination of watercourses or kill off vegetation and fauna. Inadequate management of storage areas can also result in material loss through spillages or washing away of stockpiles.

Impact severity: This impact is negative with a medium likelihood of occurrence but will be short-term in temporal extent, only occurring during the construction period and local in extent, mostly localized to areas near storage sites. However, spills in watercourses can impact remote/ distant downstream communities. Severity is therefore assessed as medium resulting in an overall significance level of *minor-moderate*.

Impact significance: Minor-Moderate

- (Negative)		Impact Likelihood			
		None	**Low**	**Medium**	High
Impact severit	**Negligible**	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Negligible-Minor	Minor
	Medium	Negligible	Minor	**Minor-Moderate**	Moderate
	High	Minor	Moderate	Major	Major

Impact receptors: This impact can occur anywhere along the road and receptors are:

- Soil and water resources near storage sites.
- Owners of contaminated land.
- Local communities dependent on affected environmental resources.

Impact mitigation:

- Contractor should protect material stockpiles from stormwater erosion (e.g. by excavating a cut-off ditch around stockpiles to keep away stormwater).
- Contractor should provide bunded storage for fuel.
- Contractor should cover material stockpiles with fabric or other materials.
- Contractor should avoid stockpiling material near waterways/wetlands or on slopes.

Residual Impact: Following mitigation, residual impact will be of low significance.

Impact management:

1. Application of good engineering practices in design and construction should ensure that water sources are not affected by road upgrade works. The most likely source of watercourse contamination is loose soil being washed into rivers and streams during construction of drainage structures and bridges. This impact is not expected to be serious but if considerable contamination is likely, then the resident engineer must instruct the contractor to construct silt traps to avoid sediment entrainment in water.
2. Additionally, the contractors should have a contractual obligation to develop and implement a construction management plan (CMP) and spill response plan, to include the following:
    - Basic training should be provided to workers, where required, to ensure effective implementation of the CMP.
    - Installation of secondary containment measures in areas where fuels, oils or lubricants are stored, loaded or unloaded, including filling points.
    - Equipment and materials should not be stored within or near watercourses;
    - Potential contaminants stored on site should be properly isolated and bunded.

- Contractor should have a portable spill control pack (comprising absorbent pads/pillows, rolls, blankets, etc) on site to contain and clean up fuel spills.

7.3.1.2.7 Loss of vegetation and littering due to asphalt plant operation

Resurfacing a 102km road will require considerable quantities of bitumen (i.e. in the range of 2,000,000Tonnes). Its preparation, storage and application could have socio-environmental impacts.

Impact evaluation: If firewood is used in heating bitumen, considerable cords of wood would be necessary representing a significant loss of vegetation for the entire road length. Littering due to poor housekeeping at the asphalt plant or improper disposal of unused bitumen and aggregates or bitumen spills would have the localized impact of contaminating environmental resource (soil and water).

Impact severity: Impact is negative, temporary and reversible but likelihood of this impact occurring is low since ingredients of asphalt (bitumen and aggregate) represent a financial cost to the contractor and waste is unlikely. Although high in organic contaminants, bitumen is biodegradable. Since contamination impact would often be localized, spatial extent is small and severity is *medium*. For the foregoing reasons and the fact that alternative heating fuel other than wood is possible, impact significance is *moderate*.

Impact significance: Moderate

- (Negative)		Impact Likelihood			
		None	**Low**	Medium	**High**
Impact severit	**Negligible**	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Negligible-Minor	Minor
	Medium	Negligible	Minor	Minor-Moderate	**Moderate**
	High	Minor	Moderate	Major	Major

Impact receptors: Residents living near contaminated sites and watercourses. This impact can occur anywhere along entire road.

Impact mitigation:

- RDA should discourage contractors from using firewood for heating bitumen. Bitumen heater should use kerosene or diesel.
- The contractor should collect leftover bitumen and aggregates properly keeping it for use on other sections of the road.
- Contractor should use bitumen emulsion where feasible. In hilly areas with steep road gradients, cut-back bitumen should be used.
- Contractor should not discharge bitumen into road side drains.
- Contractor should collect and store empty bitumen drums at equipment yards and not abandon them along the road.

Residual Impact: Following mitigation, residual impact will be of low significance.

Impact management: *RDA* should ensure that the hired contractor has appropriate equipment and would not use wood fuel to heat bitumen.

7.3.1.2.8 Contamination of soil and surface watercourses including workers suffering burns

Surfacing will be the final major operation in construction of the proposed road. Application of this final layer can pose environmental and Occupational Health Safety (OHS) impacts.

Impact evaluation: Associated with road surfacing are OHS hazards such as burns during transportation of the hot material. Spilt asphalt may contaminate soil and surface watercourses.

Impact severity: OHS risks to workers during transportation of asphalt would be short-term but injuries (for example, burns) can be long-term and irreversible. Environmental contamination is negative and reversible. Likelihood of impact occurrence is medium but severity high where workers are injured. Impact significance is therefore *major*.

Impact significance: Major

- (Negative)		Impact Likelihood			
		None	**Low**	**Medium**	High
Impact severit	**Negligible**	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Negligible-Minor	Minor
	Medium	Negligible	Minor	Minor-Moderate	Moderate
	High	Minor	Moderate	**Major**	Major

Impact receptors: Road surfacing impacts can potentially occur anywhere along the road and receptors are:

- Road construction workers - receptors of OHS impacts
- Property owners (soil, watercourses or farmlands adjoining road) - receptors of environmental contamination.

Impact mitigation:

- Contactor should erect road signs to warn other road users about road works.
- Crops and private property in work site adjoining road should be protected during bitumen spraying.
- Contactor should avoid applying bitumen during strong winds, or heavy rains.
- Road workers should take caution to avoid spilling of bitumen during road works.
- Speed controls to minimize flying stones aggregate shall be put in place.

Residual Impact: Following mitigation, the residual impact will be of low significance.

7.3.2 Socio-economic Environment

7.3.2.1 Positive Impacts

7.3.2.1.1 Employment and income opportunities

Upgrading of the proposed road presents income opportunity for contractors and tax revenue for government. About 300 people might be directly hired by the contractor during road construction. The majority of this number will be low-skilled labour which will be hired from

local communities. This presents a positive but short-term economic benefit especially for youths. The 300 workers will consist of 255 males and 45 females. Of these, 265 are expected to be locals while 35 will be expatriates. However, it is common for the largest proportion if not all of this labour to comprise male workers only but for equitable benefit and gender equity, able women should also be hired wherever they meet job requirements.

Impact severity: Duration of this impact will be short-term (construction to take 3 years) and likelihood of occurring is high but benefit (severity) to wider local communities would only be moderate (hence medium severity). Therefore, impact significance is *moderate.*

Impact significance:

- (Negative)		Impact Likelihood			
		None	**Low**	Medium	**High**
Impact severit	**Negligible**	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Negligible-Minor	Minor
	Medium	Negligible	Minor	Minor-Moderate	**Moderate**
	High	Minor	Moderate	Major	Major

Impact enhancement:

- Preference for casual labourers should be given to local people but the three Local Councils (LC) officials and local leaderships along the road corridor should be involved in recruitment processes.
- RDA can make it a contractual obligation for the road contractor to hire 15% of the workforce as women.

7.3.2.1.2 Rental income for workers camp and equipment yard site owners

Land will be required on which to set up temporary workers camp and equipment yard. The criteria for the selection of the land for the construction of a worker's camp will be influenced by availability of electricity, being further away from a school facility and having easy accessibility to amenities such as clinics and markets. The expected number of the beneficiaries will be about 50 individuals. These will mostly be senior staff of the Contractors and the Consultant who will be recruited from outside the project area. Owners of land on which these facilities will be erected will earn a rental income negotiated with contractors. This is a positive but short-term and reversible benefit ceasing with project completion or whenever such facilities are no longer required in a given location.

Impact severity: Duration of this impact will be short-term for each site used as camp or yard and likelihood of occurring is high but benefit will be to a few landowners hence low severity. Therefore, impact significance is *minor*.

Impact significance: Minor

- (Negative)		Impact Likelihood			
		None	**Low**	Medium	**High**
Impact severit	**Negligible**	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Negligible-Minor	**Minor**
	Medium	Negligible	Minor	Minor-Moderate	Moderate
	High	Minor	Moderate	Major	Major

Impact enhancement:

- As a contractual obligation, contractors should construct facilities with permanent materials that can be re-used by the land owners for other purposes.
- RDA should make it a contractual obligation for the contractor to restore camp and equipment yard sites upon their closure.

7.3.2.1.3 Income from construction materials

Road upgrading will require considerable volumes of gravel and aggregate (stone) the exact amount of which will be determined from detailed engineering design. Other materials are lime, bitumen, water, cement and steel especially for bridges. Procurement of these resources connotes income to suppliers and owners of land where quarry sites will be located. This is a positive but short-term and reversible impact.

Impact severity: Duration of this impact will be short-term (construction to take 3 years) and likelihood of occurring is high but benefit will be to a small section of community (business owners/ material suppliers) hence medium severity. Therefore, impact significance is *moderate*.

Impact significance: Moderate

- (Negative)		Impact Likelihood			
		None	**Low**	Medium	**High**
Impact severit	**Negligible**	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Negligible-Minor	Minor
	Medium	Negligible	Minor	Minor-Moderate	**Moderate**
	High	Minor	Moderate	Major	Major

Impact enhancement:

- Earth materials should be procured from legal / licensed quarries, or, as a contractual obligation, contractors should restore all depleted quarry sites upon closure. The Contractor can open and operate a quarry provided the necessary permits/approvals are obtained.
- Site restoration should utilize native vegetation species and replanting undertaken during the rainy season to ensure high re-vegetation success.
- RDA should make it a contractual obligation for the contractor to restore sites to pre-project conditions.

7.3.2.2 Negative Impacts

7.3.2.2.1 Social ills of construction labour including crime & HIV/AIDS

In local communities, construction workers will be regarded as richer with ready income to spend. This and influx of workers, typically young males seeking road construction job opportunities could lead to an increase in social pathologies such as alcohol or illicit drug abuse and prostitution. The risks include contraction of communicable diseases including HIV/AIDS.

Impact evaluation: Vices such as drug abuse and prostitution would affect social coherence and security in project communities maligning the image and intent of an otherwise good project.

Impact severity: Unless adequate sensitization of all workers is undertaken by contractor, likelihood of the impact occurring is medium (considering some level of awareness among the general populace). Duration of the above-mentioned social ills will be short-term ending with completion of road construction but associated social and health effects are long-term and irreversible. The risk HIV/AIDS makes this impact of high severity resulting in an overall significance level of *major*.

Impact significance: Major

- (Negative)		Impact Likelihood			
		None	**Low**	**Medium**	High
Impact severit	**Negligible**	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Negligible-Minor	Minor
	Medium	Negligible	Minor	Minor-Moderate	Moderate
	High	Minor	Moderate	**Major**	Major

Impact receptors:

- Road construction workers
- Local community.

Impact mitigation:

- The contractors will be expected to develop an HIV/AI/AIDs Prevention Plan to ensure a coordinated approach.
- The contractor should involve the local Zambia Police during labour recruitment to ensure people hired have no criminal record.
- Contractor should provide condoms and an HIV/AIDS poster to workers in privately convenient places such as toilets/latrines in camp.
- Local governments and the contractor should collaborate with police to reduce criminal activities.
- HIV/AIDS training and awareness campaigns lasting for three years will be conducted to target road construction workers, community leaders, local transport associations (e.g. taxi drivers/ bus operators associations) and school teachers. The goal of training and awareness will be to reduce the transmission of HIV/AIDS during and after road construction and will entail: training, support for behavior change and provision of condoms. The RDA should approve Terms of Reference for performance of HIV/AIDS sensitization and awareness services.
- ***Peer educators training:*** Based on number of targeted villages and road distance, 100 peer educators will be selected from community based on criteria set up and trained intensively on the topics related to HIV/AID. After capacity building being completed, peer educators will be responsible in taking outreach activities in their communities. They will work at least 10 days per month to provide key messages on HIV/AIDS to families in villages along the road, road construction workers and high-risk groups. The criteria for peer educator selection is (1) living in target area, (2) women and men aged from 30-40, (3) have ever attended the training course on HIV/AIDS, (4) have enough time, (6) interested in work on HIV/AIDS issues.

- ***Monthly meeting with relevant stakeholders:*** At least 20 monthly meetings will be conducted regularly every month with stakeholders from district, sub counties and NGOs to share informed, problems encountered and resolution and advice provision from stakeholders for improving program implementation.
  Community events (education campaign): *Twelve community events will be* organized (2 villages for one event) in order to train persons living in villages along the road. The training will invite the main persons such as community leaders, LC Health counselors and outstanding people in villages to participate in the course which will have 25-30 participants. All the participants will play important roles in promoting family members and neighbors after having completed courses with mention of multi topics during the training course such as HIV/AIDS.
  Training workshop with high-risk groups: Four training workshops will be conducted with high-risk groups (sex workers and beer promotion workers) along the road on HIV/AIDS. The purpose of training workshop will be to emphasize condom use to mitigate risks on HIV/AIDS.
  Awareness campaign with school students: One awareness campaign will be conducted with secondary school students in each district. The campaign will aim to provide HIV/AIDS knowledge through role play, question-and-answer (Q&A) sessions.
  Local communities outreach activities: Outreach activities will be undertaken over 18 months by peer educators to promote awareness on HIV/AIDS in villagers, truck drivers, road construction workers and high-risk groups in areas through which the road will be constructed.
  Road construction workers follow-up: Road construction workers follow up will be conducted for 18 months (at least once per month) with the aim to provide counseling on HIV/AIDS, condom provision and voluntary confidential counseling for testing (VCCT).
  Provision and distribution of condoms: Condoms will be distributed to high risk groups during training sessions.

