Consulting Services for the Preparation of the Environmental and Social Impact Assessment (ESIA) Resettlement Action Plan (RAP) for the Rehabilitation of 161.5Km of the Mpika-Chinsali Road (T2) in Muchinga Province

Final Environmental & Social Impact Statement (ESIS)

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Reviewed By	Chansa Davies- Bicon (Z) Ltd
Approved By	Mushinge Rennatus-Project Manager-Bicon (Z) Ltd

DECLARATION: DEVELOPER

I, , on behalf of the Road Development Agency of Zambia, hereby submit this Final Environmental and Social Impact Statement for the proposed rehabilitation of the 161.5Km of the T2 Road from Mpika to Chinsali in accordance with the Environmental Management Act 2011 and the Environmental Impact Assessment Regulations S.I. No. 28 of 1997.

Signed at LUSAKA on this day of , 2017

Signature:

Designation:

ROAD DEVELOPMENT AGENCY

DECLARATION: CONSULTING ENGINEER

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Signature:

Designation:

BICON ZAMBIA LTD

DETAILS:	
COMPANY/ LIS CODE	Road Development Agency (RDA)
NAME OF FACILITY	Rehabilitation of 161.5Km of the T2 Road from Mpika to Chinsali
TYPE OF FACILITY	Road
REVIEWED DOCUMENT	Final ESIS
LOCATION:	Mpika, Shiwang'andu, and Chinsali
PROVINCE	Muchinga
DISTRICTS	Mpika, Shiwang'andu, and Chinsali
ADDRESS OF DEVELOPER	Road Development Agency, P.O. Box 50003, Lusaka.
CONTACT PERSON	Gershom Chilukusha
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NON TECHNICAL & EXECUTIVE SUMMARY

INTRODUCTION AND BACKGROUND

This Environmental and Social Impact Statement (ESIS) Report, produced with inputs from both Interested and Affected Parties consulted during the field visits, as well as stakeholders who participated in data collection, highlights the most significant environmental impacts anticipated from the project. During the baseline phase, the different specialists who undertook the study investigated various issues related to the project implementation as contained in the ZEMA approved TOR[1]. The specialists consulted individual and group key informants of relevant government institutions, business communities, representatives of farmers' associations and district councils. Community members and owners of informal road side businesses within the project area were also consulted.

The project of focus is the rehabilitation of the T2 Road from Mpika to Chinsali in Muchinga Province of Zambia, which starts at Mpika Weigh Bridge to Chinsali turnoff. The project will involve a full reconstruction and widening of the existing carriageway and the enforcement of the mandatory road reserves as enshrined in the Public Roads Act of 100m for the rural sections and 36m for the urban sections of Mpika (Ch0+00-Ch7+780); Shiwang'andu urban (Ch86+800) and Chinsali turnoff (Ch165+645).

The ESIS (this Report), is being submitted on behalf of the developer (RDA), to both the Zambia Environmental Management Agency (ZEMA) and the European Investment Bank (EIB), in fulfillment of the agency and bank's environmental policies. The report covers three road sections that will be contracted separately:

- Lot 1: (From Mpika weighbridge to Mazingo with possible financing from the Chinese;
- Lot 2 - (From Km 4+100 to Km 86+770): Mpika to Shiwan'gandu Junction (D53/T2 Junction) – 82.7 km; and
- Lot 3 – (Km 86+770 to Km 165+646) Shiwan'gandu Junction (D53/T2 Junction) to Chinsali Junction – 78.8km.

In order to speed up the construction of the 165Km road stretch, the project has been divided into three lots which will be constructed by three different contractors and to be financed by two different sources as follows:

1. Lot 1: (From Mpika weighbridge to Mazingo with possible financing from the Chinese);
2. Lot 2 - (From Km 4+100 to Km 86+770): Mpika to Shiwan'gandu Junction (D53/T2 Junction) – 82.7 km with possible financing from EIB; and
3. Lot 3 – (Km 86+770 to Km 165+646) Shiwan'gandu Junction (D53/T2 Junction) to Chinsali Junction – 78.8km with possible financing from EIB.

In addition to the proposed expansion of the carriageway, GRZ through the Road Development Agency (RDA) intends to enforce the mandatory 100m road reserve applicable to all trunk roads in Zambia including the project road from Mpika to Chinsali.

[1] Appendix 1

This means that government intends to remove all built structures from the project road reserve. Two road reserves will be enforced and will include 50m on each side of the existing centerline and this will apply to much of the road length; while in three locations of the road corridor at Mpika urban area (Km0+Km7), Kalalantenkwe or Shiwang'andu BOMA (K7+770-Km89+920) and Mucheleka or Chinsali turnoff area-Km64+550-165+430) and 36m (i.e. 18m on each side of the existing centerline) road reserve will be enforced.

As mentioned earlier, all private and public properties located in the above road reserves will have to be relocated outside the road reserve in order to preserve land for future road expansion and other needs.

The scope and nature of works that will be undertaken before, during, and after construction makes the road project fall within an environmental classification of Category 1. The classification of category 1 means that there is need to carry out an Environmental and Social Impact Assessment (ESIA) and develop a Resettlement Action Plan (RAP) as required by the Environmental Management Act (2011), and the EIB -EIA requirements of Directive 85/337/EEC and in line with the Road Development Agency Environmental and Social Management Guidelines for the Road sector. In addition the magnitude of the project is expected to trigger some of the EIB Environmental and Social Safeguard Policies more especially the Environmental and Social Standards and Involuntary Resettlement Guidelines.

In order to achieve the objectives of the ESIA, the consulting team used various approaches and techniques including use of secondary sources of data through the review of various relevant documents such as study reports, policies, legislations, and national strategies, regional and global protocols related to road construction projects. The ESIA concludes that the project is highly economical and a viable to the economies of countries in the Central and Southern Africa including Zambia. The ESIA identified positive impacts, as well as a number of environmental and social challenges that will emanate from the project.

SUMMARY OF LEGAL AND POLICY FRAMEWORK

National Environmental and Social Legislation

The environmental legal framework within Zambia contains overarching laws covering such areas as Environmental Protection, Water, Waste, Nature Protection, Noise Protection, Air Quality and Cultural Heritage, which transpose the main obligations of the environmental EU Directives. The key legislation for protection of the environment, where the EIA procedure has been prescribed, is the Environmental Management Act of 2011. The requirements of the EU EIA Directive 85/337/EEC (amended by Directive 97/11/EC) have been transposed within the Law on Environment.

With regards to social aspects, there are national laws covering Health Protection, Occupational Health & Safety, Labour Relations, Working Conditions, Employment, Wages, Social Protection, Child Protection and Equal Opportunities. Zambia has ratified many International Labour Organisation Conventions and a number of international environmental and social treaties and conventions.

EIB Biodiversity Protection & Conservation Policy

The protection and conservation of biodiversity in the context of projects in which they invest is widely recognized in EIB's environmental and social sustainability policies. EIB support a precautionary approach to the conservation and sustainable use of biodiversity through the implementation of applicable international laws and conventions and relevant EU Directives. Detailed guidelines addressing this approach which this Project must meet the requirements of are provided in Annex 7 of EIB's Environmental and Social Practices Handbook.

ESIA & PERMITTING REQUIREMENTS

The EIA procedure is regulated by the EIA Regulations under Part II Clause 7 (2) (a). The Project comprises of the construction and rehabilitation of a trunk road, which falls under Second Schedule of the EIA Regulations. 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*". The national responsible body for issuing the construction permit for this category of projects is the Zambia Environmental Management Agency (ZEMA).

According to the EIBs environmental screening guidelines, the Project falls under Appendix 1: Category A projects, sub-category 7: Construction of motorways, express roads. For all Category A Projects, EIB require an ESIA to be prepared.

LAND ACQUISITION AND RESETTLEMENT

Currently, there are no specific law pertaining to involuntary resettlement in Zambia. However, there are various pieces of legislation that provide guidance regarding legal provisions for resettlement. For ***Land Take***[2] and displacement of people, specific attention is drawn to two Zambian laws that will be applicable to land tenure, compensation and resettlement in this project, namely:

- Constitution of Zambia, Chapter 1 of the Laws of Zambia, Article 16
- Lands Acquisition Act Chapter 189.

The Constitution of Zambia, Chapter 1 of the Laws of Zambia, and Article 16 of the Constitution provides for the fundamental right to property and protects persons from the deprivation of property. It states that a person cannot be deprived of property compulsorily except under the Authority of an Act of Parliament, which provides for adequate payment of compensation. The Article further provides that the Act of Parliament under reference shall provide that in default of agreement on the amount of compensation payable, a court of competent jurisdiction shall determine the amount of compensation.

Lands Acquisition Act Chapter 189 of the Laws of Zambia Section three of the Lands Acquisition Act empowers the President of the Republic to compulsorily acquire property. Sections 5 to 7 of the Act provides for the issuing of notices to show the intention to acquire, notice to yield up

[2] Land take refers to acquiring of land for some public purpose by government agencies, as authorized by the law from land owner(s) after paying compensation for losses incurred by land owner(s) due to surrendering their land.

property and to take up possession. Section 10 of the Act provides for compensation as consisting of such moneys as may be agreed from moneys appropriated for the purpose by Parliament.

Furthermore, this section provides that where the property to be compulsorily acquired is land, the President, with the consent of the person entitled to compensation, shall make in lieu or in addition to any compensation payable under the section, grant other land not exceeding in value of the land acquired. Section 11 of the Lands Acquisition Act provides for the resettlement of the disputes relating to the amount of compensation to the High Court.

In conclusion, under the Lands Acquisition Act, the principles of compensation are pivoted on the basis that the value of the property for the purposes of compensation shall be the value of the amount which the property might be expected to realise if sold on the open market by a willing seller at the time of the publication of the notice to yield up possession of the property.

Under Part VI of the Lands Acquisition Act (Cap. 189), a Compensation Advisory Board has been established to advise and assist the Minister in the assessment of any compensation payable under the Act.

The Project will be undertaken in line with EIBs Environmental and Social Standards which contains Performance Requirement that covers Involuntary Resettlement and Economic Displacement. According to this, not only those who have legal title are entitled for compensation, but also those who do not have legal rights that are directly affected by the Project.

STAKEHOLDER ENGAGEMENT & CONSULTATION

The Project will be prepared in line with both the national and EIB's Environmental and Social Standards requirements for stakeholder engagement and public consultation. Therefore the draft ESIA study will be disclosed to the public for 30 days, during which time the comments Period will last, ensuring that all stakeholders have an opportunity to express their views. Upon completion of the disclosure and comment Period, the ESIA study will be updated to reflect the comments made by stakeholders, including explanations on how comments were taken into account in the updated study. The final decision on whether or not to grant consent for the Project will be made by ZEMA and publicly disclosed. The decision will be published in at least one daily newspaper available throughout the territory of the Republic of Zambia, and on the web site of ZEMA.

The stakeholder engagement process started at the earliest stage of project planning and will continue throughout the entire life of the Project. A Stakeholder Engagement Plan (SEP) has been prepared and is submitted as separate document to this ESIA. The SEP identifies the key project stakeholders and will be updated accordingly during the development of the Project. Stakeholder engagement regarding the Project is an on-going process involving the public disclosure of appropriate information so as to enable meaningful consultation with stakeholders and potentially affected parties, and includes procedures contained within the SEP so people can make comments or complaints.

During the development of the ESIA affected stakeholders were carefully identified as well as those interested in the Project, and their concerns, expectations and preferences were taken into consideration.

Attention was given to the identification of vulnerable stakeholders whose lives and well-being may be affected by the Project. Additionally, close interaction with the local communities was maintained in order to identify opportunities for improving social performance of the Project.

For each of the stakeholder group specific communication tools have been identified in order to ensure easy, transparent, direct, open and interactive communication with all stakeholders and to get as earlier as possible their feedback during the different phases of project implementation. Public information, participation and consultation will be undertaken during all stages of project implementation and the engagement of stakeholders has been divided into the 5 main phases below. The full list of stakeholders to be consulted can be found in Annex 1 of the SEP.

- Phase 1: Pre-ESIA Consultations
- Phase 2: ESIA Study Consultations
- Phase 3: ESIA Disclosure
- Phase 4: Detailed Design and Construction
- Phase 5: Operation

Key information about the Project has been disclosed through the scoping meeting held along the project corridor. RDA, who are the project proponent, will continue to involve stakeholders and will maintain good communication practices during the lifetime of the Project. According to this approach, the aims of information disclosure and Project communications will be:

- Providing local communities with a schedule and information on activities that will be arranged, together with mechanisms for their feedback;
- To improve knowledge of what the Project involves, the stages of the Project and its expected performance;
- Ensuring best practice in terms of environmental protection and health and safety for workers and contractors; and
- To make available to the public a grievance procedure.

RDA is implementing a Grievance Mechanism to ensure that it is responsive to any concerns and complaints particularly from affected stakeholders and communities (more details are contained within the Stakeholder Engagement Plan).

PROJECT DESCRIPTION

The T2 road from Mpika to Chinsali is an existing 165.4km public trunk road, which has been in existence for over 30 years, which has seen increased traffic volume and significant damage over these years. It pavement has deteriorated such that the road is no longer capable providing a safe and sufficient road transport system to support the productive sectors and the social and economic transformation of the country as a whole. Currently, the project road is only passable because of the routine and Periodic maintenance by Government. The road maintenance costs, vehicle operating costs and travel times have obviously remained very high and therefore the need to reduce these costs associated with the current state of the road cannot be overemphasized.

The Project Road is located in the Muchinga Province in the North-Eastern part of Zambia. It starts at the RDA Weigh Bridge in Mpika at Kanjela Village (S=1152.399; E03125.765) and ends shortly before the T2 intersection with the access road to the provincial headquarter Chinsali.

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1. Lot 1: (From Mpika weighbridge to Mazingo with possible financing from the Chinese);
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As mentioned earlier, all private and public properties located in the above road reserves will have to be relocated outside the road reserve in order to preserve land for future road expansion and other needs.

In terms of expanding and rehabilitating the existing road, the project will widen the existing road by approximately 2m on both sides from the existing edge of pavement to create a total width of 11 m for the roadway and 12 m for the roadbed. This means that motor vehicles will have 7 m (3.5m for each lane) while the 2m at the end of a motor lane will be shoulder that can be used for over taking but also for cycling and walking.

In villages with lots of people where pedestrian traffic is considered to be relevant such as Mpika urban area (Km0+Km7), Kalalantenkwe or Shiwang'andu BOMA (K7+770-Km89+920) and

Mucheleka or Chinsali turnoff area-Km64+550-165+430), paved pedestrian walkway will be constructed to accommodate pedestrians.

To improve drainage along the project road, the rehabilitation works will also include making improvements to the existing major pipe culverts at Lwitikila River (Km 11+837); and Lwanya River (Km 58+346); 2x3200 diameter). All the existing minor culverts with diameter of 600mm will be replaced with bigger culverts with diameters of 900mm. Additional works include installation of cross and vertical culverts, slope reinforcement, retaining walls, and traffic safety works (signage, Km pillars, safety fencing, and paint marking).

Sixteen temporary construction staging areas of approximately 300m^2 will be located at intervals. Currently the locations of these construction camps are not yet decided upon but will be known and communicated to all stakeholders before project implementation starts. These temporary constructions staging areas will mainly be used for material and equipment storage, casting workshop, and assembly. The contractors for the three lots will also asphalt plants and the numbers for each lot will vary during the peak construction Period. These plants will not be in fixed location during the entire construction phase, but placed at convenient locations for the construction of each road section.

Aggregate material for the road will come from three stone quarries at Danger Hill (Km47+950); Shiwan'gandu (Km87+500) and (Km99+000). However, most of the stones for aggregate and stones base will come from the Danger Hill (Km47+950). Access Roads leading to the quarry areas will be repaired and widened approximately 1m on either side. It is also possible that some of the required aggregates may come from the Mununga quarry but this source is very far from the project site (i.e. about 110Km to the south from the beginning of the project road.

ESIA ASSESSMENT METHODOLOGY

In order to assess the impacts, a baseline study was performed to describe the relevant environmental and social issues that are present in the area of the Project that could be potentially affected either during construction or operation. A scoping assessment was undertaken to identify potential environmental and social impacts. The scoping assessment considered the results of the Stakeholder Scoping Meetings and the scoping opinion and guidance provided by ZEMA and other stakeholders.

The assessment of the impacts has concentrated on identifying the likely significant residual effects of the Project. For this, impacts were first assessed without taking into account of mitigation measures, with the significance of the impacts being a function of several criteria including:

- The value of the resource or the sensitivity of the receiving environment/community/receptor;
- The magnitude of the impact;
- The type of the impact (direct/indirect/cumulative) and whether adverse or beneficial;
- The reversibility of the impact and the geographic extent of the impact;
- The time when the impact occurs and duration of the impact (short term/medium term/long-term); and
- Likelihood of the impact occurring.

Mitigation measures were then developed for each adversely affected environmental or social aspect identified, and an evaluation of the likely effectiveness of the measures to prevent, mitigate or compensate the adverse impacts undertaken. Finally, based on the significance of the effect (without mitigation) and the assessment of the probability of success of the proposed mitigation, the significance of the residual effect (with mitigation) was determined.

The ESIA has been prepared in line with relevant national, EIB/EU and international ESIA legal and policy requirements.

SUMMARY OF ENVIRONMENTAL & SOCIAL IMPACTS & MITIGATION

The potential environmental and social-economic impacts of the rehabilitation, construction and operation of the Mpika to Chinsali Road have been assessed within the ESIA. The decommissioning of the road has not been considered due to limited information at this stage being available with regards to the ceasing of operation of the road and given the intention to continue to operate the road indefinitely. In the event that the project road ceases operation and needs to be decommissioned, relevant approvals will be sought and, if required, an ESIA produced for this.

The environmental and social impacts identified and assessed during the construction and operational phases are summarized in the table overleaf along with a summary of the key mitigation measures.

With mitigation, the most of the environmental impacts arising from the construction of the project road is not anticipated to be of a significant nature except for the removal of top soil and localized effects on noise levels.

The Project will require both permanent and temporary land take during construction which will give rise to the temporary loss of some land. Permanent land take will arise as a result of the enforcement of the mandatory road reserves while temporary land take will arise as a result of construction activities. After construction, land which was temporary acquired will be reinstated, where possible, to its original condition. Permanent loss of land and property will occur in the road reserves. Due to the enforcement of the mandatory road reserves, an estimated 1,039 PAFs will lose their private properties, which will include homes and shops, etc.

With the application of the mitigation measures, the majority of residual negative social effects are anticipated to not be of a significant nature, except for community disturbance and safety risks. RDA will need to carefully manage and monitor any issues related to community safety and on the safety of workers from the construction of the road.

The Project is expected to have a positive, long-term and significant residual effect on the local, national and regional economies and improve access locally and across the region. The construction of the road should stimulate economic growth at a local level and create local employment opportunities. Business opportunities may also potentially increase significantly for local contractors and especially subcontractors during construction works. Significant economic, employment and educational benefits are anticipated to arise as a result of the rehabilitation of the project at a local, Muchinga Province, national level and also on a Regional level potentially as part of the overall benefits the rehabilitation of the T2 road from Mpika to Chinsali. These

economic benefits should provide improvements in the quality of life of some communities along the route.

The other Key Issues and Mitigation include:

1. **Assessment and management of environmental and social impacts and risks**

   An environmental and social impact assessment (ESIA) has been undertaken for the project and various reports have been submitted to stakeholders such as ZEMA and EIB based on ZEMA environmental requirements. The ESIA describes the project activities; provides physical and environmental baseline information and summary socio-economic baseline information; identifies and assesses environmental and social risks and impacts during preparation, construction and operations phases; and proposes measures to mitigate adverse environmental and social risks and impacts.

   The ESIA is supplemented by an Environmental and Social Management Plan (ESMP). The ESMP was prepared with the objectives to: describe management and mitigation commitments provided in the ESIA, describe additional mitigation measures consistent with good international industry practice and the Performance Standards, identify roles and responsibilities of the environmental and social manage organization of the Project, and communicate environmental and social requirements through the Project team.

   The ESMP has also identified the standards for Project legal and regulatory compliance with GRZ laws and regulations; establishes an environmental and social management framework; identifies roles and responsibilities in the Project environmental and social management structure; provides management plans consistent with the Performance Standards and IFC EHS Guidelines (air emissions, noise and vibration, ecology, waste, water, erosion and sediment control, spill prevention and response, hazardous materials, raw materials, cultural heritage, community impacts); provides an environmental monitoring and quality supervision plan; and includes an environmental and social action plan.

   Construction contractors will be required, as a condition of their contracts with RDA, to implement and comply with the ESMP, including preparing management plans consistent with the specific management plans provided in the ESMP. RDA will rely on Supervising Engineers for Project environmental and social supervision of RDA contractors' environmental and social requirements, and RDA's Environmental and Social Management Unit (ESMU) for monitoring and reporting on environmental and social performance. The construction supervision consultant has a daily on-site presence to supervise the execution or works by the contractors. The ESMU will be on site periodically to collect samples, data and information based on the requirements of the environmental monitoring and quality supervision plan provided in the ESMP.

   To manage environmental and social risks during construction and operations, including land acquisition and resettlement, EIB has proposed to the GRZ a framework to structure EIB's engagement in the Project. Under the proposed framework, EIB has requested GRZ assurance that construction and operation of the Project fully complies with EIB's Performance Standards and the IFC EHS Guidelines.

2. Pollution Prevention and Abatement

*A. **Preparation and construction:*** Risks and impacts are related to air emissions, soil erosion and runoff, surface and ground water quality, waste, hazardous materials, and spills. These risks and impacts are expected to be managed through Project design and mitigation measures provided in the ESMP, and to be implemented by RDA contractors.

Air emissions during construction are expected from fugitive dust to be generated from site clearance, demolition, material transport and construction works; and gaseous emissions from operation of diesel powered asphalt plants, vehicles, equipment and machinery. Baseline ambient air quality was surveyed in the EIA at 6 locations, with background levels of carbon monoxide, sulphur dioxide, nitrogen dioxide and hydrocarbons found below WHO standards. Background total suspended particles were found to be below the IFC EHS Guideline value for particulate matter at 5 locations, and background sulphur dioxide levels at all survey locations were below the IFC EHS Guideline value. The ESIA estimates construction to generate approximately 812,637kg of dust from excavation and material transport, with modelling indicating that fugitive dust concentrations to dissipate to meet the IFC EHS Guideline value for particulate matter approximately 40m from the source. Modelling of gaseous emissions from vehicles, equipment and machinery provided in the ESIA indicate that nitrogen oxide emission levels generally dissipate to meet the IFC EHS Guideline value between approximately 20-80m from the source. Modelled emissions from the asphalt plants dissipated to meet the IFC EHS Guideline value approximately 350m from the source. Measures to mitigate air emissions are provided in the air emissions management plan, as part of the ESMP. These measures include: limiting vehicle speed; wet dust suppression; covering loads; minimizing material drop height; conducting regular maintenance of asphalt plants, vehicles, equipment and machinery; and ensuring diesel powered plants, vehicles, equipment and machinery are turned off when not in use. Periodic monitoring will be conducted, including some nearby sensitive receptors (e.g. schools, clinics, churches, markets), to ensure that ambient air quality meets IFC EHS Guideline values or construction activities do not further degrade existing ambient conditions.

Soil erosion and runoff risks and impacts to surface and ground water quality, flood risk, and slope and riverbank stability are expected to result from site clearance, sub-grading, excavating, embankments, road construction bridge and channel works, bridge and channel works, and surface runoff from operation of quarries and asphalt plants. Measures to mitigate these impacts are provided in the erosion and sediment management plan, ecology management plan, and raw materials plan, as part of the ESMP. These measures include: limiting clearance of vegetation and prompt re-vegetation of appropriate cleared areas; installing retaining walls, mud screens, and reinforcing embankments, as needed; maximum height limitations for material piling and storage; and programming works during the dry season and postponing works during storm events. Periodic monitoring will be conducted, including visual surveys of erosion and sediment control measures every 3 months in dry season and monthly in wet season, as well as a quarterly audit of quarry operations.

Risks and impacts to surface and ground water during construction are expected from site clearance, demolition and preparation; staging and storage areas; material extraction and quarry operations; sub-grading, excavating and embanking the road base; major culverts improvements; industrial wastewater from concrete mixers; sanitary wastewater from temporary worker camps; and spills. Baseline surface water and ground water quality were surveyed in the EIA at 3 locations, analysing for temperature, pH, conductivity, dissolved oxygen, chemical oxygen demand, biological oxygen demand, total suspended solids, ammonia, nitrates and nitrites, phosphate, oil and grease, coliform and heavy metals. Baseline surface water quality was below WHO standards for dissolved oxygen, chemical oxygen demand, biological oxygen demand but coliform exceeded the WHO standards at all the three locations.

The ESIA assessed daily loading of sanitary wastewater on surface waters to exceed WHO standards for biological oxygen demand, total dissolved solids, total suspended solids and grease; industrial waste water, including discharge from concrete mixers, was assessed to exceed WHO standards for total suspended solids, pH and grease. Measures to avoid or mitigate risks and impacts are provided in the water resources management plan, as part of the ESMP. These measures include: implementation of erosion and sedimentation plan; use of settlement ponds and sediment traps; minimizing number of staging and storage areas and locate those areas at least 50m from waterways; using beaming or diversion isolation techniques during works in watercourses; minimizing materials extraction activities; appropriate storage of hazardous substances; spill and emergency response procedures; water use efficiency and application of wastewater treatment at concrete mixers; and use of portable or permanent sanitation facilities at temporary workers camps.

Waste generated by construction activities includes construction waste, domestic solid waste and hazardous waste. Construction waste is expected to include concrete, asphalt, gravel, stone, inert materials, wood, metals, plastics, insulation, packaging, plasterboard/gypsum, earth and topsoil and vegetation. Domestic solid waste is expected to include food waste, sanitary waste, card and paper, packaging, plastics, and textiles. Hazardous waste is expected to include used engine oil, oily rags and empty containers. The ESIA estimates domestic solid waste generation on the volume of 562kg per day. Measures to manage and reduce or mitigate wastes are provided in the waste management plan, as part of the ESMP. For construction wastes, these measures include: crushing and on-site reuse of inert materials; segregation of metals, wood, plastics for reprocessing; composting of plant matter; and disposal to designated licensed landfills. For domestic solid waste, these measures include: segregation of recyclable materials; collection in on-site bins and disposal to licensed landfills. For hazardous waste, these measures include: collection and storage for off-site re-processing. Contractors will be required to develop a waste inventory that details the different waste streams, classification, quantities, storage requirements, and potential use, and treatment and disposal arrangements. Periodic audits will be conducted to ensure compliance with ZEMA requirements and EIB standards.

Hazardous materials including tar, diesel fuel, oil and grease will be transported, stored and used during construction. Measures to manage risks and impacts related to

hazardous materials are provided in the hazardous material management plan, as part of the ESMP. These measures include: preparing a register including appropriate Material Data Safety Sheets; undertaking hazardous materials assessments, with results incorporated into the spill prevention and response plan; ensuring appropriate storage with control systems (bunding, automatic alarms and shut-off systems, secondary containment); labelling; securing storage areas; and providing appropriate training to workers. Periodic audits and inspections of hazardous materials transportation transfer and use procedures will be undertaken to ensure that measures comply with the spill prevention and response plan.

Risk and impacts related to accidents and spills of hazardous material during construction will be managed according to the spill prevention and response plan, as part of the ESMP. These measures include requiring contractors, prior to engaging in construction activities, to undertake a spill risk assessment and identify measures to reduce associated risks. The spill risk assessment will be incorporated into contractors' spill prevention and response plans that will include: a description of activity and operator information; notification requirements; spill response frameworks, strategies and equipment; procedures to mobilize external resources for responding to large spills; clean up strategies and handling instructions and treatment or disposal requirements; self-inspection, training, exercises, drills and logs; and security measures. An initial inspection of existing storage tanks will be conducted to identify potential non-conformances and a corrective action plan will be implemented should non-conformances be observed. Periodic inspections will be conducted on the integrity of storage tanks and bunds, location and contents of spill kits, and presence of spill prevention measures that will be recorded in an inspection log. In the event of a significant spill, sampling and monitoring of surface and ground water will be required to assess the need for remediation.

B. ***Operations***: Risks and impacts are related to air emissions from vehicle traffic and surface runoff. The ESIA forecast vehicle traffic air emissions (dust, sulphur dioxide, nitrous oxide, carbon monoxide, and hydrocarbons) for the years 2020 and 2025, finding pollutant levels exceeding WHO standards and IFC EHS Guideline values only for nitrous oxides, which dissipated below threshold at 60m from the road in 2020 and 80m from the road in 2025. Flood risks related to storm water and surface runoff were assessed in the ESIA to be reduced during operation resulting from installation of cross and vertical culverts to improve drainage. The culverts will outlet to nearby surface waters, where potential adverse impacts to water quality have been identified from oil and grease, total suspended solids and metals.

3. Community Health, Safety & Security

A. ***Preparation and construction***: Risks and impacts are related to noise and vibration, traffic safety and community health and safety. These risks and impacts are expected to be managed through Project design and mitigation measures provided in the ESMP, and to be implemented by RDA contractors.

Noise and vibration during construction are expected from operation of quarries (blasting, grinding and hauling), vehicles, equipment and machinery (e.g. backhoe

excavators, pavers, trucks, concrete mixing machines, pile drivers, concrete rollers, cranes, compressors and generators). Maximum noise levels for construction equipment and machinery assessed in the ESIA are expected to range from 74-106 dBA at a distance 15m from the source. Based on the analysis of the ESIA, construction equipment, machinery and works should be located at minimum from 60-320m from residential areas and 340-1,900m from the nearest sensitive receptors (e.g. schools and rural health centres), with pile drivers representing the most significant impact. Noise levels during construction are expected to exceed WHO standards and IFC EHS Guidelines near populated areas and nearest sensitive receptors. The ESIA identified and assessed vibration impacts related to operation of excavators, graders, trucks, compressors and hammers, finding impacts dissipating sufficiently to meet WHO standards 12m from the source for all equipment and machinery, except mechanical hammers, which dissipated sufficiently to meet WHO standards 16m from the source. Measures to reduce or mitigate risks and impacts are provided in the noise and vibration management plan, as part of the ESMP. These measures include: engagement with residents and owner of road side businesses; restricting construction works to daytime hours; installation of noise barriers; utilizing and regularly maintaining equipment and machinery that meets good international industry practice standards for noise attenuation; ensuring that equipment and machinery is turned off when not in use; and fitting of all pneumatic tools with an air exhaust port silencer when used in close proximity to residences. Periodic monitoring of noise and vibration impacts will be conducted at locations where background samples were taken, as well as location of persistent noise complaints. Additional consideration will be made to monitor nearest sensitive receptors identified in the ESIA.

Accident risks to communities from construction-related traffic and disruptions to normal traffic patterns are expected. The ESIA has identified four locations near population centers where significant disruptions to traffic flow are expected to occur. Additional disruption is expected related to bridge construction, where temporary bridges adjacent to the existing bridges will be erected to accommodate traffic flow. Measures to promote traffic safety and mitigate traffic accident risks are provided in the community impact plan, as part of the ESMP. Contractors will be required to develop construction traffic management plans, including: identification and enforcement of haul routes, installation of appropriate barriers and signage, establishment of speed limits for construction-related vehicles, driver training, consulting and agreeing accident procedures with local emergency services such as the Road Traffic and Safety Agency (RTSA), adopting limits for trip duration and arranging driver rosters to avoid overtiredness. A procedure will be established for recording all construction related traffic accidents, and include accident investigation and corrective actions, as required.

Community exposure to health and safety hazards related to active construction works will be mitigated through the community impact plan, as part of the ESMP. Public access to construction and work areas will be restricted through use of security fencing and appropriate signage, presence of security personnel, and permit-to-enter site access controls. A procedure will be established for recording public health and safety incidents that includes procedures for recording of accidents, investigation and corrective actions, as required.

Unarmed security personnel will be employed by construction contractors to restrict public access to construction works, staging and storage areas, as well as to protect construction equipment and machinery when not in use.

B. ***Operations:*** Risks and impacts are related to traffic safety and accidents. Project design includes several features that are expected to improve traffic safety during operations, including: widening of the road, installation of lighting in some sections of the road corridor, safety fencing, kilometer pillars, signage boards, paint marking, convex spherical mirrors and escape ramps.

4. Land Acquisition & Involuntary Resettlement

Resettlement for this project will consist of permanent physical displacement of all structures and other properties such as water points located inside the road reserves and temporary impacts on mostly micro and small businesses during construction.

A. **Enforcement of the mandatory road reserve-**During preparation of this ESIA consideration was given to project components/ activities that would give rise to resettlement. These activities include the enforcement of the mandatory road reserve being defined as 100m for the rural sections and 36m for the heavily settled areas such as Mpika urban area (Km0+Km7), Kalalantenkwe or Shiwang'and BOMA (K7+770-Km89+920) and Mucheleka or Chinsali turnoff area-Km164+550-165+430). The construction activities will be carried out within 22m (i.e. 11m on both side of the existing centerline), which will be enough space to accommodate all road furniture and creation of road detours. Most of the impacts related to demolition of structures will occur in the road reserve and few impacts are within the construction width. Trading centers (i.e. road side shops especially at Mukungwa, Luanya, Mukwikile, Phillip, Kabangama and Kanakashi markets are the most affected areas by the proposed road reserves. To minimize the level of impacts, the recommended 36m road reserve for heavily settled areas of urban areas of Mpika urban, Kalalantenkwe (Shiwang'andu BOMA) and Mucheleka (or Chinsali turnoff area) will be enforced. The above consideration is in line with the Public Roads Act of 2002, which categories "trunk roads" to require a road reserve of 100m while "urban" roads to have a road reserve of 36m.

B. **Access and Siting of Borrow Pits-**The design for the project proposes to use of existing borrow pits for all new works, 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 and if this will lead into private properties, then the requirements of the Public Roads Act of 2002 in relation to involuntary settlement will be evoked to ensure that affected private properties are adequately covered.

The extent of the impact is discussed under the following categories:

A. Structures

1. ***Loss of residence-*** People who will be displaced by having to move their place of residence to allow for the preservation of the road reserve of the project road, construction camps, access roads, or any other associated infrastructure. The enforcement of the mandatory road reserves will affect 239 structures currently used as residences. In terms of lots, there are no

houses in Lot 1, which will be demolished. In Lot2 122 houses are found within the road reserve while in Lot3, 117 houses are found within the road reserve and will need to be demolished.

2. ***Loss of Roadside Shops and business*** – People who will be displaced by having to move their places of business to allow for the construction of the road related infrastructure. These are business shops and selling points etc. The enforcement of the mandatory road reserves will affect 209 shops currently used as road side shops. Of these shops, 12 shops are found in Lot1, 127 shops are found in Lot2 while 69 are found in Lot3.

B. Loss of Business Income

Shop owners or tenants are not expected to lose income as a result of the project because compensation payments are expected to be paid well in advance and shop owners or tenants will be allowed to continue operating their businesses in their current shops while new shops are being built using compensation funds. However, building of new shops will only be done within the agreeable time frame (i.e. communities proposed an 8 month period after payments of compensation).

C. Loss of land

People who will lose land over which they have established ownership or rights of usufruct (either in a permanent or temporary fashion) to allow for the construction of the road associated infrastructure. There are only two land owners with titles to their lands and lands for the rest of the PAPs are under the three traditional chiefs of Chief Chikwanda, Chief Mukwikile and Chief Chibesakunda. Given the complexity of valueing land, which has not been surveyed and under traditional chiefs, a flat value of ZMW2,000 was agreed upon with the PAPs and the local leadership for each affected PAP and has been included in the final values of the affected properties (i.e. houses and shops). The ZMW2, 000 was recommended to be appropriate in that traditional plots from area chiefs are within a range of less than ZMW1, 000. In addition, majority of the PAPs will not be relocated to other places but will need to make a push back *(i.e. majority of PAPs will not be required to completely move from their current plots and only part of their lands found inside the road reserve will be expropriated. This means that PAPs will still construct their new houses on the remaining piece of land but outside the road reserve).* The ZMW2, 000 therefore is adequate for those PAPs who may need to show a token of appreciation for new plots from area chiefs. Lot1 is the only section of the project road which has some titled land (3) in Lot2 and Lot3 all the affected land fall under traditional authority and there is no PAP with a titled land.

D. Communal resources

Members of communities who will lose access to their communal resource base. These will include unprotected wells and boreholes, water taps, communal play grounds, market places and other resources. In order to comply with international best practices, all water points regardless of

whether they are traditional wells or protected wells will all be replaced with a modern mono pump from a borehole with an estimated cost of ZMW24, 000 for each water point. Most of the affected water points are traditional unprotected wells, which shall be replaced with hand pumps. In terms of distribution, Lot1 has no water points affected; Lot2 has 13 affected water points while Lot3 has 14 affected water points.

E. Sanitation Facilities

As is the case with water points, all toilets (majority of which are pit latrines) will be replaced with Ventilated Improved Pit latrines (VIP) toilets as a way of complying with international best practices.

F. Places of worship

Worshipers who may be affected through having their place of worship having to be relocated from the road reserves. However, there are only 4 churches affected by the enforcement of the mandatory road reserve and these are found in Lot2 (1) and Lot3 (3) only.