Residual Impact: Following mitigation, residual impact will be of ***low significance***.

Impact management:

- As a contractual obligation, the contractor should have an HIV/AIDS Policy and action plan to implement it for this project (i.e. mainly for construction workers).
- Engaged the District Task force through the Provincial HIV/AIDS Task force to implement HIV/AIDS programs along the road corridor

7.3.2.2.2 Demolition of structures within the road reserve area

During road upgrade, structures within the road reserve will be demolished but it is anticipated that this will not happen until every affected person is duly compensated, given a disturbance allowance and commensurate advance notice to vacate affected properties. Vulnerable groups with their consent will be assisted by RDA to supervise the construction of their structures.

Impact evaluation: Although there will be loss of structures during road upgrading, every affected person will be compensated by Government and therefore this impact will not be critically adverse if people are compensated at replacement value and given adequate notice to vacate affected structures before construction commences.

Impact severity: The *likelihood* of the impact occurring is high. Since compensation will be provided to replace affected structures, severity of this impact will be medium resulting in a *moderate* overall significance level.

Impact significance: Moderate

- (Negative)		Impact Likelihood			
		None	**Low**	Medium	**High**
Impact severit	**Negligible**	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Negligible-Minor	Minor
	Medium	Negligible	Minor	Minor-Moderate	**Moderate**
	High	Minor	Moderate	Major	Major

Impact receptors:

- Owners of the demolished property along the road.
- Dependents/ tenants of property owners.
- Other communities dependent on such property (e.g. when shops or other commercial outlets are demolished and not rebuilt in the same locality or replaced quickly enough).

Impact mitigation: *RDA* should provide equitable and timely compensation to all affected property owners.

Residual Impact: When timely and equitable compensation is provided, residual impact of involuntary resettlement will be of low or moderate significance.

Impact management:

- RDA should provide adequate vacation notice (according to regulatory requirements, this is 3 or 6 months) to affected people before construction commences. This will also allow affected property owners to plan appropriately or take any salvageable material from their demolished structures without delaying contractor's work.
- Due to the urgency of this project, RDA should institute a strong grievance committee so that complaints and dissatisfactions about the resettlement/ compensation process do not unduly delay contractors progressing works.

7.3.2.2.3 Occupational health and safety risks for workers

Impact identification: Road works will have the following occupational health and safety risks with potential to cause serious injuries to workers:

- Burns (handling hot bitumen, welding/hot works, etc)
- Falls from working at heights or wet surfaces
- Electrocution
- Noise and body vibration from equipment
- Injury from fly rock e.g. at quarry sites or debris when demolishing affected buildings
- Injury from accidents of construction vehicles

Lack of hand wash water and mobile toilet facilities at work sites could also pose considerable health risk to workers (and local communities traversed).

Impact evaluation: OHS impacts will potentially occur at any point during road construction and while some accidents could be minor, others might be grave leading to permanent disability or loss of life of construction workers.

Impact severity: Duration of the impact will be short-term occurring only during the construction phase. Extent of the impact will be local or national depending on origin of construction workers. Likelihood of the impact occurring is high considering the usually low level of safety at construction sites in Zambia. Significance of this impact is therefore predicted to be major.

Impact significance: Major

- (Negative)		Impact Likelihood			
		None	**Low**	**Medium**	**High**
Impact severit	**Negligible**	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Negligible-Minor	Minor
	Medium	Negligible	Minor	Minor-Moderate	Moderate
	High	Minor	Moderate	Major	**Major**

Impact receptors: Construction workers

Impact mitigation: Contractors should provide all workers with requisite protective gear indicated in Table 7-1, onsite toilet and washing water for workers.

7.3.2.2.4 Child and Forced Labour

Impact identification: Road works will attract a multitude of involving wanting to earn a living through the employment opportunities that will be made available. However, there are potential risks of engaging child labour below the age of 18 years and the possibility of forced labour happening at sites. Forced labour is any work or service that people are made to do against their will. According to the 2020 Child Labour Report Child labour is a widespread phenomenon in Zambia, and is one that has not declined despite the existence of laws that prohibit burdensome forms of child labour and the constant efforts of many governmental, non-governmental and international organizations to protect children's rights. The estimated number of children in child labour was 430,075 of which females accounted for 63.4 percent while males accounted for 36.6 percent. Rural areas had 58.1 percent of children in child labour while urban areas accounted for 41.9 percent.

Impact evaluation: Child labour and forced labour can potentially occur at any point during road construction. Child labour is detrimental to the physical, emotional and mental health of the child.

Impact severity: Duration of the impact will be short-term occurring only during the construction phase. Extent of the impact will be local or national depending on origin of construction workers. Likelihood of the impact occurring is low considering that there will be regular monitoring of activities at the construction site by the consulting Engineer and the Road Development Agency. Significance of this impact is therefore predicted to be low.

Impact significance: low

- (Negative)		Impact Likelihood			
		None	**Low**	**Medium**	**High**
Impact severit	**Negligible**	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Negligible-Minor	Minor
	Medium	Negligible	Minor	Minor-Moderate	Moderate
	High	Minor	Moderate	Major	**Major**

Impact receptors: Children in the community

Impact mitigation: Contractors will only employ people whose age is above 18 years based on the production of their National Identification Cards (NRC) to avoid child labour while all those that will be employed will need to sign contracts to avoid forced labour.

7.3.2.2.5 Discrimination at Work Place

Impact identification: Road works are predominantly male dominated and as such there is potential risks of the discrimination of the females at the construction sites based on their gender.

Impact evaluation: Discrimination can potentially occur at any point during road construction.

Impact severity: Duration of the impact will be short-term occurring only during the construction phase. Extent of the impact will be local or national depending on origin of construction workers. Likelihood of the impact occurring is high considering that the construction industry is male dominated. Significance of this impact is therefore predicted to be high.

Impact significance: high

- (Negative)		Impact Likelihood			
		None	**Low**	**Medium**	**High**
Impact severit	**Negligible**	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Negligible-Minor	Minor
	Medium	Negligible	Minor	Minor-Moderate	Moderate
	High	Minor	Moderate	Major	**Major**

Impact receptors: Female employees

Impact mitigation:

- Recruitment of workers will be done fairly without discrimination by giving equal opportunity to all prospective employees including vulnerable workers such as women, persons with disabilities, in accordance with the labour management procedures.
- Putting in place a Code of Conduct (CoC) that will prohibit any form of discrimination.

7.3.2.2.6 Impact on Vulnerable Groups (e.g. elderly, children, persons with disabilities, female-headed households)

Impact identification: The impact on the vulnerable groups will mainly arise as a result of the expected relocation of structures from the road reserve areas.

Impact evaluation: The impact on the vulnerable groups will occur during the construction phase of the road works.

Impact severity: Duration of the impact will be short-term occurring only during the construction phase. Extent of the impact will be local as it will mostly affect the vulnerable groups residing within the project area. Likelihood of the impact occurring is high considering that all structures that are located in the road reserve area are expected to be relocated prior to the commencement of road works in any particular road section. Significance of this impact is therefore predicted to be high.

Impact significance: high

- (Negative)		Impact Likelihood			
		None	**Low**	**Medium**	**High**
Impact severit	**Negligible**	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Negligible-Minor	Minor
	Medium	Negligible	Minor	Minor-Moderate	Moderate
	High	Minor	Moderate	Major	**Major**

Impact receptors: Vulnerable Groups in the community

Impact mitigation:

- Vulnerable groups with their consent will be assisted by RDA to supervise the reconstruction of their structures outside the road reserve area
- Equal employment opportunity will be given to all prospective employees including vulnerable workers such as women, persons with disabilities, in accordance with the labour management procedures.

7.3.2.2.7 Road Safety Risks for Local Communities

Impact identification: The project will likely result in an increase in construction related traffic in the local area travelling to and from the site delivering materials and removing waste as well as associated with the transportation of workers. The increase in traffic is likely to result in increased traffic congestion and decreased road safety. Increase in traffic and decrease in road safety may potentially cause traffic-related injuries and fatalities among members of the public including construction workers.

Impact evaluation: The impact will occur during the construction phase of the road works.

Impact severity: Duration of the impact will be short-term occurring only during the construction phase. Extent of the impact will be local as it will mostly affect the workers and the local communities residing within the project area. Likelihood of the impact occurring is

high considering that there will be an increase in traffic flow from construction vehicles and equipment. Significance of this impact is therefore predicted to be high.

Impact significance: high

- (Negative)		Impact Likelihood			
		None	**Low**	**Medium**	**High**
Impact severit	**Negligible**	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Negligible-Minor	Minor
	Medium	Negligible	Minor	Minor-Moderate	Moderate
	High	Minor	Moderate	Major	**Major**

Impact receptors: Local people and workers

Impact mitigation:

- Designing of roadways to accommodate anticipated traffic volume and flow
- Maintenance of the road to prevent mechanical failure of vehicles due to road conditions
- Construction of roadside rest areas at strategic locations to minimize driver fatigue
- Installation of measures to reduce collisions between humans and vehicles by having flaggers at strategic places and the use of reflectors
- Regular servicing of the construction vehicles and equipment
- Employing only qualified drivers and operators of equipment

Table 7-7-1: Requisite protective gear to be provided by contractors for workers

Objective	Workplace hazards	Suggested PPE
Eye and face protection	Flying particles	Safety glasses
Head protection	Falling objects, inadequate height clearance, and overhead power cords	Plastic hard hats with top and side impact protection
Hearing protection	Noise	Ear plugs or muffs
Foot protection	Falling or rolling objects, pointed objects	Safety shoes and boots
Hand protection	Hazardous materials, cuts or lacerations	Gloves made of rubber or synthetic materials
Respiratory protection	Dust, lime operations, stone quarries	Facemasks filters for dust removal
Body/leg protection	Hazardous materials, biological agents, cuttings and lacerations.	Overalls /coveralls
Protection against falls	Working on slippery, wet floors	Rubber boots
	Fatal falls from working at heights	Safety latches (fall arrestors)

Residual Impact: Following mitigation, residual impact will be of low significance

Impact management: Project supervising engineers should inspect contractors' compliance with safety precautions during construction.

7.4 OPERATIONAL PHASE RISKS AND IMPACTS

7.4.1 Positive Road Use Risks and Impacts

7.4.1.1.1 An upgraded and improved road

Improvement of the road will have positive, significant and long-term local, national and regional socio-economic impacts. These include:

- Reduced vehicle wear/ tear.
- Reduced travel time.
- Safer journeys with reduced accident risk (design will remove sharp corners and steep inclines). Accident rates change following improvement in road geometry and pavement. Upgrading of the project road will improve visibility, reduce braking distances and have road signs installed where none existed. Although speeds are expected to increase, there is evidence that overall, upgrading of the project road will reduce accident rates and fatalities.

Impact severity: Duration of this impact will be long-term and likelihood of occurring is high after road improvement. Benefit to every road user will be of local and regional spatial extent hence high severity. Therefore, impact significance is *major*.

Impact significance: Major

+ (Positive)		Impact Likelihood			
		None	**Low**	**Medium**	**High**
Impact severit	**Negligible**	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Negligible-Minor	Minor
	Medium	Negligible	Minor	Minor-Moderate	Moderate
	High	Minor	Moderate	Major	**Major**

Impact receptors: Since the project road from Mwinilunga to Jimbe serves Zambia and Angola, impact receptors are local, national and regional road users (passengers and traders).

Impact enhancement:
RDA should ensure that road design should provide facilities and signage for pedestrians to cross road.

7.4.1.1.2 Increased economic activity

A good road will enhance access to cross border trading, improving local and regional economies. Road improvement will also stimulate development of businesses along the road, for example, roadside markets and secondary job opportunities from new businesses.

This is a positive and long-term impact. Secondary benefits such as jobs created as a result of increased economic activity will also be long-term.

Impact severity: Duration of this impact will be long-term and likelihood of occurring is high after road improvement. Increased economic activity in local economies would benefit all communities along the road hence high severity. Therefore, impact significance is *major*.

Impact significance: Major

+ (Positive)		Impact Likelihood			
		None	**Low**	**Medium**	**High**
Impact severit	**Negligible**	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Negligible-Minor	Minor
	Medium	Negligible	Minor	Minor-Moderate	Moderate
	High	Minor	Moderate	Major	**Major**

Impact receptors: Traders along the road corridor.

Impact enhancement: Ensure continual road maintenance.

7.4.1.1.3 Shorter travel time and reduced transportation fares

An improved road will attract more operators of public transport and ensuing competition would lower fares for both goods and passengers. A good road would reduce travel. The benefit is long-term and of national regional spatial extent.

Impact severity: Duration of this positive impact will be long-term and likelihood of occurring is high after road improvement. The benefit will be for all communities along the road hence high severity. Therefore, impact significance is *major*.

Impact significance: Major

+ (Positive)		Impact Likelihood			
		None	**Low**	**Medium**	**High**
Impact severit	**Negligible**	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Negligible-Minor	Minor
	Medium	Negligible	Minor	Minor-Moderate	Moderate
	High	Minor	Moderate	Major	**Major**

Impact receptors: Public and private road users or transporters of goods and passengers along the road.

Impact enhancement: RDA should ensure continual road maintenance.

7.4.1.1.4 Improved access to social services

An improved road will ease access to social services, most vitally healthcare. This will especially benefit women by way of improved maternal health, reduced infant and maternal mortality and general public health improvement in all communities traversed by the road.

Impact severity: Duration of this impact will be long-term and likelihood of occurring is high. The benefit will be for all communities along the road, hence high severity. This connotes major impact significance.

Impact significance: Major

+ (Positive)		Impact Likelihood			
		None	**Low**	**Medium**	**High**
Impact severit	**Negligible**	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Negligible-Minor	Minor
	Medium	Negligible	Minor	Minor-Moderate	Moderate
	High	Minor	Moderate	Major	**Major**

Impact receptors: Public and private road users or transporters of goods and communities along road.

Impact enhancement: RDA should ensure continual road maintenance.

7.4.2 Negative Road Use Risks and Impacts

7.4.2.1.1 Increased Traffic Accidents

Drivers on a newly improved road will always excitedly drive faster than is often safe: a phenomenon referred to as "*new road effect*". This usually happens in the first months of commissioning a new road and is associated with frequent road accident. Likely effects will be human and livestock accidents.

Impact evaluation: Driving at unsafe speeds on a newly completed road would pose accident risk with possible loss of life and goods.

Impact severity: Impact is negative but reversible with safe road use sensitization campaigns for 1-2 months before road commissioning. The impact would be short-term but resultant effect long-term if no concerted effort is expended in sensitization of road users and local communities. Likelihood of impact occurrence is medium but severity high where accidents lead to loss of life. Impact significance is therefore *major*.

Impact significance: Major

- (Negative)		Impact Likelihood			
		None	**Low**	**Medium**	High
Impact severit	**Negligible**	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Negligible-Minor	Minor
	Medium	Negligible	Minor	Minor-Moderate	Moderate
	High	Minor	Moderate	**Major**	Major

Impact receptors: This negative impact can occur on any section of the improved road and generally, receptors are all road users and wildlife.

Impact mitigation:

- Potential accident hotspots shall be marked with appropriate road signs.
- Road design shall provide signs warning motorists about pedestrians and animals on the road.
- Speed control provisions such as humps will be installed near schools and approaches to trading centres or large settlements.
- Traffic safety awareness programmes shall be conducted both during construction and use of the road. Training will target teachers (who should train pupils), health workers,

public transport drivers and police. The training will focus on elements of road safety namely: engineering, environment and awareness. The training is expected to last over the entire construction period as provided below:

i. *Once every 2 months:* Training for 100 people from categories: teachers, health workers, public transport drivers and police, and provide them with requisite information packs such as brochures.
ii. *Once every quarter:* Print information packs such as brochures or posters to be used in next training and for display in schools and public places (taxi parks, hotels).
iii. *Twice every month (in 1st and 4th week of each month):* Announcements will be made on local radio stations about road safety targeting pedestrians, school children, taxi and bus drivers and motorcycle cyclists.

Residual Impact: Even after mitigation, residual impact can still be of moderate or high significance.

Impact management: RDA and the three local councils should undertake road safety campaigns for at least 2 months before and 2 months after commissioning the improved road.

7.4.2.1.2 Increased exploitation of natural resources

An improved road will ease access to natural resources, possibly increasing their exploitation. This will be especially the case for charcoal burning and trading. The project road passes through two local forests namely Luakera River National Forest No. 35: from km 2.6 to km 17.1 and Nkomba Protected Forest Area No. 75: from km 78.6 to km 84.6 (0.5 km to 10.0 km LHS). The main threat to the miombo woodlands and forest reserves will result from increased deforestation for the production of stimulated by an improved road, assuming that a better road will result in more traffic, creating a greater demand for wood and charcoal and facilitating easier transport of these products from the project area. The demand for fuelwood/charcoal by the workforce may also result in felling of trees, thereby also having significant long-term impacts.

Impact evaluation: Excessive or illegal exploitation of natural resources would be detrimental to national and local (district –level) goals of sustainable development.

Impact severity: Impact is negative but reversible with good enforcement. The impact would be long-term; its likelihood of occurrence is high. Considering that the problem of charcoal burning and trading is already existing, sseverity is therefore assessed as high resulting in an overall significance level of Major.

Impact significance: Major

- (Negative)		Impact Likelihood			
		None	**Low**	**Medium**	High
Impact severit	**Negligible**	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Negligible-Minor	Minor
	Medium	Negligible	Minor	Minor-Moderate	Moderate
	High	Minor	Moderate	**Major**	Major

Impact receptors:

Potential resources likely to suffer increased exploitation are good standing miombo woodlands in the protected forests.

Impact mitigation:

- District authorities and Forest Department in particular should intensify monitoring activities along road corridor.
- Disturbance to vegetation and soil within forest areas will be prohibited, so no borrow pits or hardstone quarries will be opened in national or local forest reserves, and no camps will be located in or near miombo woodlands or forest reserves.
- In forested areas or woodland, construction works will be confined to the minimum possible width to minimise destruction of forests and woodlands.
- The workforce will not be permitted to buy charcoal. Use of gas or kerosene will be made mandatory in the camps. A central canteen to serve the entire workforce will be set up within the camp which will eliminate the need for fuelwood/charcoal.
- Support will be given to NGOs in the project area to encourage the planting of woodlots and to promote sustainable charcoal production and efficient charcoal use. NGOs identified in the project area are Imiti Ikula Empanga (IIEEDO) in Mwinilunga town and the FCE Kalene Mission.
- In addition to the above, an environmental sensitisation campaign along the project will be initiated during construction to inform the roadside communities about the short-term, long-term and cumulative impacts of deforestation and charcoal production.

Residual Impact: Even after mitigation, residual impact can still be of moderate significance. For example, illegal charcoal burning will continue to take place with or without upgrading the road.

7.4.2.1.3 Improper drainage of stormwater from the road

Upgrading will increase volume and erosive power of runoff from the road/carriageway and discharged onto sinks (grassland, forests or farmlands, etc) adjoining the road.

Impact evaluation: If discharged onto private land and farmlands, erosive stormwater poses a risk of gullies, land degradation and siltation of streams, swamps and rivers. These impacts are already occurring and road upgrade could aggravate them.

Impact severity: Impact is negative but avoidable with good drainage design and construction. The impact would be long-term, its likelihood of occurrence is medium especially in rolling/hilly terrain. Severity of land degradation is medium. Impact significance is therefore Minor Moderate.

Impact significance: Minor-Moderate

- (Negative)		Impact Likelihood			
		None	**Low**	**Medium**	High
Impact severit	**Negligible**	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Negligible-Minor	Minor
	Medium	Negligible	Minor	**Minor-Moderate**	Moderate
	High	Minor	Moderate	Major	Major

Impact receptors: Landowners along the road.

Impact mitigation:

- Road design should provide for erosion protection works at outfall drains.
- Contractor should erect erosion protection measures e.g. scour checks, lining of drains and stepped drains in hilly areas. Regular drains maintenance will also minimize soil erosion.
- Contractor should construct interception ditches, settling ponds to prevent muddy water ingress into surface watercourses.

Residual Impact: After mitigation, significance of residual impact of impaired drainage due to road construction or use would be marginal.

7.5 CLIMATE CHANGE IMPACTS

7.5.1 Road Impact on Climate Change

Vehicle emissions containing greenhouse gasses will be generated both during road construction and operation phases. The project implementation is unlikely to lead to any climate change risks as vegetation clearance will be restricted to areas where civil works will be implemented and furthermore the road project will be undertaken in an area that is already developed. The recommended complementary activities of tree planting are expected to minimize any possible climate change risks.

Vehicle emissions containing greenhouse gasses will be generated both during road upgrade and eventual use. Quantities generated will depend on type, age and number of equipment used during construction while operation-phase emissions will depend on traffic volume. These emissions would have a negligible cumulative negative effect on climate change.

Embodied carbon (EC) associated with construction of the road would also to some extent have climate change effects. EC refers to energy consumed and resultant carbon emissions associated with production of materials used in construction of the proposed road, including extraction and transport of raw materials.

However, potential climate change risks associated with the proposed project are outlined below:

- **Increased traffic**: The improved road will increase vehicular traffic as indicated in the economic feasibility report and the result will be higher greenhouse gas emissions during road use.
- **The highway itself**: CO_2 from road construction and maintenance.
- **Indirect fuel consumption**: Cars that travel on a new highway may need to travel on other roads to get to and from the highway; this will result in some additional vehicle mileage beyond the driving that takes place on the highway itself.

Impact severity: Impact is negative but avoidable with good greenhouse gas reduction measures. The impact would be long-term; its likelihood of occurrence is medium. Impact significance is therefore Minor Moderate.

Impact significance: Minor-Moderate

- (Negative)		Impact Likelihood			
		None	**Low**	**Medium**	High
Impact severit	**Negligible**	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Negligible-Minor	Minor
	Medium	Negligible	Minor	**Minor-Moderate**	Moderate
	High	Minor	Moderate	Major	Major

Impact mitigation: During construction, mitigation actions recommended for Greenhouse gas reduction are:

- **Optimizing transportation:** Transport represents a significant share of GHG emissions from road construction activities (20% to 30% depending on the road and works types). As soon as bitumen, steel, lime or cement are involved, the share of transport in overall road construction emissions exceeds 25 percent and may even rise beyond 30 percent for major roads. It is lower for rural roads involving the use of only local materials, where it is still above 20 percent of overall GHG emissions.
- **Optimizing work zone traffic management**: Proper traffic management practices will limit GHG emissions due to traffic congestion (i.e. minimal on project road) caused by road construction works.
- **Managing overloading**: Optimally loaded trucks hauling construction materials will have lower GHG emissions than over-loaded ones.
- **Use of low roughness:** Fuel consumption of vehicles driving on a road depends, among others, on roughness of road surface. Low roughness will therefore reduce GHG.
- **Use of modern bitumen plants** that have the capacity to minimize carbon emissions.
- **Use of existing material sources:** The proposed project will entail rehabilitating an existing road and as such no significant green areas will be opened up. There are however, measures that will be applied to reduce the overall embodied carbon. For example, wherever feasible use of existing borrow pits rather than opening new sites will reduce embodied carbon associated with sourcing and processing aggregates.
- **Tree planting along the road:** Another mitigation measure recommended for the operational phase is planting trees along the road, which would in part be undertaken for carbon sequestration, as well as beautification. Trees and shrub planting will be required to be species of local provenance, that will be suitable for the local climate and not susceptible to impacts from vehicle emissions and that require little maintenance. It is highly recommended that RDA procures professional services for tree planting to ensure that the right species are planted.
- **Use of equipment in good mechanical condition:** The contractor should ensure all motorised equipment is in good mechanical condition and regularly serviced to reduce emissions they generate.

Residual Impact: Even with foregoing design provisions, there is expected to be residual climate change impacts associated with construction and use of the road.

Impact mitigation: Contractor to use low emission equipment which are in good mechanical condition and regularly serviced.

7.5.2 Impacts of Climate Change on the Road

Transport can be vulnerable to many different types of weather conditions, of which, some of them could be exacerbated with climate change. Climate changes relate to extreme weather conditions (e.g. storms, extreme precipitations, extreme temperatures) which on their turn

may result in severe consequences for the physical environment (e.g. floods, etc) and represent risks for transport infrastructures and operations. Both temperature and precipitation represent weather stress parameters that can first contribute to initiate and accelerate some damaging effects.

- ***Damage to the road:*** Higher temperatures can cause pavement to soften and expand. This can create rutting and potholes, particularly in high-traffic areas and can place stress on bridge joints/ structures. With these changes, it could become expensive to build and maintain roads. Transport conditions are also highly affected by extreme weather events such as heavy rainfall. Heavy rains may result in flooding, which could disrupt traffic, delay construction activities, and weaken or wash out the soil and culverts that support roads and bridges. Exposure to flooding also shortens the life expectancy of road. Landslides and wash-outs could also occur more frequently, as saturated soils are exposed to more rainwater especially in the hilly areas;
- ***Bridge scour:*** This is the removal of sediment from around bridge abutments or piers. Scour, caused by swiftly moving water, can scoop out scour holes, compromising the integrity of a structure. Bridge scour is basically induced by the fact that water normally flows faster around piers and abutments making them susceptible to local scour. Therefore, increased flow velocities would result in scouring and weakening of the bridges.

Impact severity: Impact is negative but avoidable with good drainage design and construction. The impact would be long-term, its likelihood of occurrence is medium especially in hilly terrain. Severity of land degradation is medium. Impact significance is therefore Minor Moderate.

Impact significance: Minor-Moderate

- (Negative)		Impact Likelihood			
		None	**Low**	**Medium**	High
Impact severit	**Negligible**	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Negligible-Minor	Minor
	Medium	Negligible	Minor	**Minor-Moderate**	Moderate
	High	Minor	Moderate	Major	Major

Impact mitigation:
Ensure adequate design and maintenance of road infrastructure.