G. Archaeology and cultural heritage

There are no known archaeological remains and structures of historical importance in the area. The cultural heritage along project road such graves were found to be located outside the road reserve and therefore no impacts are expected.

H. Impact on Vulnerable Groups

The socio-economic survey and subsequent analysis indicates that there are PAPs who are particularly vulnerable and are at greater risk of further impoverishment because of the implementation of the project. According to the Law on Social Welfare and Child Protection, vulnerable are usually identified as people find themselves in a situation of sudden and temporary need and are not able to cope with the situation and therefore requires external support. In Zambia, disability, old age, women headed household, internally displaced people or refugees, ethnic groups, minorities, landless labourers, women head of household, etc.), are usually regarded as vulnerable. The household assessment conducted among the PAPs show that 25 households fall had one or two of the above classifications and therefore fall within the category of vulnerable people. The identified vulnerable household heads will get special treatment during the resettlement process. The following table shows the vulnerable project affected persons and the special treatment that will be provided for them.

Majority of the affected PAPs (98.3%) have indicated that they have enough land in their current localities to build new structures using compensation fund and such it is expected that only a push back away from the road reserve will occur and very few if any will complete relocate to new areas. Majority of the PAPS therefore will remain in their same villages and localities.

Physical resettlement has not yet occurred but will likely to be carried out within the next several months. Preparatory work has begun. The consultation and resettlement process for these households is as follows, and reflects the different roles of the government and private project sponsors in the Zambian context. First, the project company works with local authorities to confirm the social demographic information and property inventories for each household. Second, RDA will submit a RAP Framework (a resettlement planning document) to the local authorities to establish compensation to be paid in each case. Third, RDA and the local authorities will meet with the households affected to discuss the finalized compensation amounts. Fourth, provided that PAPs agree with the compensation proposed, RDA and local authorities will together establish a schedule for acquisition and payment. If PAPs do not agree with the compensation proposed, additional meetings will be held until an agreement can be negotiated. The government has powers of expropriation it can exercise if an agreement is not ultimately possible, but local authorities interviewed reported that in recent resettlement activities for other projects they have not experienced any case, which has resulted in resorting to courts although PAPS affected by this project will be at liberty to resort to courts of law.

There are approximately 239 PAPs involved in micro and small businesses situated along the sides of the road. Temporary impacts are anticipated and will include impacts as a result of noise, dust, and impaired access to the business sites while construction is taking place in the immediate vicinity. The most important mitigation measure will be to complete construction as quickly as reasonably possible in each location. The project estimates construction time as being 21-36 days for most sections. Other mitigation measures include standard measures for dust and noise, discussed above, as well as the construction of simple, temporary wooden bridges to allow access across culverts. Business owners have generally expressed support for the project and expect a permanent improvement in business following completion of construction.

Issues that are still pending resolution or confirmation at this stage in order to ensure compliance include: 1) determination that the compensation amounts to be paid for physical resettlement adequately correspond to full replacement value for all lost assets, and as part of this, that any distinctions made based on ownership or type of tenure are consistent with the regulations and laws of Zambia and EIB standards; 2) possible supplementation of the official grievance mechanisms where necessary; 3) verification that household lessees to be permanently resettled, who are not believed to be numerous, will receive adequate compensation; and 4) ongoing monitoring and mitigation of business impacts during construction.

5. Labour and Working Conditions

At peak construction, RDA contractors will employ approximately 1,000 workers. RDA will require receiving a Human Resources policy for contractors and all construction contractors consistent with the Zambian labour laws and EIB standards, reflecting transparent worker relations, terms and duration of employment, and a grievance mechanism, all based on the principle of non-discrimination.

Occupational health and safety ("OHS") measures provided in the ESMP include, requiring contractors to identify potential hazards and develop responses to eliminate sources of risks or minimize workers' exposure to hazards. Residual risks that cannot be avoided will be managed through appropriate protective measures, including controlling the hazard at the source and providing appropriate personal protective equipment (e.g. hats, gloves, boots, vests). Contractors will be required to provide training to all workers on OHS aspects relevant to their daily work and emergencies. All occupational injuries, illnesses and fatalities will be documented, recorded and investigated. Access to first aid and medical assistance from trained and licensed professionals will be provided. A health and safety technical consultant will be contracted to establish and notify contractors of OHS procedures, periodically inspect and report on OHS performance of construction activities and promptly notify the resident engineer and RDA of non-conformances and recommend remedial measures.

Construction workers will be housed in rooms and homes to be constructed by contractors. Minimum requirements for these accommodations are provided in the ESMP.

ENVIRONMENTAL & SOCIAL MANAGEMENT & MONITORING

An Environmental and Social Management and Monitoring Plan (ESMMP) for project road have been prepared. The ESMMP describes the environmental and social mitigation and monitoring measures, the criteria for their successful implementation and the organizational measures to be implemented during the pre-construction, construction and operation of the Project. The ESMMP involves a long term and phased process which will need to be regularly reviewed and updated as the Project evolves to reflect any changes in the Project implementation and organization as well as in regulatory requirements.

The ESMMP details environmental and social measures for the construction and operation of the project road; including the requirement to establish and implement an Environmental and Social Management System and monitoring plan along with a number of specific Environmental and Social Management Plans, including a Dust Management Plan, Biodiversity Management Plan and Traffic Management Plan.

For each identified impact a monitoring protocol will be established that will define the objective of the monitoring, the description and timing of monitoring activities, the indicator to measure the effectiveness of the measure, and any thresholds to be taken into account. Monitoring reports will be required from the Contractor during the construction phases. These will be submitted to the relevant inspection authority. The monitoring plan is integrated within the ESMMP.

The goal of the ESMMP is to ensure that all necessary mitigation measures are carried out to counter any adverse environmental impacts, and that enhancement measures are used where feasible and practical. The ESMMP will allow for redesigning mitigation measures if from the monitoring it is observed that the mitigation measures are not working.

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ABBREVIATION/LIST OF ACRONYMS

ASL	Above Sea Level
CBD	UN Convention for Biological Diversity
CBO	Community Based Organization
CLO	Community Liaison Officer
CPC	Concrete pipe culverts
CSO	Central Statistics Office
DC	District Commissioner
DFS	Definitive Feasibility Study
DIA	Direct Impact Area
EHS MS	Environmental, Health and Safety Management System
EIA	Environmental Impact Assessment
ESIA	Environmental and Social Impact Assessment
EIB	European Investment Bank
EIS	Environmental Impact Statement
EPB	Environmental Project Brief
EMP	Environmental Management Plan
ESMP	Environmental and Social Management Plan
EPPCA	Environmental Protection and Pollution Control Act 1990
ESMP	Environmental and Social Management Plan
ESIA	Environmental and Social Management Plan
ESSS	Environmental and Social Scoping Study
ESU	Environmental and Social Unit
EU	European Union
GMA	Game Management Area
GRZ	Government of the Republic of Zambia
HCS	Hazardous Chemical Substances
HH	Household
HOD	Head of Department
INDIA	Indirect Impact Area
HSEC	Health, Safety, Environment, Community
NCS	National Conservation Strategy
NGO	Non- Governmental Organization
NHCC	National Heritage Conservation Commission
NRFA	National Road Fund Agency
PLC	Public Liaison Committee
RAP	Resettlement Action Plan
RHC	Rural Health Centre
RDA	Road Development Agency
ROADSIP	Road Sector Investment Programme
RTSA	Road Transport Safety Agency
SEP	Stakeholder Engagement Plan
SNDP	Sixth National Development Plan
TOR	Terms of Reference

T2	Code for the Mpika-Chinsali Road
UNFCCC	United Nations Framework Convention on Climate Change
ZEMA	Zambia Environmental Management Agency
ZMW	Zambian Kwacha

CHAPTER ONE

PROPOSED REHABILITATION OF THE MPIKA TO CHINSALI ROAD (T2)

1.1. Introduction

This document is the Draft Report of the Environmental and Social Impact Assessment (ESIA) Report for the proposed rehabilitation of the T2 Road from Mpika to Chinsali in Muchinga Province of Zambia. The Republic of Zambia (GRZ) has approached the European Investment Bank (EIB) to finance the rehabilitation and construction works on the T2 road from Mpika to Chinsali.

As part of the application for funds and in order to meet regulatory requirements, the Road Development Agency (RDA) has procured the preparation of a Project Design Review and the Environmental Social Impact Assessment (ESIA) for the Project. This draft ESIA is being published and disclosed for comment as part of the process for finalizing and gaining regulatory approval and financing of the Project. Following the comment Period, the ESIA will be updated to reflect comments made by stakeholders and information will be provided regarding how comments have been addressed. The final decision and version of the ESIA will be made publically available.

1.2. Legal and Policy Requirements for the ESIA

According the Zambia 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*".

Similarly, the EIBs environmental screening guidelines, projects involving upgrading and rehabilitation of major roads are subject to the EIA requirements of Directive 85/337/EEC[3].

As part of their decision making process, EIB require an evaluation of the proposed Project through an Environmental and Social Impact Assessment (ESIA) that meets, EIB and other applicable international guidelines and requirements. According to the EIB categorization of the financed projects based on environmental and social criteria reflecting the level of potential impacts and nature and level of assessments, information disclosure and stakeholder engagement, the Project falls within Appendix 1:

Category A projects, subcategory 7: Construction of motorways, express roads and lines for long distance road traffic. Therefore a participatory assessment process was carried out following the EBRD Performance Requirements given in their Environmental and Social Policy (20084), as well as the EIB's environmental and social requirements outlined in their Environmental and Social Practices Handbook (Version 2: 24/02/2010). The development of

[3] Council Directive of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment (http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1985L0337:20030625:EN:PDF

the Zambian EIA and EIB's ESIA has been consolidated into one process and documented in this single report.
In line with Zambian EIA regulations on public participation in the EIA process and EIB requirements[4] there must be public involvement in the ESIA procedure. Therefore the draft ESIA is being published for comment as part of the process for finalizing and regulatory gaining of approval and financing of the Project.

1.3. The Project

The Project Road is located in the Muchinga Province in the North-Eastern part of Zambia. It starts at the RDA Weigh Bridge in Mpika at Kanjela Village (S=1152.399; E03125.765) and ends shortly before the T2 intersection with the access road to the provincial headquarter Chinsali.

The project will involve widening of the existing road by approximately 2m on both sides from the existing edge of pavement to create a total width of 11 m for the roadway and 12 m for the roadbed. This means that motor vehicles will have 7m (3.5m for each lane) while the 2m at the end of a motor lane will be shoulder that can be used for over taking but also for cycling and walking.

The construction approach will be as follows:

- Rip the existing pavement down to under the sub grade and reuse the material as much as possible in fill. Then prepare the road bed and come up with an improved sub grade, cement stabilized sub base and crushed stone base with wearing layer of 50 mm AC. The thickness of the layers depends on the overall E Modulus remaining in the road structure after it is ripped. This option also allows for raising the road which helps taking the critical pavement layers outside the permanent moist zones.
- Widening of the road base (cut or fill) removing the existing shoulders and leaving a clear cut in the existing cemented base and underlying existing granular subbase. Preparation of widened road base as described under SPA clause 3305.
- Construction of 150 mm granular subbase layer of the widened section, till the base level of the existing CTB layer and compacted against the remaining CTB of the old carriageway.
- Spread additional material as needed to widen the existing CTB layer, cut and mill old CTB layer and mix with added material. Stabilize to homogeneous new cemented sub-base layer over the whole road bed width (shoulder to shoulder) in layer thickness of 150 to 200 mm as specified in the drawings.
- Add a new granular base course in layer thickness 150 mm over the whole road bed width (shoulder to shoulder).
- Finishing of pavement with asphalt base and surface layers from shoulder to shoulder as specified in the typical cross section drawings.

In order to speed up the construction of the 165Km road stretch, the project has been divided into three lots which will be constructed by three different contractors and to be financed by two different sources as follows:

[4] Including the EIB Corporate Operational Plan 2011-2013, the EIB Statement of Environmental & Social Principles & Standards; 2009 and the EIB Environmental & Social Practices Handbook (Version 2 of 24/02/2010).

1. Lot 1: (From Mpika weighbridge to Mazingo with possible financing from the Chinese);
2. Lot 2 - (From Km 4+100 to Km 86+770): Mpika to Shiwan'gandu Junction (D53/T2 Junction) – 82.7 km with possible financing from EIB; and
3. Lot 3 – (Km 86+770 to Km 165+646) Shiwan'gandu Junction (D53/T2 Junction) to Chinsali Junction – 78.8km with possible financing from EIB.

In addition to the proposed expansion of the carriageway, GRZ through the Road Development Agency (RDA) intends to enforce the mandatory 100m road reserve applicable to all trunk roads in Zambia including the project road from Mpika to Chinsali. This means that government intends to remove all built structures from the project road reserve. Two road reserves will be enforced and will include 50m on each side of the existing centerline and this will apply to much of the road length; while in three locations of the road corridor at Mpika urban area (Km0+Km7), Kalalantenkwe or Shiwang'andu BOMA (K7+770-Km89+920) and Mucheleka or Chinsali turnoff area-Km64+550-165+430) and 36m (i.e. 18m on each side of the existing centerline) road reserve will be enforced.

In villages with lots of people where pedestrian traffic is considered to be relevant such as Mpika urban area (Km0+Km7), Kalalantenkwe or Shiwang'andu BOMA (K7+770-Km89+920) and Mucheleka or Chinsali turnoff area-Km64+550-165+430), paved pedestrian walkway will be constructed to accommodate pedestrians.

1.3.1. Total Project Cost/Investments

The expected project cost is approximately ZMW 460 billion

1.4. Project Objectives

The principal, overall objective of the services is to "provide the necessary reconstruction of the T2 road from Mpika to Chinsali with a view of achieving a 20 year life with appropriate maintenance."

In addition, the RDA has resolved to enforce the mandatory road reserve of 100m applicable to the project road (i.e. 50m on either side of the road from the existing centerline) as per the Public Roads Act. It is obvious that enforcement of this road reserve has serious implications on properties, crop fields, fruits and service facilities located within the road reserve.

1.5. Justification of the Project

The T2 Road from Mpika to Chinsali has outlived its life span. The average life of a bituminous road surface is 20 to 30 years. However, it starts to show signs of distress and deterioration much earlier. Exposure to sunshine oxidizes the bituminous material and causes drying and cracking. Rain can seep through cracked surfaces into the road base and cause premature failures such as pot-holes. When the road surface has been properly maintained by sealing or overlaying every 7 to 10 years, then more expensive reconstruction is necessary only every 20 to 30 years. The current pavement for the T002 road from Mpika to Chinsali has existed for over 30 years now and therefore needs to be reconstructed.

In its current state, the road does not provide a safe and sufficient road transport system capable of supporting the productive sectors and the social and economic transformation of the

country as a whole. Currently, the project road is only passable because of the routine and Periodic maintenance by Government. The road maintenance costs, vehicle operating costs and travel times have obviously remained very high and therefore the need to reduce these costs associated with the current state of the road cannot be overemphasized.

The primary economic function of the road is the long distance transportation of goods between Zambia, Tanzania and the Democratic Republic of Congo. Thus the rehabilitation of the road has immediate relevance to inter-regional trade and transit traffic between Zambia and its neighbours. In addition, this road traverses productive agricultural areas and is essential for the local transportation of agricultural inputs and produce. The project area also has great potential to develop its livestock industry.

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.

1.6. Purpose of the ESIA

The purpose of the ESIA is to identify and assess the potential positive and adverse impacts that may arise from the rehabilitation of the project road and enforcement of the relevant road reserves on the physical and natural workforce) at the local (municipalities), regional (Muchinga Province), national (Zambia) and transboundary levels, including an assessment of road accidents and identification of road safety provisions.

The Project activities that have been considered as part of the ESIA include those to be undertaken during the design, rehabilitation/construction and operation of the road. Decommissioning of construction sites and temporary facilities is also considered within the scope of the assessment. However, decommissioning of the road has not been considered within the ESIA at this stage due to both limited information being available at this stage with regard to the ceasing of operation of the project road and given the intention that with maintenance the project road will continue to operate beyond its design life. In the event that the project road ceases operation and needs to be decommissioned relevant approvals will be sought and if required an ESIA will be prepared.

Identified impacts have been assessed taking into account the environmental and social baseline conditions analyzed for the study area, and, where necessary and appropriate, mitigation measures to avoid, prevent, mitigate or compensate significantly adverse impacts and enhance beneficial impacts have been proposed. In this regard, a mitigation and monitoring plan to both monitor and evaluate the implementation of mitigation measures and the Project performance on environmental and social baseline conditions has been included as an integral part of the ESIA. Furthermore, the assessment determines the significance of residual effects remaining on the environment and community as a result of the Project following implementation of the mitigation measures.

The ESIA has been prepared in line with the ZEMA EIA requirements and with reference to EIB requirements and other international applicable standards, such as the International Finance Corporation (IFC) Environmental, Health & Safety (EHS) Guidelines for Roads

(April 2007). The scoping assessment and methodology for the ESIA is presented in Chapter 5 Assessment Methodology & Scoping.

The draft ESIA will be disclosed to the public. The comment Period will be 30 days, ensuring that all stakeholders have an opportunity to express their views. A Stakeholder Engagement Plan (SEP) has been developed as a communication tool for the Project and using this the stakeholders were identifie and have been involved during the development of the draft ESIA. Upon completion of the comment Period, the ESIA Study will be updated to reflect the comments made by stakeholders and information will be provided about how comments have been addressed. In addition, these comments will be fed into the future work on the detailed design and construction of the Project. The final decision and version of the ESIA will be made publically available.

1.7. Project Proponent

The Road Development Agency (RDA) on behalf of the Republic of Zambia (GRZ) is the project proponent.

1.7.1. Contact Details of Applicant

The Director and Chief Executive Officer
Road Development Agency
Government/Fairley Road
P.O. BOX 50003
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Tel: (260)-211-253088/253002/253801
Fax +(260)-211-253404/251420
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Contact Person

Gershom Chilukusha -Environnemental Officer
gchilukusha@roads.gov.zm

1.7.2. Particulars of Shareholders/Directors

Road Development Agency (RDA) representing the Government of Zambia.

1.7.3. Track Record

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

1.8. Content of the ESIA

The ESIA has been structured to follow a commonly accepted impact assessment format and is reflective of the stages within the Zambian EIA procedure. The ESIA is organized into 15 chapters with the following content:

- **Chapter 1- Non-Technical Summary (NTS):** presents the Non-Technical Summary of the ESIA of the proposed Project.

- **Chapter 2- Introduction:** provides general information about the Project, the legal & policy basis of the ESIA, the Project proponent and ESIA assessment team, and the purpose and content of the ESIA.
- **Chapter 3- Legal & Policy Requirements:** describes environmental and social policy, legislation and standards relevant to the Project, at both national and EU levels, as well as multilateral agreements and conventions signed/ratified by the Republic of Zambia.
- **Chapter 4-Project Description & Consideration of Alternatives:** describes the technical specification of the Project and its background, need and objectives along with outlining the expected benefits from the Project, the land use and land take, the Project phases and programme, and the proposed labour and workforce arrangements and facilities. The Chapter also describes the route alternatives considered and the selection of the final route.
- **Chapter 4 Assessment Methodology & Scoping Assessment:** defines the scope of the assessment based on the issues which have the potential to cause significant effects on the receiving environment and communities, and the opinions of stakeholders. Describes the methodology applied for the assessment of potential environmental and social impacts and the determination of the significance of residual effects.
- **Chapter 5 Baseline Environmental & Social Conditions:** describes baseline environmental and social conditions, focusing on sensitive issues and vulnerable groups.
- **Chapter 6 Potential Environmental & Social Impacts:** describes the potential environmental and social impacts resulting from the proposed road project activities, including cumulative, synergy and transboundary impacts.
- **Chapter 7 Environmental & Social Mitigation Measures and Residual Environmental & Social Effects:** presents the environmental and social mitigation measures proposed to avoid, prevent, mitigate and/or compensate the adverse impacts and enhance the beneficial impacts of the road Project. Describes the potential residual environmental and social effects remaining from the Project following the implementation of mitigation measures and presents the likely significance of these residual effects along with a summary of the likely significant residual environmental and social effects.
- **Chapter 8 Environmental & Social Management & Monitoring:** presents the proposed environmental and social management and monitoring program designed to evaluate the implementation and performance ofthe mitigation measures and the overall environmental and social performance of the Project.
- **Chapter 9 Analysis of Technical Insufficiency & Need for Update of the ESIA Study:** describes the various technical insufficiencies encountered during the ESIA development in terms of data availability (lack of data) and collection.
- **Chapter 10 Conclusion:** summarizes the key findings and conclusions of the assessment including the potential significant residual environmental and social effects.

CHAPTER TWO

POLICY, LEGAL AND ADMINISTRATIVE FRAMWORK

2.1. Zambia Policies and Legal Frameworks

2.1.1. Relevant Policy Framework

2.1.1.1. National Policy on Environment (2007)

- To promote the sound protection and management of Zambia's environmental and natural resources in their entirety, balancing the needs for social and economic development and environmental integrity to the maximum extent possible, while keeping adverse activities to the minimum;
- To ensure broad-based environmental awareness and commitment to enforce environmental laws and to the promotion of environmental accountability;
- To build individual and institutional capacities to sustain the environment;
- To regulate and enforce environmental laws; and
- To promote the development of sustainable industrial and commercial processes having full regard for environmental integrity.

2.1.1.2. National Forest Policy (2014)

- To ensure the integrity, productivity and the development potential of the forest resources;
- To ensure adequate protection of forests, by empowering local communities and promoting the development and use of wood, non-wood forest products and services;
- To ensure sustainable management of forest ecosystems and biodiversity through the application of both scientific and local knowledge;
- To improve the role of forests in the provision of ecosystem services and abatement of climate change; and
- To ensure the establishment and sustainable management of forest resources for wood fuel production.

2.1.1.3. National Agriculture Policy (2013)

- To promote the sustainable management and use of natural resources; and
- To mainstream environment and Climate Change in the agricultural sector.

2.1.1.4. Draft National Policy on Climate Change (2012)

- Provide a conducive and enabling policy framework and a concerted programme of action to minimize the impacts of climate change, based on existing sectoral policies and strategic plans;
- Provide a coordinated approach and overall guidance to the implementation of climate change activities including climate change adaptation and mitigation programmes, awareness creation, education, capacity building, technology development and transfer, and financing, among others;

- Put in place robust adaptation and mitigation measures needed to minimize risks associated with climate change and maximize opportunities as well as monitoring, verification and reporting systems;
- Promote multi-communication and dissemination pathways and enhance awareness and understanding of climate change and its impacts;
- Promote development pathways that generate co-benefits and provide incentives for addressing climate change more effectively;
- Promote Zambia's effective participation in the global climate change negotiations;
- Promote investment to achieve climate-resilient and low emission development;
- Promote and support research on climate change and variability; and
- Establish a long term institutional arrangement for implementation of climate change actions.

2.1.1.5. National Climate Change Response Strategy (2012)

- Enhancing sustainable agricultural production and food security;
- Sustainable water resource management;
- Protecting health from climate change and climate variability;
- Developing sustainable land use systems;
- Climate-proofing infrastructure;
- Developing a less-carbon intensive transport system;
- Ensuring the resiliency of the energy systems to climatic shocks;
- Investing in/developing less carbon-intensive energy systems; and
- Mainstreaming: Climate Screening and Proofing carried out in all relevant sectors.

2.1.1.6. National Agriculture Investment Plan (2013)

- To improve land-use planning and enhance community participation in integrated land-use systems (land administration and management);
- Efficient water use and management;
- Promotion of afforestation, community woodlots and agroforestry;
- Promotion of efficient energy use from natural resources;
- Sustainable capture fisheries management; and
- Promotion of sustainable crop and livestock production.

2.1.1.7. National Adaptation Programme of Action on Climate Change (2007)

- The aim of the programme is to improve the conservation of biodiversity to mitigate the impacts of climate change and promote resilience among local communities and businesses.

2.1.1.8. National Tree Planting Programme (2013)

- The aim of the programme is to plant a total of 2,000 ha of exotic tree plantation, as well as community woodlots, in each of the 10 provinces. Additional objectives include improving protection of ecosystem services such as watershed management and biodiversity conservation through reduced pressure on indigenous forests.

2.1.1.9. Guidelines for Road Rehabilitation Environmental and Maintenance Work

In August 1997, the former Ministry of Transport and Communications (MOTC) published guidelines to be used by those involved in the planning, designing, and 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 Mpika-Chinsali Road project, 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.*

2.1.1.10. National Resettlement Policy Guidelines

Resettlement due to road rehabilitation activities in Zambia is a new phenomenon primarily because the country is sparsely populated, and there hasn't been significant new road construction that might have given rise to human displacement. Although Zambian legislation covers compensation for lost structures, cropland and fruit trees, resettlement issues have hitherto not been addressed. The RDA's Guidelines for involuntary resettlement dated November, 2003, is the first policy document that aims at ensuring that persons who suffer displacement and resettlement arising from road rehabilitation activities can be compensated adequately for their losses at replacement costs[5]. Moreover, the Guidelines seek to outline roles and responsibilities by various stakeholders in the planning, implementation, monitoring and evaluation of resettlement activities. These Guidelines are in tandem with World Bank Operational Policies on Involuntary Resettlement and existing national legal provisions.

Relevance: *These guidelines are relevant to the current project in that an estimated 255 structures are likely to be demolished as they are found in the road reserve of 100m.*

Compliance: *The consultant has prepared a Resettlement Action Plan (RAP) in line with these policy guidelines and the RAP is being submitted under a separate cover to this EIS.*

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 rehabilitation project from Mpika-Chinsali.

[5] **Replacement cost** – The rate of compensation for lost assets must be calculated at full replacement cost, that is, the market value of the assets plus transaction costs. With regard to **household and public structures** – it is equivalent to the cost of purchasing or building a new structure, with an area and quality similar to or better than those of the affected structure, or of repairing a partially affected structure, including labor and contractors' fees and any registration and transfer taxes.

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: *During the detailed study, the consultant did not only review the EMA but also identified all the negative environmental and social impacts likely to result from the project. The consultant has further developed mitigation measures for the negative impacts, and advised RDA on how best to implement the mitigation measures in order to minimize the impacts in line with the requirements of this Act.*

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: *The consultant had in the initial phase of the EIA process, conducted scoping meetings along the road corridor, and produced a Scoping Report and Terms of Reference (TOR) for the rehabilitation of the Mpika-Chinsali road project. The TORs were consequently approved by the Zambia Environmental Management Agency (ZEMA) as attached in Appendix 1. After the approval of the TOR, the consultant then carried out baseline studies by different specialists and in line with the approved TOR. This EIS Report is a summary of the baseline studies conducted along the project road corridor in line with the requirements of the EIA Regulations, and contains an Environmental and Social Management Plan (ESMP).*

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 rehabilitation of the Mpika-Chinsali Road in that:

- *During construction, the contractor will generate lots of used oils and petroleum waste which will need to be disposed off;*
- *The project will generate lots of waste from construction activities, and in the construction camps by construction workers, which will need to be disposed off; 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: *The Consultant has, in this EIS, proposed mitigation measures and has recommended that RDA and its contractors should comply with the requirement of these regulations, by using services of a licensed company to dispose off used oils and petroleum waste and this will apply to the project area in total. In addition, the Consultant has proposed measures that the RDA's contractors, through the risk assessment, environmental, health and safety guidelines, shall use to manage all wastes generated during project implementation. The consultant has also recommended to RDA the necessary steps that will be required in order to abstract water from these water bodies in line with the Act.*

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 some water bodies crossed by the Mpika-Chinsali Road such as Lwitikila and Luanya Rivers. These water bodies are a main source of water for communities found in the project area.*

Compliance: *The consultant has in this ESIS proposed measures that 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. The consultant has recommended to RDA on necessary steps that will be required in order to abstract water from these water bodies in line with the Act.*

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: *Although the project road corridor is void of any tourist attraction sites within its immediate areas of influence, it is a major route for tourists who may wish to visit the North Luangwa National Park No2* (i.e. Lwanya Village (Chitembo junction) at North Luangwa National Park turn off.) *In addition, the Shiwan'gandu Ranch, Kapisha Hot springs and the Chipoma falls are also some of the tourist attractions serviced by the project road. The 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, the ESIA consultant engaged various stakeholders to understand how the rehabilitation of the Mpika-Chinsali road might help to boost tourism in the project area of influence. In addition, the consultant has recommended that the RDA and its contractors make deliberate effort 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 project road corridor.*

2.1.2.6. The Zambia Wildlife Act, Act Number 14 of 2015

An Act to provide for the winding up of the affairs of the Zambia Wildlife Authority; establish the Department of National Parks and Wildlife in the Ministry responsible for tourism; provide for the appointment of a Director and other officers responsible for National Parks and Wildlife; provide for the transfer of the functions of the Authority to the Ministry responsible

for tourism, Department of National Parks and Wildlife and Director of National Parks and Wildlife; establish the Wildlife Management Licencing Committee; provide for the establishment, control and management of National Parks, bird and wildlife sanctuaries and for the conservation and enhancement of wildlife eco-systems, biological diversity and objects of aesthetic, pre-historic, historical, geological, archaeological and scientific interest in National Parks; provide for the promotion of opportunities for the equitable and sustainable use of the special qualities of public wildlife estates; provide for the establishment, control and co-management of Community Partnership Parks for the conservation and restoration of ecological structures for non-consumptive forms of recreation and environmental education; provide for the sustainable use of wildlife and the effective management of the wildlife habitat in Game Management Areas; enhance the benefits of Game Management Areas to local communities and wildlife; involve local communities in the management of Game Management Areas; provide for the development and implementation of management plans; provide for the regulation of game ranching; provide for the licensing of hunting and control of the processing, sale, import and export of wild animals and trophies; provide for the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora, the Convention on Wetlands of International Importance especially as Waterfowl Habitat, the Convention on Biological Diversity, the Lusaka Agreement on Cooperative Enforcement Operations Directed at Illegal Trade in Wild Fauna and Flora and other international instruments to which Zambia is party; repeal the Zambia Wildlife Act, 1998; and provide for matters connected with, or incidental to, the foregoing.

Relevance: *The initial assessment during the Scoping phase of the EIA has given some indication that the road corridor is void of significant wildlife, especially mammals. This is particularly so because the road corridor does not pass through any National Park or Game Management Area (GMA). However, the turn off to North Luangwa National Park is located along the project road corridor at Km59+400 at Luanya Village. In addition, the project road corridor host the junction to the Shiwa Ng'andu Ranch, which is a private conservation estate located about 32 Km off the project road at Shiwa Ng'andu Boma.*

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

2.1.2.7. The Forest Act, Act Number 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 organisations and other stakeholders in sustainable forest management; provide for the conservation and use of forests and trees for the sustainable management of forests 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 Water Fowl Habitat, the Convention on Biological Diversity, the Convention to Combat Desertification in those Countries exRDAencing 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.

Relevance: *The project road cuts across the Bwinjimfumu National Forest Reserve. In addition, the rehabilitation works and widening of the project road will also entail clearing of trees to pave way for road construction and this impact will be severe in areas where construction camps and detours will be set up or constructed and where new borrow pits will be opened.*

Compliance: *The consultant 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 EIA, the consultant has paid particular attention to establish the presence of any artefacts or objects of archaeological significance along the project road.*

2.1.2.9. The Urban and Regional Planning Act of 2015:

This provides for development, planning and administration principles, standards and requirements for urban and regional planning processes and systems; provide for a framework for administering and managing urban and regional planning and establish a democratic, accountable, transparent, participatory and inclusive process that allows for involvement of communities, private sector, interest groups and other stakeholders in the planning, implementation and operation of human settlement development. To ensure sustainable urban and rural development by promoting environmental, social and economic sustainability in development initiatives and controls at all levels of urban and regional planning.

Relevance: *This Act is relevant to the current project in that the contractor would need permission from authorities for construction camps and for sources of materials. In addition, there are some properties and structures located within the project road reserve and such would need to be relocated in line with the provision of the Act.*

Compliance: *The consultant engaged the three councils and boundaries have been noted. During the Resettlement Action Plan (RAP) preparation, the ESIA and RAP consultant engaged various stakeholders such the three local authorities (Mpika, Shiwang'ndu and Chinsali) and local traditional authorities to ensure that the project does not lead to unplanned settlements and development along the project road corridor.*

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 structure is allowed.

Part II of the Act and Clause 21 gives the width of any road or class of roads and states that:

(2) Except as otherwise provided the width referred in subsection (1) shall be-

- For trunk road, one hundred meters
- For a main road, sixty meters;
- For a district road, thirty six meters;
- For a branch road, thirty six meters;
- For an urban road, thirty six meters;
- For a park road, eighteen meters; or
- For any other class of road, eighteen meters.

Relevance: *Although the project road is an existing road, very few people along the road corridor are aware of the road width requirement for the project road. The project plans to relocate all structures and properties found within the proposed road reserve (i.e. 50m on both side of the existing center line for rural section of the road and 36m for the urban areas such as (Mpika urban area, Kalalantenkwe (Shiwang'andu BOMA) and Mucheleka (or Chinsali turnoff area).*

Action: *The consultant has prepared a Full Resettlement Action Plan (RAP) which has captured all structures and assets within these road reserves so that owners of such assets can be compensated for the relocation of their properties outside the road reserves.*

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 to the Project: *During the construction phase, the project is expected to be transporting materials and will be operating heavy construction machineries. This has potential to cause accidents hence traffic control measures have to be implemented in accordance with the provisions of the Act. During operation phase, over-speeding may increase as a result of the "new road fever" which may results in accidents and therefore measures will have to be implemented in line with the Act.*

Compliancy: *The designs for the project road has included production of a Road Safety Report have highlighted the measures to be implemented in order to improve on issues of safety in line with the Act. These safety measures shall have been included in the ESMP and in Appendix 11.9.*

2.1.2.12. The Public Health Act, 1930 Cap 535 of the Laws of Zambia:

This act, as amended from time to time, has the objective of preventing and suppressing diseases and generally regulates all matters connected with public health in Zambia. This law may be read together with the *Local Government Act, Cap 281* of the laws of Zambia.

The Public Health Act empowers a Council to prevent diseases and pollution dangerous to human health and to any water supply for domestic use.

Relevance: The project road corridor has a number of surface water bodies, *which can be contaminated by the project activities. In addition, there are other project activities such as dust that has potential to pose public health risk, and therefore, this Act is very relevant to the proposed project.*

Compliance: *RDA and its management will ensure that measures to prevent diseases and pollution dangerous to human health are taken into account by ensuring that there are good toilet facilities as well as waste disposal systems on its working premises.*

2.1.2.13. The Employment Act, 1999:

An Act to provide 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; to make provision for the protection of wages of employees; to provide for the control of employment agencies; and to provide for matters incidental to and consequential upon the foregoing.

Relevance: *This Act is relevant to the project because during the construction phase, a number of individuals will be employed, and this Act is the principal piece of legislature governing employment rights in Zambia.*

Compliance: *RDA and its management will comply with regulations under this Act.*

2.1.2.14. Workers' Compensation Act:

An Act to revise the law relating to the compensation of Workers for disabilities suffered or diseases contracted during the course of employment; to provide for the establishment and administration of a Fund for the compensation of workers disabled by accidents occurring, or diseases contracted in the course of employment; and to provide for matters connected with and incidental to the foregoing.

Relevance: *This Act is relevant to the project because workers in general, especially construction workers will be at higher risk of having disabilities or contracting diseases due to the nature of their work environment.*

Compliance: *RDA and its management will comply with regulations under this Act and shall ensure that the contractor is up to date with compliancy.*

2.1.2.15. The Occupational Health and Safety Act:

An Act to establish the Occupational Health and Safety Institute and provide for its functions; provide for the establishment of health and safety committees at workplaces and for the health, safety and welfare of persons at work; provide for the duties of manufacturers, importers and suppliers of articles, devices, items and substances for use at work; provide for 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; and provide for matters connected with, or incidental to, the foregoing.

Relevance: *This Act is relevant to the project because it provides for dissemination of information on occupational health and safety at the work place, and also provides for compensation of workers in case of accidents.*

Compliance: *The consultant has developed safety measures which will be aimed at enhancing the health, safety and welfare of all workers to be employed by the project. .*

2.1.2.16. 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.*

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

2.1.2.17. The Factories Act, 1967

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

Relevance*: The three contractors to work on the T2 Road from Mpika to Chinsali will have crushing plants and mixing plants and the regulation may become applicable during construction.*

Actions*: The ESIA Team has proposed measures of how RDA and its contractors shall comply with regulations under this law during construction.*

2.1.2.18.The National HIV/AIDS/STI/TB Council Act 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 and TB in order to reduce the personal, social and economic impacts of HIV/AIDS/STIs and TB.

Relevance: *This Act is relevant to the current project in that the construction workers may indulge in casual sex with risks of contracting STI/STDs.*

Action: *The ESIA Team has developed measures that RDA contractors will use to address the concerns of this Act.*

2.2. The European Investment Bank Environmental and Social Standards

2.2.1. Introduction

All operations located in the EU, Candidate and potential Candidate countries, which are likely to have significant effects on the environment, human health and well-being and may interfere with human rights, will be subjected to an assessment according to the EU EIA Directive 2011/92/EU. These standards are applied to the current project in addition to the Zambian policy and legal frameworks as described above.