(i) ***Floods:*** The points prone to floods along the road the low-lying sections and some stream crossings which have dambo. With the surge in climate change (i.e. in an event of unusually high rainfall), these areas might be affected. In the design however, hydrology assessment was done and intervention measures put in place to mitigate impacts of floods on the infrastructure to be constructed.

(ii) ***Use surface dressing that is characteristic to the local weather conditions.*** *Temperature:* In the design, minimum and maximum temperatures of 3ºC and 36ºC were considered should there be a temperature variation between these extremes.

(iii) Maintenance and repairing activities have to be planned long time in advance to avert any failures.

Entity responsible for impact mitigation:
RDA should ensure regular monitoring and maintenance of the road and its associated structures to keep them in good conditions.

7.6 GENDER IMPACTS

Gender equity in the transport sector in Zambia seeks to strengthen women's participation and benefit from road projects. This is especially significant considering that roads are used by the majority of the rural poor, including women, to secure their livelihoods, access markets, healthcare and public institutions such as schools and places of worship. Participation of women in road construction is a desired gender-related benefit but this may be constrained by the fact that road construction in Zambia is predominantly male-dominated which disadvantages women involvement in provision of labour.

Reconstructing the proposed road would have both positive and negative impacts. It was observed that the project road is used by the majority of people, including women, to secure their livelihoods, access to markets, healthcare and public institutions such as schools and places of worship.

Impact identification: Construction and use of the road project will have the following potential gender impacts:

7.6.1 Construction-phase Risks and impacts:

- There will be opportunity for women to sell meals and drinks to construction workers, which is a common positive impact for road construction projects in Zambia.
- Construction of road through trading centres and associated dust impacts would equally affect both genders (men and women traders). This is a negative impact.
- There will be opportunity for employing women during road construction, a positive impact, although the number of women hired may be less than that of men for the reason that road contractors consider women less suited for strenuous menial labour. However, a gender-responsive approach would be to hire women in roles they are best suited to handle and it is proposed that 25 percent of the workers or project employees are women. Other possible hindrances to participation of women in road construction employment are:
  - ✓ Farming activities in the rainy seasons demand a lot of work by women, which may impede their employment in road construction.
  - ✓ Married women may benefit less from construction employment because their spouses may dictate whether they work on road project or not. This choice being solely a responsibility of an unmarried woman means that single women might benefit from the proposed road construction jobs more than their married counterparts.
- Roadworks which block access to private property (i.e. homes) or institutions (i.e. schools, healthcare facilities, or places of worship) would affect women and girls more than men who more easily would jump across ditches and obstacles.
- Spread of HIV/AIDS and teenage pregnancy are also reportedly common around workers camps.

7.6.2 Gender Risks and impacts during Operation:

- A good road will ease access to healthcare and while this is a benefit for both men and women, the latter will particularly benefit from quick and safe transport to medical facilities, during medical emergencies such as labour. A good road and transport services can enhance access to HIV/AIDS care services.
- Improved opportunities for income generating activities through roadside markets/ kiosks which are usually owned and operated by women.

Impact severity: Unless adequate sensitization of all community members along the road corridor is undertaken by contractor, likelihood of the impact occurring is medium (considering some level of awareness among the general populace). Duration of the above-mentioned gender ills will be short-term ending with completion of road construction but associated social and health effects are long-term and irreversible. The risk HIV/AIDS makes this impact of high severity resulting in an overall significance level of *major*.

Impact significance: Major

- (Negative)		Impact Likelihood			
		None	**Low**	**Medium**	High
Impact severit	**Negligible**	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Negligible-Minor	Minor
	Medium	Negligible	Minor	Minor-Moderate	Moderate
	High	Minor	Moderate	**Major**	Major

Impact mitigation:

- During road construction, women can be involved in a wide range of activities including traffic control, store-keeping, security, painting stone pitching, beautification/ landscaping and sweeping.
- The contractor should use gender-sensitive language such as: *"Go Slow, Work in Progress"* instead of *"Go Slow, Men at Work".* This, coupled with women's visibility in road works would, contribute to women's empowerment as well as breaking the stereotype that road construction is a preserve of men.

CHAPTER EIGHT

8.0 ENVIRONMENTAL AND SOCIAL MONITORING & MANAGEMENT PLAN

8.1. INTRODUCTION

This second part of the ESIA report outlines the measures to be undertaken by RDA to ensure sustainable management of the potential positive and negative impacts of the upgrading of the Mwinilunga Jimbe road. These measures serve to enhance the benefits that can accrue from the positive impacts while adequately mitigating against the effects arising from the negative impacts. This Environmental and Social Management Plan (ESMP) therefore provides guidance regarding the various interventions and measures to be effected during both the construction and operational phase. It provides a framework for the most acceptable environmental standard of implementing the road project.

8.2. ENVIRONMENTAL MANAGEMENT PLAN

The Environmental and Social Management Plan is prepared to show how site-specific concerns and mitigation measures are addressed through the detailed design, pre-construction, construction and post-construction / operation phase of the project. The key stakeholders in the environmental management activities for the upgrading of the road are: Road Development Agency-Environmental and Social Management Unit, Zambia Environmental Management Agency, the Consultant, the Contractor, Government agencies, Local Authorities, the affected Local Communities, the Road users and to some extent the Public.

The ESMP has been developed with project knowledge and information available to date. Some of the Project's final details, such as proposed locations of construction camps, actual locations of borrow areas to be used by the Contractor, disposal areas for construction debris among other issues, are unknown at the present time. As project commencement and scheduling plans are developed and changed, components of the ESMP might require amending. This is therefore a working document, which can be updated whenever new information is received or site conditions change.

The ESMP consists of three main components namely:

- Implementing the Risk and Impact Mitigation Plan;
- Monitoring the implementation of the ESMP; and
- Institutional Framework for Monitoring, Reporting and Supervision of the ESMP.

8.3. OBJECTIVES OF THE ESMP

The Environmental and Social Management Plan describes the range of environmental issues associated with the project and outlines corresponding management strategies that will be employed to mitigate potential adverse environmental impacts. The ESMP conveys the project's environmental and social constraints.

The project will comply with all local laws and regulations, which seek to ensure that the construction work does not adversely affect the environment and social community resources. The Supervising Consultant may periodically revise the ESMP in consultation with the Contractor, and subject to the approval from the Road Development Agency (RDA). Revisions may be made to accommodate changes in work, weather and site conditions.

The ESMP should be made available to all Project Staff.

The main objectives of the ESMP are:

- To bring the project into compliance with applicable national environmental and social legal requirements;
- To outline the mitigating/enhancing, monitoring, consultative and institutional measures required to prevent, minimize, mitigate or compensate for adverse environmental and social risks and impacts, or to enhance the project beneficial impacts; and
- To address capacity building requirements within the relevant authorities and agencies if necessary.

8.4. RISK AND IMPACT MITIGATION PLAN

The Risk and Impact mitigation plan allocates the responsibilities for implementation of the proposed mitigation measures to the various stakeholders and indicates at what stage in the project they should be performed. The Plan is presented in this chapter under Table 8.1 and it addresses the negative impacts that will be generated by the construction works and presents the associated cost estimates of mitigating the adverse impacts. The key components of the proposed risk and impact mitigation plan are:

- Employment creation
- Income generation
- Land and Soil
- Vegetation
- Sedimentation
- Protected areas
- Surface water
- Groundwater
- Air Quality
- Noise
- Solid and Hazardous Waste
- Properties in the Road Reserve Areas
- Archaeology and Cultural Heritage
- Road Traffic and Safety
- Occupational Health & Safety
- Community Health and Safety
- Vulnerable Groups
- Employment (Child labour and discrimination)
- Local Economy

8.5. RESPONSIBILITIES

In order to ensure the sound development and effective implementation of the ESMP, it will be necessary to identify and define the responsibilities and authority of the various persons and organizations that will be involved in the project. The following entities will be involved in the implementation of the ESMP:

8.5.1. Ministry of Infrastructure Housing and Urban Development

The Ministry will play a role in ensuring the RAP guidelines are implemented through their representative in the RDA Board of Directors and would mainly be involved in supervision and ensuring compliance with policies of the transport sub-sector.

The Department of Valuation and Property Management (DVPM) which is located in the Ministry of Infrastructure, Housing and Urban Development is responsible for the preparation of Valuation Reports upon request from a user Ministry or Institution such as RDA. The Valuation reports form a basis for the fair compensation of project affected persons that may have their structures affected by the upgrading of the Mwinilunga to Jimbe road project. Further DVPM will play a big role in the resolution of disputes relating to the valuation amounts as part of the grievance redress mechanism.

8.5.2. Road Development Agency (RDA)

The project road is under the jurisdiction of the RDA. Therefore, the responsibility for ensuring that mitigation measures specified in this ESMP and the contract documents are implemented will lie with RDA. The Road Development Agency through its Environmental and Social Management Unit-ESMU will implement the RAP in conjunction with respective district local governments of Mwinilunga and Ikelenge Districts and other key stakeholders such as traditional leaders. RDA will mobilise the required funds and effect payments to the PAPs. It will also have the overall mandate of ensuring that the RAP is smoothly implemented by coordinating with all relevant stakeholders. RDA will pay the affected PAPs before the commencement of civil works.

8.5.3. Road Transport and Safety Agency (RTSA)

Road safety and accident prevention is the responsibility of the Ministry of Transport and Logistics through the Road Transport and Safety Agency (RTSA) and the Ministry of Home Affairs through the Traffic section of the Zambia Police. It will be the responsibility of these institutions to ensure that road safety policies detailed below are implemented:

- Mandatory use of seat belts;
- Compulsory driver training and testing;
- Prohibition and punishment of driving while impaired by drugs or alcohol;
- Traffic safety education for children; and
- Testing and inspection of all vehicles according to national vehicle safety standards.

The Ministry of Home Affairs and Traffic Police should also ensure the following:

- Ensuring that post-accident emergency assistance and medical care are available to all accident victims;
- Developing an accurate accident data recording system;
- Conducting research and regularly monitoring the state of road safety;
- Determining the need for further road improvements (based on accident data); and
- Encouraging research and development of new, safety-oriented road technologies.

8.5.4. Zambia Environmental Management Agency (ZEMA)

The responsibility of the Zambia Environmental Management Agency (ZEMA) is to exercise general supervision and co-ordination over all matters relating to the environment and to be the principal instrument of Government in the implementation of all policies relating to the environment and to ensure that all mitigation measures proposed are actually implemented.

ZEMA will be expected to undertake compliance monitoring activities during the road construction phase to ensure that the Environmental Management Act is being adhered to.

8.5.5. Resident Engineer and Environment / Social Officer

The Resident Engineer (RE) will be appointed by the Supervising Consultant and will be required to oversee the construction programme and construction activities performed by the Contractor, in compliance with the ESMP. The RE should have an Environmental and Social Officer (ESO) in his team to co-ordinate all aspects of the environment during project implementation.

During construction, the ESO will be responsible for the following tasks:

- Updating environmental aspects (not covered in the ESIA / ESMP) during project implementation;
- Auditing environmental and safety aspects at the work sites; S/He shall participate in the definition of the no working-areas and the location of campsites, borrow pits, quarries and other areas;
- Recommending solutions for specific environmental and social issues;
- S/He shall facilitate the creation of Community Liaison Groups and shall monitor the compliance of the social clauses of the Contract, in terms of local labour force and HIV/AIDS campaign;
- Overseeing strategies for sensitizing the local population on health and safety problems;
- Attending consultations held at key stages of the project with the community and interested parties;
- S/He will be required to liaise with the respective Environmental Authorities on the level of compliance with the ESMP achieved by the Contractor on a regular basis for the duration of the contract;
- Controlling and supervising the implementation of the ESMP;
- Preparing quarterly environmental and social progress or "audits" reports on the status of implementation of measures and management of work sites.

8.5.6. Contractor

The Contractor will be appointed by the RDA and will be required to comply with the requirements of the ESIA/ ESMP and the Standard Specifications for Road Works in Zambia, which include specifications for Environmental Protection and Waste disposal, Borrow Pit and Quarry Acquisition and Exploitation, Landscaping and grassing and so on. The Contractor will also be required to prepare and implement the Contractor - Environmental and Social Management Plan (C-ESMP) during the mobilisation phase prior to the commencement of civil works. The Contractor will be expected to ensure that safety issues are prioritized to avoid accidents that may derail the project. The Contractor is also expected to cultivate a cordial working relationship with the traditional leadership and the community at large along the road corridor through the engagement of Community Liaison Officers.

8.5.7. Local Authorities

The relevant departmental officers in the local authorities will where necessary during project implementation provide the necessary permits and advisory services to the project implementers. Some of the areas for which the officers will be required to provide support include:

- Approving locations for establishing work camps;

- Liaising with the NGOs in the project area to assist in the sensitization campaigns for HIV/ AIDS and public health to the workforce and the local community;
- Identifying locations for disposal of construction debris; and
- Issuing permits or relevant documentation for health and safety monitoring in accordance with local health and safety legislation and / or ILO standards.

Local authorities are key players in the mobilisation of local people's participation in developmental programmes such as the rehabilitation of the Mwinilunga to Jimbe road.

8.5.8. Community

The community along the road corridor will be expected to provide support to the Contractor(s) for the smooth implementation of the project. They will be expected to provide labour which is a major input in the execution of the civil works. The community members will not be expected to involve themselves in acts of vandalism that are a drawback to the civil works. They will be expected to report any such acts to relevant authorities for action.

8.5.9. Compensation

RDA will oversee all matters relating to compensation on the road project. This will include compensations that will be paid through the works contract by the Contractor. Progress of land acquisition will be monitored by the RDA. An independent consultant will be engaged to undertake quarterly review of implementation activities and submit annual reports to the RDA.

8.5.10. Monitoring and Reporting Arrangements

Monitoring will verify if predicted impacts have actually occurred and check that mitigation actions recommended in the ESIA are implemented and ensure their effectiveness. Monitoring will also identify any unforeseen impacts that might arise from road project implementation.

Who monitors and how: Regular environmental and social monitoring will be undertaken by the RDA (ESMU) while ZEMA will conduct "third party monitoring" in accordance with its mandate under the Environmental Management Act of 2011. Another government agency that may undertake "third party monitoring" is the Occupational Health & Safety Department in Ministry of Labour & Social Security. This unit has authority to inspect any facility for compliance with national requirements on safety in workplaces. Monitoring will be done through site inspection, review of grievances logged by stakeholders and *ad hoc* discussions with potentially affected persons.

Frequency: Monitoring will be undertaken monthly over the construction period.

Reporting: Detailed monthly monitoring reports shall be compiled by the contractor's environmental officer under oversight of the supervising engineer (SE). The reports will be based on records kept as per requirements of the contract to be signed. These detailed reports with evidence of compliance shall be prepared and appended to summary monthly reports.

8.6. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

The set of instructions provided in this Chapter and summarized in Table 8-1 constitute the Environmental & Social Management Plan. The following issues require special attention:

- Material sources, especially the quarry sites and borrow bits;
- At the locations for livestock grazing and crossings, signage must be erected.

- Designs must take into consideration the soil conditions especially the poorly drained soil areas;
- Informative signs shall be considered for all social amenities (educational institutions, health centers, trading centres etc);
- The Contractor shall ensure that all pertinent permits, certificates and licenses have been obtained prior to any activities commencing on site and are strictly enforced / adhered to; and
- The Contractor shall maintain a database of all pertinent permits and licenses required for the contract as a whole and for pertinent activities for the duration of the contract.

Table 8-1 presents a tabulated environmental and social management plan. It includes the impacts, objectives for mitigation, actual mitigation measures, and indicators for actions, responsible parties and the estimated costs.

Table 8-1: Environmental and Social Monitoring Plan (ESMP)

Aspect	Objective	Mitigation	Monitoring Indicators	Responsibility	Time Frame	Cost Estimates
Land and Soil	• To conserve soil and avoid stripping of top soil	• Direct road runoff away from the road by installing side drains and mitre drains; • Embankment side slopes should be planted with shrubs and grasses to stabilise them and prevent erosion; • Replant sections already completed immediately; • Topsoil and overburden should be stored in separate piles; • The spoil heaps should be covered to reduce the amount of soil washing/blowing away. • On areas where the risk of erosion is evident, stabilize the areas and prevent erosion. These may include, but not limited to; ✓ Confining construction activities; ✓ Using cut off drains; ✓ Using mechanical cover or packing structures such as geo-fabric to stabilize steep slopes or hessian, gabions, mattress and retaining walls; ✓ Mulch or chip cover; ✓ Constructing anti-erosion berms	• Excavated materials and excess earth will be kept at appropriate sites approved by the Supervising Engineer; • The earth dumping sites will be designed in such a manner as to facilitate natural water discharge; • The erosion prevention measures must be implemented to the satisfaction of the RE; • Where erosion does occur on any completed work/working areas, the Contractor shall reinstate such areas and areas damaged by the erosion at his own cost and to	• RDA – ESMU • Supervising Engineer	During Construction Phase	Cost not applicable as this is part of the construction cost included in the BOQ and Tender Documents/Contract

			the satisfaction of the RE and ESO.			
	• To contain any petroleum spillage from spreading in case of an accident.	• Maintenance of machinery, bunding the garage, and directing spills to an oil sump which should be emptied into a designated final disposal site; • Bulk oil storage tanks must be contained in a concrete bund and the bunded area must have a concrete floor, with no drain outlet; and • The workshop should be entirely surrounded by a drain leading to an interceptor.	• Monitoring at specified stations affected; and • Record of Analysis • Reports on site.	• RDA – ESMU • Supervising Engineer	During Construction Phase	• 200,000.00
Vegetation	• To promote ecological conservation	• Conduct training on ecological conservation measures for all construction workers. • Encourage re-vegetation after construction activities are finished • Limit clearing of vegetation to what is absolutely necessary; • Keep construction width to a minimum • No use of herbicides; and • Provide workforce with alternatives to fuelwood and charcoal.	• Number of trainings conducted on ecological conservation • Number of places re-vegetated	• RDA – ESMU • Supervising Engineer	During Construction Phase and Operation Phase	• 300,000.00

Sedimentation	• To reduce sedimentation in rivers	• Erosion control measures must be implemented to prevent introduction of sediment-laden runoff into surface waters (e.g. gabions, hay bales, silt screens, settling basins, sediment traps) • Sides of drainage channels shall be planted with grass or stone pitched	• Number of places re-vegetated • Number of erosion control measures put in place	• RDA – ESMU • Supervising Engineer	During Construction Phase And Operation Phase	300,000.00
Protected Areas	• To minimise disturbance to the protected forest reserve areas. • Retardation of vegetation growth due to contamination from dust particles and gas emissions.	• Limit clearing of vegetation to what is absolutely necessary; • Provide workforce with alternatives to fuelwood and charcoal.	• Hectarage of the Forest Reserves	• RDA – ESMU • Supervising Engineer	During Construction Phase	N/A
Surface and Underground water	• To avoid polluting the water resources that communities depend on	• Control the amount of material that is required to be laid onto the crossings, and ensure that this material is applied carefully, and immediately compacted; • Rehabilitation of the culverts and swamp crossings should be done during the dry season, wherever possible; • Ensure that construction debris is disposed of in a sensible manner and not thrown into the swamps and rivers, or along the roadside; • Wastewater and sewage from the contractor's yard must also be	• Water quality	• RDA – ESMU • Supervising Engineer	During Construction Phase and Operational Phase	350,000.00

		disposed of properly; and • Construct a septic tank at construction yard and at the workmen's camp where all wastewater and sewage should be disposed of.				
	• To protect surface water pollution through filtering finest particles in water current.	• Design drains and culverts to capture and slow down runoff water and settle sediment; and • Stores oil and fuels at contained locations away from drains.	• Visual assessment of suspended solids; • Record of Analysis reports on site.	• RDA – ESMU • Supervising Engineer	During Construction Phase	150,000.00
Air Quality	• To reduce pollution of the ambient air	• Suppress dust through water sprinkling by using a water bowser or the application of molasses or other palliatives on the road surfaces; • Wet quarry loads being transported in open trucks; • All workers should wear dust masks at all times when at the sites of high dust generation; • Warn the neighbourhood of possible generation of dust beyond normal levels; and • Construction machinery should be well maintained and low sulphur diesel should be used.	• No of complaints received from stakeholders	• RDA – ESMU • Supervising Engineer	During Construction Phase	400,000.00
Aspect	**Objective**	**Mitigation**	**Monitoring Indicators**	**Responsibility**	**Time Frame**	**Cost Estimates**
Noise	• To avoid exposure of the	• Special care should be taken when construction is taking place	• No. of complaints received from the	• RDA – ESMU • Supervising	During Construction	300,000.00

	community living around the project area and workers to noise nuisance	near sensitive receptors such as schools and clinics; • To the extent possible, heavy vehicles should not be used at night across populated areas; • Ensure that construction equipment is operating optimally and with operational noise mufflers where possible. • Controlled blasting shall be used to just weaken the rock for excavation with earth moving machines. • Protective clothes for ear protection shall be provided to all the workers and inductions shall be conducted • Operations shall be conducted with observation by safety officers and all activities shall be conducted during the normal working hours of the day to avoid noise disturbance at night • Periodic noise monitoring shall be conducted to ensure that the noise emitted is below the international threshold limit value of 85dBA outside the plant • The crushing plant shall be frequently serviced to ensure operations are within the manufacturer's specifications. • Notify the community about works due to take place in any particular road section at least 5 days before construction is due to commence in their vicinity; • Establishment of signboards near	surrounding communities	Engineer	Phase	

		sensitive receptors like schools, places of worship etc.				
Aspect	**Objective**	**Mitigation**	**Actions/Indicators**	**Responsibility**	**Time Frame**	**Cost Estimates**
Solid and Hazardous wastes	• To ensure the that generated waste is disposed in accordance with the law and best practices.	• Store construction waste, garbage, and domestic and human waste in designated places only and remove and dispose regularly. • Ensure that waste materials are properly disposed of at suitable locations. • Inspect waste storage areas and facilities periodically. • The contractor should develop a waste management plan; • All personnel shall be instructed to dispose of all waste in a proper manner • Contractor shall provide litter collection facilities; • The final disposal of the site waste shall be done by approved waste disposal agents;	• Waste disposal Registers	• RDA – ESMU • Supervising Engineer	During Construction Phase	300,000.00
Properties in the Road Reserve area	• To ensure that affected people are not left homeless	• It is estimated that about 1,497 PAPs will lose their houses/kitchens or trading shops. The owners of these structures will however be compensated at current market value in accordance with the AfDB guidelines.	• Number of property owners compensated • Valuation Report	• RDA – ESMU • Supervising Engineer	During Construction Phase	44,410,898.40

Archeology and Cultural Heritage	• To preserve archaeological and cultural heritage	• Construction activities to be confined to approved site areas • Chance finds to be reported to National Heritage Conservation Commission	• Number of finds	• RDA – ESMU • Supervising Engineer	During Construction Phase	100,000.00
Road Traffic and Safety	• To minimise the occurrence of road traffic accidents on the project	• Control of dust emissions from the roads • Limiting construction activity during day time working hours • Install speed humps at schools and settlements to slow down traffic • Install road signage e.g. speed limits • Hold regular sensitization meetings with the surrounding communities • Hold regular toolbox talks with drivers and equipment operators	• No of accidents • No of toolbox talks • No. of community sensitization meetings	• RDA – ESMU • Supervising Engineer	During Construction Phase and Operation Phase	200,000.00
Occupational Health and Safety	• To reduce occurrences of occupational health and safety accidents	• The Contractor shall comply with all standard and legally required health and safety regulations as promulgated by Factories and Other Places of Work Act and also the ILO Guidelines on Safety and Public Health in the construction activities; • The Contractor shall provide a standard first aid kit at the site office; • There should be a Safety Officer on site who has first aid training and knowledge of safety procedures; • Speed limits appropriate to the vehicles driven are to be observed	• Number of first aid kit provided on site. • Number of PPE issued to workers • Numbers of accidents recorded	• RDA – ESMU • Supervising Engineer	During Construction Phase	350,000.00

		at all times on access and haul roads; • No unauthorized firearms are permitted on site; • The Contractor shall provide the appropriate Personal Protective Equipment for staff. • Limiting construction activity during day time working hours • Install speed humps at schools and settlements to slow down traffic • Install road signage e.g. speed limits				
Community Health and Safety	• To reduce transmission of diseases; • To create awareness of the HIV/AIDS.	• The Contractor shall be responsible for the protection of the public and public property from any dangers associated with construction activities, and for the safe and easy passage of pedestrians and traffic in areas affected by the construction activities; • All works which may pose a hazard to humans and domestic animals are to be protected, fenced, demarcated or cordoned off as instructed by the RE. If appropriate, symbolic warning signs must be erected; • The HIV/AIDS prevention campaigns should be conducted at the camps as well as in the trading / market centres. The contractor shall take an active role in civic and public health education to his employees. The	Implement STD and HIV/Aids awareness programme to the construction workers and the community	• RDA – ESMU • Supervising Engineer	During Construction Phase	900,000.00

		campaign shall include the training of facilitators within the workers, information posters in more frequented areas in the campsite and public areas, availability of promotional material (T-shirts and caps), availability of condoms (free), and theatre groups. • The contractor will provide condoms at appropriate places in the work camps. The campaigns will be continuously done by the relevant Government organization even during operation phase of the road. • Train peer educators • Work with schools to target the youth				
Vulnerable Groups	• To protect vulnerable groups during the project implementations	• Provide equal employment opportunities to the vulnerable groups • Reserve 15% jobs to the women • Children below the age of 18 should not be employed on the project	• Number of women and disabled people employed on the project	• RDA – ESMU • Supervising Engineer	During Construction Phase	50,000.00
Discrimination On employment opportunities	• Employment of Local communities	• To avoid conflicts with the local people on employment is it proposed and important that the Contractor employs the locals in liaison with local leaders and administration in unskilled and semi-skilled duties; • To promote the livelihood of vulnerable groups such as women, there will be a need to undertake sensitization and	• Employment of local people • Specific jobs will be exclusive for women	• RDA – ESMU • Supervising Engineer	During Construction Phase	50,000.00

		awareness campaigns to the local community to promote gender equity in employment during the road construction works. • Contractor to make deliberate efforts to include and retain women in construction				
Local Economy	• Employment	• For unskilled workers priority will be given to local people • Construction materials and food items to be obtained locally	• Number of local people employed	• RDA – ESMU • Supervising Engineer	During Construction Phase	N/A
					Total cost	**48,360,898.40**

8.7. ESMP Implementation and Monitoring budget

Table 8-2: Environmental mitigation, management and monitoring cost estimates

	Mitigation Measures	Quantity	Unit Cost (ZMW)	Total Cost (ZMW)
01	Compensation	About 1,497 Households	Varying for structures, Land, Water Points and Fruits	44,410,898.40
02	Conservation projects, awareness & sensitization	36 Months	Lumpsum	334,950
02	Road safety awareness & sensitization	36 months	Lumpsum	72,439
04	Public traffic flow management during construction	36 months	"	35,975
05	HIV/AIDS awareness and education including Gender awareness & Sensitization	36 months	"	300,000
06	OHS provisions for workers	36 months	"	60,365
07	Erosion and drainage control	36 months	"	73,780
08	Air and water quality monitoring	36 months	"	49,329
09	ESMP Management and Audits	36 months	"	182,926
10	Institutional Collaboration and Monitoring of ESMP	36 months	"	300,000
	Grand Total			**45,748,223.40**

8.8. ENVIRONMENTAL HAZARD MANAGEMENT

The upgrading of the Mwinilunga Jimbe road could entail occupational hazards/ risks and accidents especially involving motorized road construction equipment, asphalt plant and stone quarries. The following measures are proposed to control this risk:

(a) Accidents from equipment: Only trained/ certified operators will operate motorized equipment.