2.2.2. EIB Environmental and Social Standards

In conducting the environmental and social assessment of impacts of risks, the EIB has a set of Environmental and Social Standards, which must be applied to and satisfied. These standards set the policy context for the protection of the environment and human well-being. The following brief overview of the standards outlines RDA's responsibilities in its application to EIB projects:

2.2.2.1. Assessment and management of environmental and social impacts and risks

This first standard underscores the importance of managing environmental and social impacts and risks throughout the life of an EIB project through the application of the precautionary principle. The standard's requirements allow for the development of an effective environmental and social management and reporting system that is objective and encourages continual improvements and developments. The standard includes requirements for stakeholder engagement and disclosure throughout the life of the project.

Relevance: *The proposed project for the rehabilitation of the T2 road from Mpika to Chinsali requires a full environmental and social assessment in order to establish the level of impacts and risks the project will pose to communities along the project road corridor.*

Compliance: *During the detailed studies for the baseline, the consultant through stakeholder consultation and professional investigations established all the potential impacts and risks the project is anticipated to have along the project road corridor. In addition, an Environmental and Social Management Plan (ESMP) has been produced as part of the Environmental and Social Management System for the project.*

2.2.2.2. Pollution prevention and abatement

This second standard is aimed at avoiding and minimizing pollution from EIB-supported operations. It outlines a project-level approach to resources efficiency and pollution prevention and control in line with the best available techniques and internationally disseminated.

Relevance: *The proposed project for the rehabilitation of the T2 road from Mpika to Chinsali can be a source of emissions into air, water and soils, generation of waste, and potential sources of accidents, which makes this EIB standard relevant.*

Compliance: *The consultant, has during the detailed studies identified all possible sources of pollution for the project and has developed appropriate preventive measures in order to prevent, reduce and as far as possible eliminate pollution that may arise from different project activities.*

This will also involve establishing a general framework for the control of possible sources of pollution. For the emissions of atmospheric pollution, to water and soil, RDA will put in place adequate measures to prevent emissions to soil and groundwater and regularly monitor these measures so as to avoid leaks, spills, incidents or accidents occurring especially during the construction phase of the project. In addition, RDA through its consultant has developed measures aimed at preventing waste generation but also reducing its hazardousness to human health and the environment.

2.2.2.3. Biodiversity and ecosystems

The EIB acknowledges the intrinsic value of biodiversity and that its operations may have a potential impact on biodiversity and ecosystems. This standard outlines the approach and measures RDA has to take to protect and conserve all levels of biodiversity. The standard applies to all habitats whether or not previously disturbed or legally protected. It focuses on major threats and supports the sustainable use of renewable natural resources and the equitable sharing of benefits from the project's use of natural resources.

Relevance: *Although the Mpika-Chinsali road is an existing road and there is no realignment envisaged, the rehabilitation works will involve widening of the road, which may result in the cutting of some trees. In addition, the project will require lots of construction natural resources, which may affect the biodiversity and ecosystems of the project road corridor.*

Compliance: *The consultant has during the detailed studies established the level of vegetation clearance likely to result from the project and has engaged various stakeholders to formulate measures for prevention of unnecessary vegetation clearance. In addition, the consultant has made recommendations to the project so that the exploitation of natural resources required by the project does not result in the degradation of the environment and will not be at the expense of the communities who depend on the biodiversity and ecosystems of the project road corridor*

2.2.2.4. Climate-related standards

EIB financing as a whole is aligned with EU climate policies, which should be taken into account at all stages of the project cycle, in particular regarding the assessment of the economic cost of greenhouse gas emissions and the climate vulnerability context. Specifically, project promoters must ensure that all projects comply with appropriate national and, where applicable, EU legal requirements, including multilateral agreements, related to climate change policy.

Relevance: *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 cumulative negative effect on local air quality and global 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.*

2.2.2.5. Cultural heritage

Through its projects, the EIB recognizes the central role of cultural heritage within individual and collective identity, in supporting sustainable development and in promoting cultural diversity. Consistent with the applicable international conventions and declarations, this standard aims at the identification, management and protection of tangible and intangible cultural heritage that may be affected by project activities. It emphasizes the need for the implementation of a "chance-find procedure", which outlines the actions to be taken if previously unknown cultural heritage is encountered.

Relevance: *The relevance of this standard lies in the fact that the activities of the project during construction will involve excavation which may in the process lead to the discovery of artefacts or objects of archaeological significance. In addition, the project road corridor is home to some national heritage such as the Chipoma Falls.*

Compliance: *During the detailed studies, the ESIA consultant has paid particular attention to the identificsation of any elements of cultural heritage that likely to be adversely affected by the project and assessed the likelihood of any chance finds. The ESIA team worked with communities, government agencies and relevant stakeholders to identify, and manage places, objects and practices of cultural significance.*

2.2.2.6. Involuntary resettlement

EIB projects sometimes necessitates land acquisition, expropriation and/or restrictions on land use resulting in the temporal or permanent resettlement of people from their original places of residence or their economic activities or subsistence practices. This standard is rooted in the respect and protection of rights to property and to adequate housing, and of the standard of living of all affected people and communities. It seeks to mitigate any adverse impacts arising from their loss of assets or restrictions on land use. It also aims to assist all affected persons to improve or at least restore their former livelihood and living standard and adequately compensate for incurred losses.

Relevance: *This standard is relevant to the project in that the implementation of the of the project road reserve will definitely lead to changes in land use and involuntary resettlement of people located within the project road reserve.*

Compliance: *The consultant has during the detailed study; carry out a census and a socio-economic baseline survey to establish the number of people to be displaced, livelihoods affected, and property to be compensated. The surveys have taken into account persons affected through anticipated cumulative impacts of the resettlement. In addition detailed stakeholder consultation have been consulted as documented in this report and these consultations involving a variety of stakeholders, including project-affected people, host communities, the promoter, community-based organisations (CBOs), non-governmental organisations (NGOs) and a multitude of governmental agencies, national and local, will continue as part of the Stakeholder Engagement (as documented in the Stakeholder Engagement Plan) and during the implementation and monitoring of the resettlement process. In addition, the ESIA team has recommended a grievance mechanism which will allow prompt addressing of specific concerns about compensation and relocation from the affected people and host communities and other directly involved entities.*

2.2.2.7. Rights and interests of vulnerable groups

The EIB seeks to protect all vulnerable project affected individuals and groups, whilst seeking that these populations duly benefit from EIB operations. The standard requires that there is full respect for dignity, human rights, aspiration, cultures and customary livelihoods of vulnerable groups including indigenous peoples. It requires the free, prior and informed consent of affected indigenous groups.

Relevance: *This standard is relevant to the current road rehabilitation of the T2 road from Mpika to Chinsali in that there are some individuals or groups along project road corridor who are likely to be less resilient to risks and adverse impacts than others. The ESIA team has already noticed that employment of women who are married (especially if husband is not employed) is likely to cause misunderstanding in some homes and this may deter women from seeking project opportunities. The findings also indicate that early pregnancies and early marriages may rise in communities due to construction workers who may be looked upon as "people with money" and may contribute to school dropout.*

Compliance: *The ESIA team has identified various vulnerable individuals likely to be affected by the project and has d*eveloped a Stakeholder Engagement Plan (SEP) through which these vulnerable groups should be *engaged during project implementation in order to take the necessary measures and to appropriately manage the risks and adverse impacts of the project on vulnerable individuals and groups, including on women and girls, minorities and indigenous peoples. In so doing, RDA will seek to avoid, minimise, or otherwise mitigate or remedy the exposure of vulnerable populations to project-related risks and adverse impacts. In addition, the ESIA team has identified all discriminatory practices, inequalities and other factors which contribute to vulnerability and made necessary recommendations on how the project can appropriately, strengthen the adaptive capacity of vulnerable individuals or groups by promoting inclusive development and benefit sharing.*

2.2.2.8. Labour standards

Good labour practices and the use of appropriate codes of conduct are important to ensure the fair treatment, non-discrimination and equality of opportunity of workers. This standard aims at ensuring that promoters of EIB projects comply with the core labour standards of the International Labour Organisation and with national labour and employment laws. The standard also requires the establishment, maintenance and improvement of worker-management relationships.

Relevance: *The Standard is relevant to the project in that both unskilled and skilled labour will be required during project implementation. Given that Zambia has a young population and given the poverty levels along the project road corridor, it is possible that child labour may become an issue during project implementation. Migration of labour may also be an issue and may lead to trafficking.*

Compliance: *The ESIA team engaged people along project road corridor to understand how the project will comply, at a minimum, with the relevant national labour laws and how it will implement and operate the project in respect of the principles of the Core Labour standards outlined in the ILO Declaration on Fundamental Principles and Rights at Work. In addition, the ESIA Team has been sensitizing community members on the importance of ensuring that they have employment contracts, independently of their type (e.g. direct employees, contractors,*

workers in the supply chain). The ESIA Team has also made recommendation on RDA shall ensure that the contractor has an effective management system, which should cover the enforcement and compliance of labour standards, and the monitoring of the contractors.

2.2.2.9. Occupational and public health, safety and security

The EIB expects promoters to protect and secure public and occupational health, safety and security and promote the dignity of the affected community in relation to project-related activities, with particular attention to vulnerable groups. The standard also requires promoters to adhere to the international norms and relevant human rights principles when using security services.

Relevance: *The relevance of this standard lies in the fact the activities of the project has potential to increase exposure to hazards, risks and negative impacts in terms of public health and safety. These may arise through or be amplified by project-related occurrences such as increased environmental pollution; elevated noise levels the spread of communicable diseases.*

Compliance: *The ESIA Team has dully identified all health and safety risks falling under this project and has proposed mitigation measures to adequately address the risks. In addition, the ESIA team has developed satisfactory occupational and public health and safety management plans and systems, based on best international practice, and tailored to the road sector.*

2.2.2.10. Stakeholder engagement

The EIB actively promotes the right to access to information, as well as public consultation and participation. This standard promotes to uphold an open, transparent and accountable dialogue with all project affected communities and relevant stakeholders in an effective and appropriate manner. The value of public participation in the decision-making process is stressed throughout preparation, implementation and monitoring phases of a project. The right to access to remedy, including through grievance resolution, is actively required.

Relevance: *This standard is relevant to the current project in that RDA is seeking to implement the recommended road reserve of 100m and this will have serious implications on various stakeholders located within the road reserve. The views, interests, and concerns of the affected people, communities and other interested stakeholders needs therefore to be heard, understood, and taken into account throughout the project lifecycle.*

Compliance: *The ESIA team has engaged various stakeholders as demonstrated in this ESIA report and has also developed a Stakeholder Engagement Plans for future consultation. More stakeholder engagement have been planned for and will be carried out without discrimination, taking into account differences in risk exposure and the increased sensitivity and reduced resilience of vulnerable groups. Planned stakeholder engagement, including disclosure and dissemination of information, will be carried out in line with the principles of prior, informed and free engagement and informed participation, in order to lead to broad community support by the affected communities and longer-term sustainability of the project's activities.*

2.3. Relevant International Agreements Signed By Zambia

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

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 of the project. This explains the relevance of the convention to the project.

   Compliance: RDA and its management will comply with regulations under this convention.

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 of influence extends to green field sites which may be home to endangered flora and fauna species that require protection hence the relevance. The project will enhance the flora and fauna species.

   Compliance: RDA and its management will comply with regulations under this convention.

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 greenhouse 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 protocol is therefore relevant to the project.

   Compliance: RDA and its management will comply with regulations under this convention.

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 Departments of Agriculture, Forestry, Fisheries and National Parks and Wildlife Department.

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

   Compliance: RDA and its management will comply with regulations under this convention.

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.

   Compliance: RDA and its management will comply with regulations under this convention.

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 of influence includes green field areas, with possibilities of these protected birds flying to the site. Therefore, taking note of the provisions of this agreement is necessary.

   Compliance: RDA and its management will comply with regulations under this convention.

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.

   Compliance: RDA and its management will comply with regulations under this convention.

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

A number of institutions will have a regulatory and monitoring role on the project under their governing legislation.

2.4.1. Ministry of Transport and Communication

The Ministry of Transport and Communication is responsible for overall policy formulation and monitoring of the transport sector. The Ministry has the following departments charged with various responsibilities: Departments of Road Transport, Civil Aviation, Maritime and Inland Waterways, Government Communication Flight and the Zambia Meteorological Department. This Ministry oversees construction and civil engineering activities to the extent that they should not adversely affect the environment. The Ministry is further concerned with maintaining waterways in passable condition.

The Ministry will play a role in ensuring the environmental guidelines are implemented through their representative on the RDA Board of Directors.

2.4.2. Road Development Agency (RDA).

The RDA was established through the Public Roads Act No. 12 of 2002 to be responsible for the care, maintenance and construction of public roads in Zambia. This was aimed at removing the fragmentation and duplication in the planning and implementation of road projects. It is governed by a Board of Directors drawn from various stakeholder organizations.

The Agency has eight Departments: Central Administration, Planning and Design, Construction and Maintenance, Technical and Commercial Services, Corporate Services, Finance, Audit and Procurement. The Agency also maintains Regional Offices in all the provinces.

The RDA is charged with the responsibility of developing the entire road network in the country covering rural, feeder, district, main, trunk and urban roads, through the

implementation of programmes approved by the Committee of Ministers on Road Maintenance Initiative (RMI). The Agency undertakes programming, procurement, monitoring and overall supervision of all road works in the country.

The Environmental and Social Management Unit (ESMU) in the RDA is manned with two environmental scientists and two sociologists. They are responsible for ensuring that environmental and social management plans (ESMPs) are implemented, and also carry out monitoring of activities on trunk, main and district roads.

2.4.3. National Road Fund Agency (NRFA)

In order to co-ordinate all funding to the road sector, Government has established a National Road Fund Agency. 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 now responsible for collection, disbursement, management and accounting of the National Road Fund, reporting through 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.

2.4.4. Road Transport Safety Agency (RTSA)

The Department of Road Transport and the National Road Safety Council have been merged to constitute a Road Transport Safety Agency. This Agency is under the Ministry of Transport, Works, Supply and Communications. The Agency is responsible for 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.

2.4.5. Zambia Environmental Management Agency (ZEMA)

ZEMA was created through the Environmental Management Act of 2011. Its functions are to:

- Advise on formulation of policies on all aspects of the environment and sustainable management of the environment;
- Develop and enforce measures aimed at preventing and controlling pollution;
- Develop in liaison with other relevant appropriate authorities, standards and guidelines related to the protection of air, land, water and other natural resources;
- Review environmental impact and strategic environmental assessment reports;
- Mainstream environmental concerns in overall national planning;
- Research or sponsor research on emerging environmental issues;
- Conduct enhanced environmental education and public awareness.

ZEMA provided input to the development of RDA's environmental guidelines.

2.4.6. Ministry of Lands, Natural Resources and Environmental Protection

The recognition of the importance of environmental management in the development process led to the establishment of the Ministry of Environment and Natural Resources (now Ministry of Lands, Natural Resources and Environmental Protection (MLNREP)). The MLNREP is the key institution entrusted with the formulation of environmental policies, pollution control, and

natural resource conservation and is responsible for formulation and administration of land policy which includes land use planning. Moreover, the Ministry oversees operations of ZAWA while operations of the National Heritage and Conservation Commission are supervised under the Ministry of Chiefs and Traditional Affairs. Tourism affairs are the responsibility of the recently created Ministry of Foreign Affairs and Tourism.

The MLNREP carries out its mandate through the Zambia Environmental Management Agency (ZEMA), the Forestry Department and Department of Planning and Information. The ZEMA's basic responsibility is quality control of the environment through enforcement of the EMA (2011). The Forestry Department is responsible for licensing on wood harvesting for commercial purposes, manages the reservation of new forest areas, conducts forest inventory and mapping, manages plantation sites and prepares management working plans. The Department undertakes research in basic silviculture, measuration, tree improvement, forest protection and various aspects of timber processing. It also has an extension service, which deals with community forestry programmes and public education.

2.4.7. Ministry of Energy and Water Development

The Ministry Energy and Water Development has a responsibility of regulating the use of water resources and the development of the energy sector in the country. The project area a number of streams and rivers and as such, the Ministry will be concerned with the pollution of water during the construction phase. Water pollution and the related matters are the responsibility of the Department of Water Affairs.

The Department of Energy within the Ministry is responsible for regulating electricity generation, processing and transportation of fossil fuels. The client aims to implement the requirements of the department by ensuring all fuel handling requirements are met by the contractors including the licenses for bulk storage and use of clean energy in project development.

2.4.8. Ministry of Local Government and Housing

Local Authorities are concerned with the health of local communities and the conservation of natural resources within the realm of their administrative influence. Functions of local authorities include approval of project plans and labour camps, sewage handling facilities, parking areas for project vehicles etc.

2.4.9. Ministry of Agriculture and Livestock

Specific objectives of this Ministry include: assuring national and household food security, ensuring that the existing agricultural resource base is maintained and improved upon, promoting sustainable and environmentally sound agricultural practices, maintaining agro-biodiversity and promoting conservation and preventing and controlling pests, crop and livestock diseases of national economic importance. The project road area has a lot of crop farmers and there are no Food Reserve Agency depots in the area.

CHAPTER THREE

3.0. DESCRIPTION OF THE PROJECT AND PROJECT JUSTIFICTION

3.1. Project Description

3.1.1. Project Location

The Project Road is located in the Muchinga Province in the North-Eastern part of Zambia. It starts at the RDA Weigh Bridge in Mpika at Kanjela Village (S=1152.399; E03125.765) and ends shortly before the T2 intersection with the access road to the provincial headquarter Chinsali.

The report covers three road sections that will be contracted separately as highlighted in the Figures below:

- Lot 1: (From Mpika weighbridge to Mazingo with possible financing from the Chinese);
- Lot 2 - (From Km 4+100 to Km 86+770): Mpika to Shiwan'gandu Junction (D53/T2 Junction) – 82.7 km; and
- Lot 3 – (Km 86+770 to Km 165+646) Shiwan'gandu Junction (D53/T2 Junction) to Chinsali Junction – 78.8km.

3.1.1.1. Lot 1

The first section of the project road is entirely located in the urban section of Mpika Town. This section, which will have a stretch of 7Km will be financed with funds from the Chinese Government.

It starts at the existing RDA weigh bridge in Mpika and traverses through the built area of Mpika town by passing the Kasama-Mpika road junction (Ch3+400), main Mpika CBD (Ch4+800), and will terminate at Mazingo area near Mazingo Lodge (Ch7+800).

In line with the public roads act, this section of the road project will have a mandatory road reserve of 36m (i.e. 18m on each side of the existing center line).

A number of infrastructures will be affected with this road reserve enforcement such as shops at at Ch0+100, wall fence for Samfuel Filling Station; fuel storage tanks and pump stations for continental oil at the Kasama-Mpika Junction; wall fence for Mazingo Lodge among other shops and assets.

Figure 1-1 below shows the location map of this section of the project road for Lot 1 while Figures that follows shows the locations of affected assets along the project road corridor for Lot 1.

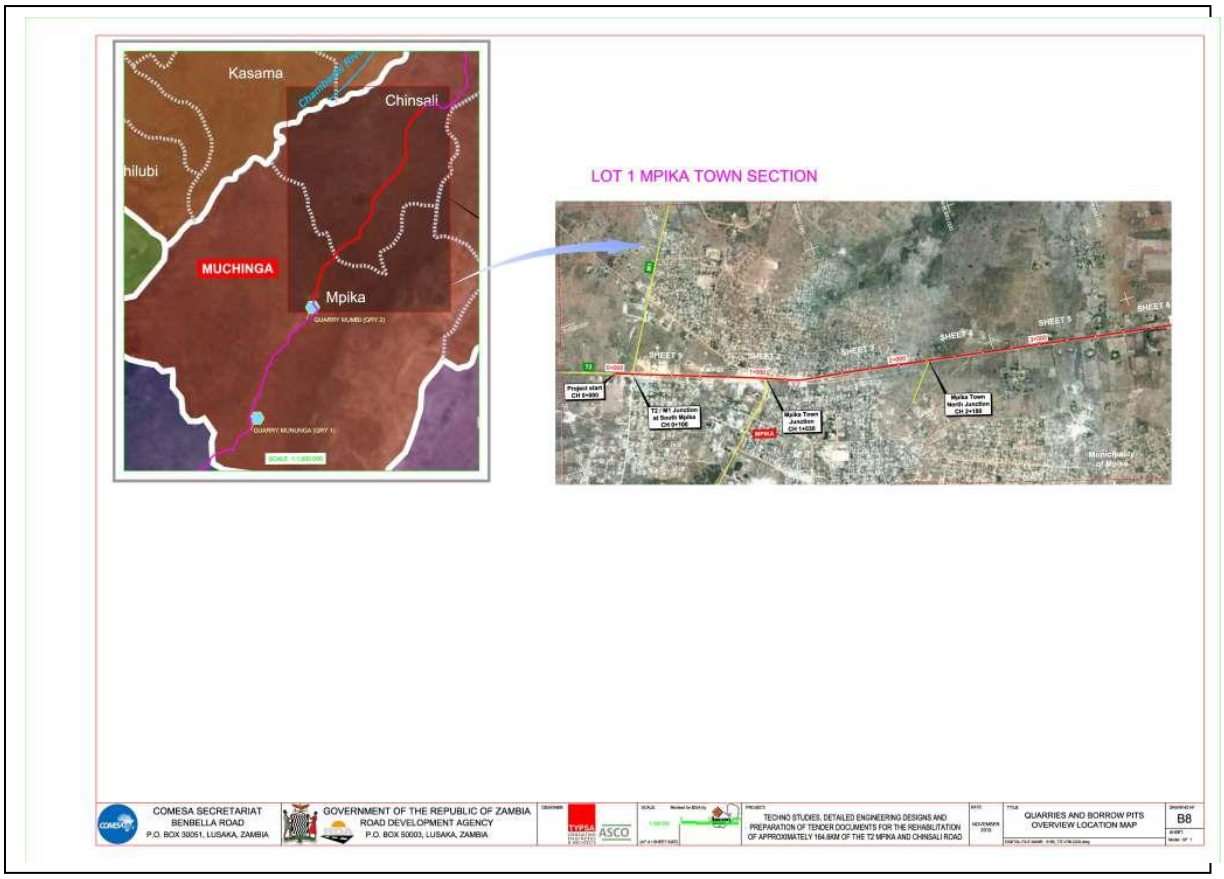
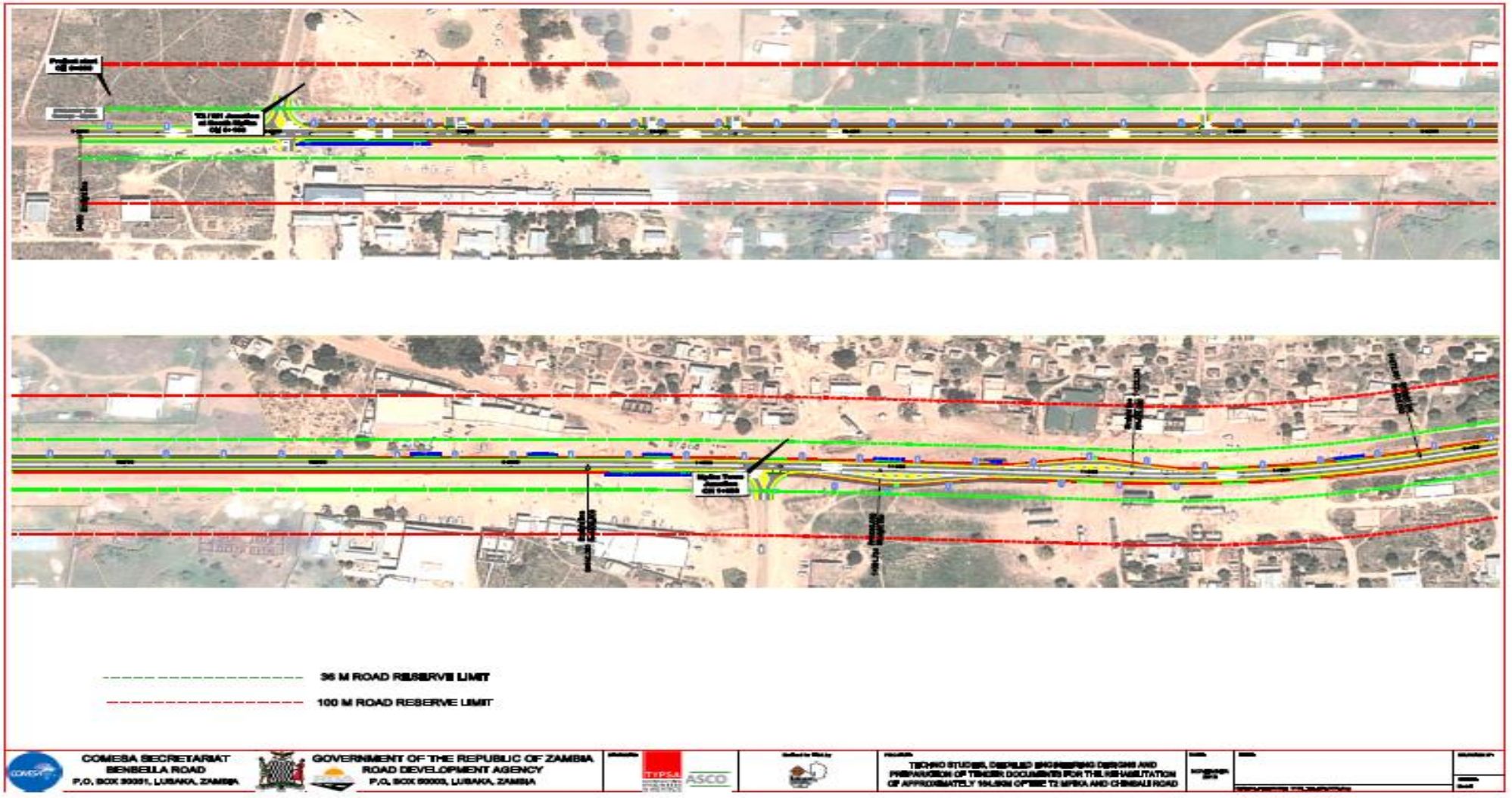


Figure 1-1: Project Road Alignment for Lot 1:


36 M ROAD RESERVE LIMIT
100 M ROAD RESERVE LIMIT
COMESA SECRETARIAT
BEMBELLA ROAD
P.O. BOX 30081, LUSAKA, ZAMBIA
GOVERNMENT OF THE REPUBLIC OF ZAMBIA
ROAD DEVELOPMENT AGENCY
P.O. BOX 50003, LUSAKA, ZAMBIA
TECHNO STUDIES, DETAILED ENGINEERING DESIGNS AND PREPARATION OF TENDER DOCUMENTS FOR THE REHABILITATION OF APPROXIMATELY 161.5KM OF THE T2 MPIKA AND CHINSALI ROAD

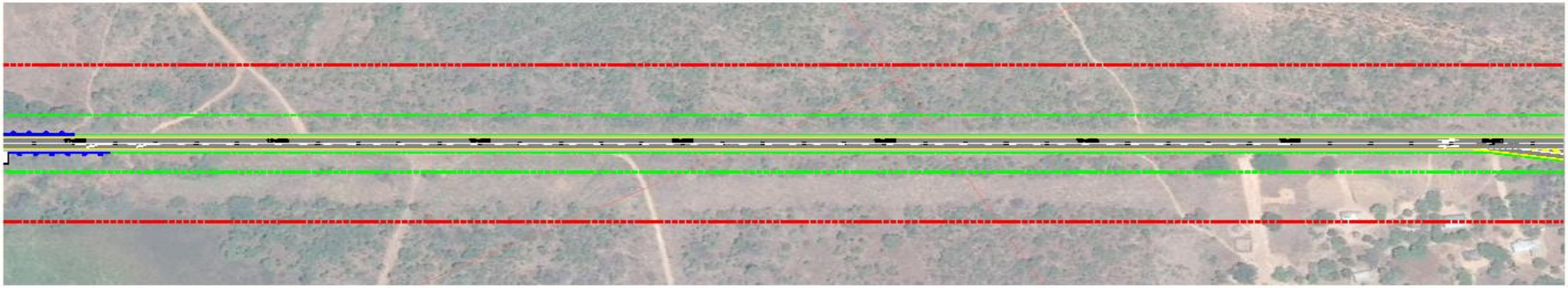
3.1.2. Lot 2

This section of the project road will be financed by the EIB. The section road starts at Mazingo Lodge (Ch7+800) and terminate at Kalalantenkwe-Ch 86+770-89+920 (Shiwang'andu BOMA). From Mazingo Lodge, the road passes through a number of settlements of which the major ones are Mwalala (Ch11+400); Chikwanda (Ch12+760); Danger Hill (22+200); Mukungwa (Ch38+500); Luanya (Ch59+400); Mukwikile (Ch70+700) and Shiwang'ndu urban (Ch86+800).

This section of the project road has much of its road length located in rural setting except for the first 2Km from Mazingo Lodge (Ch7+800) to Mwalala village (Ch11+400); which is under the urban section of Mpika urban area and the section at Shiwang'ndu urban (Ch86+800). These two sections have a road reserve of 36m in line with the public road act.

There rest of the road section from Mwalala (Ch11+400); Chikwanda (Ch12+760); Danger Hill (22+200); Mukungwa (Ch38+500); Luanya (Ch59+400); Mukwikile (Ch70+700) falls under the rural area and therefore a road reserve of 100m will apply in line with the public roads act.

Figure 1-2 shows the location map for the road section for Lot 2 while the figures that follows shows the areas along the project road section where properties are likely to be affected as a result of both road rehabilitation and road reserve enforcement.



35 M ROAD RESERVE LIMIT

100 M ROAD RESERVE LIMIT

COMESA SECRETARIAT
BENBELLA ROAD
P.O. BOX 30051, LUSAKA, ZAMBIA

GOVERNMENT OF THE REPUBLIC OF ZAMBIA
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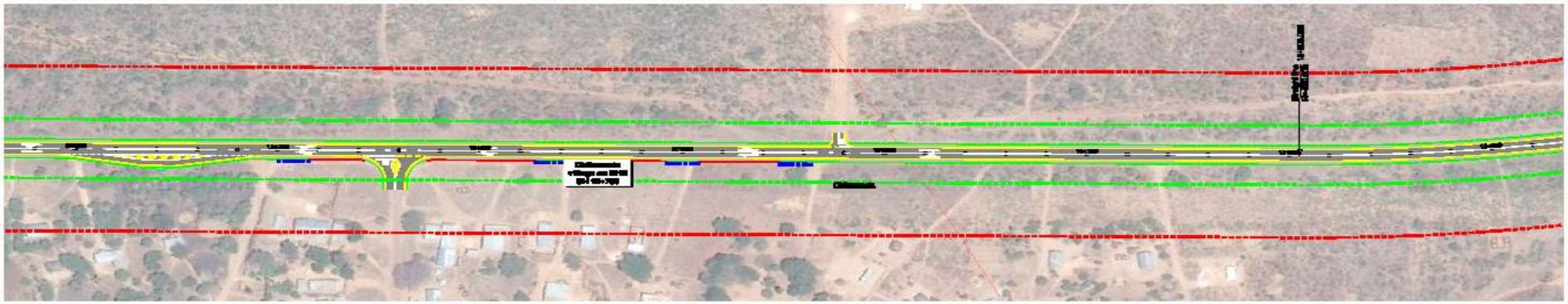
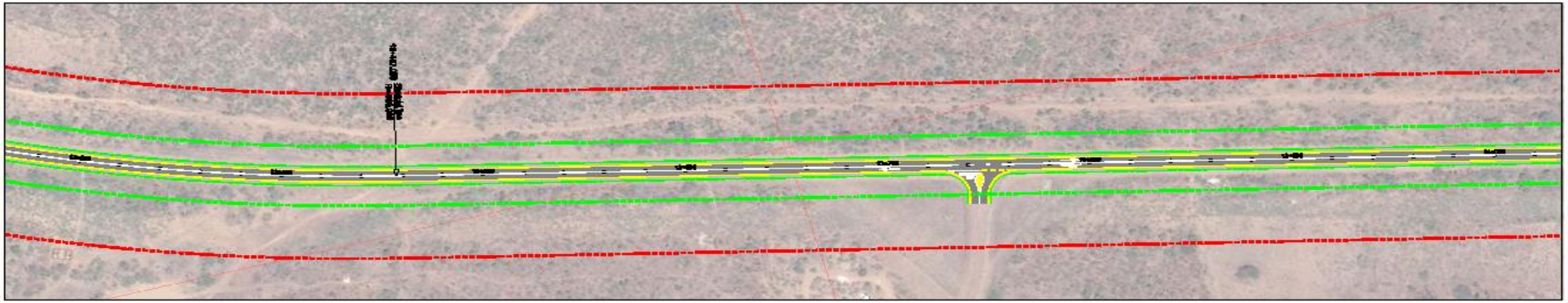
TECHNO STUDIES, DETAILED ENGINEERING DESIGNS AND PREPARATION OF TENDER DOCUMENTS FOR THE REHABILITATION OF APPROXIMATELY 161.5KM OF THE T2 MPIKA AND CHINSALI ROAD





36 M ROAD RESERVE LIMIT

100 M ROAD RESERVE LIMIT

COMESA SECRETARIAT
BENBELLA ROAD
P.O. BOX 30051, LUSAKA, ZAMBIA

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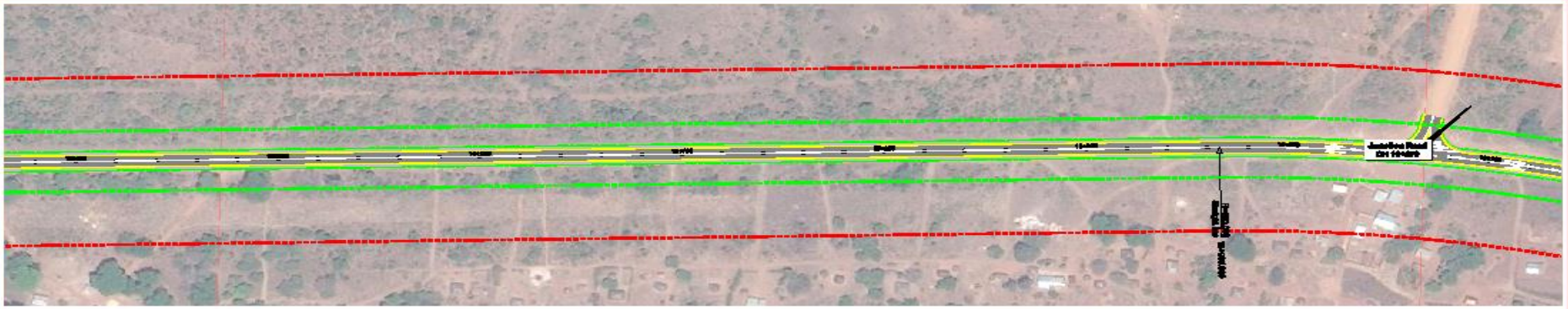
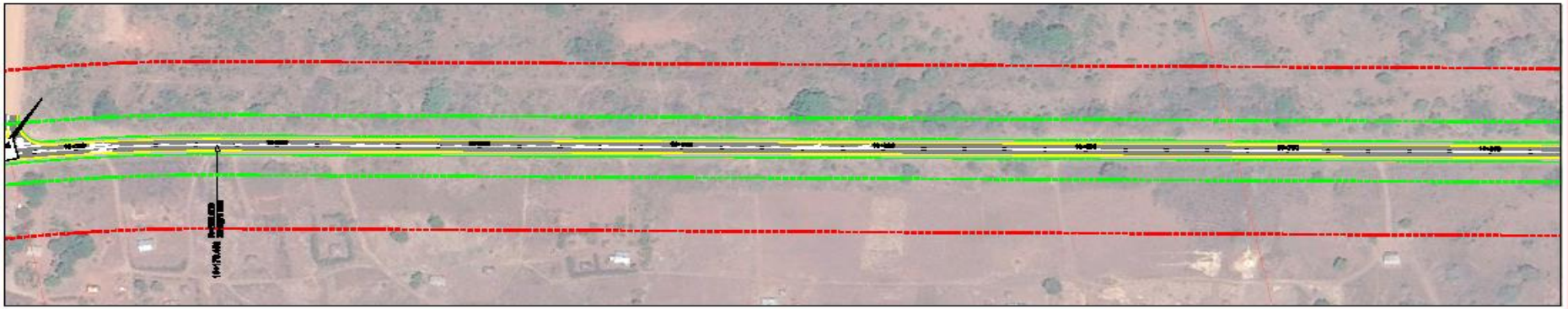
TECHNO STUDIES, DETAILED ENGINEERING DESIGNS AND PREPARATION OF TENDER DOCUMENTS FOR THE REHABILITATION OF APPROXIMATELY 161.5KM OF THE T2 MPIKA AND CHINSALI ROAD





36 M ROAD RESERVE LIMIT

100 M ROAD RESERVE LIMIT

COMESA SECRETARIAT
BENBELLA ROAD
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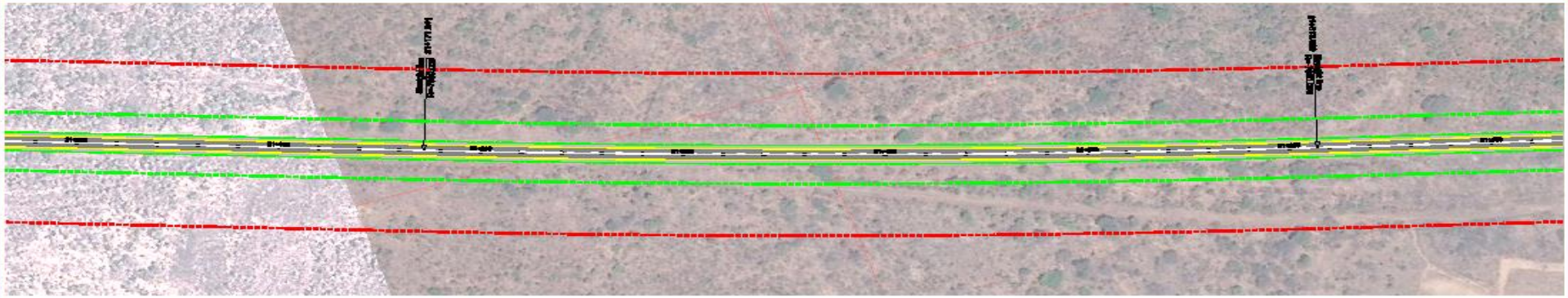

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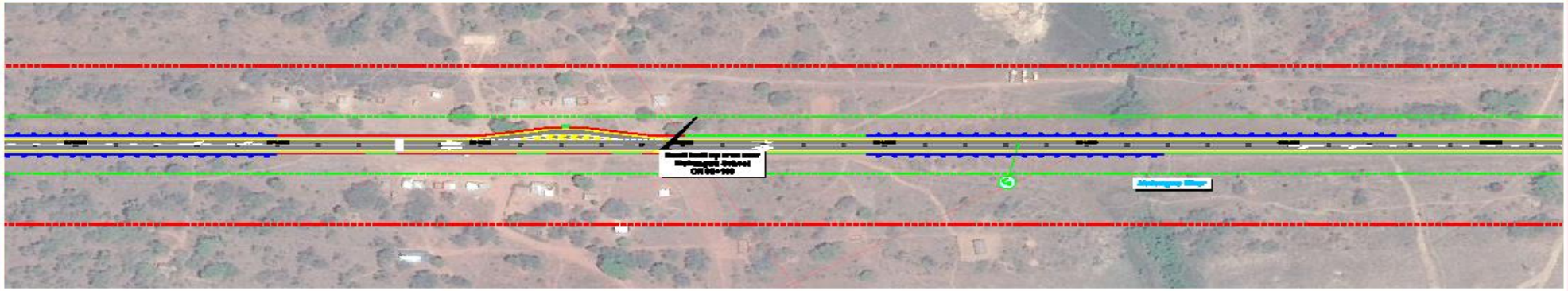

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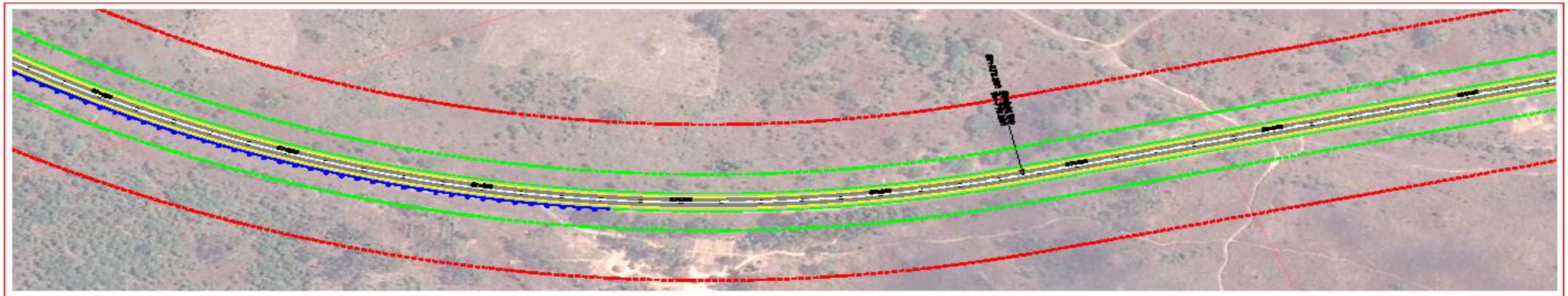

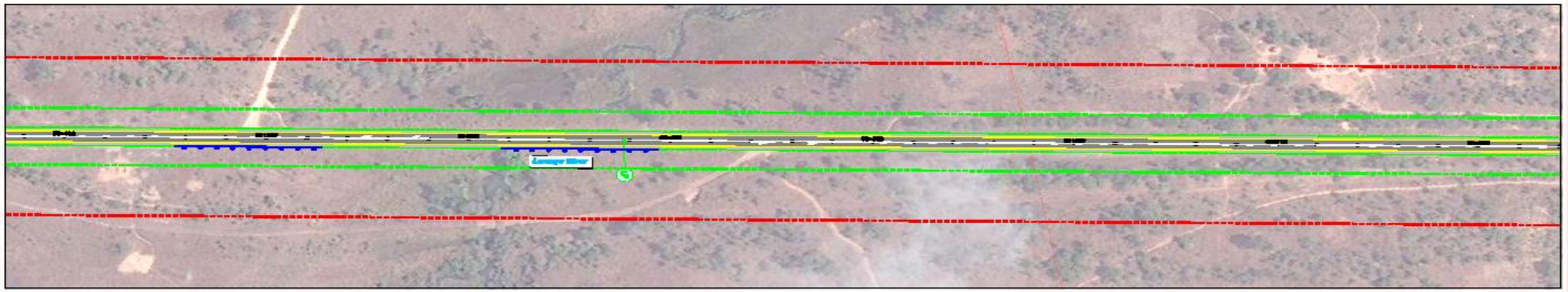

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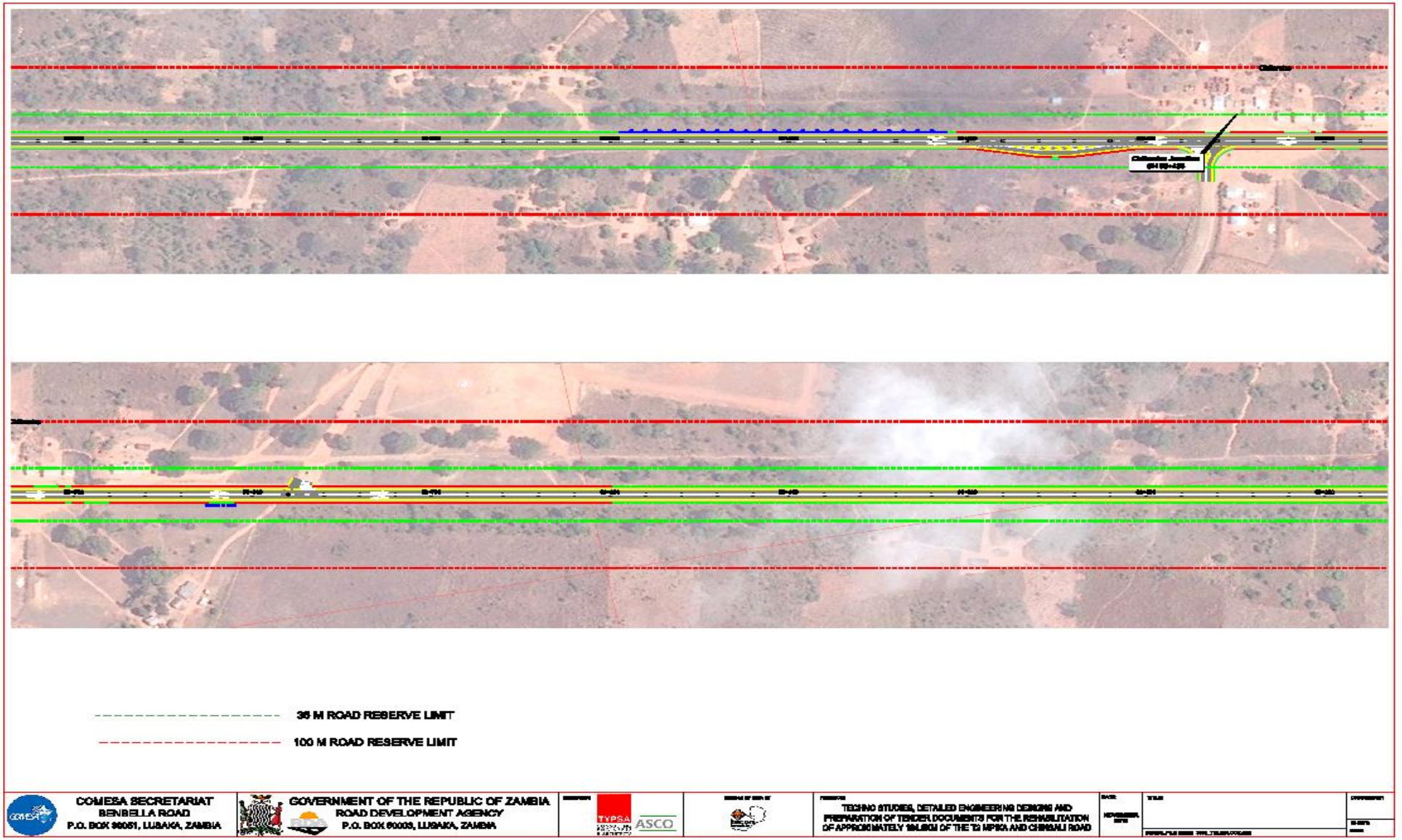
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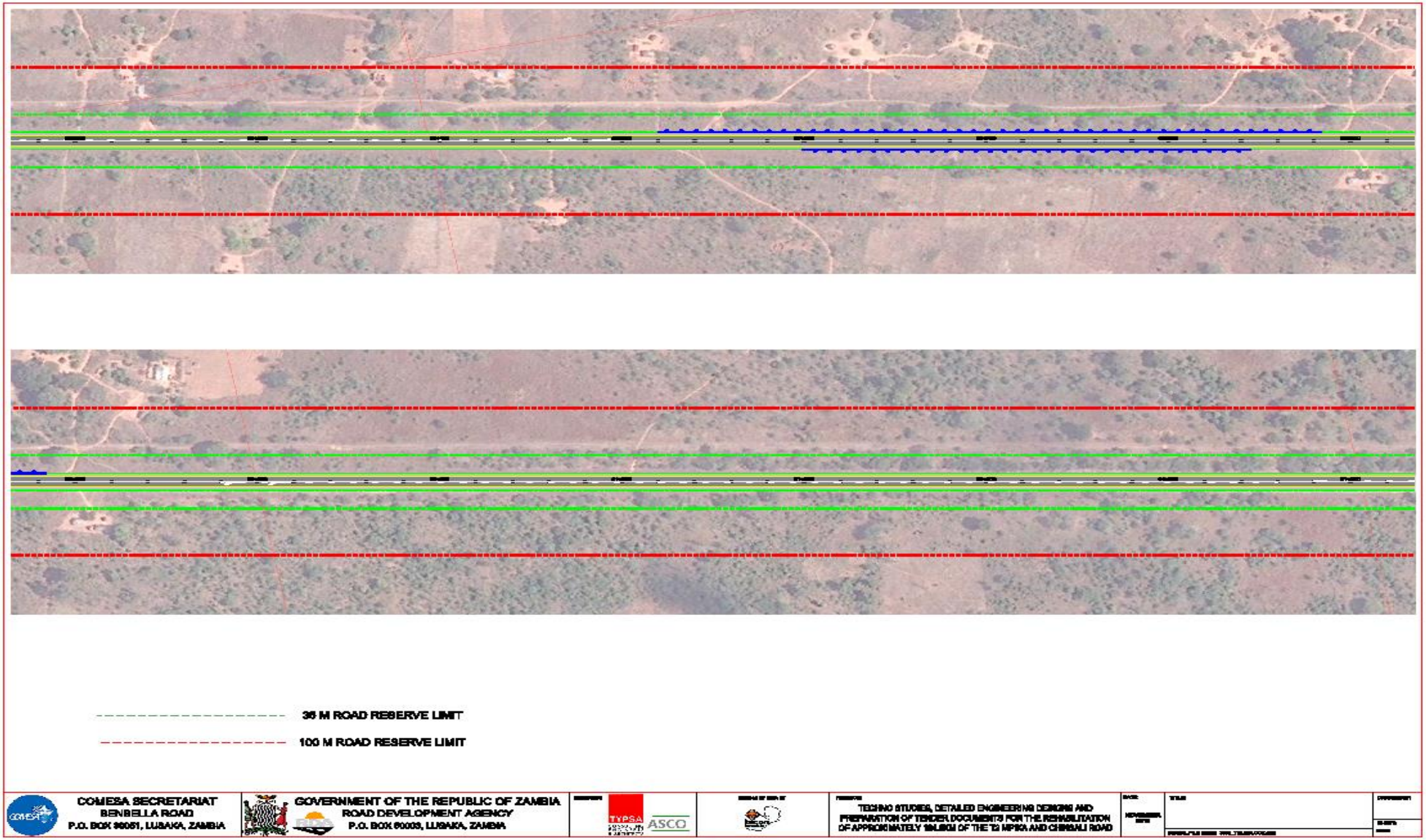
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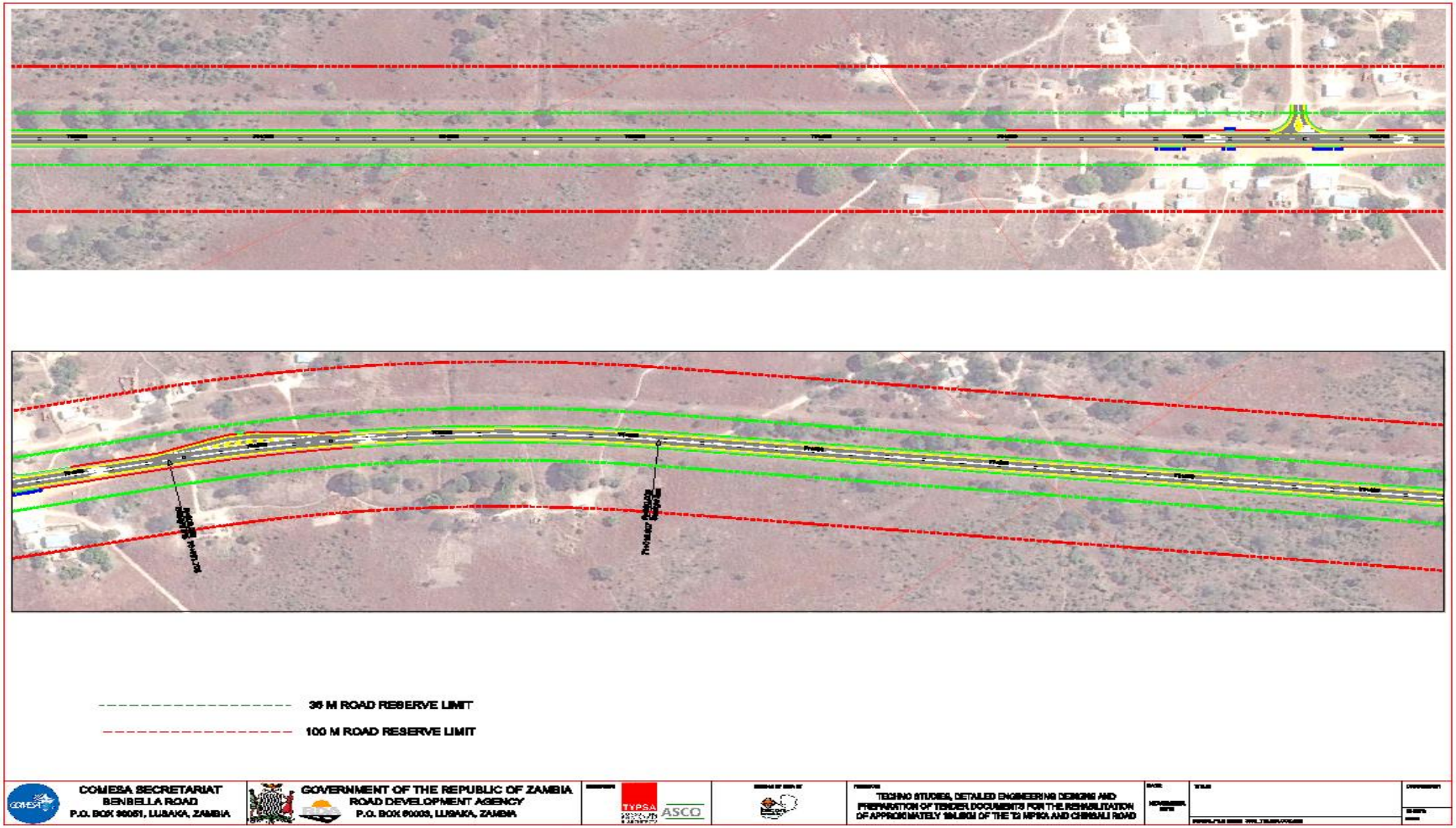
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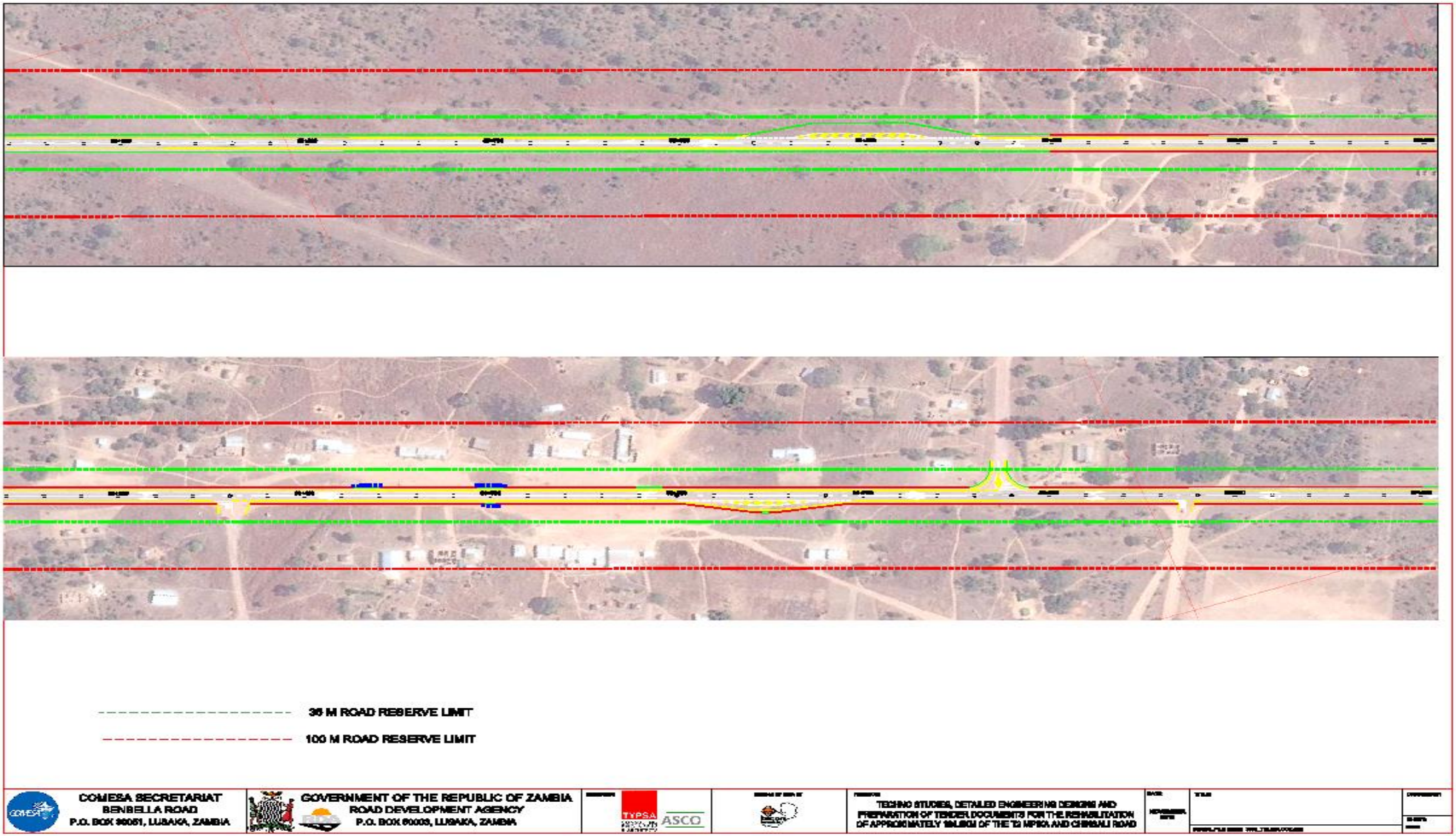
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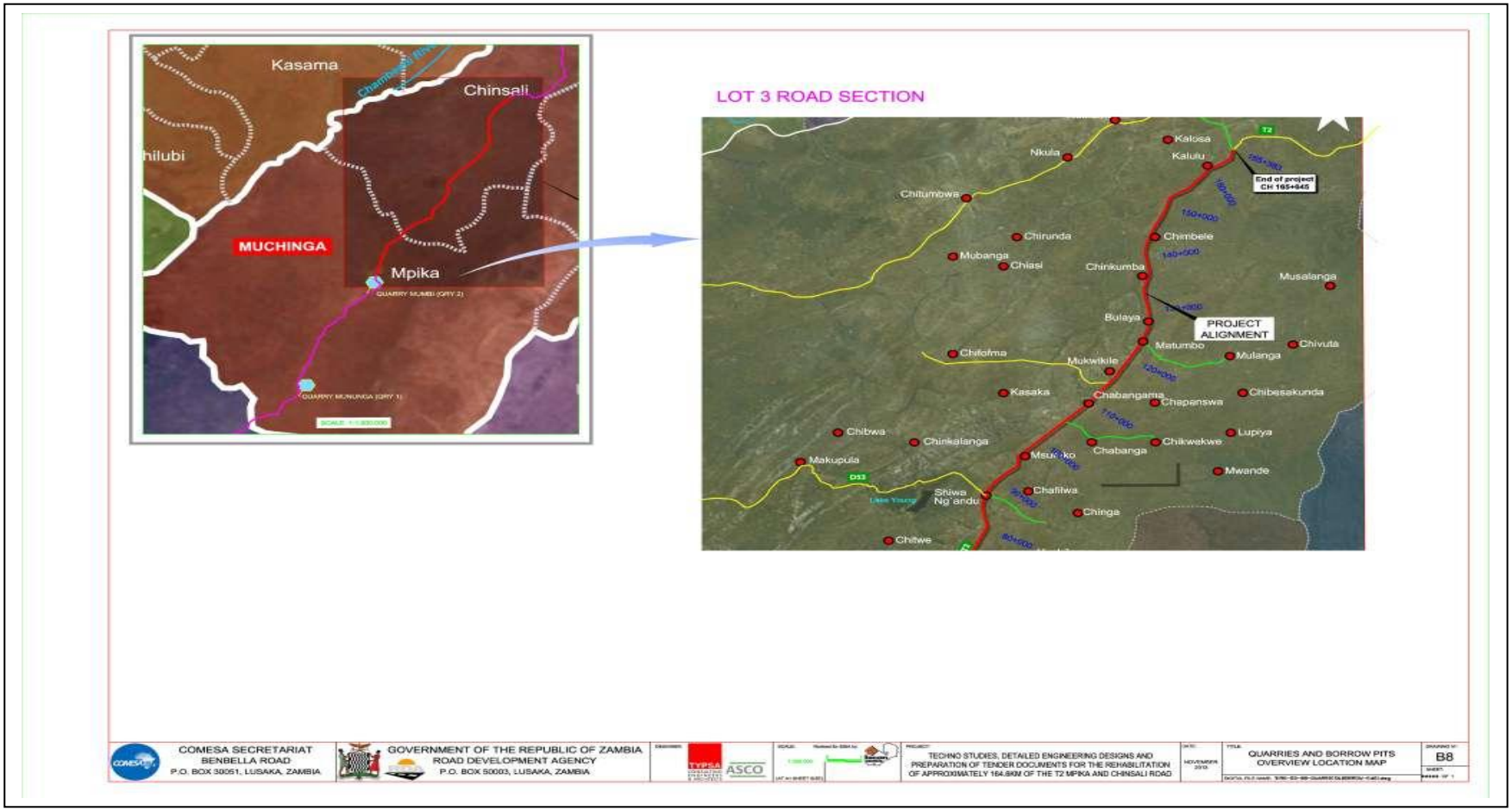
3.1.3. Lot 3

This section of the project road will also be financed by EIB. The section starts from Shiwang'ndu urban (Ch86+800) and will traverse various settlements such as Philip (101+100); Kabangama (Ch110+100); Kasangala (Ch120+250); Chakunta (Ch121+150); Matumbo (Ch123+800-Ch124+300); Bulaya (Ch127+000); Chikumba (Ch135+300); Chipoma (Ch146+400); Tazama (Ch160+500); and Chinsali Turnoff (Ch165+645).

As is the case with Lot 2, this section of the road project has much of its road length located in the rural areas and therefore the 100m road reserve will apply. There only two areas of the road section where the urban road reserve will apply at Shiwang'ndu urban (Ch86+800) and Chinsali Turnoff (Ch165+645).

Figures 3-2 and Figure 3-4 below show the location Maps of the proposed alignment for the Mpika to Chinsali road rehabilitation project for Lot 2 and 3 respectively.


Kasama
Chinsali
MUCHINGA
Mpika
LOT 3 ROAD SECTION
Kalosa
Nkula
Kalulu
End of project CH 165+645
Chitumbwa
Chirunda
Chimbele
Mubanga
Chiasi
Chinkumba
Musalanga
Bulaya
PROJECT ALIGNMENT
Chitofma
Matumbo
Chivuta
Mukwikile
Mulanga
Kasaka
Chabangama
Chapanswa
Chibesakunda
Chibwa
Chinkalanga
Chikwakwe
Lupiya
Chabanga
Makupula
Mwande
Shiwa Ng'andu
Chafilwa
Chinga
Chitwe
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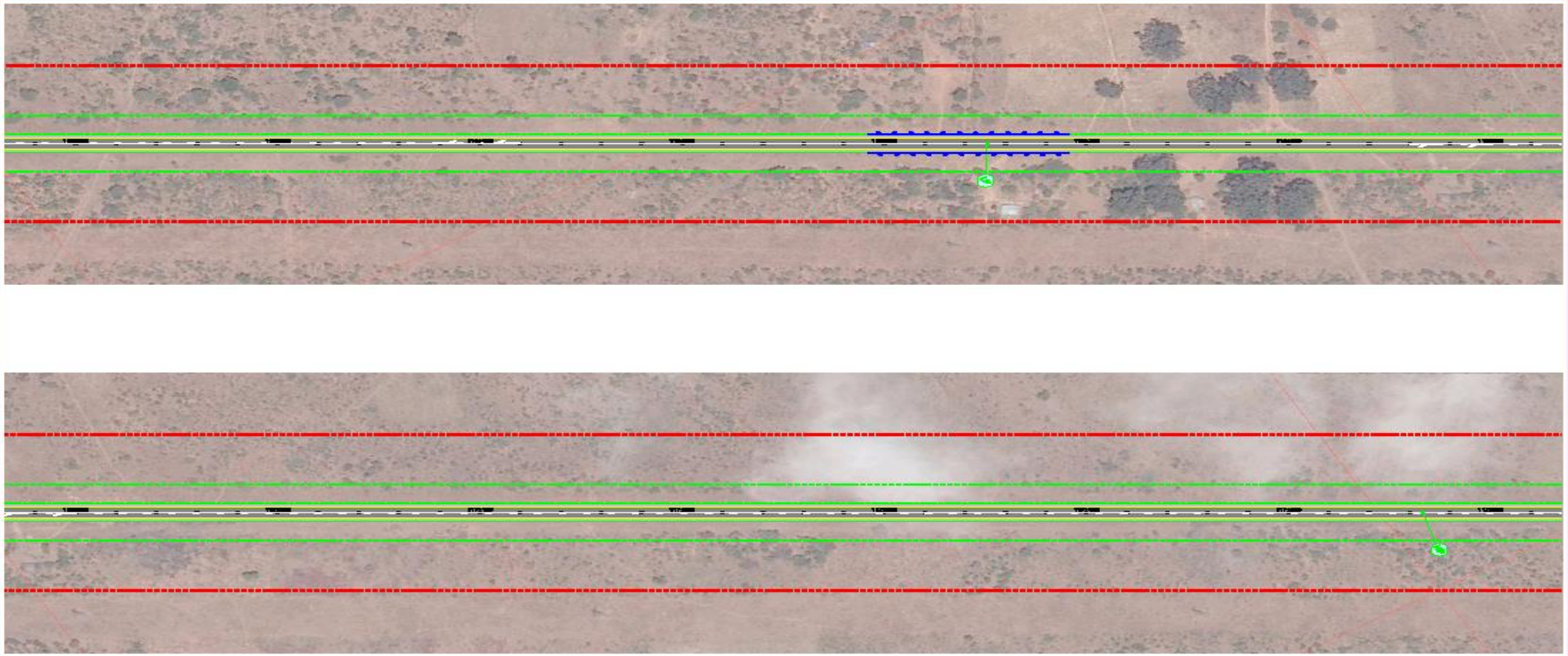
TECHNO STUDIES, DETAILED ENGINEERING DESIGNS AND PREPARATION OF TENDER DOCUMENTS FOR THE REHABILITATION OF APPROXIMATELY 164.6KM OF THE T2 MPIKA AND CHINSALI ROAD
QUARRIES AND BORROW PITS OVERVIEW LOCATION MAP
B8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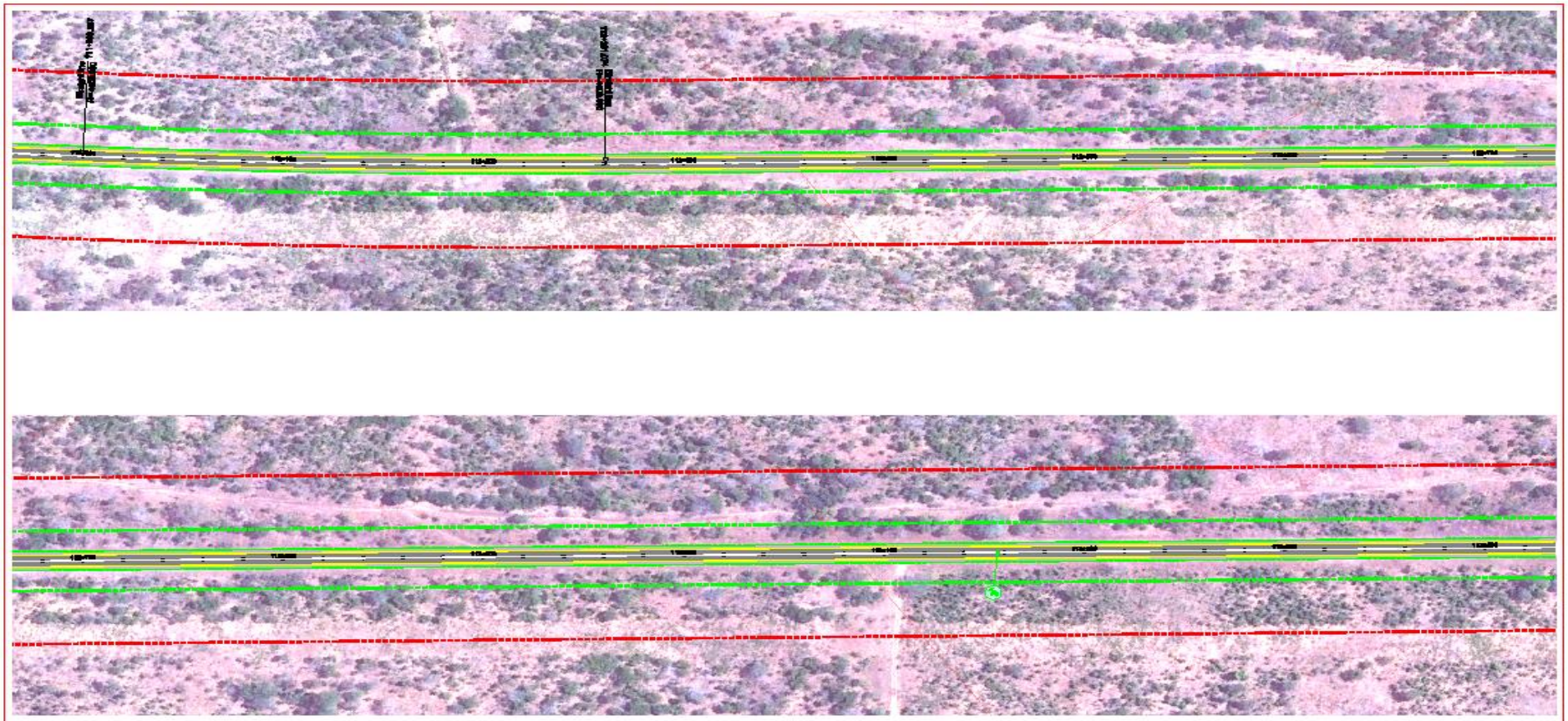
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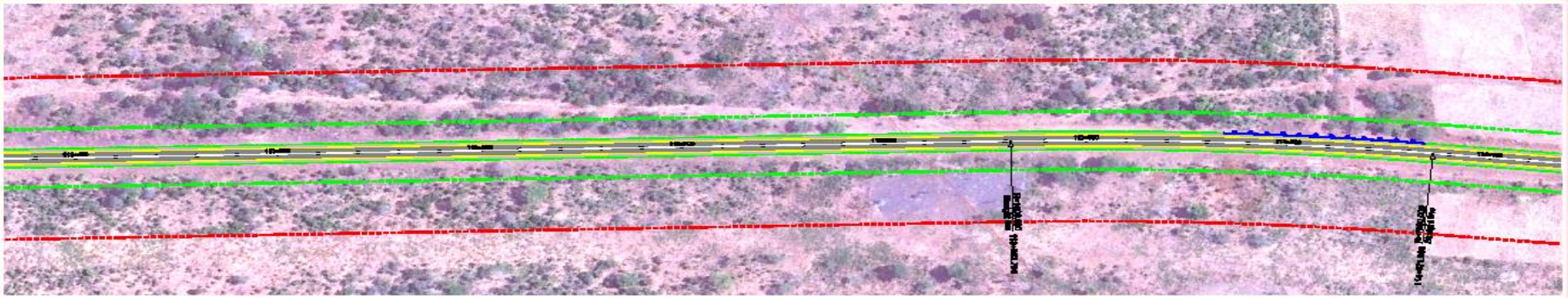

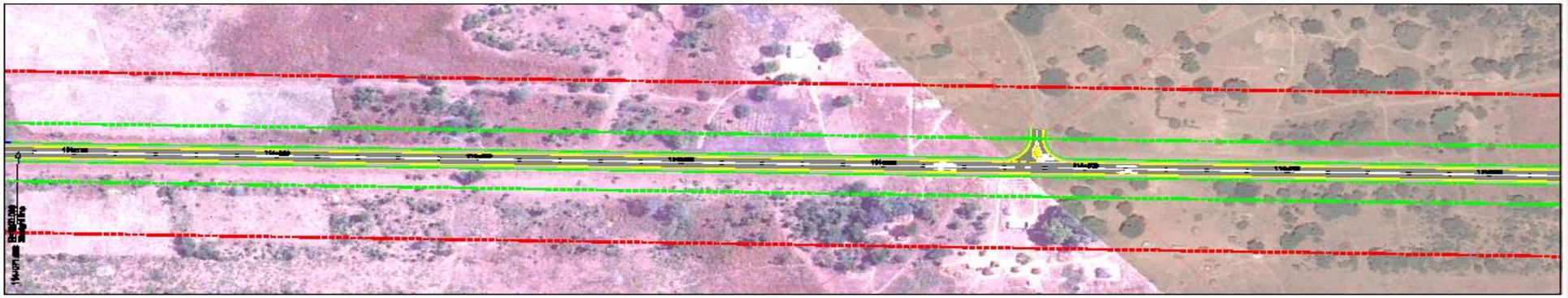

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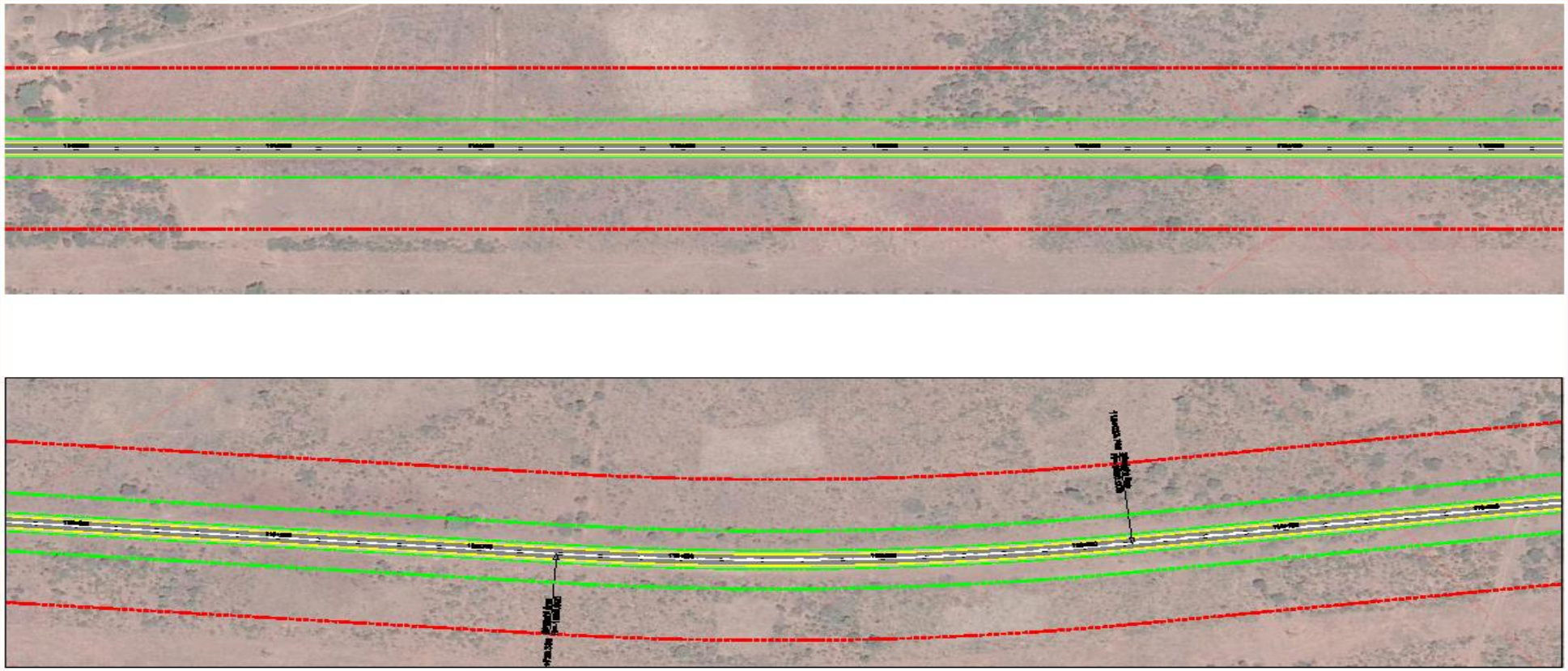