(b) Blasting explosives safety: During road construction, the contractor will ensure the following:

- Stone blasting is only done by licensed blasters.
- All explosives are delivered to quarry sites (under security escort as Zambia's security requirements demand) on the day of blasting and any remnants returned into security custody after blasting. After each blast, site inspection will be conducted for un-detonated explosives.
- Advance warning is given to local communities near quarry sites before a blasting episode.
- After each blasting incident, inspection is conducted in communities around quarry sites to identify any offsite damage to private property, which should be duly and equitably compensated.
- All workers should be adequately protected from risk of fly rock and blasting noise.

(c) **Risk of burns/ scald at asphalt plant:** This risk will be averted by contractors using only licensed operators following stringent safety guidelines and operation procedures. Operations involving hot bitumen shall be limited to daytime in adequate natural light.

(d) **Fire safety:** Fire safety equipment and personnel will be provided in workers' camp. Warning signs will be provided at areas of potential fire source, e.g. at fuel storage areas.

(e) **Medical emergency response:** The contractor will have a medical clinic and a standby vehicle to immediately transport any accident victims to a nearby hospital (i.e. Mwinilunga, Kalene Mission General Hospitals). *First Aid* facilities will be provided on construction sites, equipment yards and in camps.

(f) **Oil/ fuel spills:** Accidental oil and/ or fuel spills would occur when the contractor's trucks or vehicles are involved in road accidents or negligence of staff while on duty. Accidents may be caused by improper use of equipment, mechanical faults in equipment or vehicles among others. Spills or leakages would result in contamination of soils and water resources with hydrocarbons. Hydrocarbons and particulate matter if released into the soil will affect its productivity and pose a health risk to the community, animals and plants around. In water resources, it would affect the aquatic vegetation and fauna in addition to disrupting water supply to the community that rely on these water resources.

(g) No vehicle or equipment shall be allowed to be used if any oil or fuel leak is observed. The contractor shall have spill control equipment on standby both at the workers camp and the road construction site to ensure that any leakage or spill is contained and cleaned on time.

8.9. ACTION PLAN FOR INCIDENTS & ACCIDENTS

8.9.1. Introduction

Industrial injuries create a no-win situation for everyone involved. Employees experience pain, suffering and incapacitation while the company suffers from the loss of the injured person's contributions. This section presents environmental management procedures for activities with potential to cause harm to human health and the environment. The rationale is to provide a systematic approach to the manner in which environmental management shall be conducted. The section also provides a foundation for developing an Environmental Management System (EMS) for the project.

8.9.2. Objective

The general objective is to systematically establish and implement minimum SHES requirements for contractors and visitors in order to minimize non-compliances and prevent environmental and safety incidents that may be caused by contractors. In addition, it will help contractors to ensure that contractors and visitors comply with provisions of the Occupational Health and Safety Act No. 36 of 2010.

8.9.3. Scope

These procedural requirements shall apply to all contractors and visitors conducting work along the road project. Major issues shall include environmental and safety best practices and all visitors and contractors have a duty to care.

8.9.4. Procedures

RDA through its contractor is expected to integrate the procedures into the appropriate work activity and employees are expected to apply them on the job.

8.9.5. Dissemination

During construction period, the contractor shall avail this plan to all his/her supervisory and management personnel.

8.9.6. Institutional Arrangements:

The primary oversight to ensure mitigation actions are implemented will rest with the RDA's Directorate of Construction and Rehabilitation working with the Environmental and Social Management Unit under the Directorate of Planning and Design. The Zambia Environmental Management Agency will conduct is regulatory supervisory and monitoring roles.

RDA shall require contractors to comply with this ESMP and assign a fulltime staff - Environmental and Safety Officer (ESO) to undertake environmental supervision during construction. RDA confers full mandate to the supervising engineering consultant (SEC) to supervise the road project on a day-to-day basis. The SEC will oversee the work of the contractor through an environmental specialist. This specialist will provide guidance to the contractor's Environmental Officer in undertaking his/her own responsibilities, including reporting.

8.9.7. General Procedure Requirements

1. It is mandatory for the main contractors and all sub-contractors to go through Safety, Health, Environmental and Social (SHES) induction before performing any activity or visiting any construction site.
2. After the induction, contractors shall at least be able to understand the basic SHES requirements with more emphasis on environmental and safety issues.
3. No work shall be performed by any contractor without a SHES Permit to Work which shall be approved by both the Environmental and Safety Officer (ESO) and the Resident Engineer (RE).
4. The ESO shall keep signed records of all contractors inducted and cumulative figures of the number of inductions shall be reported in monthly reports.
5. Prior to performing any activity, a qualitative and/or quantitative SHES risk assessment shall be conducted and activities with high risk shall have corrective measures proposed. The risk assessment shall be reviewed by the both the ESO and RE and once approved; a copy shall be kept for future reference.
6. All contractors shall keep records of SHES incidents encountered in the past and these shall form part of the daily SHES discussion topics.
7. All the machinery for contractors shall be fit for the job and proof of fitness specifically the servicing schedule and last date serviced shall be provided before commencement of work.
8. All the machine operators shall provide proof of competence (licence) to operate machinery.

9. All environmental and safety incidents under the contractor shall be reported to the RE by the ESO and corrective measures shall be implemented by the contractor.
10. Contractors working for periods of more than 30 days shall be required to submit a monthly SHES report to the RE within 7 days following the reporting period.
11. It shall be the duty of each contractor to provide the right PPE to workers.
12. It shall be the duty of contractor to ensure that their working places have met the minimum SHES requirements. These requirements shall depend on the nature of activity. Examples include hydrocarbons spillage containment facilities, adequate working space, adequate lighting, use of hazard barrier tapes where necessary and use of waste bins.
13. Working under the influence of alcohol or drugs shall never be tolerated and the ESO and RE shall conduct random alcohol tests. Refusal to be tested shall render such employees to be dismissed from the construction site with immediate effect. This rule shall apply to everyone.
14. Daily safety talks shall be conducted before start of each working day and a register of participants shall be kept by supervisors.

8.9.8. Specific Action Plans

8.9.8.1. Hazardous Waste & Fuel Management Procedures

The major types of hazardous waste that shall be generated are used batteries, used oil, used oil filters and used energy saving lights.

This section describes procedural issues for hazardous waste management. Alongside these, the preferred options shall be to avoid generation or reduce generation hence the waste management hierarchy in Figure 8-1 below shall apply.

Figure 8-1: Waste Management Hierarchy

8.9.8.1.1. Objectives

- To protect human health and the environment by managing all forms of hazardous waste in an environmentally and socially acceptable manner.
- To comply with provisions of the Hazardous Waste Management Regulations No. 125 of 2001.

8.9.8.1.2. Scope

- These procedure requirements shall cover generation, storage, transportation, treatment and disposal.

8.9.8.1.3. Key Words

1. **Hazardous waste: -** The term means waste, including objects, articles or substances, which are poisonous, corrosive, irritant, explosive, inflammable, toxic or harmful to man, animal, plant or the environment.

2. **Hazardous waste disposal site: -** This means the legally authorized land on which hazardous waste disposal facilities are physically located.
3. **Hazardous Waste Management: -** It applies to the generation, handling, separation, collection, transportation, storage, treatment, recycling and disposal of hazardous waste, including after-care of disposal sites.

8.9.8.1.4. Procedure Requirements

1. **Fuel management: -** A fuel bowser shall be used for refueling purposes, which shall be installed at the contractors' construction camp. A concrete lined parking area for the bowser shall be constructed and this shall be bunded. Support facilities shall include a concrete lined perimeter drain which shall be connected to the oil/water separator for the workshop. The parking area shall be big enough to accommodate refueling activities. Explosion management and prevention facilities shall include fire extinguishers, sand buckets and warning signs. Other facilities shall include a high-pressure water source and a lightening arrester which shall be installed higher than the bowser.
2. **Hazardous waste storage facility: -** An appropriate hazardous waste storage facility shall be constructed as part of the engineering workshop. The facility shall have a concrete floor, intact roof, concrete bund wall, good ventilation, adequate lighting and enough space for movement of material. Other facilities shall include access prohibition signs, hazard warning sign, fire extinguisher and spillage containment facilities.
3. **Used Batteries:** - Used batteries shall include heavy duty and light duty batteries. All the used batteries shall be stored in the hazardous waste storage facility and once a reasonable quantity accumulates for economic transportation, a licensed transporter shall be used to transport the used batteries to a licensed recycling facility such as Chloride Zambia Limited. No issuance of used batteries to the local people or unlicensed facilities shall be accepted. Records of the number and type of hazardous waste generated shall be kept by the workshop foreman and reported monthly to the Environmental and Safety Officer (ESO). These shall tarry with the number of new batteries issued during the reported period.
4. **Used Oil and used Oil Filters: -** All the used oil shall be stored in drums within the hazardous waste store room area. Generation of used oil shall be done in the workshop by draining it into decant trays before loading into drums. To minimize leakages, a decant pump shall be procured for this purpose. Drip pans, absorbents, boom and hazardous waste bins shall always be available.

   Likewise, used oil filters shall be drained into drums that shall be fitted with a wire mesh to facilitate smooth draining. The drained oil filters shall also be treated as hazardous waste and shall be stored in drums within the storage house. All the used oil and oil filters shall be disposed through approved means. Therefore, giving of used oil for whatever reasons shall not be allowed. Transportation shall also be done with a valid transportation license. Records of the quantities of used oil and filters generated shall be maintained by the foreman and reported monthly to the ESO.

   Filters and any other hydrocarbon contaminated waste maybe encapsulated as another alternative means of disposal. Hydrocarbon contaminated waste may be encapsulated.

Used oil may also be used in paint manufacturing, foundries, boilers and furnaces as a fuel. Alternatively, it may be incinerated at very high temperatures and controlled conditions.

5. **Used Grease and Oil Contaminated Rags: -** These shall be stored in drums in their separate form and shall also be handled just like used oil.

6. **Hydrocarbon Contaminated Soil: -** The contaminated soil shall initially be mixed in equal proportion with top soil as a way of introducing micro-biological activities. The means of treatment shall include mixing the contaminated soil with a nitrogen-based fertilizer, moistening the soil with effluent from the modular sewage treatment plant and frequent aeration as a way of supplying the bio-remediation bacteria with oxygen. The treatment shall be done for at least 9 months after which soil shall be planted with an indigenous grass species as the final remedial measure.

7. **Protective Clothing:** - Appropriate PPE shall be provided to all employees that shall be handling hazardous waste. The PPE shall be replaced once damaged or after a period of Six months, whichever shall come first. It shall be a disciplinary offence for an employee to handle hazardous waste without using the right PPE.

8. **Inspections and Basic Training:** - The ESO shall be responsible for routine inspections of hazardous waste management. He/she shall also be responsible for on-site training of all the employees about the hazardous nature of waste to their health and the environment. Records of the inspections and people trained shall be maintained by the ESO and these shall be reported in monthly reports.

8.9.8.2. Domestic and Commercial Waste Management Procedures

These waste types are not hazardous but they have potential to affect human health and the environment. The waste management hierarchy presented above shall apply to domestic and commercial waste.

8.9.8.2.1. Objectives

1. To protect human health and the environmental from potential harm that may be caused by domestic and commercial waste.
2. To comply with provisions of the Waste Management (Licensing of Transporters of Waste and Waste Disposal Sites) Regulations No. 71 of 1993.
3. To comply with the general guidelines provided under the National Solid Waste Management Strategy for Zambia of 2004.

8.9.8.2.2. Scope

The procedures cover generation, storage, transportation re-use and disposal of domestic and commercial waste

8.9.8.2.3. Key Words

1. **Domestic Waste: -** This is waste generated from household activities. Domestic waste includes kitchen waste, garden waste and general housekeeping waste.
2. **Commercial Waste: -** This is waste generated from commercial activities such as wood off cuts from the wood workshop, metal off cuts from the engineering workshop, used PPE, waste paper from offices and used tires.