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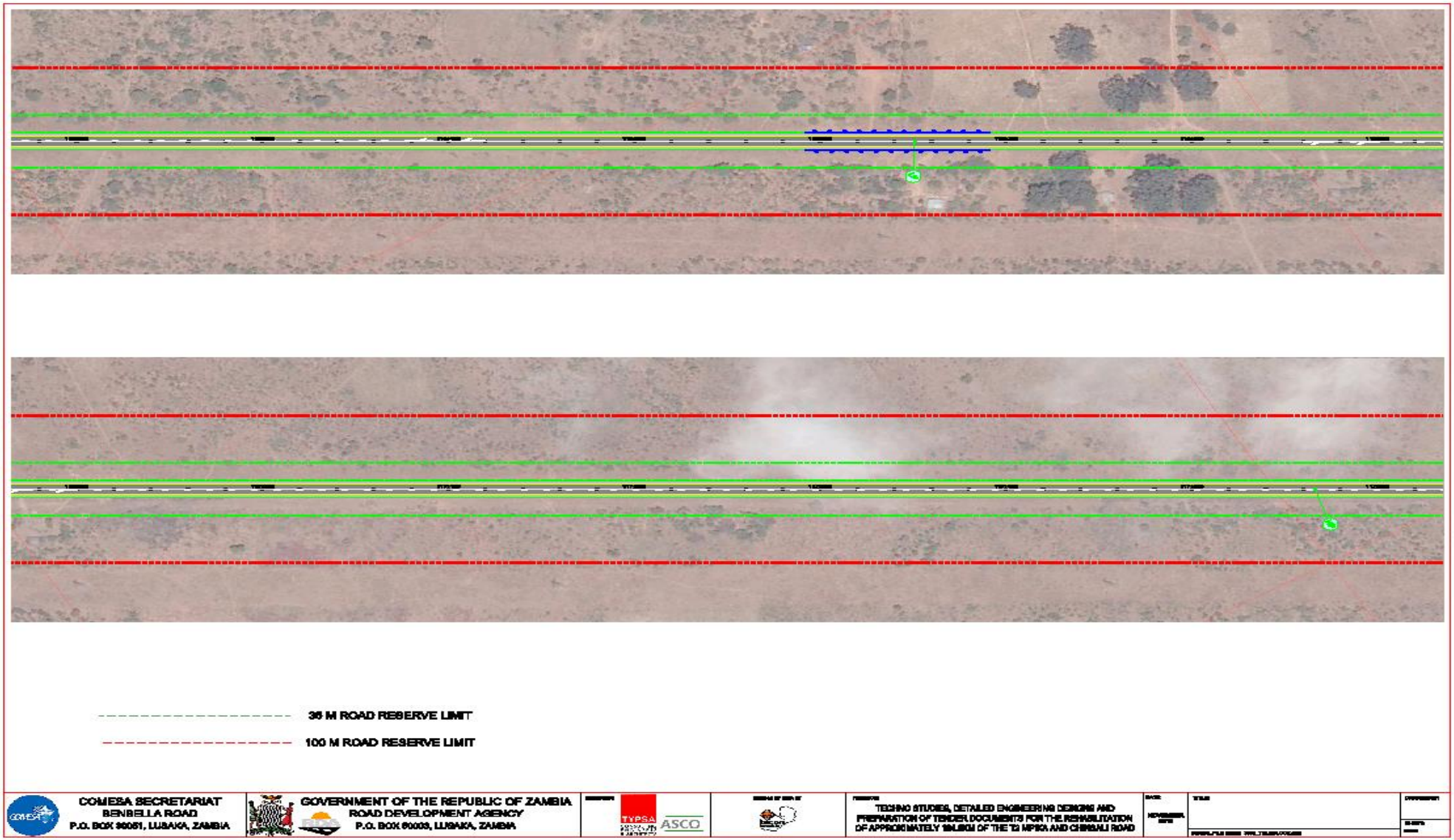
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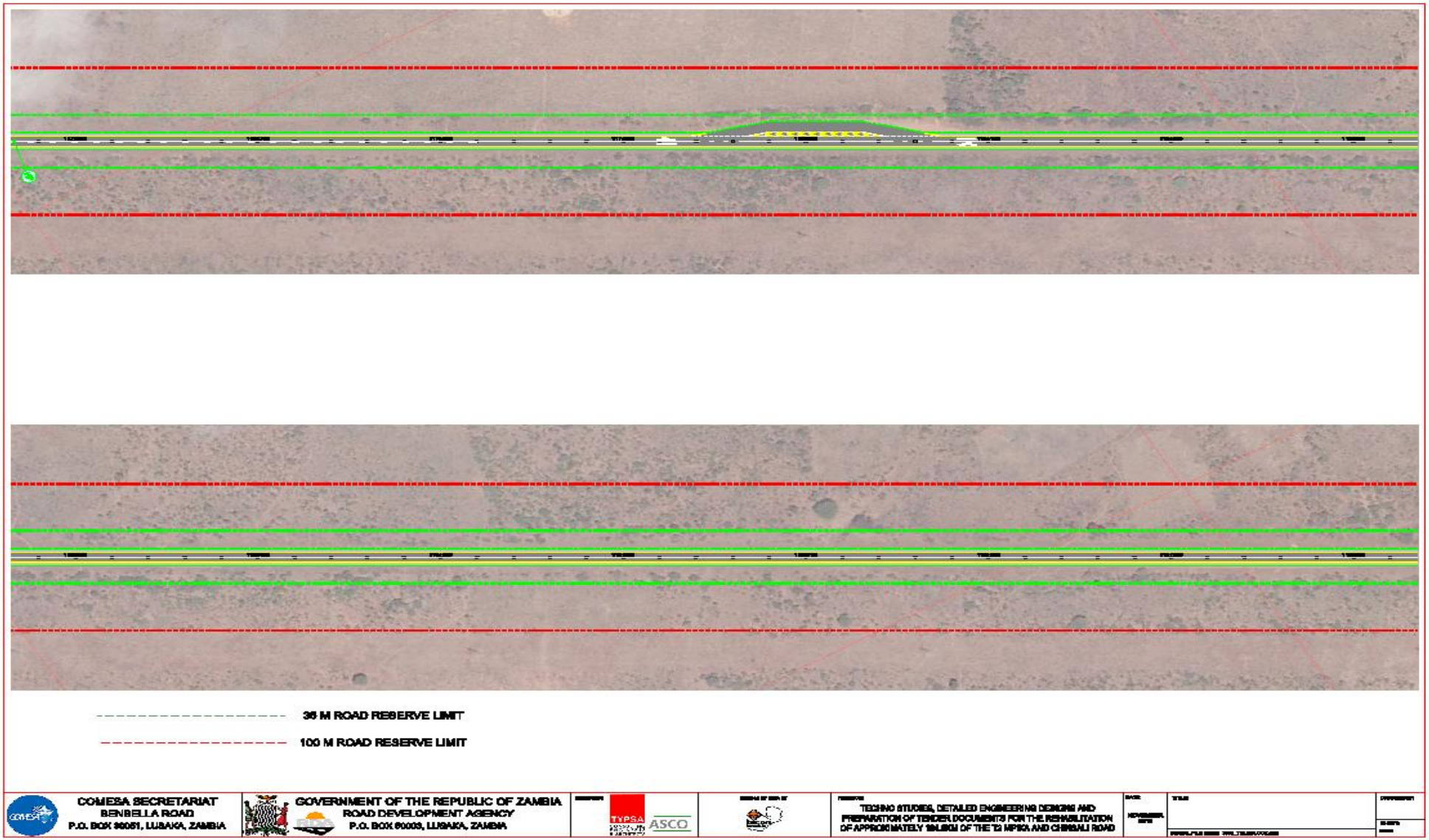
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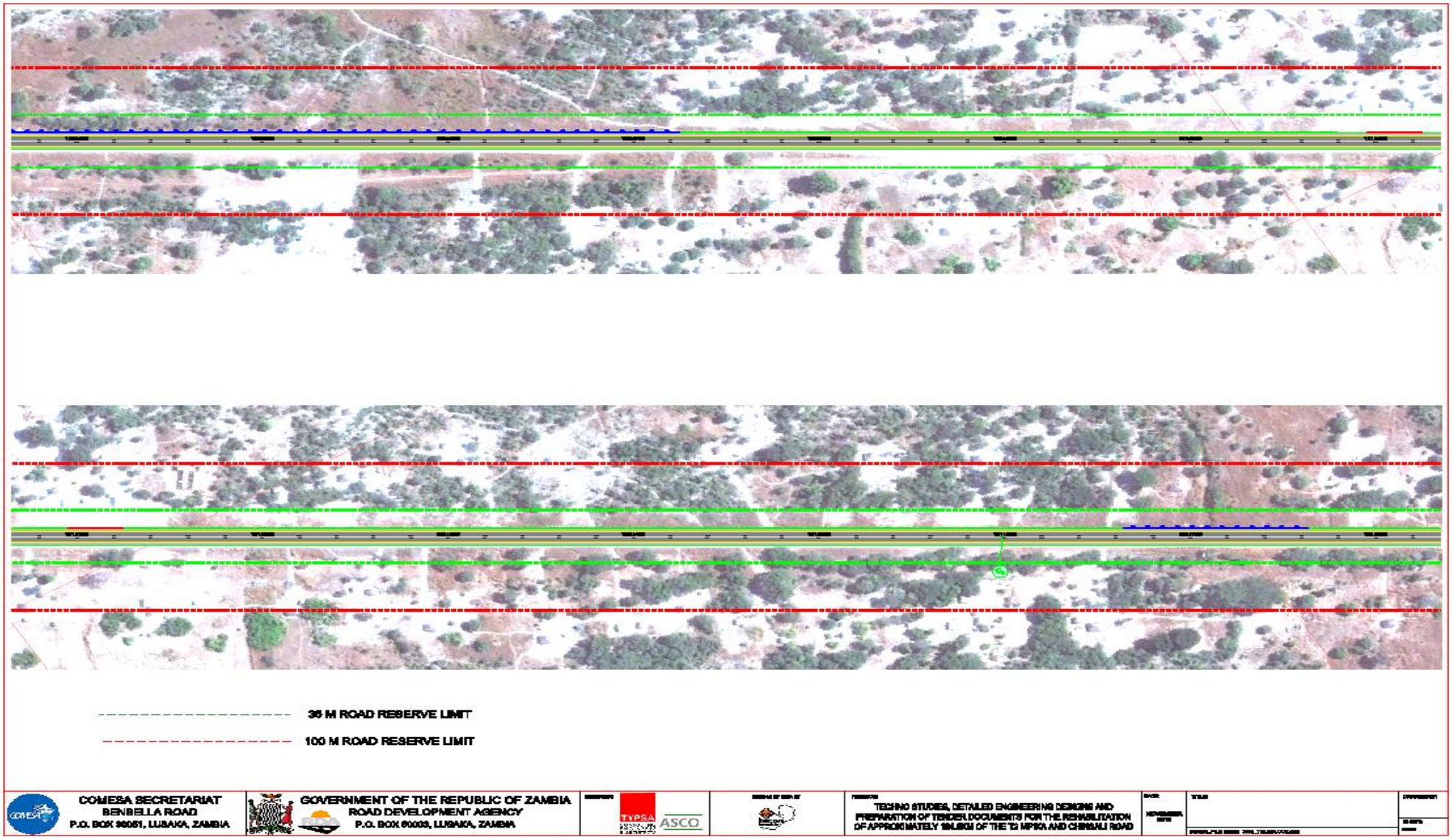
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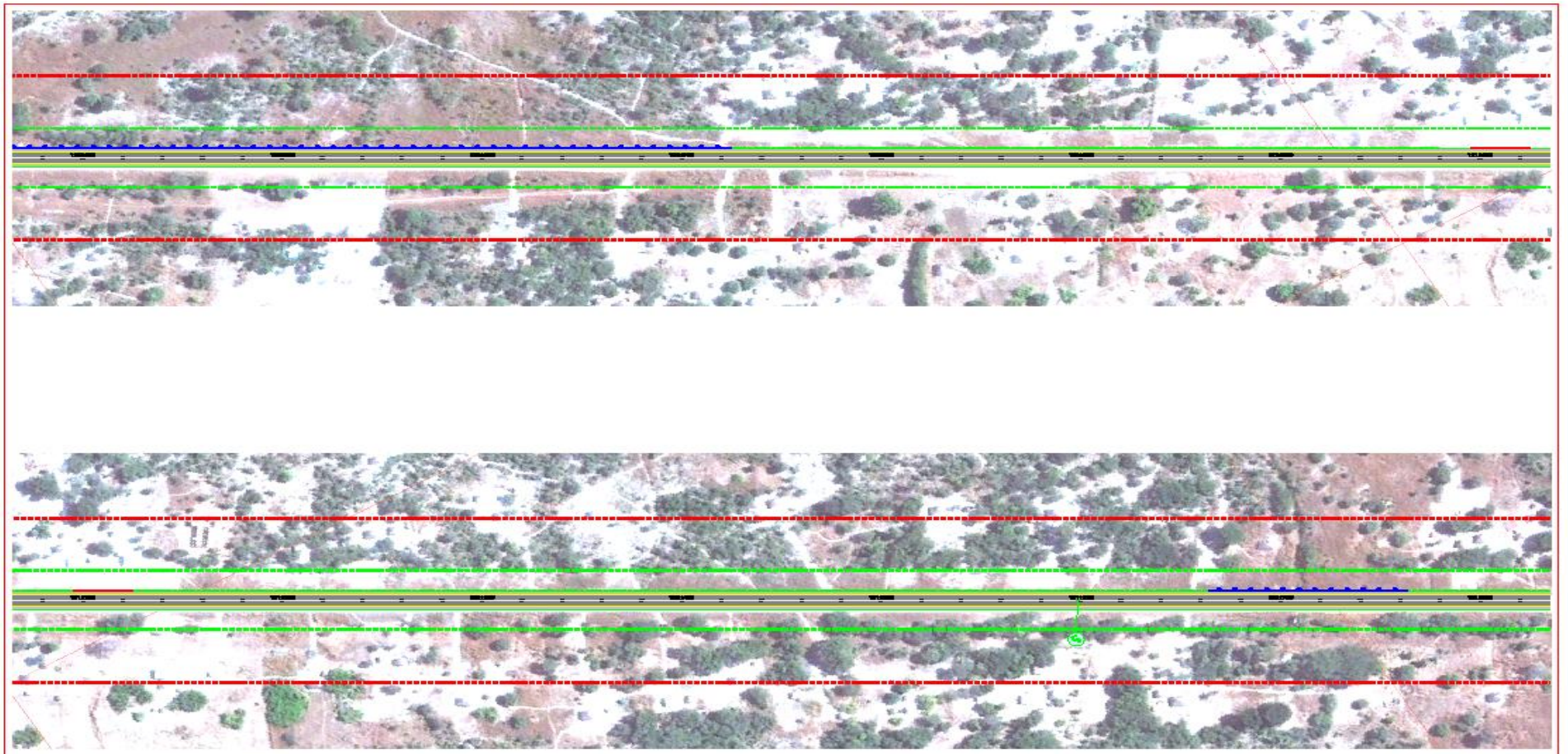
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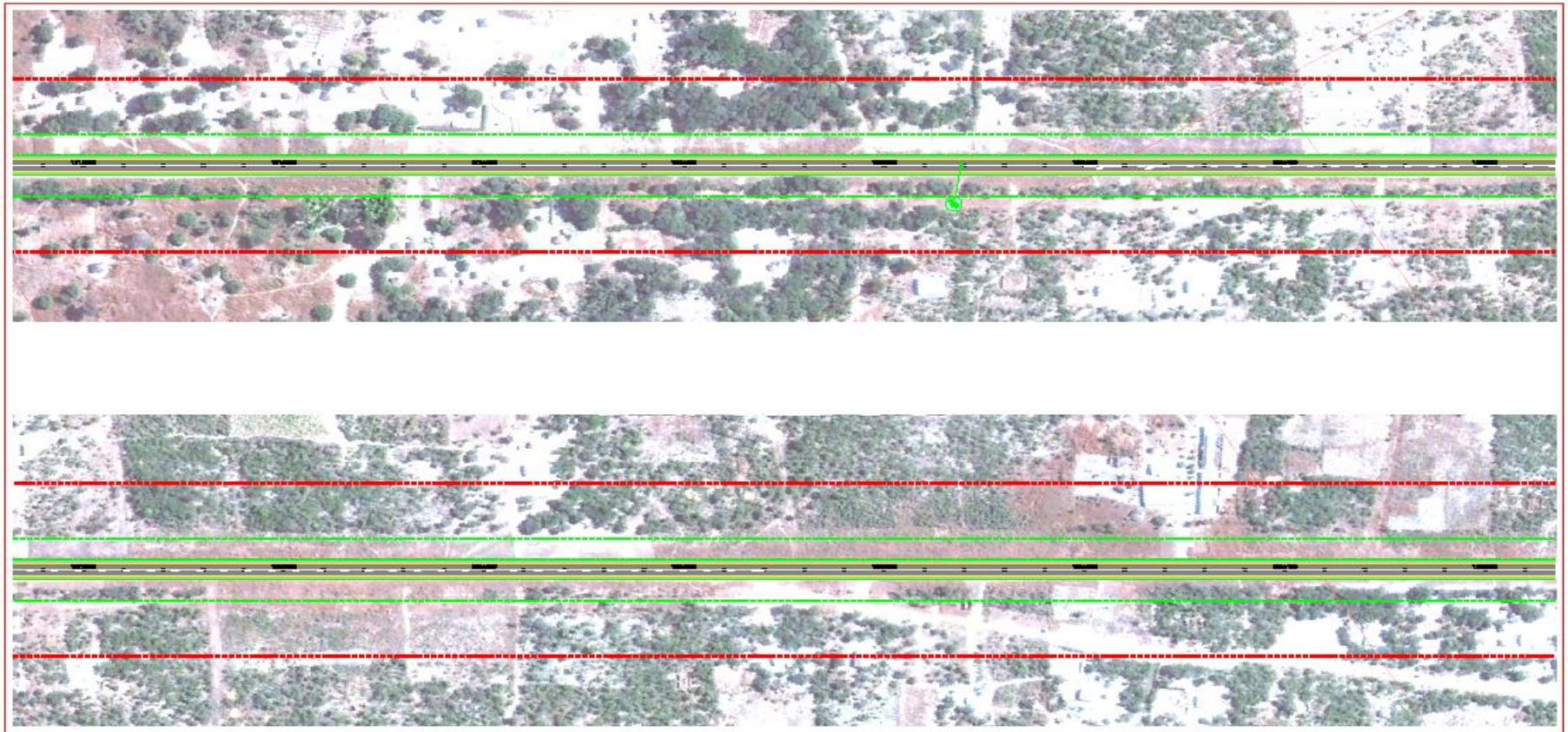
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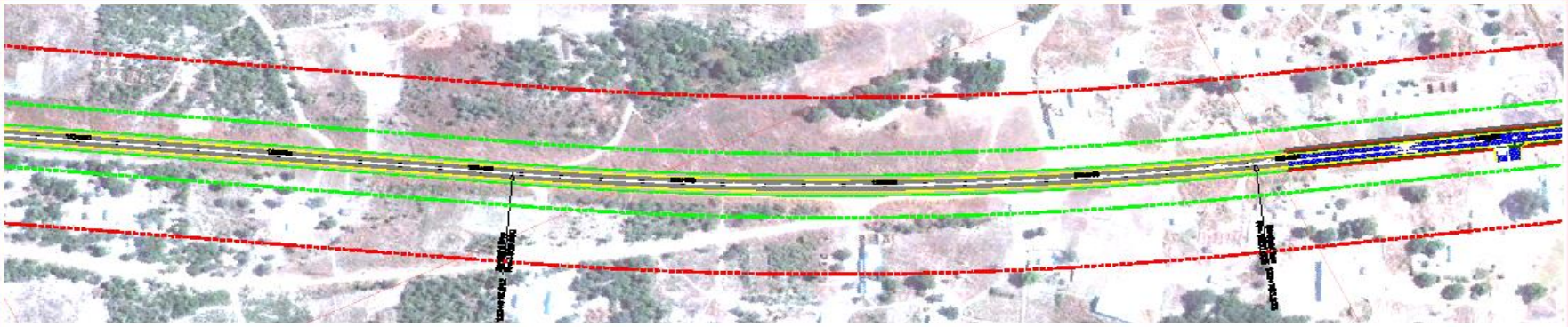

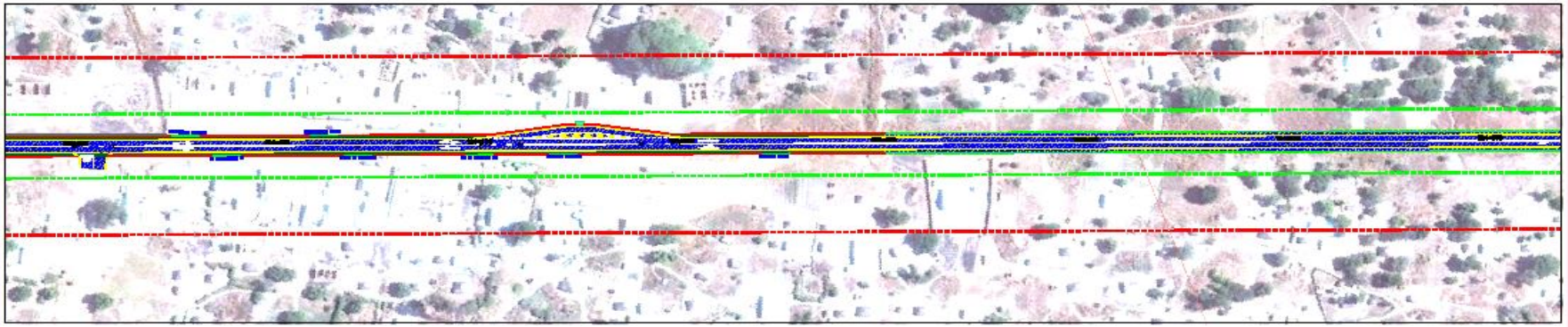

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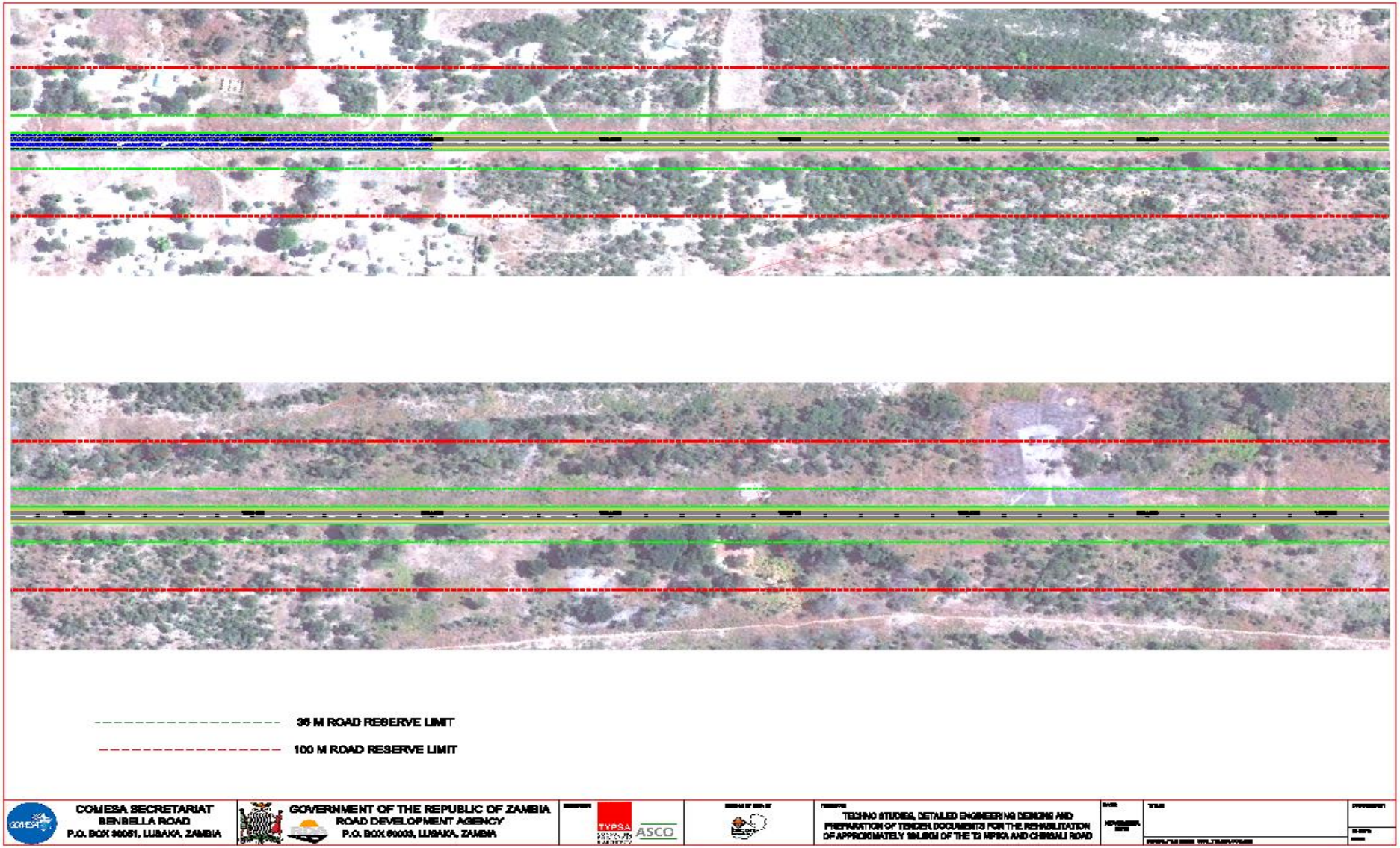
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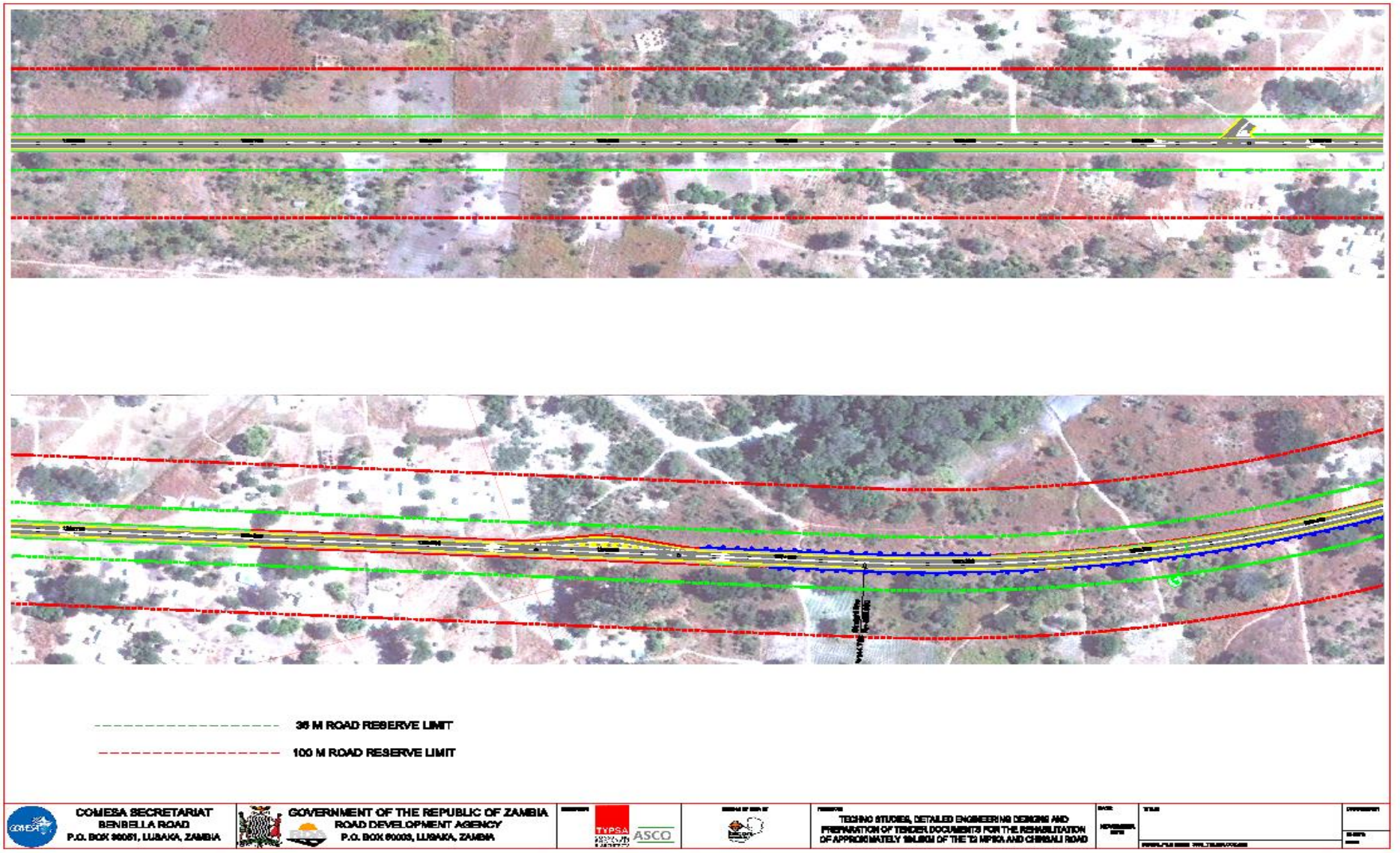
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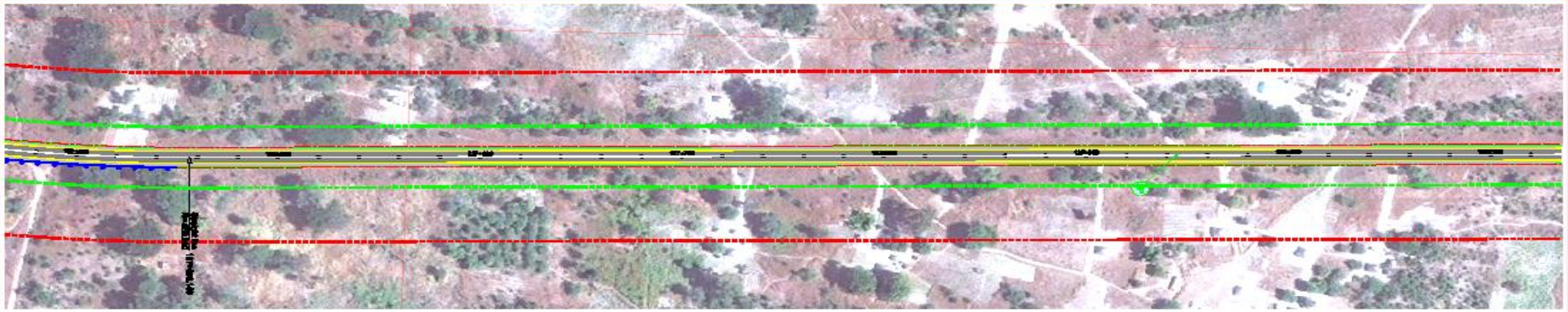

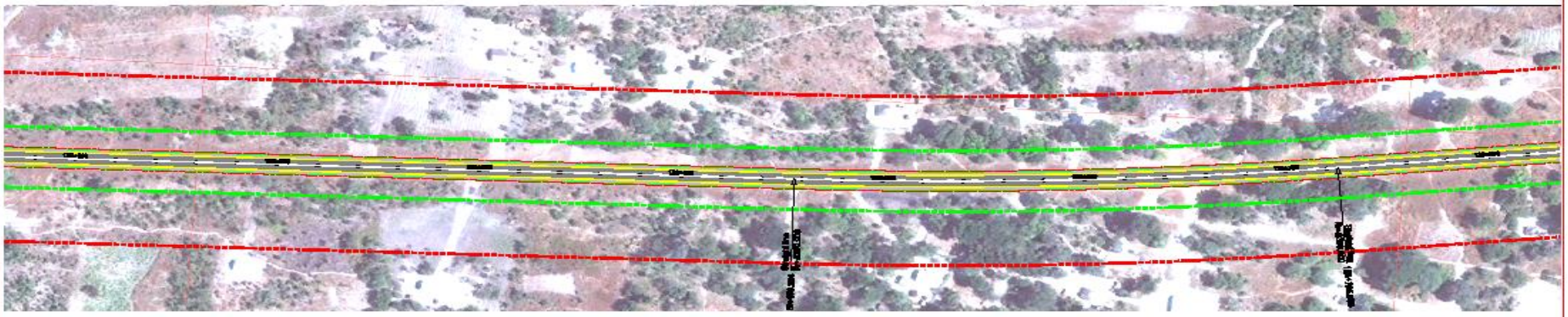

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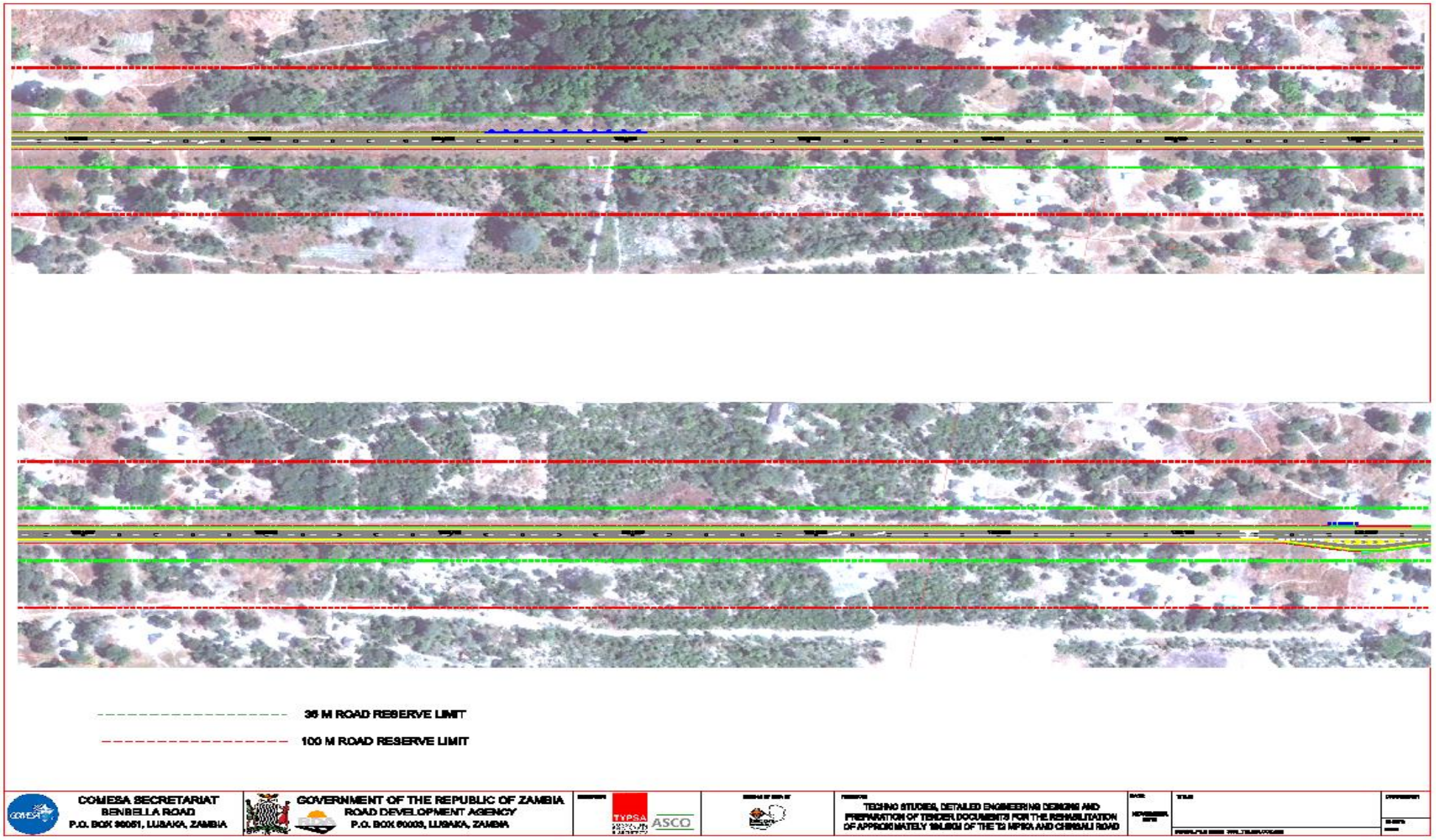
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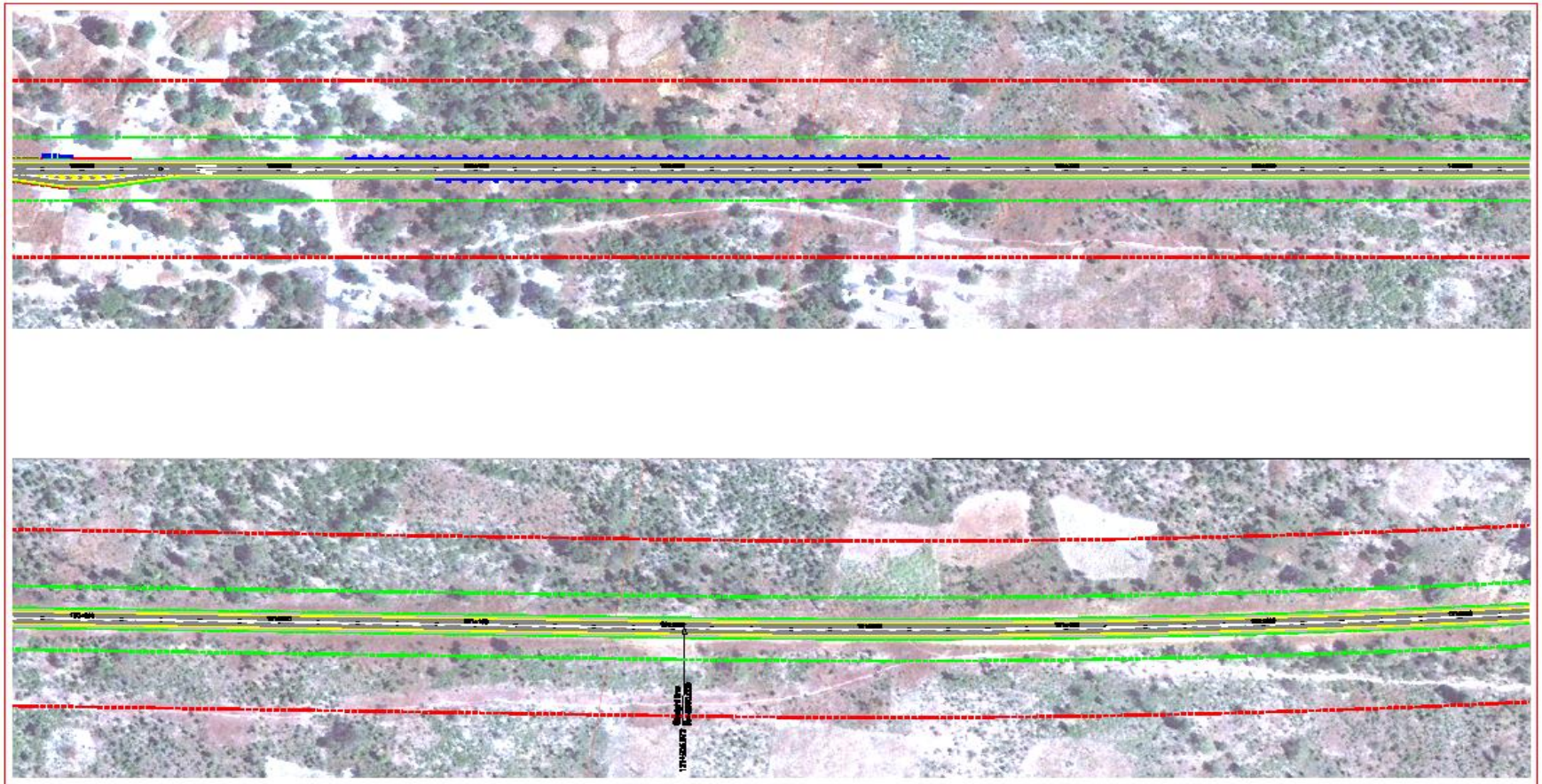
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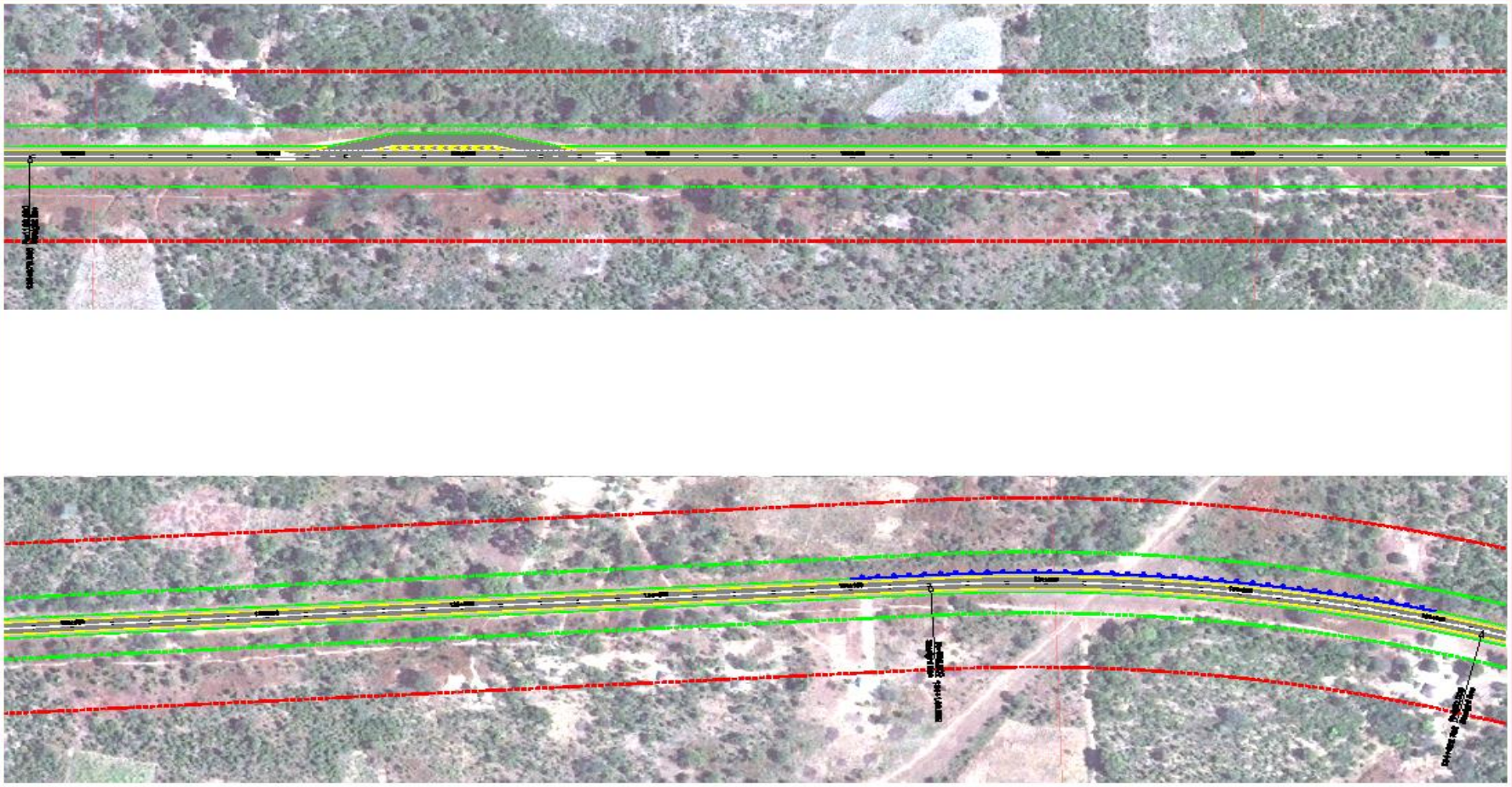
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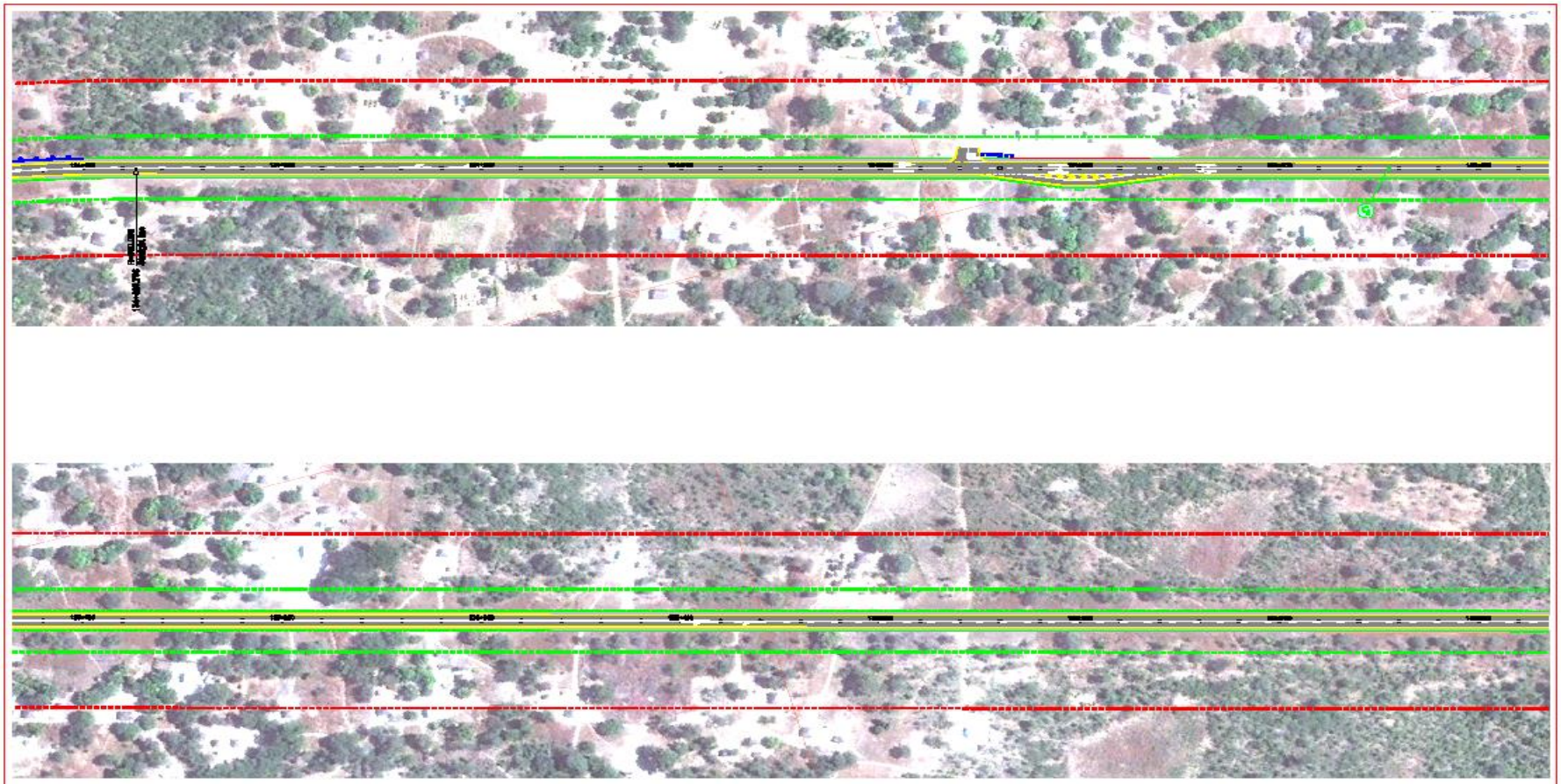
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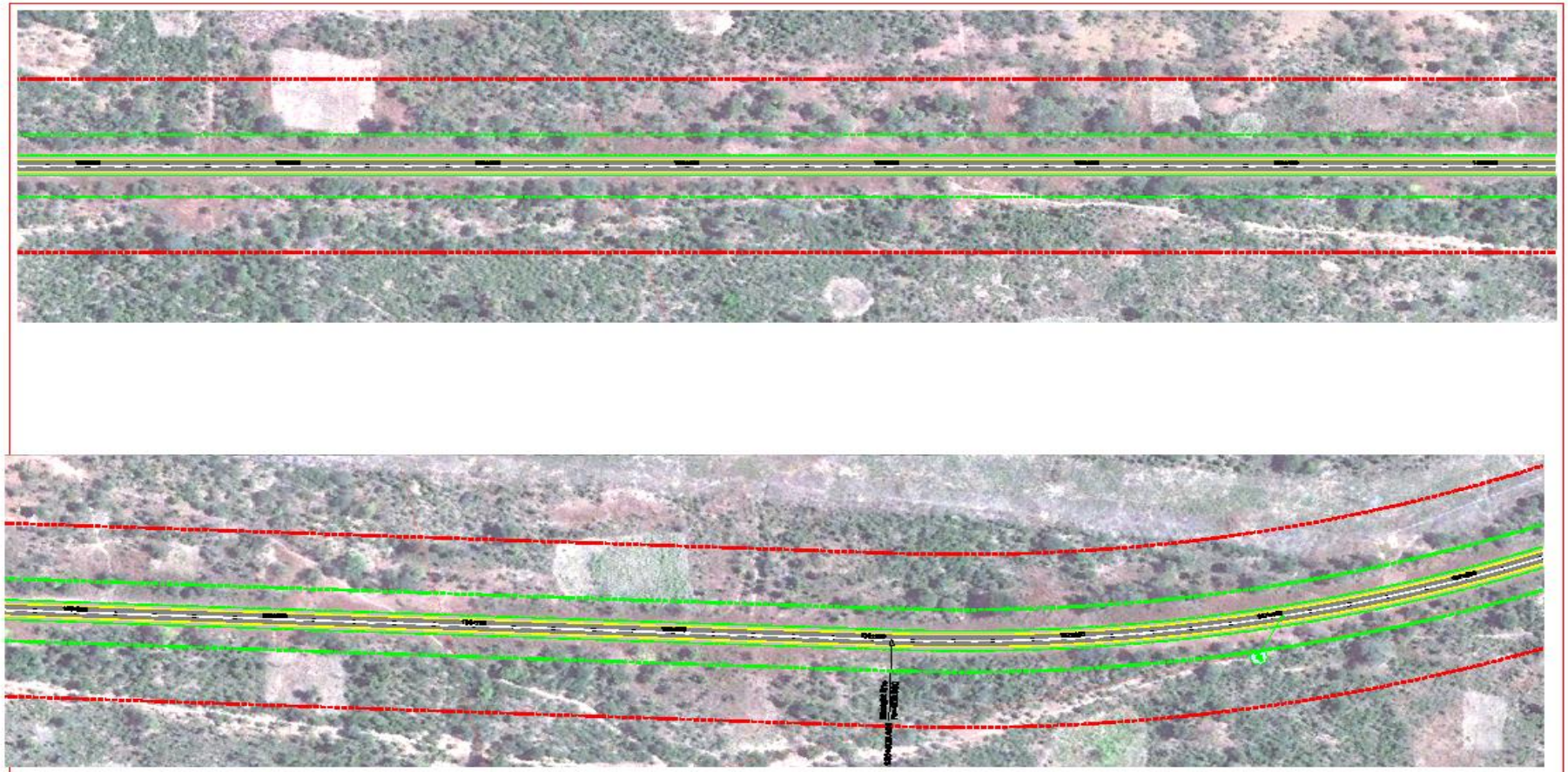
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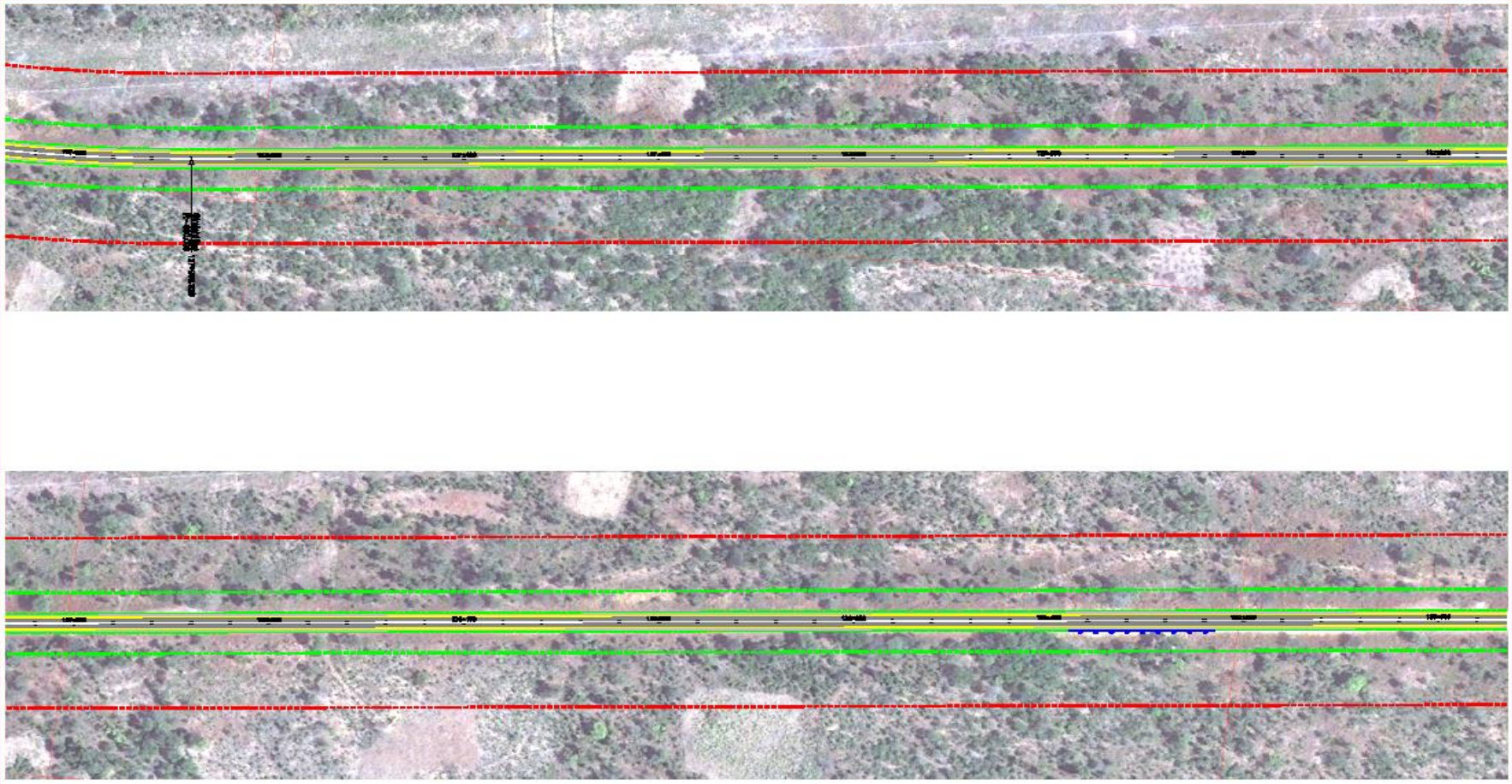
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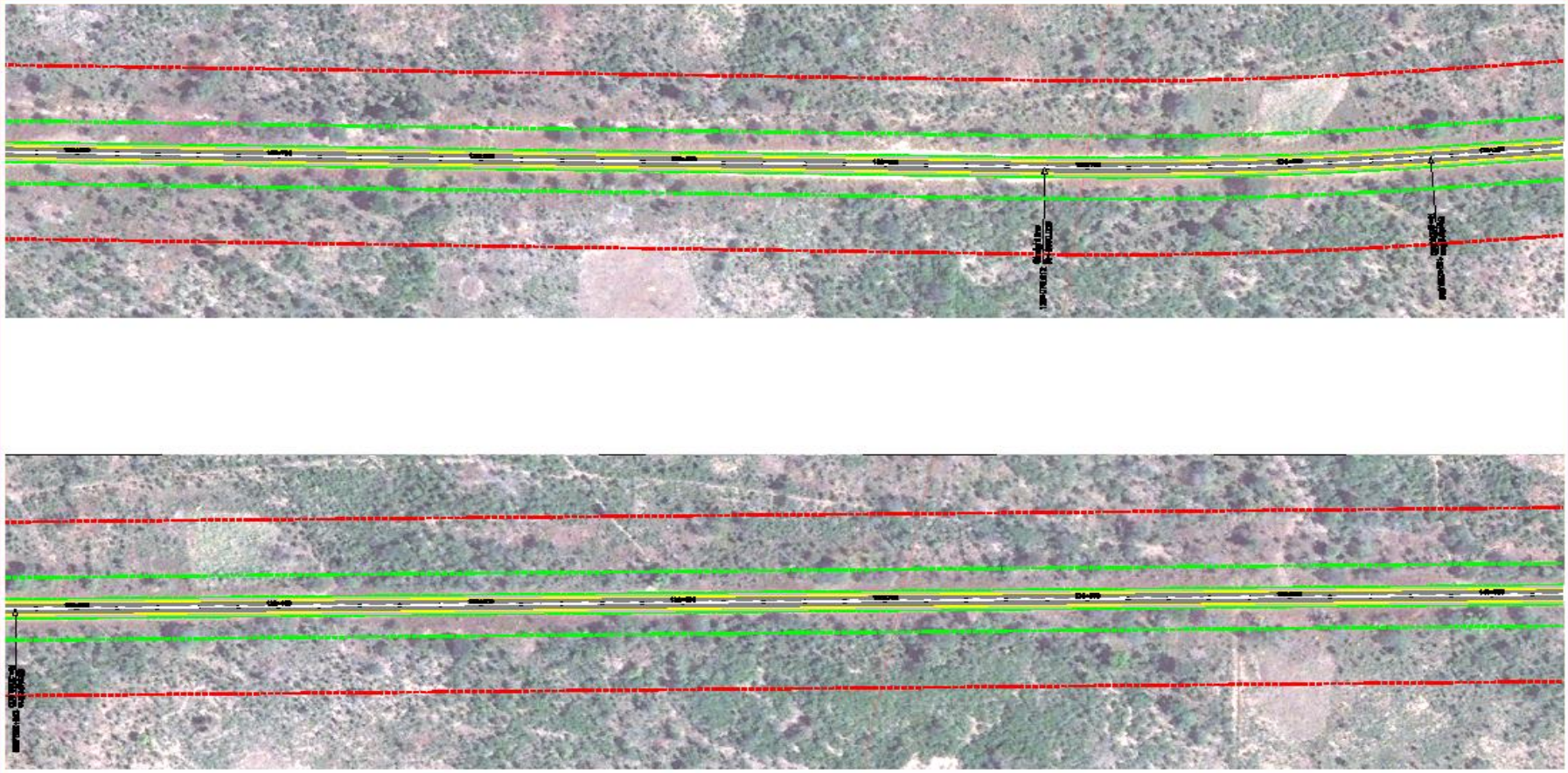
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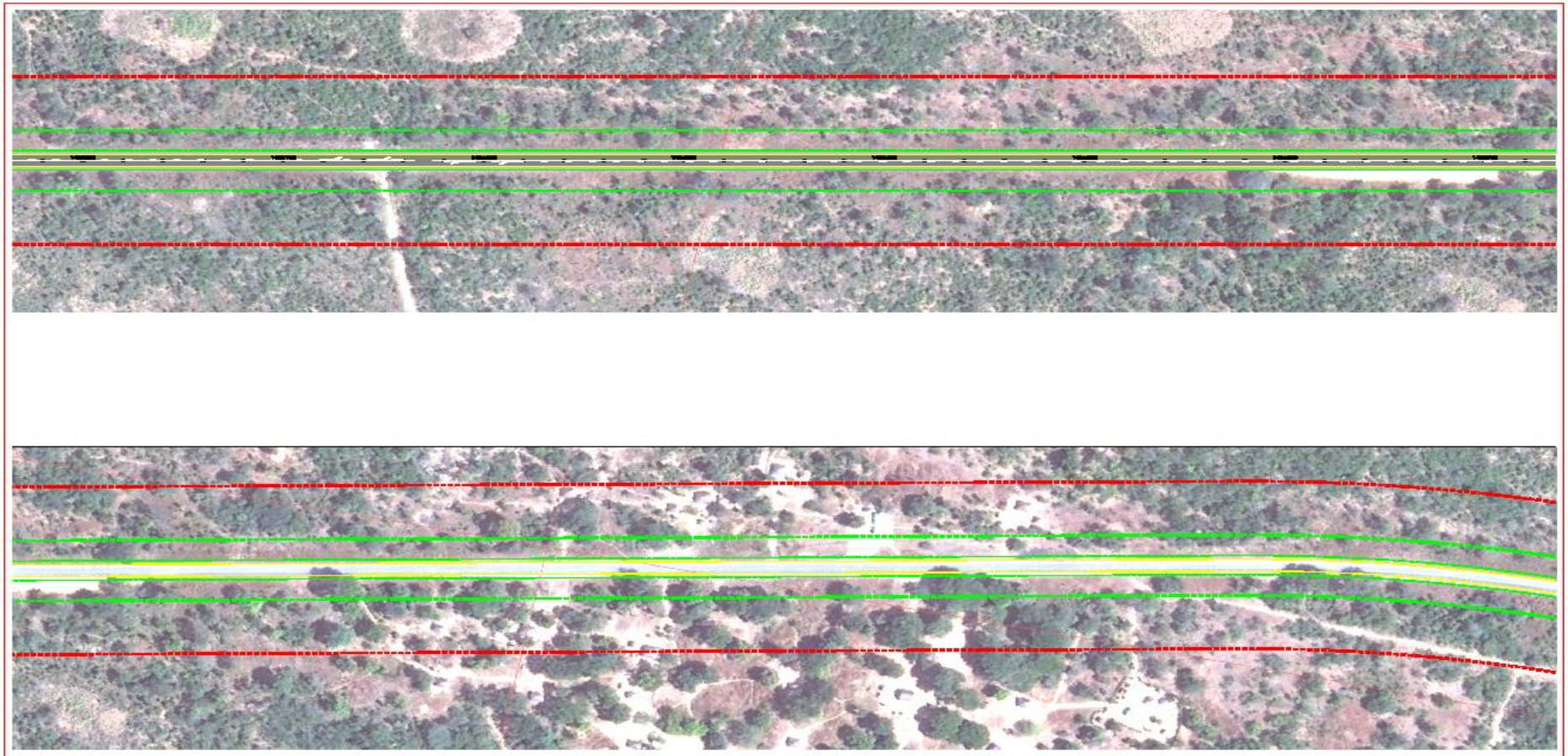
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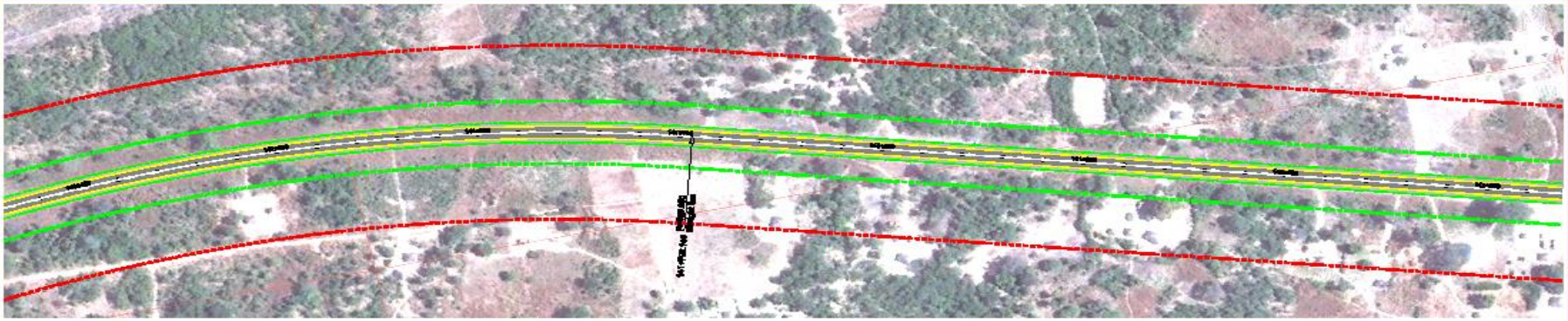

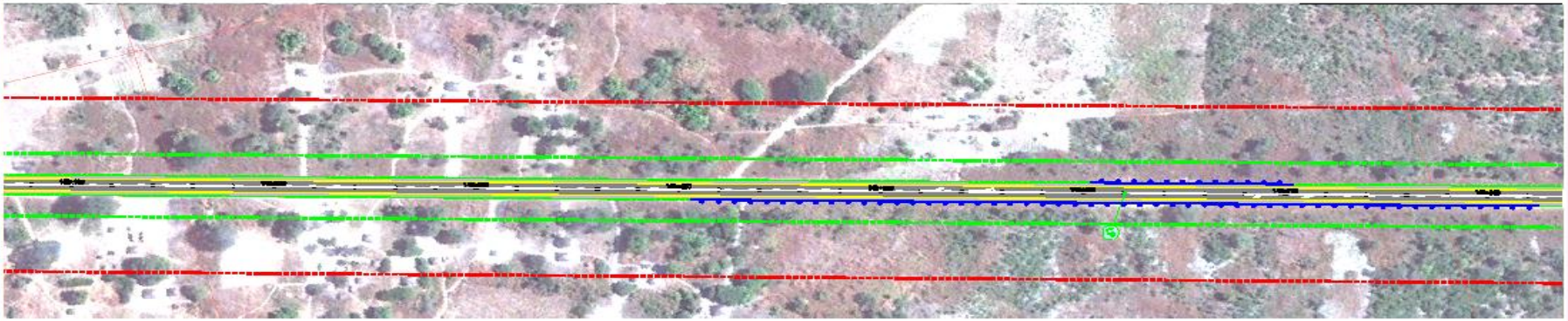

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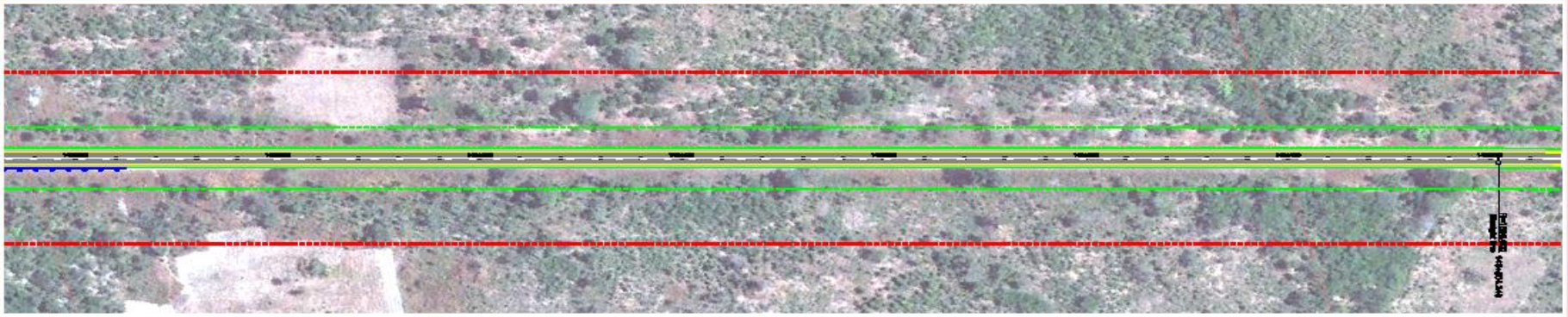

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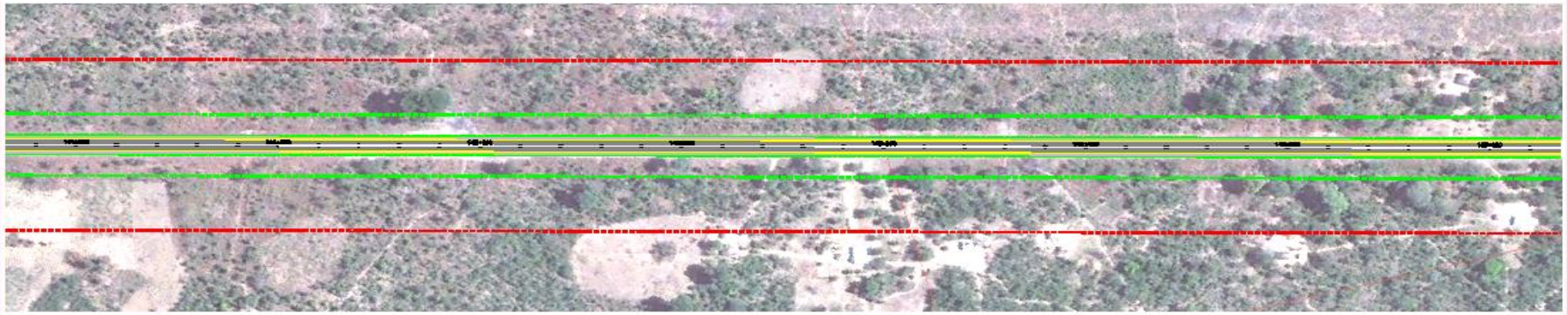