8.9.8.2.4. Procedure Requirements

1. Waste separation at the point of generation shall be a fundamental activity and appropriate signs shall be painted on waste bins to facilitate separation.
2. Biodegradable waste shall be collected in waste bins and dumped at the landfill which shall be created within the mine area and licensed with ZEMA.
3. Domestic waste bins shall be distributed at appropriate places and these shall be labeled for waste disposal. Bin-liners shall always be provided to avoid double handling.
4. A "Please No Littering, Use Waste Bins" sign shall be installed at the gate to remind everyone entering the construction camp that littering is not acceptable.
5. Weekly records of biodegradable waste bins collected shall be kept by the head of housekeeping and these shall be reported in monthly reports.
6. The landfill shall strictly be used for biodegradable waste mainly from the kitchen and disposal shall be done in a systematic way followed by progressive backfilling of the landfill cells.
7. The landfill shall be fenced, shall have a lockable gate and shall have warning signs for restricting access.
8. All the salvageable material shall be kept within a salvage yard which shall be created within the camp. The material that shall be kept in the salvage yard shall include used tires, scrap metal and any material that can be re-used or sold.
9. Wood waste from workshop shall be stockpiled at the kitchen and used as firewood.
10. Records of the commercial waste and domestic waste generated per month shall be kept by the ESO and these shall be reported in monthly reports.

Figure 8-0-2: Typical Bin Liners to be provided

8.9.8.3. Environmental Safety Emergency Response Procedures

Considering environmental aspects associated with the project, major emergencies may arise from explosives, fuel, spillages of hazardous waste, dump wall collapsing or pit collapsing.

8.9.8.3.1. Objectives

1. To protect human health and the environment from environmental emergencies.
2. To comply with provisions of the Zambian legal requirements such as the Occupational Health and Safety Act No. 36 of 2010.
3. Contact the ZEMA, Hospital, Police and Fire Brigade on the following toll-free numbers 953, 992, 991 and 993 respectively.

8.9.8.3.2. Scope

The scope is limited to environmental and safety emergencies that may occur as a result of the proposed road construction related activities.

8.9.8.3.3. Key Words

1. **Emergency:** A serious, unexpected, and often dangerous environmental and or health situation requiring immediate action.
2. **Hazard:** The inherent potential of a substance or scenario to cause environmental and/or health harm.
3. **Hazardous Substances:** These are substances with the potential, even in low concentrations, to have a significant adverse effect on public health and the environment because of their inherent toxicological, chemical and physical characteristics. These include chemicals, healthcare waste and hazardous waste
4. **Risk:** It is the probability of the inherent potential of a substance or scenario to cause environmental and/or health harm.

8.9.8.3.4. Procedure Requirements

1. All complex jobs shall only be performed after conducting a risk assessment and it shall be the duty of supervisor to ensure that risk assessment are conducted and assessment forms submitted to the RE for approval.
2. All drivers shall be required to fully comply with all the traffic rules and safety procedures during transportation of materials including hazardous substances.
3. All hazardous substances shall be handled with spills response facilities available, appropriate protective clothes, an emergency shower in proximity to the storage facility, first aid box and fire extinguisher.

4. All supervisors handling hazardous substances shall understand the hazardous nature of the substance they are handling and information on the Material Safety Data Sheets (MSDS).
5. All working sites should have enough working space, adequate lighting and obstacles removed. Appropriate safety signs should be provided.
6. Conduct an incident investigation as soon as possible and report findings to the ESO for future preventive measures.
7. Conduct follow-up activities.
8. Do not dispose of any clean-up waste into aquatic environments or terrestrial ecosystems. These should be left at the emergency scene for treatment or collection for appropriate disposal.
9. Do not store hazardous substances in facilities that do not have an impermeable floor, bund wall of at least 110% the capacity of the storage vessel, perimeter drain, warning signs, fire extinguisher, absorbents and an appropriately designed oil/water separator;
10. Implement clean-up measures as described in the MSDS or as advised by ESO.
11. Implementation of prevention measures should be done immediately the clean-up is complete.
12. Construction machinery and vehicles shall only be operated by officers with the necessary permits to operate such machines. RDA through its contractor shall also conduct an in-house assessment of the operator's competence and issue successful workers with a permit.
13. No horse play or fighting shall be tolerated within the construction camps and construction sites mine area.
14. Report all emergences immediately they occur to the ESO.
15. Report all safety emergencies and near misses to the ESO who shall in turn report appropriately to top management and government institutions.
16. Reporting for work under the influence of alcohol or drugs shall be an instant dismissal offence. For this purpose, the ESO and RE shall be provided with alcohol testers to conduct random checks.
17. Restrict access to an environmental incident area immediately an environmental emergency occurs.
18. Review the emergency after completion of remedial measures to identify what went wrong and take note of mistakes that led to the immanency.
19. Storage of hazardous substances outside licensed storage facilities shall not be allowed.
20. Transportation of hazardous substances in the same vehicle with people shall not be acceptable.
21. Transportation of liquid hazardous substances without absorbents shall not be acceptable.
22. Use of PPE is mandatory and all workers shall be provided with PPE. It shall therefore be the duty of the employee to ensure that PPE is used as intended.

8.9.8.4. Record Management and Authentication Procedures

8.9.8.4.1. Objectives

Record keeping is the only way to prove that an activity was performed. Good record keeping provides a good defense platform in case of litigation and proves transparence and good will for SHES activities. Specific objectives for the Record Management Procedure are:

1. To facilitate cross-referencing and review of past performance for future improvement.
2. To facilitate use of procedures approved by management thereby indicating top management commitment and authority.
3. To give a tracking system for evaluating environmental performance.
4. To provide the relevant information for regulatory and external auditing purposes.
5. To prevent miss-application of wrong information by providing the necessary document identification in form or versions and authorization.

8.9.8.4.2. Scope

The scope of the "Record Management Procedure" includes all SHES related documents such as, but not limited to operating procedures, environmental management standards, legal register, statutory reports, incident reports, external correspondences and environmental permits.

8.9.8.4.3. Key Words

1. **Document: -** This means any form of information and the medium of communication. The communication medium can be print, electronic, audio or a combination of all the three.
2. **Environmental Policy: -** This is an environmental performance policy statement expressing top management commitments.
3. **Record: -** A form of information storage expressing proof of SHES activities conducted.

8.9.8.4.4. Procedure Requirements

1. **Approval of documents: -** The ESO shall present the procedures in this report for approval by RE after adding the necessary document control information. This may be done with assistance from an external consultant.
2. **Document Custody: -** All the SHES documentation shall be kept by the ESO using an appropriate filling system with the document version number and reference number. The ISO 14001 document control system shall be adopted.
3. **Distribution: -** Only signed documents shall be distributed for use to respective employees. These documents shall be distributed as hard copies or scanned electronic copies.
4. **Review: -** All the procedures shall be reviewed annually and all reviews shall be initiated by the ESO every first month of the year.

5. **Document Identification: -** For purpose of efficiency and continued improvement, the ISO 14001 document referencing system shall be adopted.
6. **Inspections and Monthly Reports: -** Inspections and monthly reports shall be referenced and hard copies printed for authentication by the RE. These shall be kept by the ESO for future reference and external auditing purposes. They shall also provide proof of environmental management performance.
7. **Checklists: -** Inspection checklists shall be developed for all forms of inspections in order to conduct these inspections in a systematic manner. The inspection checklists shall be reviewed and kept by the ESO. These checklists shall always be used to show proof that an inspection was conducted and follow-ups made.

CHAPTER NINE

9.0 CONSULTATIONS

9.1 Public consultations

Public consultations were undertaken at various levels to enlist the perceptions of the different stakeholders on the impacts of the road project. During the period March to April 2025, discussions were held with district officials in the project area at Mwinilunga and Ikelenge and with the affected people at Jimbe on 2 April 2025, Kalene Trading centre on 2 April 2025 and at Lwakela Trading centre on 3 April 2025. The meetings were used to disseminate information about the road rehabilitation project and the anticipated relocation of properties from the road reserve areas along the road corridor. Project risks such as dust pollution, transmission of sexual diseases, loss of vegetation and water pollution.

Among other issues and concerns that were raised during stakeholders' consultations were suggested strategies on how negative impacts can be mitigated. From the FGD and interviews the respondents made the following strategies for addressing the negative impact.

- Create awareness among the community about the positive and negative impacts of the proposed road upgrade;
- Local people be given job opportunities in employment;
- Enhance awareness on health issues such as HIV&AIDS, drug/alcohol abuse;
- Establish counselling centres of HIV&AIDS;
- During construction, the road should be watered constantly to reduce dust;
- Compensation for demolished structures;
- Notices should be given in good time (12 months) to allow those affected to shift;
- Any loss of property/business should be compensated;
- Compensation should be done in a very transparent manner;
- Parents should sensitise their youth on dangers of drug/alcohol abuse and immoral acts;
- Involvement of the affected persons at all levels of the process so that they are psychologically prepared; and
- Have drivers adhere to traffic laws.

The above outlined strategies formed part of the basis for the formulation of project mitigation measures in the ESMP and informed the RAP process.

Most of the respondents in the project area have a positive outlook towards the rehabilitation of the project road. The youth are looking forward to employment opportunities during the construction phase while the Project Affected Persons were mainly concerned about compensation aspects. Though these findings and observations reveal that, the wider population and the PAPs are largely in favour of the project, efforts need to be made by RDA and the District administration to sensitize and mobilize the PAPS so that they can sustainably benefit from the road project. Of concern is the need to assist PAPs on strategies of managing and utilizing compensation packages for improvement of their livelihoods and replacement of lost assets.

9.2 Public Disclosure

The ESIA will be disclosed on the RDA website and at the AfDB's Public Information Centre in compliance with relevant GRZ regulations and the AfDB ISS Operational Policies. Further RDA will provide copies of the ESIA and RAP reports to Mwinilunga and Ikelenge Council offices for public access. The ESIA and RAP summaries will be disclosed in the Bank Infoshop for 120 days since it is a Category 1 project.

9.3 Stakeholder Engagement Plan

Prior to the start of civil works, RDA will prepare a Stakeholder Engagement Plan (SEP) which will be a tool that will provide a mechanism for the continued engagement of stakeholders throughout the lifespan of the project.

CHAPTER TEN

10.0 CAPACITY DEVELOPMENT & TRAINING PLAN

The institutions that will play key roles in implementing the ESIA are Ministry of Infrastructure Housing and Urban Development, Road Development Agency (RDA), District Councils and Traditional Leadership, Zambia Environmental Management Agency (ZEMA), National Road Fund Agency (NRFA), Road Transport Safety Agency (RTSA), Ministry of Labour and Social Security, Contractors and Supervising Engineers and the local Communities. The table below illustrates some of the institutions that may require their skills and capabilities to be strengthened for the smooth implementation of the ESMP.

S/N	Institution	Capacity Development Needs	Budget (US$)
1	Ministry of Infrastructure Housing and Urban Development	• Enhancing skills of officers in the Department of Valuation and Property Management on the conduct of asset valuations in line with AfDB requirements on compensation of Project Affected People	15,000.00
2	Road Development Agency	• Training E&S staff on the AfDB E&S requirements • Training E&S staff on the conduct of the Root Cause Analysis of accidents/incidents • Training E&S staff on occupational health and Safety • Training E&S staff on the conduct of environmental and social monitoring • Training E&S staff on GBV/SEA/SH aspects • Purchase of equipment for undertaking air, noise and pollution monitoring • Provision of equipment for collecting GPS locations	50,000.00
3	Zambia Environmental Management Agency (ZEMA)	• Training the E&S staff on the AfDB E&S requirements • Support ZEMA to undertake E&S compliance monitoring visits	20,000.00
4	Contractors and Supervising Engineers	• Training on the preparation of the C-ESMP and other related documents such as the HSMP, TMP • Training the E&S staff on the AfDB E&S requirements • Training the E&S staff on the conduct of the Root Cause Analysis of accidents/incidents • Training the E&S staff on occupational health and Safety	30,000.00
5	Road Transport Safety Agency (RTSA)	• Support RTSA to undertake regular road safety awareness campaigns among the local communities and other road users	25,000.00

6	Ministry of Labour and Social Security (MLSS)	• Enhance officer's skills on the provisions of AfDB E&S Operational Safeguards 2 and 4 • Support MLSS to undertake periodic sensitization and monitoring of the contractors	30,000.00
		TOTAL	**170,000.00**

CHAPTER ELEVEN

11.0 CONCLUSION AND RECOMMENDATIONS

11.1 CONCLUSION

The findings from the Environmental Impact Assessment show that although the proposed road upgrading of the Mwinilunga Jimbe Project Road is expected to have a number of negative impacts on the environment, most of these are anticipated to occur during the construction phase and are mitigated in the overall road design. Most of the negative impacts are such that they are easily containable within acceptable limits provided that the appropriate mitigation measures are adopted. The assessment also shows that there are also many positive impacts of the project.