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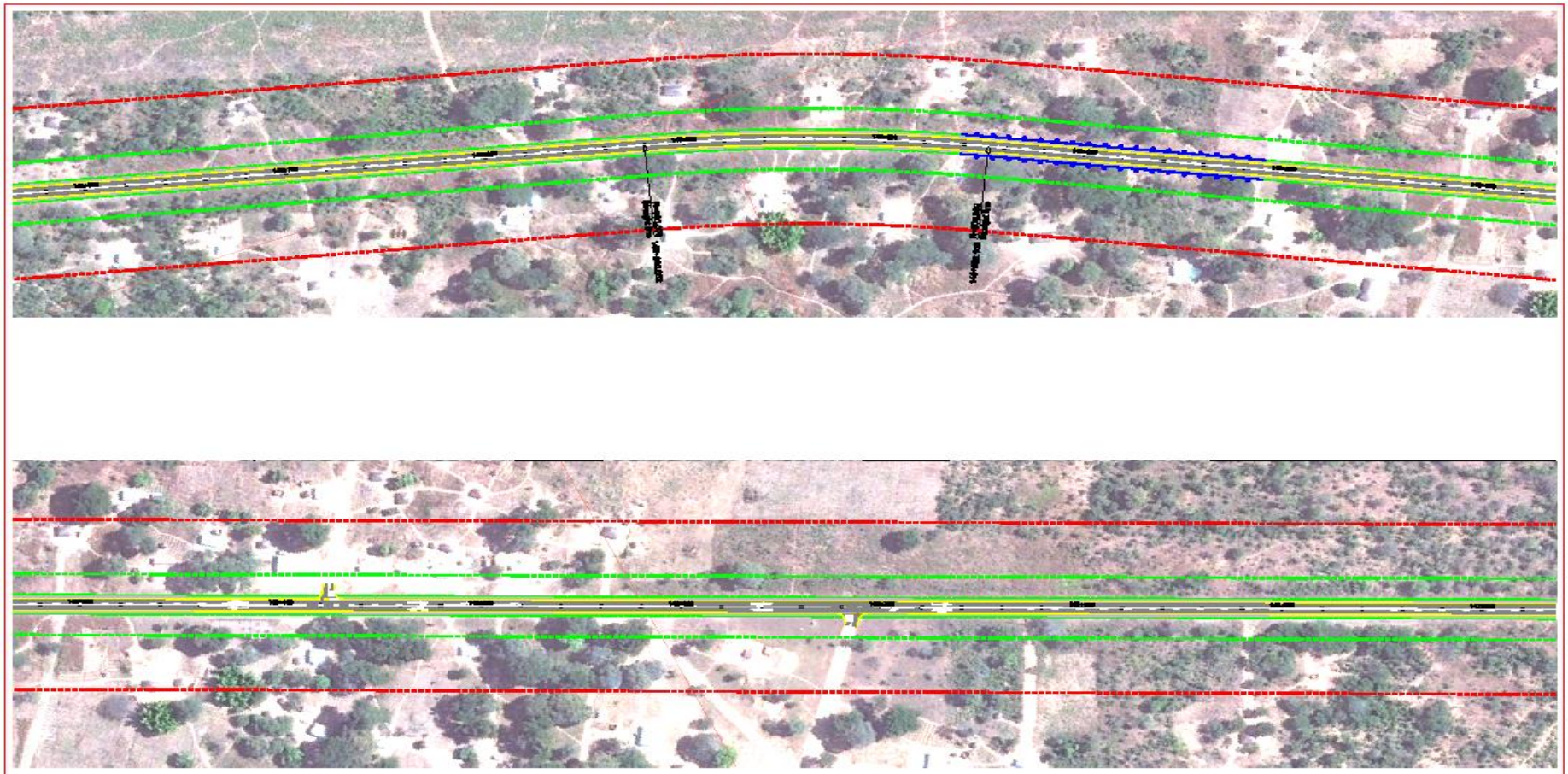
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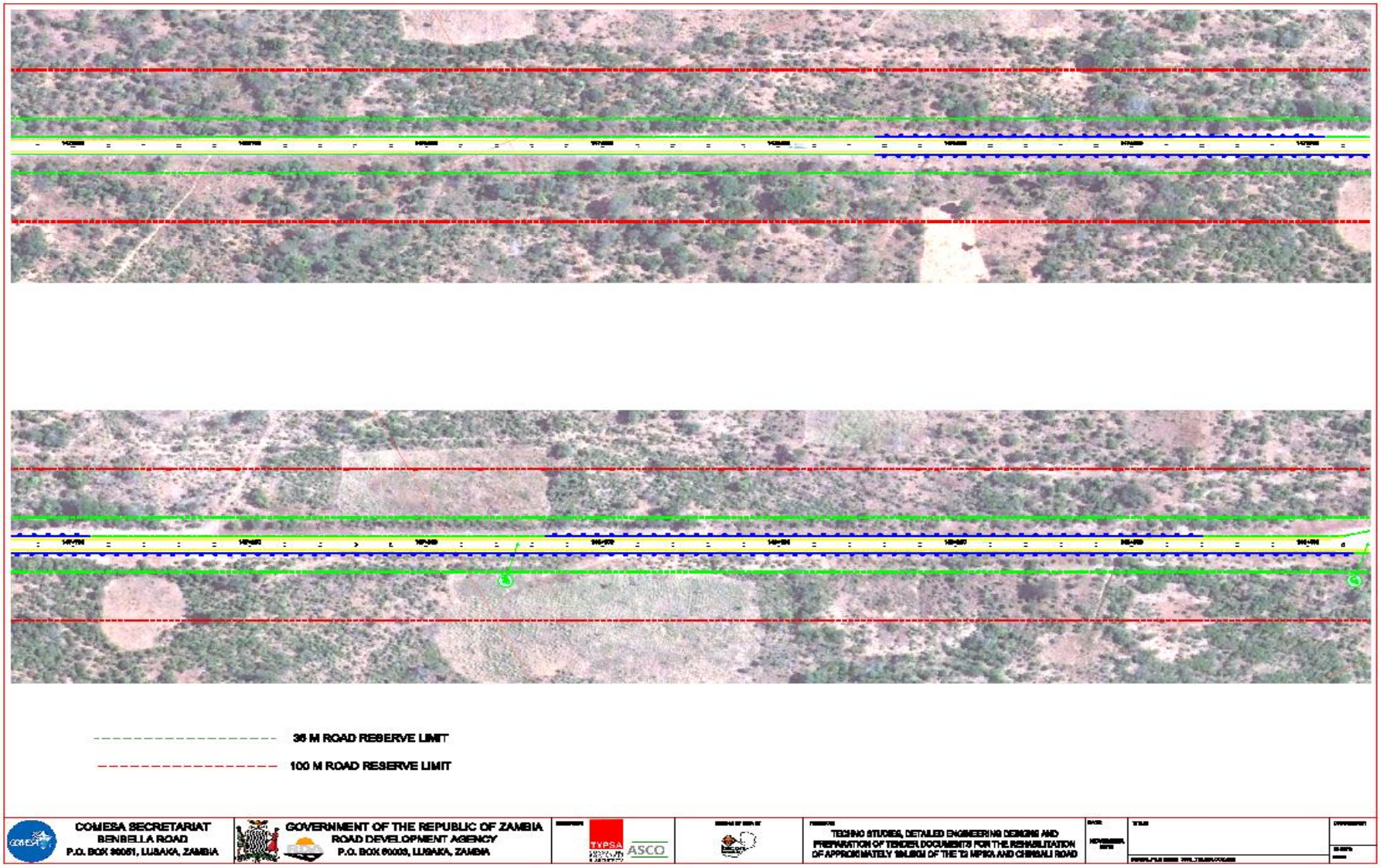
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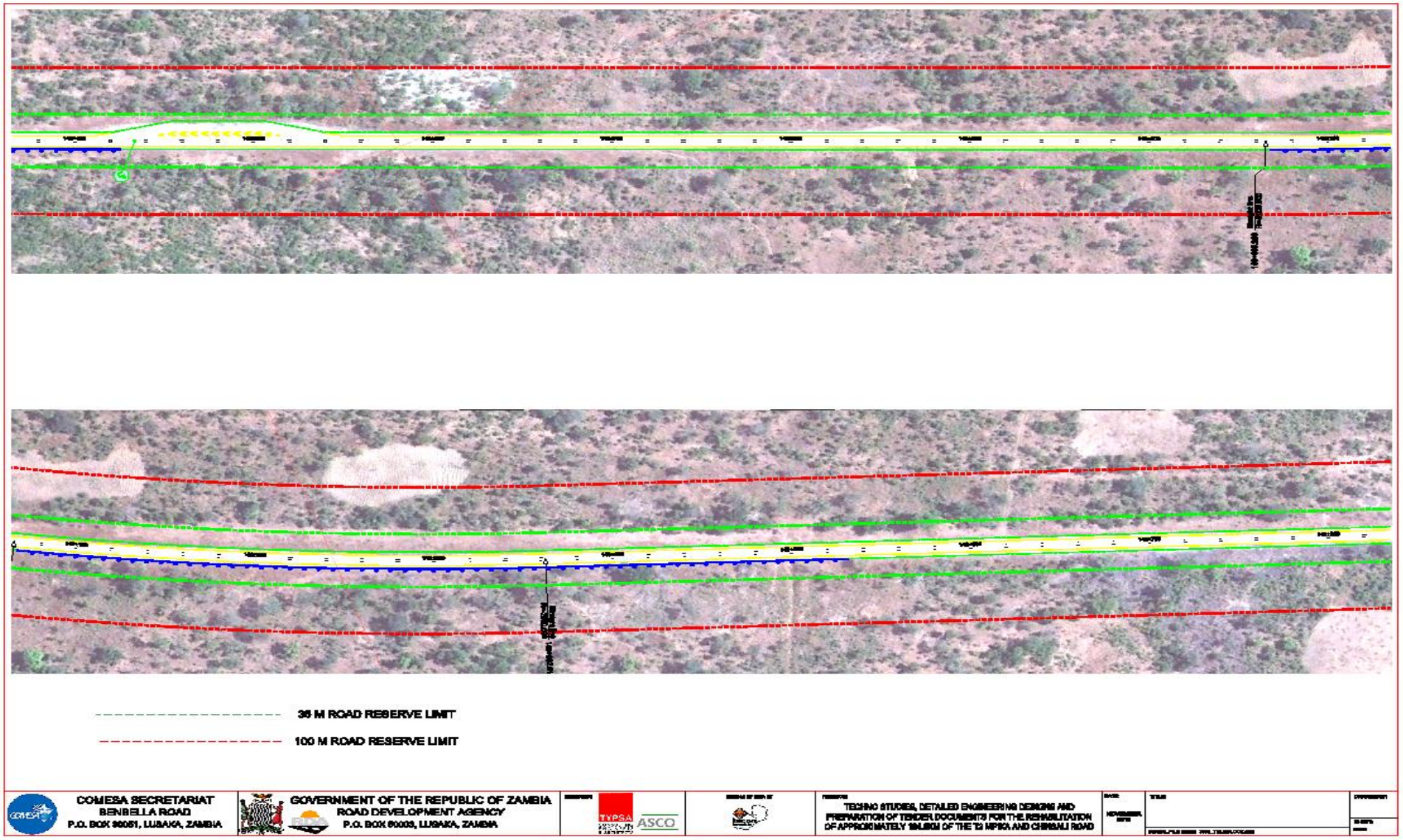
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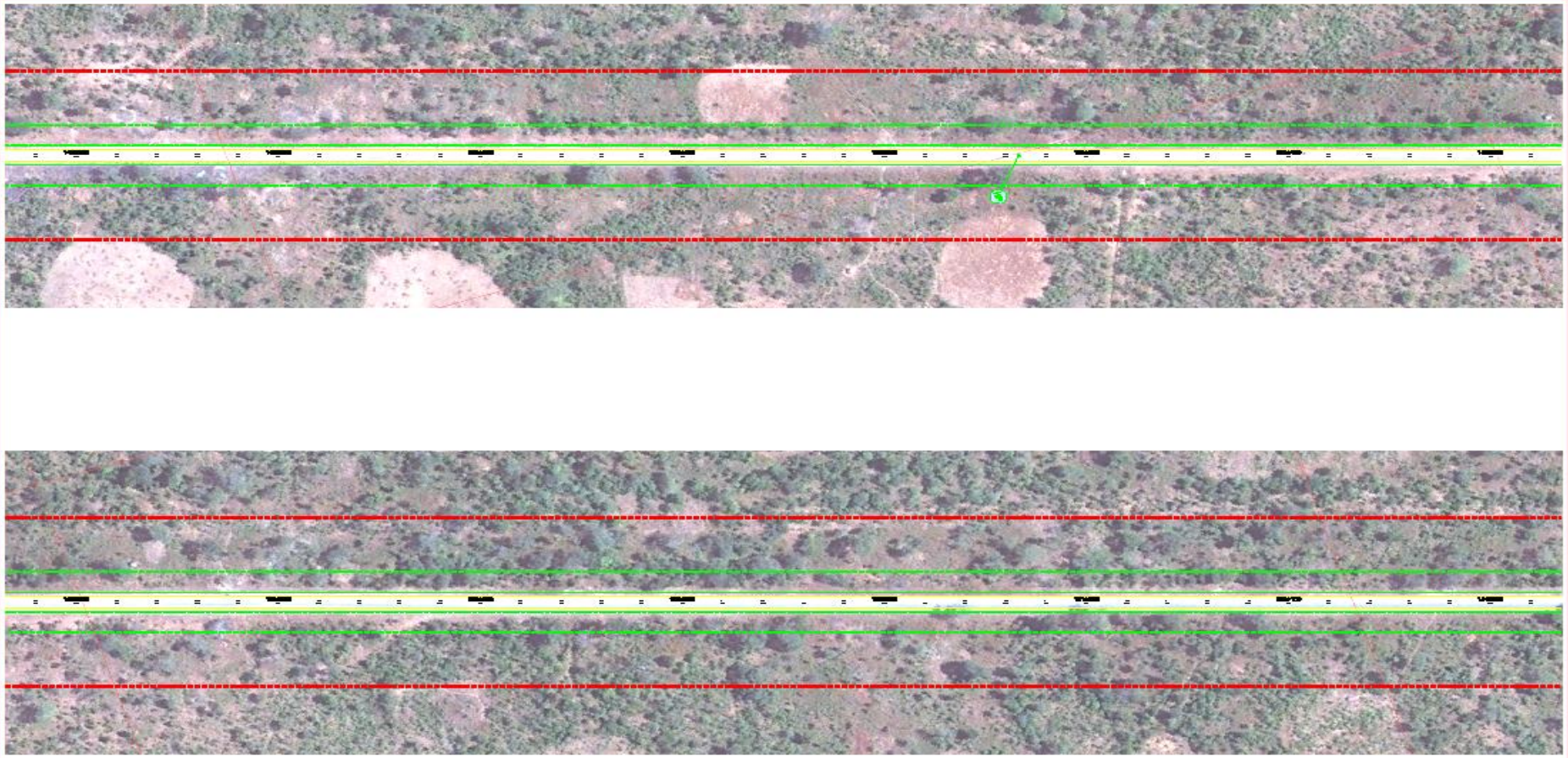
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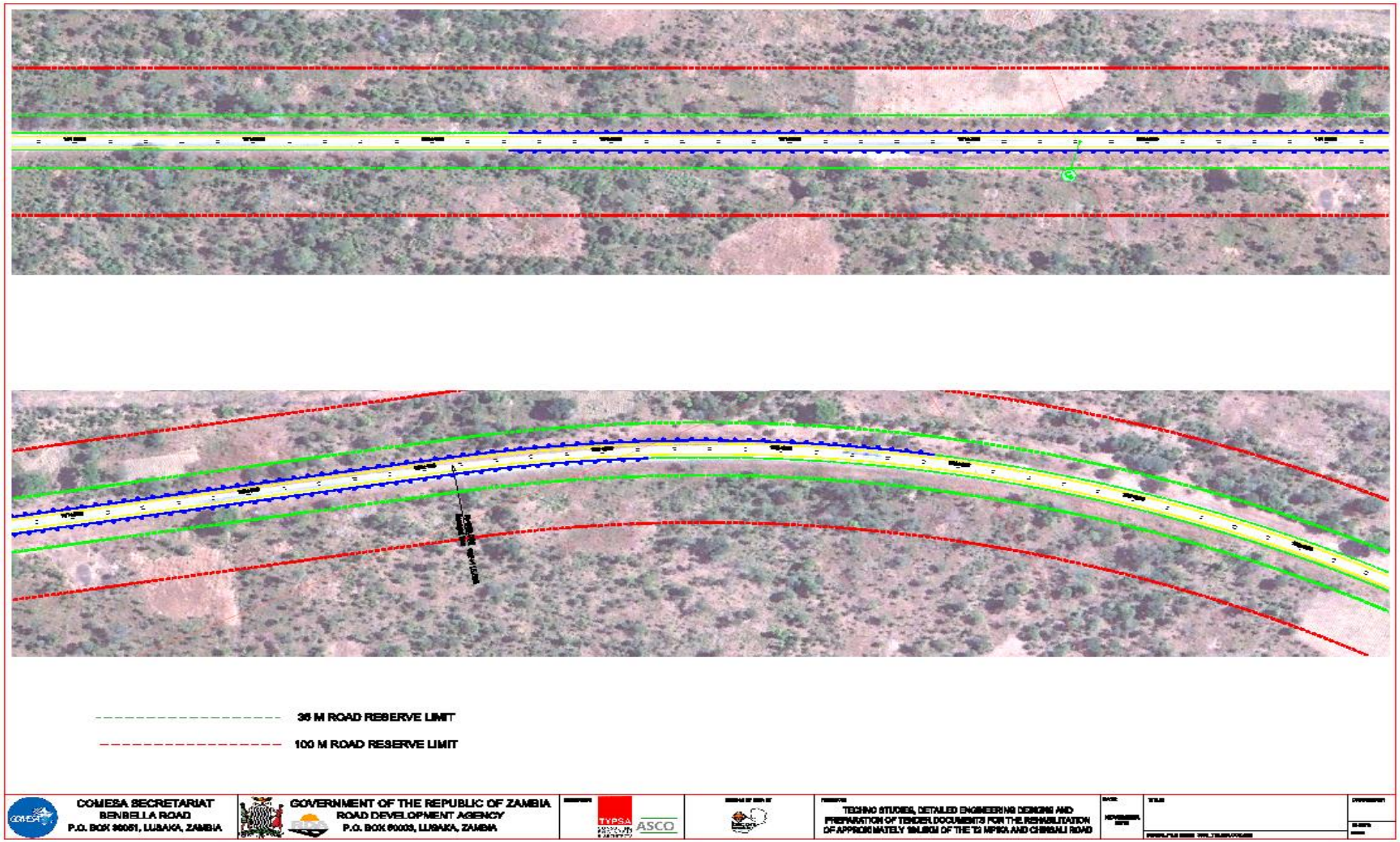
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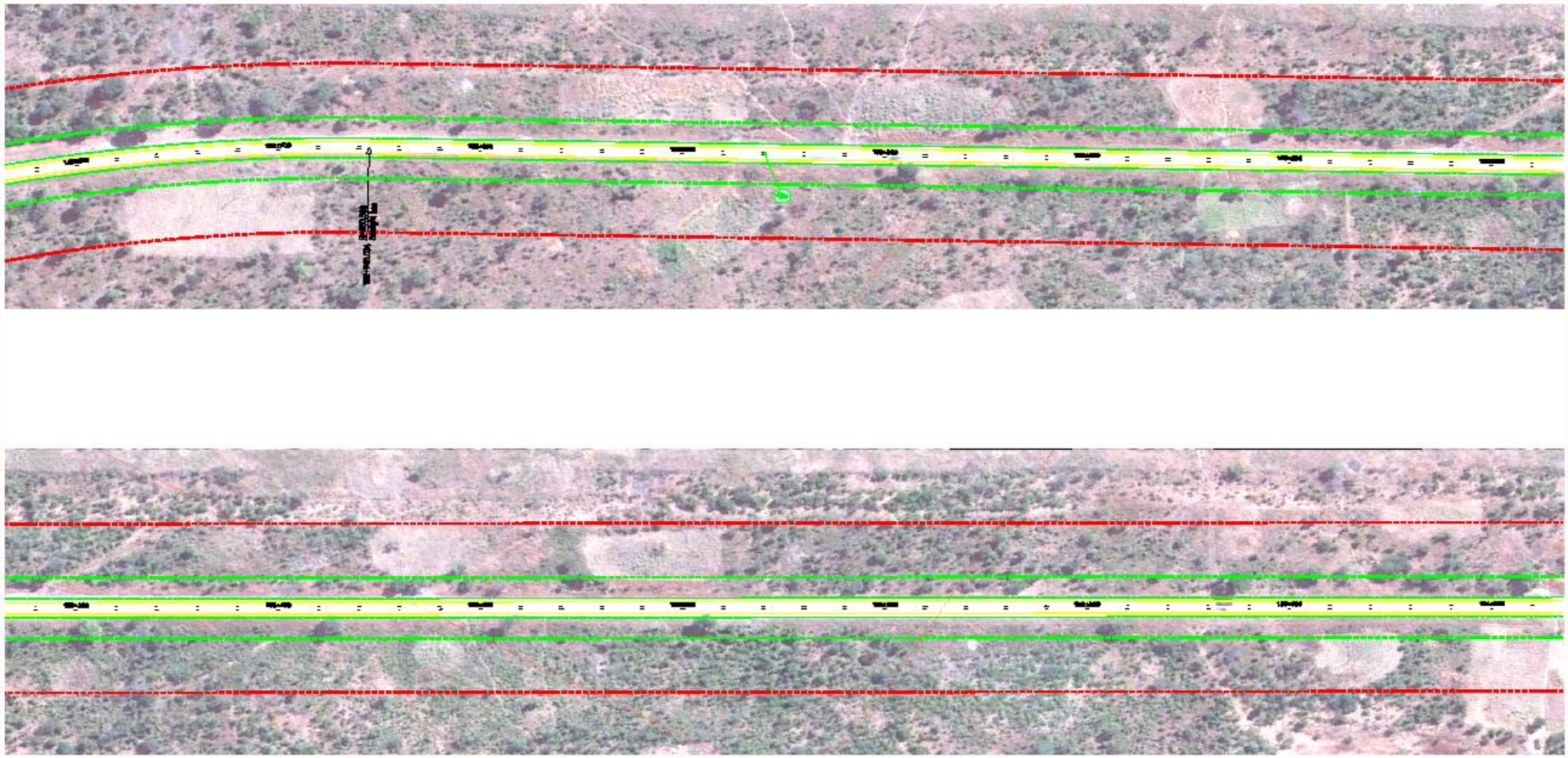
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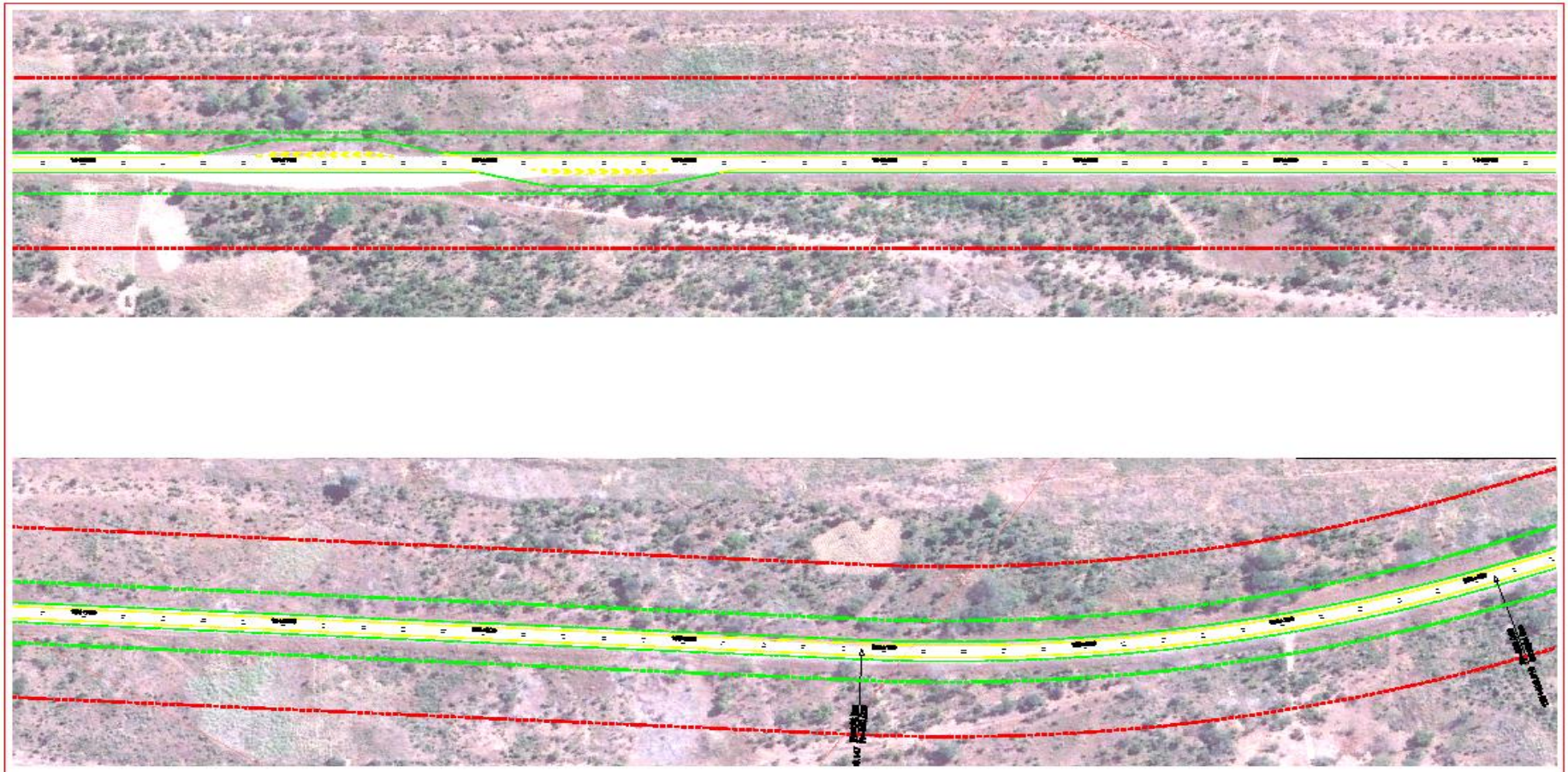
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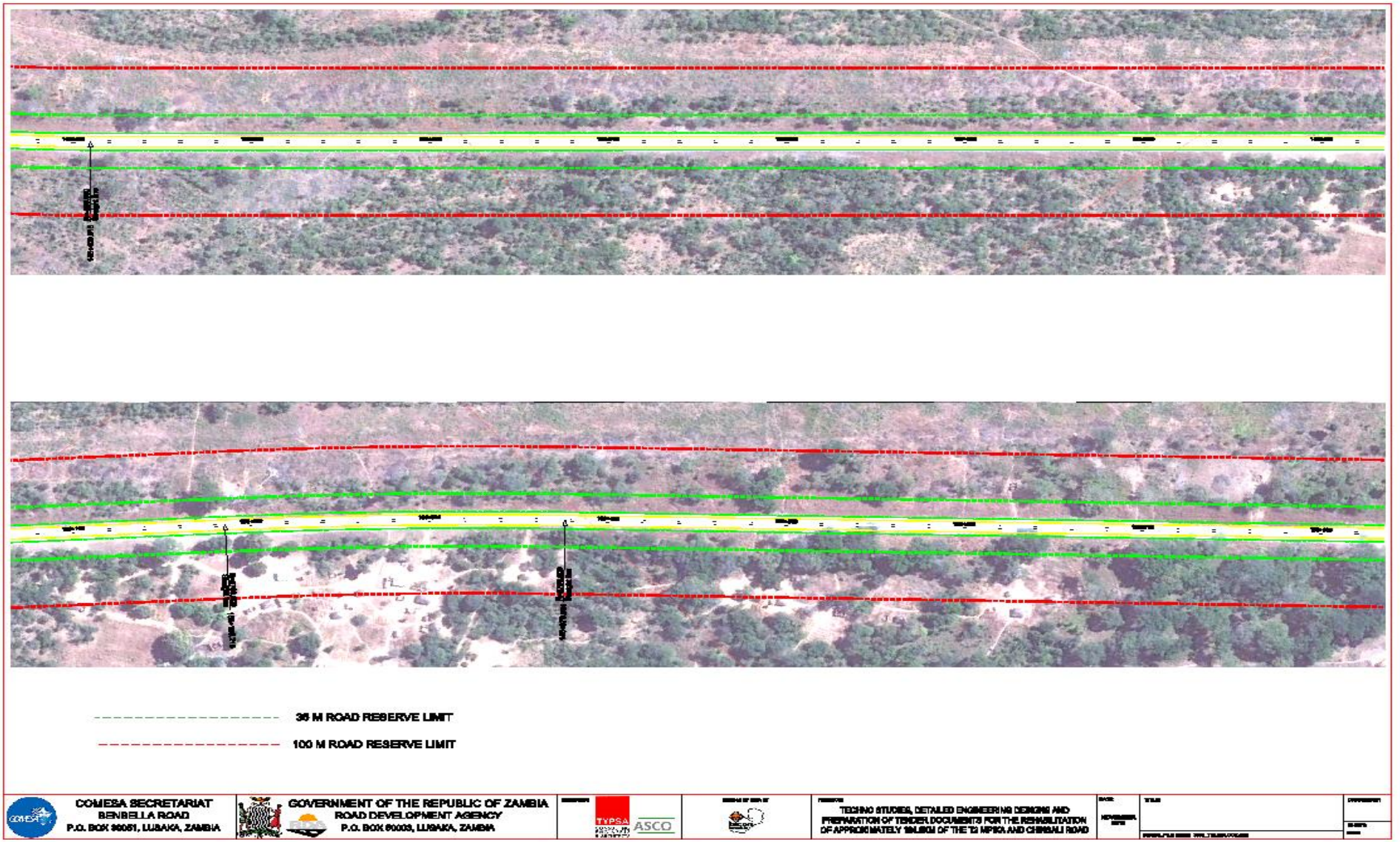
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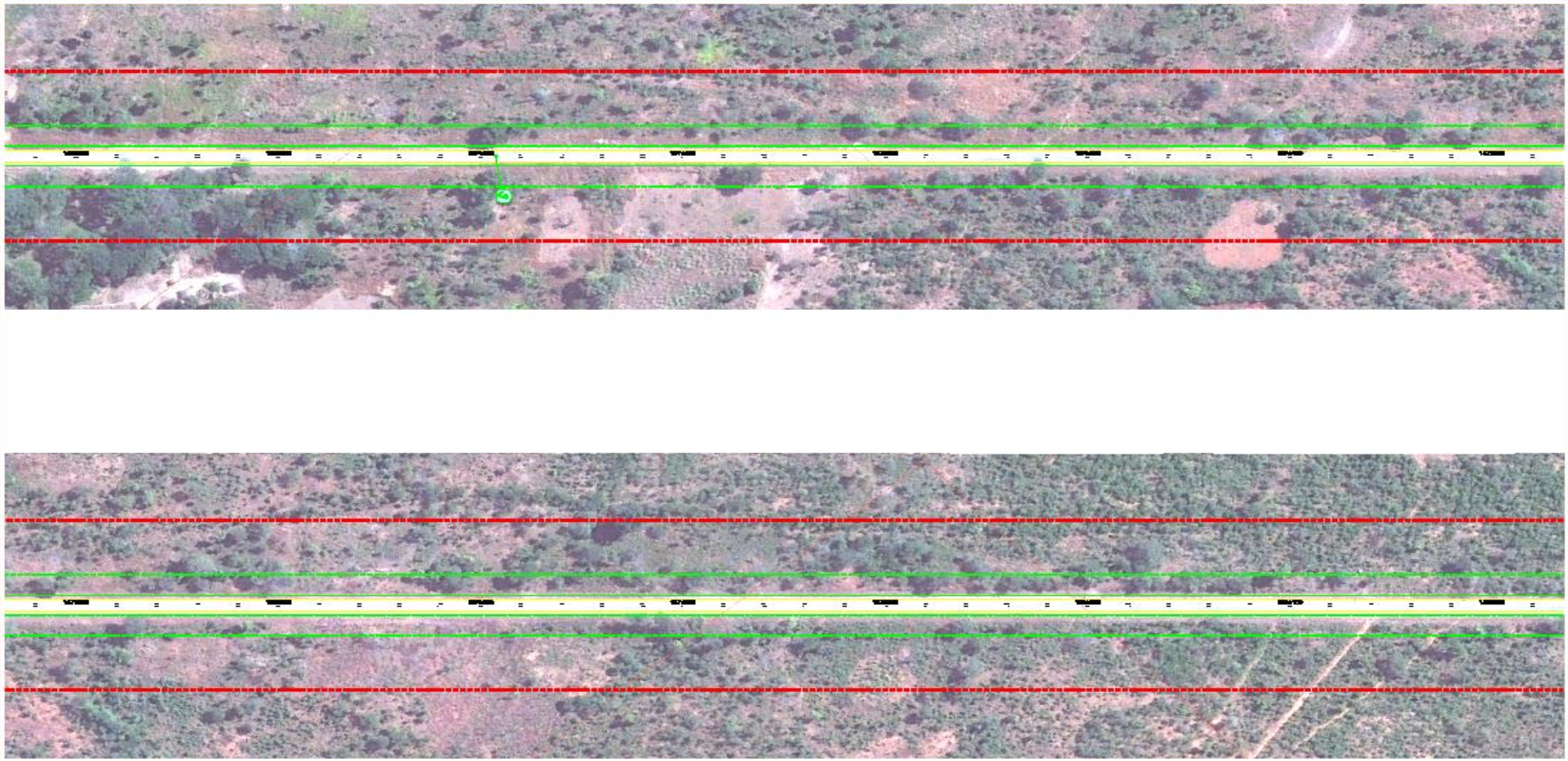
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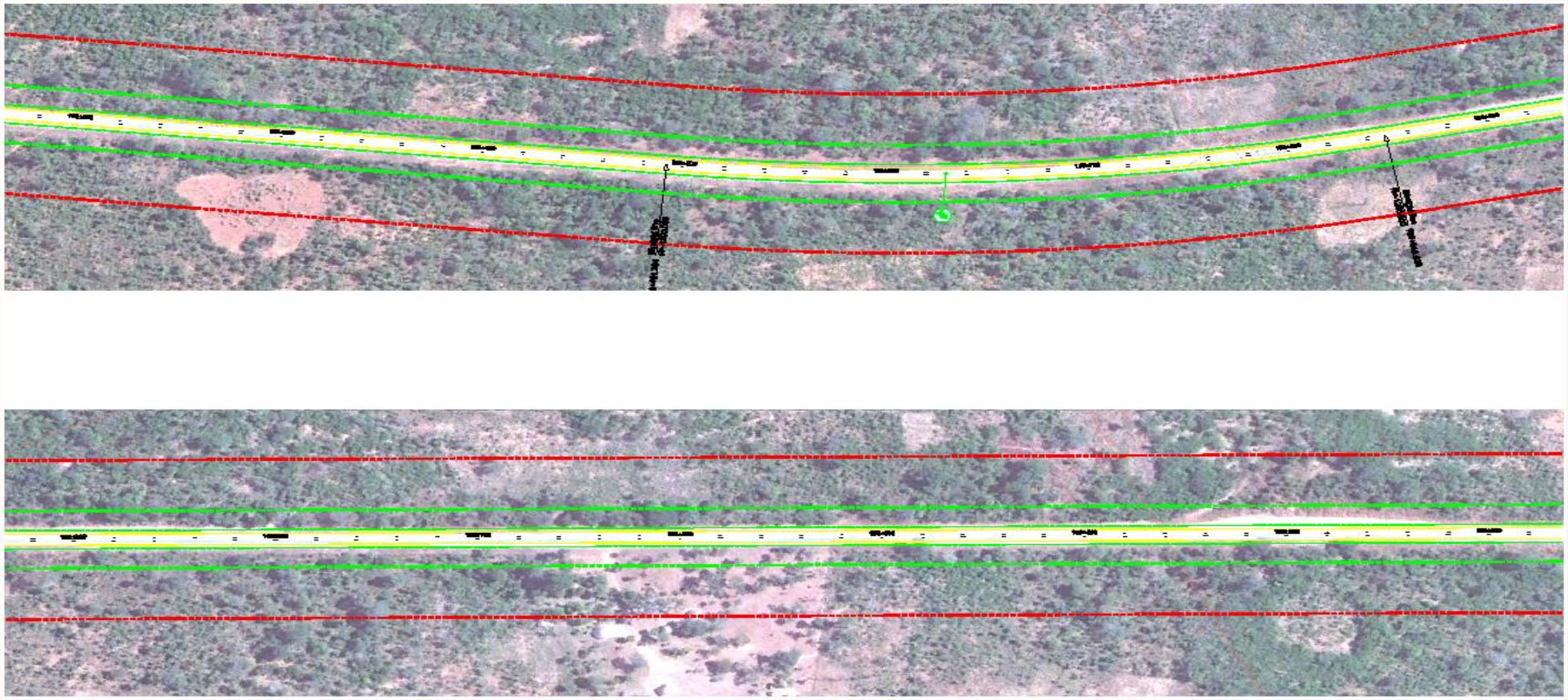
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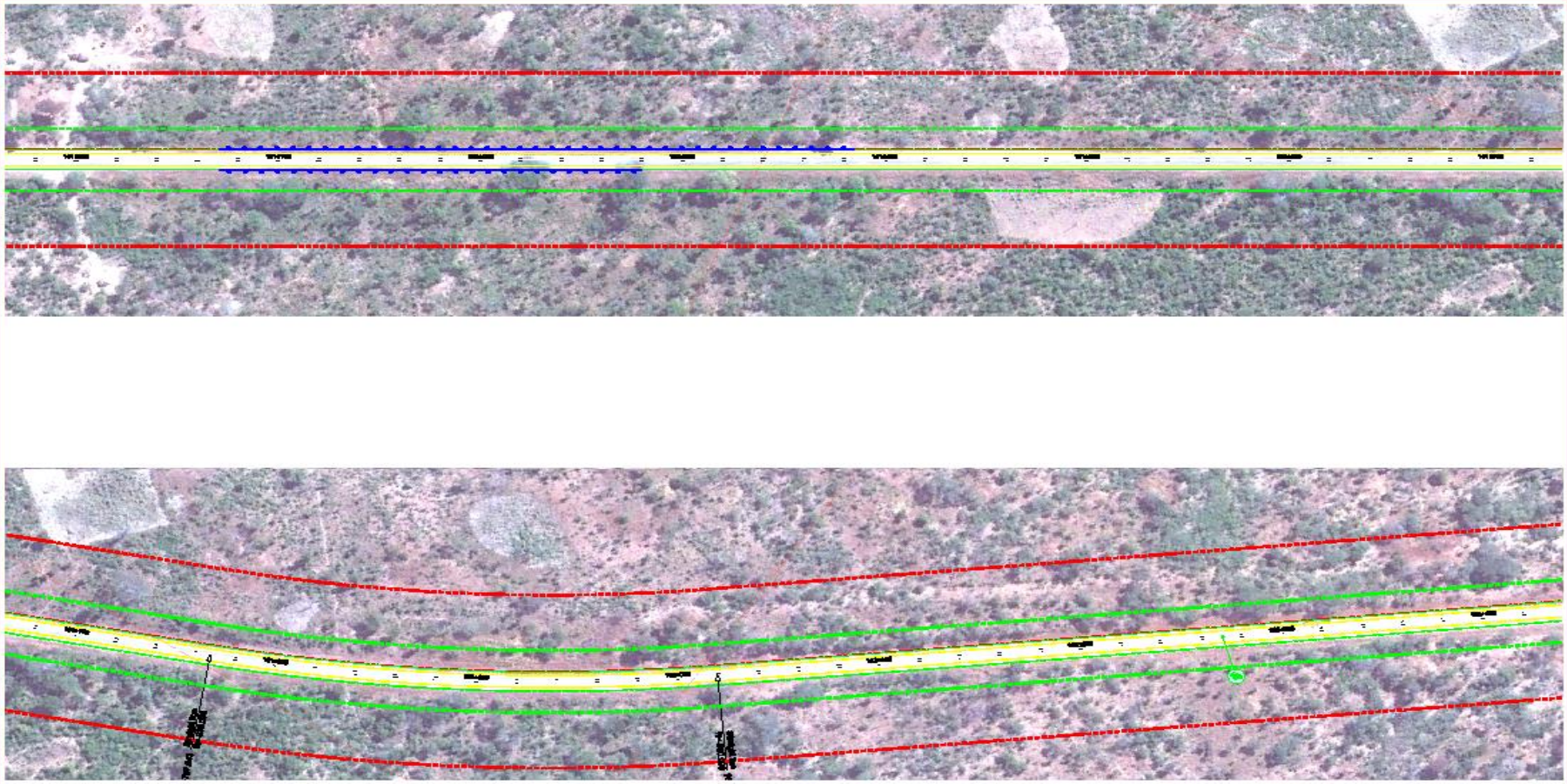
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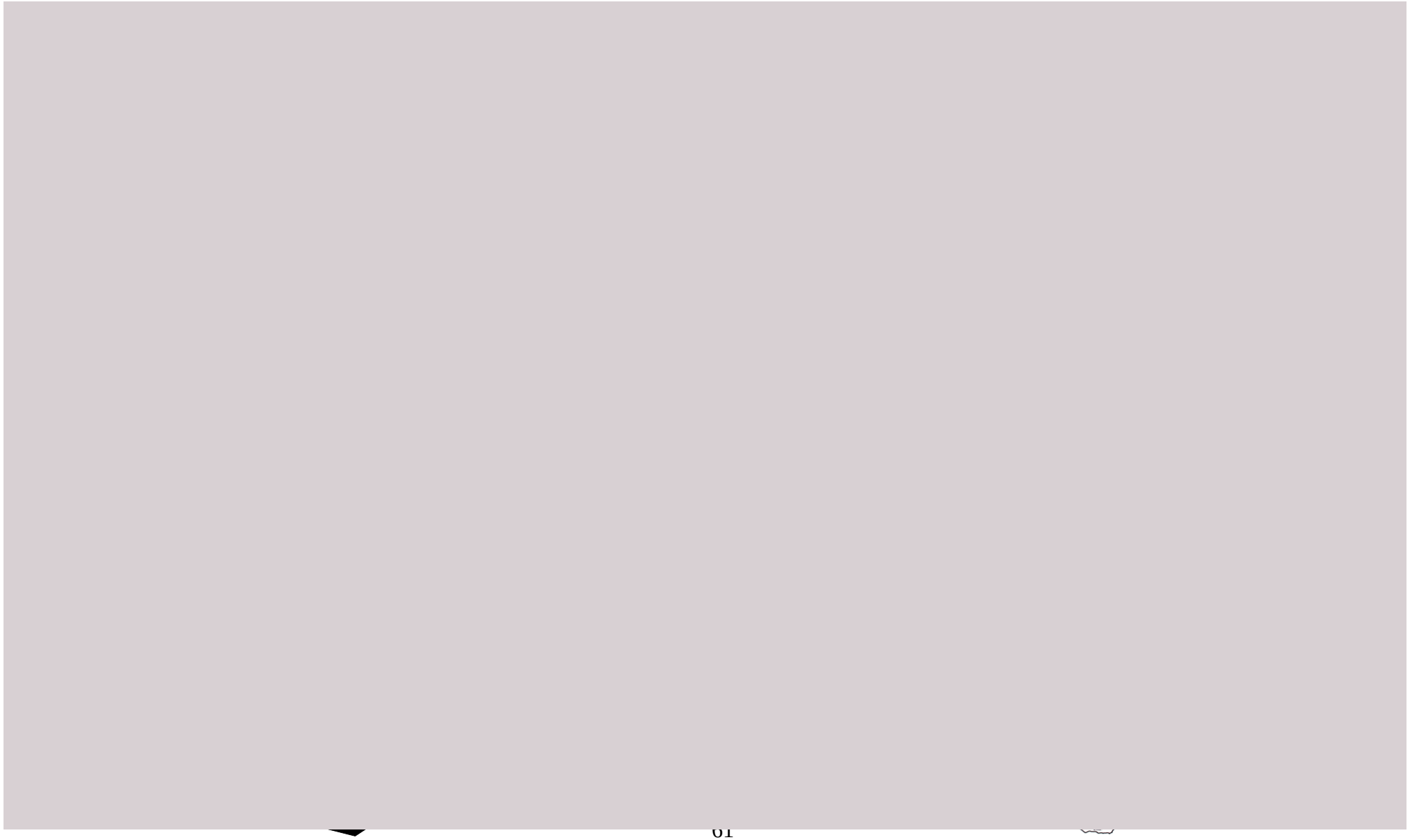