There are some important potential environmental impacts that will accompany the project, both in the short and long term. During construction, potential negative impacts that are considered to be significantly high relate to impacts on demolition of structures, increased charcoal burning and trading, public health and soil degradation. These potential impacts are relatively easy to mitigate and their impacts are reversible.

All environmental and social concerns will be mitigated as detailed in the ESMP. A framework for the implementation and monitoring of the ESMP has been proposed and budgeted for. Compared to socio-economic benefits of the road project, many of the negative impacts will be insignificant as long as fair compensation and mitigation actions are implemented. Overall the project is expected to accrue more benefits to the Zambian and SADC regional economies.

11.2 RECOMMENDATION

It is recommended that the project should go ahead with the implementation of the ESMP proposed in this report to mitigate the foreseen environmental and social impacts. In overall terms, Best Engineering Practices should be employed and proactive measures during O&M should be implemented and if achieved, the environmental and social impacts of the project should be easy to mitigate.

CHAPTER TWELVE

12.0 APPENDICES

Appendix 1: Minutes of Public Consultations

MINUTES FOR THE CONSULTATIVE MEETINGS ON THE MWINILUNGA TO JIMBE ROAD HELD AT JIMBE TRADING CENTRE, THE KALENE TRADING CENTRE AND LWAKELA TRADING CENTRE.

Date: 2 April 2025 at Jimbe and Kalene Trading Centres
Date: 3 April 2025 at Lwakela Trading Centre

OPENING REMARKS
The meetings were opened with the introductions of the Team from RDA. Thereafter Mr Gershom Chilukusha gave an outline of the proposed road works on the T5 road from Mwinilunga to Jimbe. He informed the participants the role of the Road Development Agency (RDA) as being the care, maintenance and construction of the road infrastructure across the country and that RDA does work with district councils across the country to realise the improvements of the road infrastructure. He informed the meetings that the Zambian Government working with cooperating partners such as the African Development Bank (AfDB) had plans to re-construct the Mwinilunga to Jimbe road which was currently in a bad state and that the road works would be part of the Lobito Corridor that would connect Zambia to Angola and the ultimately the Atlantic Ocean to facilitate for the smooth and efficient movements of goods and services.

He informed the meetings that the Road Development Agency Staff were currently in the project area to enumerate structures that have been built in the road reserve area of the Mwinilunga to Jimbe road. The meeting was informed that the road reserve of the Mwinilunga to Jimbe road was 100 meters (i.e 50 meters from either side of the road centreline). The participants were informed that the Public Road Act of 2002 does not allow for the construction of permanent infrastructure such as shops and houses in the road reserve. Further the participants were informed that the construction of such infrastructure were also a safety hazard especially when the road becomes busy after its rehabilitation.

He also explained that as part of the road works preparation process the Road Development Aggency was also collecting data to update the Environmental and Social Impact Assessment (ESIA) that had been prepared in 2015 in accordance with the Environmental Management Act, of 2011, which he said is the main environmental law in Zambia

The participants were also informed that the Zambian law does not provide for the compensation of individuals that have built infrastructure in the road reserve area. However, they were informed that since the project was likely to be financed by some cooperating partners such as the African Development Bank, the affected individuals would be paid some

compensation in accordance with the safeguard policies of the Bank to enable them relocate their structures outside the road reserve area and most importantly to ensure that the project does not leave them in a worse off position. The participants were advised that Valuation Surveyors would be visiting the marked structures in a few weeks' time to assess their compensation value and that there would be continuous engagements with the people along the road project before and during the civil works.

He informed the meetings that there was still a long way before the civil works could begin as a lot of planning still needed to be done such as the preparation of designs and the engagement of contractors and supervising consultants. He requested for the continued cooperation of the people in the project area to ensure that the dream of constructing the Mwinilunga to Jime road is realised with minimum challenges.

QUESTION AND ANSWER SESSIONS

Question: We are thankful for this good news. We have waited for too long for this road, and some people have died. I wanted to find out what is going to happen if ones' house or mango, banana, orange and guava trees are found in the road reserve. How will the government handle such?
Response: Owners of any property that will have to relocated from the road reserve area will be compensated by the Road Development Agency prior to the start of the road works in any particular road section.

Question: Are we going to be compensated or is the Government going to ensure they build new houses for everyone?
Response: Government working in collaboration with cooperating partners will compensate the properties that have been marked in the road reserve, but no new properties should be built in the road reserve henceforth.

Question: When is the construction of the road likely to commerce so that people begin preparing? Construction of this road is long overdue, people have really suffered.
Response: Construction of the road may begin in the next two years or so

Question: Where are people going to be moved to?
Response: The traditional leaders will be contacted to help in finding alternative land for the people who will have difficulties to shift within their current yards.

Question: What about our fields and crops that are in the road reserve?
Response: In the meantime, people can continue cultivating in the road reserve until such a time when they will be told to stop cultivating.

Question: What happens to people whose structures are at foundation level?
Response: Those at foundation level are advised not to continue but seek alternative sites to build. However, in the case where the Government decides to compensate individuals affected, people with structures at foundation level will also be considered as long as the structure has been marked.

Question: Will the contractors be Zambian or foreign.
Response: Unfortunately, we do not know the contractor who will be awarded the contract.

Question: The pay is little and workers usually work long hours. They start work as early as 06:00hours and knock off as late as 17:00hours. The extra hours they work are not compensated for.
Response: Sometimes the problem we have is that when the contractor comes, we rush into working without signing contracts or agreeing on conditions of work. So, when the contractor comes, let us make sure we sign contracts and agree on work conditions before we rush into starting work.

Question: Another issue of concern is that some contractors run away without paying workers their salaries. How will this be avoided? I would also like to find out where workers will be paid their monthly salaries from?
Response: You have raised a real problem. But that is not expected to happen in this contract, because the contractor that will be appointed will be a reputable contractor who cannot afford to run away with workers' salaries.

Question: On employment issues. Maybe the contractor has his own people in mind and may not employ local people; at least let the contractor employ local people for unskilled labour.
Response: The local people will definitely be employed so that they can also benefit from the development in their area.

Question: How will people with trades be employed?
Response: The categories are different and people will be employed based on their skills. There will also be jobs for the unskilled people.

Question: What is the minimum wage you can recommend to the contractor?
Response: The contractors will be expected to pay workers below the minimum wage according to the labour laws.

Comment: I would like to seek clarity on the kind of works that will be allocated to women. When women are employed, their marriages will end up being broken because most of them have a tendency of looking down on their husbands and disrespecting them just because they are earning some money. So, women should only be employed after seeking the consent of their husbands.
Response: That is a problem that has been identified. The project will give equal employment opportunities to women

Question: On the issue about bus stations. Are we the ones suggesting where they will be placed or are there specific distances where they should be placed? We also need to have speed humps on the road for safety purposes.
Response: The road designs will indicate the locations of bus stations. These will consider the settlements in the surrounding areas.

Comment: We have a place where we fetch water from, it is called Lemba. We are appealing to the contractor to fix the road for us as it is in a very bad state. The contractor might even be sourcing water from there since the place has plenty of water.
Response: We have taken note of that.

CLOSING REMARKS

Mr Chilukusha thanked the community members for turning up to the meetings and for their open discussions as evidenced by the questions and comments that they had made. He assured the attendees that Government through the Road Development Agency was committed to rehabilitate the Mwinilunga to Jimbe road in order to ease the movements of goods and services to spur socio-economic development in North Western Province and Zambia as a whole. He called upon the local people to provide their maximum cooperation to the project if its objectives were to be fully realised.

Appendix 2: Pictures of Scoping Meetings Held in 2025

Meeting at Kalene Shopping Centre on 2 April 2025

Meeting at Jimbe on 2 April 2025

Meeting at Kalene Shopping Centre on 2 April 2025

Meeting at Lwakela Shopping Centre on 3 April 2025

Appendix 3: Some Indicator Species in Ikelenge area

Some indicator species of the biodiversity in the Ikelenge pedicle, northwest Zambia. These are either endemic species **(E)** or occur marginally **(M)** in the pedicle.

TAXON		STATUS
Odonata		
Chlorocnemis wittei		M
Ceragrion bakeri		M
Ceriagroin Platystigma		M
Ceragrion Sakejii		E
Ceragrion Sanguinostigma		M
Pseudagrion greeni		M
Pseudegrion Kibalense		M
Pseudagrion Williamsi		M
Chlorocypha Frigida		E
Chlorocypha wittei		M
Umma distincta		M
Prodasineura flavifacies		E
Aciagroin Zambiense		E
Aciagroin nodosum		E
Agriocnemis angolensis spatulae		E
Chlorocypha wittei		M
Enallagma vaginale vaginale		M
Ischnuragrion nodosum		E
Onychogomphus kitchingmani		E
Onychogomphus quirkii		E
Phyllogomphus brunneus		E
Diastatomma Selysi		M
Aeshna moori		E
Aeshna wittei		M
Anax congoliath Lisombae		E
Heliaschna cynthiae		M
Monardithenis Flava		E
Allorhizucha Longistipes		E
Crocothemis brevistigma		E
Orthertrum macrostigma		M
Nesciothemis Fitzgeraldi		E
Macroma bispina		M

Porpacithemis leakeyi		E
Trithemis anomala		E
Trithemis dichroa		M
Zygonyx flavicosta mwinilungae		E
Zygonyx eusibia		M
Lepidoptera		
Bicyclus Sebetus		M
Bicyclus triophus		M
Bicyclus sophrosyne overlaeti		M
Kamilla ansorgei		M
Papilio phorcas congoanus		M
Papilio hersperus		M
Graphium ridleyanus		M
Pseudopontia paradoxa austrlis		E
Acarea (Actinote)Mirifica		E
Leptosia hybrida somereni		M
Leptosia nupta		M
Charaxes Acuminatus		E
Artitropa cama		M
Argema kuhnei	kuhne's Luna Moth	M
Temnora scitula	Temnora Hawk Moth	M
Amphibia		
Hylarana Lemairei	Lemaire's Frog	M
Ptychadena obscura	Plain Ridged Frog	M
Pychadena Keilingi	Keiling's Ridged Frog	M
Leptopelis cynnammeus	Bocage's Tree Frog	M
Kassina wittei	Witte' Kassina	M
Hyperolius Major	Greater Reed- Frog	M
Hyperlius bocagei	Bocage'Reed-Frog	M
Hyperolius quinquevittatus quinquevittatus	Five- lined Reed- Frog	M
Hyperolius marmoratus	Redamd white Reed- Frog	E
Bufo fuliginatus	Sooty Toad	M
Reptilia		
Pelusios nanus	Dwarf Hinged Terrapin	M
Lygodactylus heeneni	Heenens Dwarf Gecko	M
Adolfus africanus	Congo Forest Lizard	M

Causus lichtensteinii	Forest night Adder	M
Grayia ornata	Ornate Water-Snake	M
Grayia tholloni Mocquard	Thollon's Water-Snake	M
Psammophis leopardinus	Chain-marked Grass-Snake	M
Thrasops jacksonii	Black Tree-Snake	M
Thrasops aethiopissa iuturiensis	Variegated Tree-Snake	M
Thelotornis kirtlandii	Forest Vine Snake	M
Aves		
Sarothura pulchra	White-spotted flufftail	M
Jynx ruficollis	Red-throated wryneck	M
Columba unicincta	Afep Pigeon	M
Cercococcyx olivinus	Olive long-tailed cuckoo	M
Alcedo leucogaster	White-bellied kingfisher	M
Pyrrhococcyx turdinus	Spotted thrush babbler	M
Neolestes torquatus	Black-collared bulbul	M
Bleda syndactyla	African bristlebull	M
Indicator exilis	Western least honeyguide	M
Campethera caroli	Brown-eared woodpecker	M
Stizorhina fraseri	Rufous ant thrush	M
Apalis rufogularis	Buff-throated apalis	M
Dyathrophiya castanea	Chestnut wattle eye	M
Muscicapa cassini	Cassin's grey flycatcher	M
Muscicapa infuscata	Sooty flycatcher	M
Terpsiphone rufiventer	Red-bellied paradise flycatcher	M
Megabyas flammulatus	Shrike-flycatcher	M
Bradypterus alfredi	Bamboo warbler	M
Nectarinia batesi	Bates's sunbird	M
Nectarinia rubescens	Green-throated sunbird	M
Nectarinia bannermani	Bannerman's sunbird	M
Ploceus superciliosus	Compact weaver	M
Mammalia		
Potamogale velox	Otter shrew	M
Crocidura ansellorum	Ansell's musk shrew	M
Micropteropus pusillus	Dwarf epauletted fruit bat	M
Lissonycteris angolensis	Angola fruit bat	M
Myonycteris torquata	Collared fruit bat	M
Rhinolophus sakejiensis	Sakeji horseshoe bat	M
Colobus angolensis	Angola pied colobus	E

Cercopithecus ascanius	Red-tailed monkey	M
Manis tricuspis	Tree pangolin	M
Anomalurus beecrofti	Beecroft's anomalure	M
Graphiurus monardi	Monard's dormouse	M
Graphiurus sp.	Dormouse	?
Hylomyscus denniae	Wood mouse	M
Pelomys minor	Creek rat	M
Steatomys krebsii	Mary's fat mouse	E
Hybomys univittatus	Hump-nosed mouse	M
Malacomys australis	Ansell's long-footed rat	M
Colomys goslingi	Forest brook rat	M

Source: Cotterill, 2022