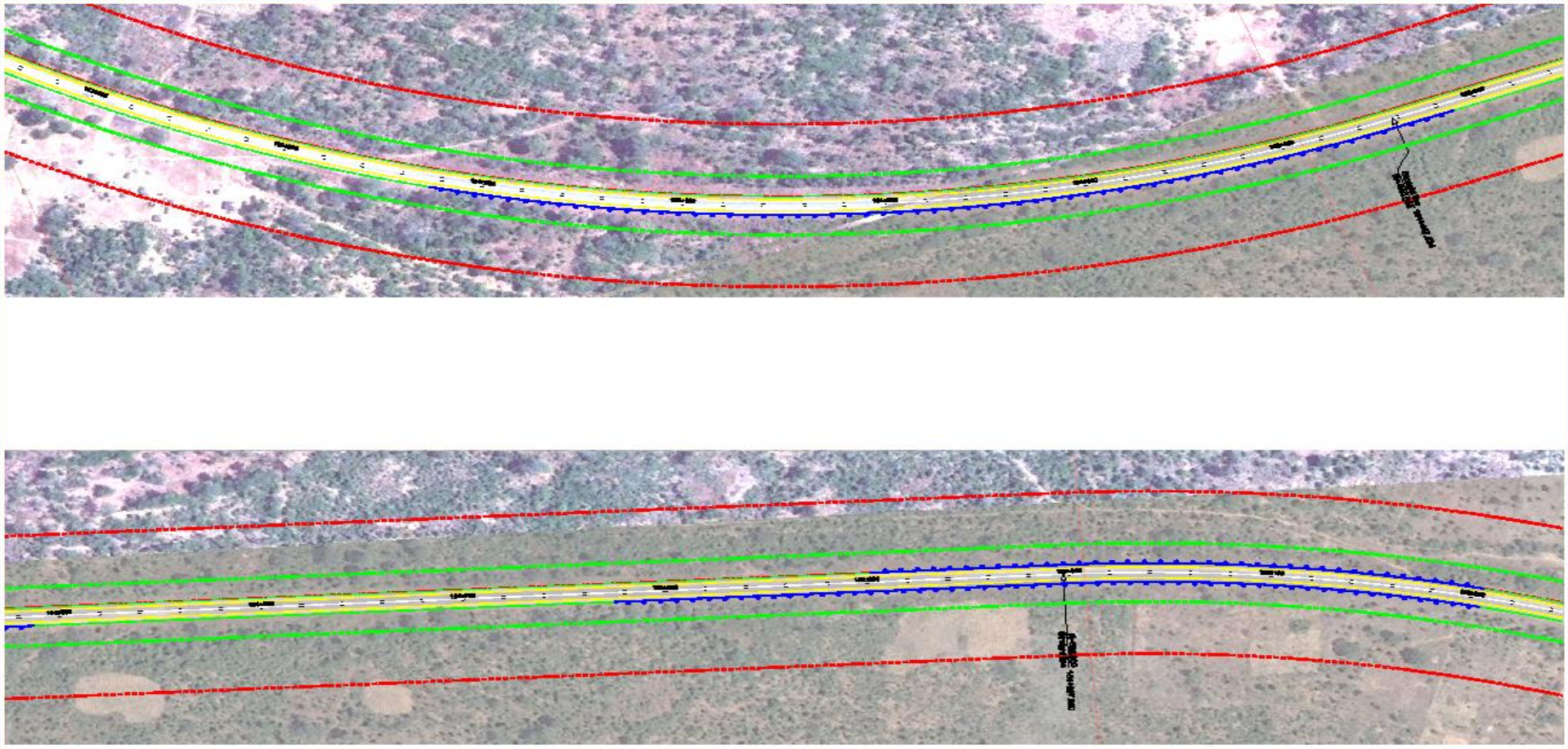
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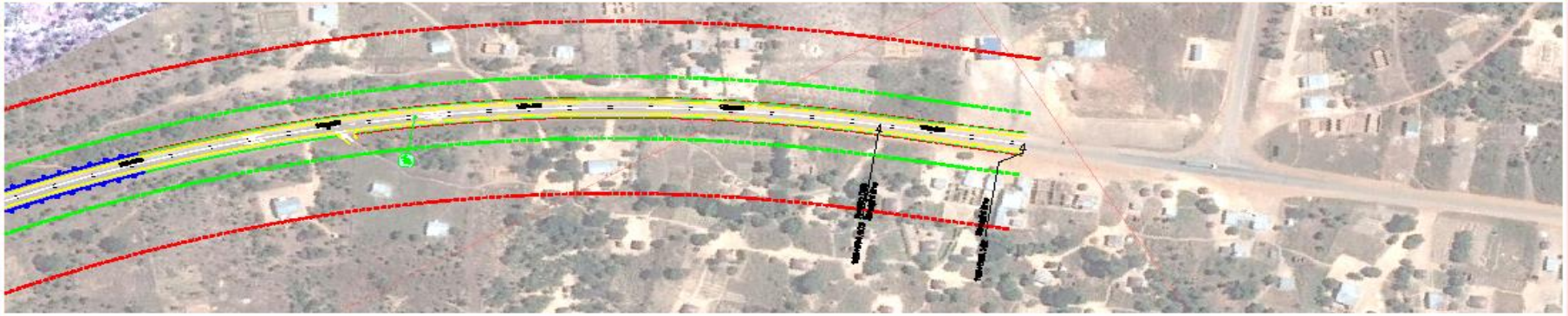

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3.1.4. Area of Influence

This is defined as the area that will be affected by the project development. The zones in this area have been defined based on the intensity of the impacts. These were identified under the Direct Impact Area (DIA) and Indirect Impact Area (INDIA). The DIA is an area that will have a direct impact from the project activities. The key DIA areas include: the road reserve, the camp sites (temporary), the road diversions, the borrow pit areas proposed in 14 locations, the quarry site proposed at 2sites (but others to be identified) and soil disposal sites like the abandoned existing borrow pits as well as the streams/rivers that is likely to receive storm water from offshoots.

The INDIA refers to areas that are surrounding the project area that may not be directly affected by the project, but may be influenced by human activities anticipated after the project has commenced. These areas include: the local communities along the road reserve on either side of the road, the rivulets and rivers on which bridges are to be constructed.

3.1.5. The Current Project Road

The project road was constructed over 50 years ago as a 6.1 m road with in-situ cement stabilized base layer (CTB) covered with a double seal surface treatment (ST). The stabilized base layer was constructed with a thickness of 150-200 mm over a granular subbase mostly 150 mm thick (300mm locally) and locally improved subgrade.

Maintenance works carried out in 2013-2014 were the first major rehabilitation works since the last resurfacing which was a new double surface seal spread 15 years ago. The maintenance works included patching of potholes, repairing of edges and reconstruction of heavily damaged sections. However, it is clear that a more general rehabilitation intervention is needed to maintain sustainable functionality of the road with increasing traffic and to improve the long-term condition of the whole road.

3.1.6. Proposed Road Rehabilitation

3.1.6.1. Introduction

The project involves a full reconstruction of the existing carriageway and enforcement of the road reserve of 100m (i.e. 50m on both sides of the existing centreline in the rural section of the road and 36m on both side of the existing centerline in heavily settled areas such as *Mpika urban area, Kalalantenkwe (Shiwang'andu BOMA) and Mucheleka (or Chinsali turnoff area).*

In addition to the construction activities to be carried out, RDA is looking at enforcing the mandatory road reserves for different road sections as follows:

- Enforcement of a 100m road reserve (i.e. 50 on either side of the road from the existing centerline) for the rural sections of the road; and
- Enforcement of a 36m road reserve (i.e. 18 on either side of the road from the existing centerline) for the heavily settled and urban sections of the road such as Mpika urban area-CH 0+00-7, Kalalantenkwe-Ch 86+770-89+920 (Shiwang'andu BOMA) and Mucheleka (or Chinsali turnoff area-CH 164+550-165+430).

It is obvious that the enforcement of these road dimensions has serious implications on private properties and assets and would require the preparation of a full Resettlement Action Plan (RAP).

For a road such as this one, it is not anticipated that it will become redundant 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 would need to be strengthened.

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 movements of pedestrians and bicycles along the road have been considered in the overall design.

3.1.6.2. Standard cross section

The new cross section of the road will have a total width of 11 m for the roadway and 12 m for the roadbed, formed by the following elements:

- Roadway: 7.00 m divided into two 3.50 m wide lanes (the actual carriageway is 6.20 m wide),
- Shoulders: 2.00 m each side, except in zones with climbing lanes or bus bays, where the width will be 1.00 m.

Figure 3-4 shows the typical cross section which shall be applied to the T2 road from Mpika to Chinsali.

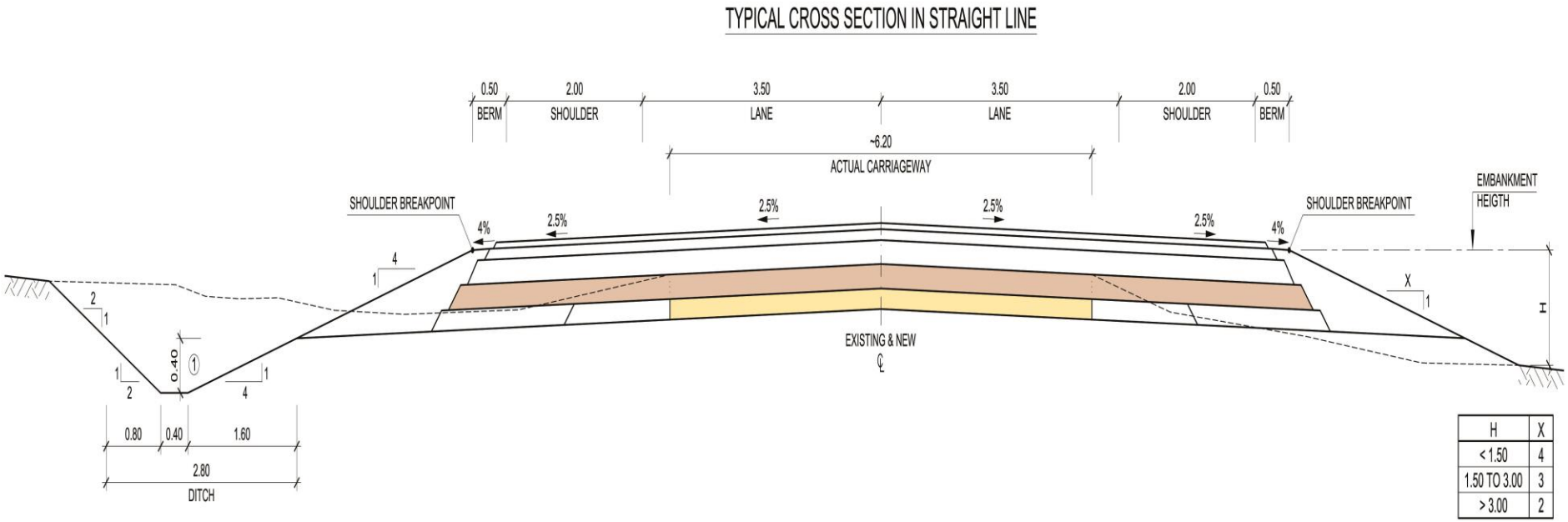


Figure 3-4: Typical Cross Section for the proposed T2 road from Mpika to Chinsali Road Rehabilitation

3.1.6.3. Pavement Design

Based on existing pavement investigations and traffic and axle load surveys, the preferred rehabilitation option is pavement reconstruction which includes the reworking of the existing pavement material, provision of a new crushed stone base and an asphalt concrete surface with widening the existing travelled way on both sides to achieve an after works width of 7m for the travelled way. Further widening is required to provide the 2.0m wide sealed shoulders.

Table 3-1 shows the structure for final pavement composition, which has been determined and adopted:

Table 3-1: Adopted rehabilitation design sections

Section	0+000 - 24+500	24+500 – 120+000	120+000 – 146+000	146+000 – 167+000
Subgrade Class	S4	S5	S4	S5
HMA	125mm	125mm	125mm	125mm
Granular base	150mm	150mm	150mm	150mm
Cemented subbase	200mm*	150mm*	200mm*	150mm*

3.1.6.4. Shoulder design

The roadway widening includes the construction of 2m wide new shoulders on both sides of the trafficked lanes. Although not considered to be trafficked other than sporadically, for safety reasons the shoulder will have the same pavement structure as the trafficked lanes and will be constructed at the same level as these, with homogeneous construction of recycled cemented subbase layer, new crushed stone base layer, asphalt base layer and asphalt surface layer.

For some built up areas such as (Mpika urban area, Kalalantenkwe (Shiwang'andu BOMA) and Mucheleka (or Chinsali turnoff area) the paved shoulders will be partly occupied by cycle lanes.

3.1.6.5. Design Speed

The project road will be designed to have a design speed of 120 Km/h out of the urban areas and 65 Km/h in built-up areas.

3.1.6.6. Bus Bays / Bus Stops

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 a raised island.

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

- 40m 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 with visibility painting/kerbface marking);
- 6m wide and 20m long bus bay (stopping area);
- Pavement/surfacing of the bus bay is the same as for the Project Road.

21 locations for bus bays (bus stops) have been identified as summarised in Table 1-2. Further locations may be identified and added during implementation of the Project.

3.1.6.7. Truck Parking/Lay By's

Truck lay-bys have been included in the designs, to be provided in suitable areas for resting drivers outside urban areas and segregated from the main traffic by raised islands. Eight locations for truck parking have been identified as reflected in Table 1-2 below.

The layout of the lay-by for truck parking comprises the following main features:

- 30m long entry and merging/exit tapers (lead-in and lead-out sections), positioning the lay-by 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 with visibility painting/kerbface marking).
- 40m long stopping area of 6.50m width, comprising a 3.50m wide passing lane and a 3.00m wide longitudinal parking lane.
- Raised/semi-mountable kerb with visibility painting/kerbface marking along the parking lane for driver guidance and protection of the edge of pavement.
- Pavement/surfacing of the lay-by for truck parking is the same as for the Project Road.

Table 3-2: Location of Lay-By Areas, Bus Buys & Parking areas

Lay-By Areas

Chainage		Side
From	To	
9+632	9+769	Right
17+927	18+064	Left
18+902	19+039	Left
19+039	19+177	Right
26+717	26+854	Right
41+777	41+914	Right
49+382	49+519	Left
64+005	64+143	Right
64+143	64+280	Left
73+672	73+809	Left
73+809	73+947	Right
77+116	77+254	Right
82+712	82+849	Left
85+829	85+966	Left
111+117	111+254	Left
111+254	111+392	Right
117+937	118+074	Left
133+122	133+259	Left
148+412	148+549	Left
154+052	154+189	Left
154+189	154+327	Right

Bus Bay Areas

Chainage		Side
From	To	
1+050	1+152	Right
1+152	1+253	Left
12+591	12+693	Right
21+941	22+043	Left
37+992	38+093	Left
59+298	59+400	Right
70+742	70+843	Left
86+597	86+698	Right
110+047	110+148	Left
120+107	120+208	Left
124+099	124+201	Left
126+949	127+051	Left
130+149	130+251	Right
134+849	134+951	Right

Parking Areas

Chainage		Length (m)	Side	Area (m2)
From	To			
1+180	1+320	140	Right	1867
0+830	1+345	515	Left	10133
12+700	12+965	265	Right	5025
21+930	22+070	140	Right	1867
22+060	22+155	95	Left	1135,82
37+945	38+080	135	Right	2180
59+430	59+490	60	Left	484
59+500	59+590	90	Right	726
70+580	70+680	100	Right	1.600
86+425	86+590	165	Left	2.839
101+130	101+250	120	Right	2.608
110+035	110+200	165	Right	2.602
121+080	121+140	60	Left	775
123+945	124+100	155	Left	1862
123+970	124+260	290	Right	3151
130+180	130+240	60	Left	540
134+850	134+950	100	Left	873
TOTAL				**40.267,82**

The majority of the existing cross culverts are concrete pipe culverts (CPC), with the majority of 600mm diameter being severely blocked. In view of the foregoing, the existing 600mm diameter CPCs will be replaced by the 900mm diameter concrete pipes. Larger Diameter pipes having year round flow will be replaced by suitable box culverts. All the minor crossings between side drains should have a minimum diameter of 900mm in order to facilitate cleaning and avoid clogging with silt and debris.

3.1.6.8.2. Bridges and Culverts

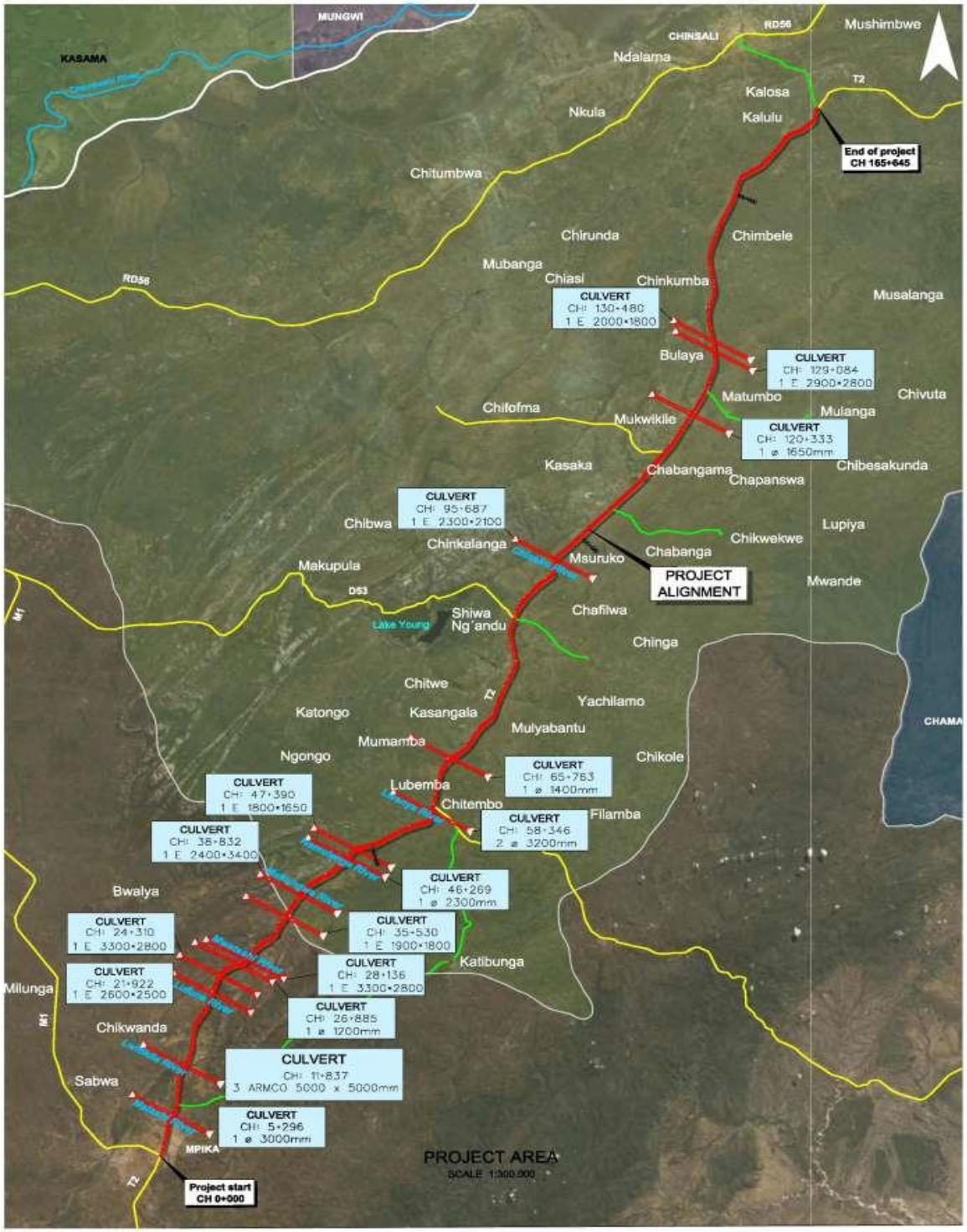
There are no bridges on the Mpika to Chinsali Road according to the definition contained in the SATTC Specification Clause 1106. There are two multi-pipe culverts (Lwitikila River ch 11+837; 3x5000 diameter and Lwanya River ch 58+346; 2x3200 diameter). There are several culverts, mostly constructed at low points in high embankments. The vertical alignment of these will not alter significantly and safety features are required such as guardrails, signage and pedestrian walkways. Drainage channels and chutes are also a feature of these locations. The minimum width of the embankment should be sufficient to cater for the new carriageway width, installation of guardrails and a separate pedestrian.

For ease of reference, the locations of culverts on high embankments are listed below:

Table 3-3: Locations of culverts in high embankments

No.	Location	Size (mm)	Description
1	5+296	3000 dia	4m to soffit – Malashi River
2	11 + 837	3 x 5000	Lwitikila River – not a high embankment, however largest structure
3	21+922	2600 x 2500	Lufune River - 3m to soffit
4	24 + 310	3300 x 2800	4m depth to soffit - 9m only between safety barriers
5	26 + 885	1200 dia	3m depth to soffit
6	28 + 136	3300 x 2800	Mwateshi River - 5m depth to soffit
7	35 + 530	1900 x 1800	3m depth to soffit
8	38 + 832	2400 x 3400	Mukungwa River - 5m depth to soffit
9	46 + 269	2300 dia	Namulenga River - 4m depth to soffit
10	47 + 390	1800 x 1650	3m depth to soffit
11	58 + 346	2 x 3200 dia	Lwanya River - 5m depth to soffit
12	65 + 763	1400 dia	3.5m depth to soffit
11	95 + 687	2300 x 2100	Chiseko River - 5m depth to soffit – 9m between safety barriers
13	120 + 333	1650 dia	3m depth to soffit
14	129 + 084	2900 x 2800	3m depth to soffit
15	130 + 480	2000 x 1800	2.8m depth to soffit

Safety features and features to accommodate pedestrians are required at locations where pedestrian traffic is considered to be relevant. For sections 2 and 13 above a paved pedestrian walkway, 1.2 m wide, will provide safe passage separated from the traffic by guardrails. The walk way will start and end at 1 – 1.5 m height and a length of 60 m and 480+20 m has been measured for the different sections.


MUNGWI
KASAMA
CHINSALI
RD56
Mushimbwe
Ndalama
T2
Kalosa
Nkula
Kalulu
End of project
CH 165+645
Chitumbwa
Chirunda
Chimbele
Mubanga
Chiasi
Chinkumba
RD56
CULVERT
CH: 130+480
1 E 2000*1800
Musalanga
Bulaya
CULVERT
CH: 129+084
1 E 2900*2800
Matumbo
Chivuta
Chifofma
Mukwikile
Mulanga
CULVERT
CH: 120+333
1 ø 1650mm
Kasaka
Chabangama
Chapanswa
Chibesakunda
CULVERT
CH: 95+687
1 E 2300*2100
Chibwa
Lupiya
Chinkalanga
Chikwekwe
Chabanga
Msuruko
PROJECT ALIGNMENT
Makupula
Mwande
D53
Chafilwa
Shiwa Ng'andu
Lake Young
Chinga
Chitwe
Katongo
Kasangala
Yachilamo
Mulyabantu
CHAMA
Mumamba
Ngongo
Chikole
CULVERT
CH: 65+763
1 ø 1400mm
CULVERT
CH: 47+390
1 E 1800*1650
Lubemba
Chitembo
Filamba
CULVERT
CH: 58+346
2 ø 3200mm
CULVERT
CH: 38+832
1 E 2400*3400
CULVERT
CH: 46+269
1 ø 2300mm
Bwalya
CULVERT
CH: 24+310
1 E 3300*2800
CULVERT
CH: 35+530
1 E 1900*1800
CULVERT
CH: 28+136
1 E 3300*2800
Katibunga
Mlilunga
CULVERT
CH: 21+922
1 E 2600*2500
CULVERT
CH: 26+885
1 ø 1200mm
Chikwanda
CULVERT
CH: 11+837
3 ARMCO 5000 x 5000mm
Sabwa
CULVERT
CH: 5+296
1 ø 3000mm
MPIKA
PROJECT AREA
SCALE 1:300,000
Project start
CH 0+000

3.1.6.8.3. Side Drains and Mitre Drains

These were in evidence along much of the roadside. However, a complete lack of maintenance was noted which has led to overgrown and unusable drains and culverts. As part of the construction project, roadside drains will be regraded according to standard details. This will include designing to maximum safe velocities when channel erosion is to be prevented. Mitre drains will be re-dug. The spacing of mitre drains will vary from location to location depending on the gradient, soil and soak away areas.

3.1.6.8.4. Access points

Access points will be built for private properties, farm trails and crossing roads. Longitudinal pipes (dia 600mm) should be installed under these access roads. Approximately 180 of these access points were identified during a drainage survey undertaken in September 2012 and this number is likely to increase over time. These are considered capable of carrying vehicles and vary in size from small to medium to large. It is likely that the new road design will lead to a raising of the surface level and that culverted accesses will be required at some of these locations. Culverted accesses will be provided. These, together with the headwalls will be constructed in accordance with the Road Development Agency Standards. It is important to provide access points to ensure correct drainage and to avoid damage to the embankments and side drains due to unwarranted access to the main road. Experience has shown in Zambia where accesses have not been provided for, people have formed their own without a culvert, thus disrupting existing drainage patterns.

3.1.6.8.5. Removing and salvaging existing Culverts

Detailed specifications for removing and salvaging existing culverts, as well as corresponding pay items of the Bill of Quantities, have been prepared and will be included in the contract documents.

Removed and salvaged concrete culverts suitable for re-use may be incorporated in the Works, or temporarily used in detours or haul accesses and/or stored on approved locations for RDA's later use.

Material from removed concrete culverts declared not suitable for re-use shall be broken into suitably sized pieces and may be placed on slopes of fills/embankments or channels for erosion/scour protection.

Dismantled/removed and salvaged corrugated metal culverts (CMC's) suitable for re-use may be temporarily used in detours or haul accesses and/or stored on approved locations for RDA's later use.

Material from removed CMCs declared not suitable for re-use shall be stored in approved locations for RDA's utilisation of the material/metal value.

3.1.6.8.6. Flood Prone Areas

Interviews with local residents and road users have indicated some areas of concern. Flash flooding is known to occur at the Danger Hill area (km15 to 25+00). Although this area has the greatest concentration of culverts the hilly terrain points to the need for more culverts along this stretch of road. This is particularly necessary due to the additional run-off due to the increased road area and the likelihood of further residential development in the area.

The other areas of concern are towards the Chinsali end of the road where there are recognised areas of flooding due to the low marshy nature of the adjoining ground. Some of these areas are have being raised through variations to the maintenance contract, which ended in 2014; however it is recommended that additional cross-culverts be provided as a relief measure.

3.1.6.9. Road safety

3.1.6.9.1. Introduction

Road safety engineering plays a vital role in influencing driver behavior as engineering measures like traffic control, for example, rely heavily upon the driver to see, interpret, respond to and obey that measure. The road environment should assist the driver in making a series of correct decisions and, if not correct, provide a forgiving road environment to reduce the severity of the crash.

During the design phase of the project, the current state of the road was carefully observed and analysed and led to an identification of the main insufficiencies of this road as it was at the dates when the observations were held. The main conclusions are as follows:

1. Insufficient width of carriageway and large and excessive edge breaks. Along almost all the road length, the width of the carriageway is clearly insufficient for the types of vehicles using the road (average of 6.1m but lowering to 5.9m in some observed locations). At points with severe edge breaking actual widths are reduced to 4.5m or even less.
2. Absence of road markings. The current road does not have any horizontal road markings painted on the surface of the carriageway. This, by itself, is a good reason for the number of accidents at night-time.
3. Absence of road traffic signs. The current road has very few vertical road traffic signs. In some instances some road signs may have once existed but have since been stolen.
4. Drunk drivers and drunken pedestrians. All available information within the Zambian administration indicates that these are main causes of accidents on this road. This is particularly true near major population centres, mainly Mpika and the junction at Chinsali, but also at bars at some of the trading areas along the road. The Mpika police department has insisted on the need for the project to properly treat and include barriers both for vehicles and mainly pedestrians at the T2 junction with the town road. This is the site of a concentration of bars and nightclubs and has the highest number of accidents due to drunken pedestrians and drivers.
5. Steep step between carriageway and shoulder. The existing road does not have sealed shoulders. Even where severe edge breaking has not yet taken place there is a steep step from the carriageway to the more irregular shoulder that causes frequent accidents.

6. Temporary Warning Signs. Drivers need to be aware of the new arrangements and the posted signs referring to ongoing works which impact traffic flow in order to assure the safety both for workers and circulating traffic. When works are completed, temporary warning signs are frequently left behind leaving conflicting information and leading to traffic hazards.
7. Damaged or broken guard rails. Many guardrails have been hit and some have been pushed down by swerving vehicles. Some have been vandalized and must be replaced. The guardrails poles are all made of wood. They should be replaced by steel beams. Repeated roadside grass fires have consumed the wood or weaken it to a level where it is no longer capable of holding the guardrails. The table of guardrails included on the Safety Assessment Report provides good evidence for this conclusion.
8. Crest curves, where curvature imposes reduced sight distance and a few sag curves, where oncoming traffic from both directions accelerates towards the same point. The problem is further aggravated of the absence of roadmarkings and signs. Ongoing emergency works should improve this situation as they include the painting of road markings along the complete length of the project road.
9. Parking Safety problems may be experienced mainly in some of the smaller 'Lay- By' trading areas along the road. Besides these areas have very little or no safety protection devices or infrastructure.

3.1.6.9.2. Proposed Safety Improvements

These main problems as other of less relevant scale has been properly addressed and corrected in the Final Design of the widened and rehabilitated Mpika-Chinsali project road, some of the major safety measures being:

- Widening of carriageway to 3.5 m lanes and 2.0 m shoulders, totalling 11 m of paved road width.
- Improved pavement, eliminating existing distresses and guaranteeing a long lasting adequate road surface.
- Improved side slope geometry and provision of guardrails for sections with embankments > 3 m high.
- Improved road safety in built up areas with physical separation of pedestrians from carriageway traffic, and introducing speed reducing measures such as road humps, rumblestrips and speed limitation to 60 km/h. Street lighting through Mpika and at the main junctions of the town.
- Improved signing and road marking, installing road studs for improved driving at night.
- Improved road junctions, bus bays and widened paved lay bys to lead stopping trucks from the carriageway.

CHAPTER FOUR

4.0. TECHNICAL DESCRIPTION OF PROPOSED CONSTRUCTION WORKS FOR THE PROJECT

4.1. Schedule of Works

The work is scheduled to complete in four phases comprising Pre- Construction, Construction and Decommissioning phases which include: detailed road designs, rehabilitation, decommissioning of civil works and operation and maintenance of the new road. During the detailed designs a number of studies will be carried out including the geo-technical surveys and this ESIA to inform the design process. Rehabilitation and upgrading of the T2 road from Mpika to Chinsali road will involve all the project activities outlined above. Once project activities come to an end, there is needed to systematically decommission the civil works by implementing a comprehensive rehabilitation programme as advised in this report.

4.2. Design Phase

The technical designs for the project road were carried out by TYPSA in Association with ASCO in 2012 and these designs have already been approved by RDA. Due to the passage of time, RDA had in 2016 engaged COWI to carry out a design review of the project.

4.2.1. Scoping and Terms of Reference

The Consultant conducted scoping exercise along the Mpika-Chinsali road in line with the provisions of Statutory Instrument No. 28 of 1997 (Environmental Impact Assessment Regulations). The consultant the prepared a Scoping report and the Terms of Reference (TOR) for this ESIA study and these were consequently approved by ZEMA.

4.2.2. Environmental and Social Impact Assessment (ESIA) and Environmental and Social Management Plan (ESMP)

The Consultant reviewed the EIA and the EMP approved by ZEMA on 12 May 2014 in view of the expansion of the ROW for rural sections of the trunk road to 100m and has updated both documents as necessary to ensure that they both comply with the EU's environmental and social policies and with the requirements outlined in EIB's Environmental and Social Handbook. Urban sections of the trunk road, as defined in the design report, should be clearly delineated in the assessment and the statutory ROW of 36m applied in accordance with the Public Roads Act of 2002. In particular, the consultant has ensured that the scope of the EIA and the EMP are broadened to comply with the requirements of an ESIA and an ESMP, respectively. The Consultant has prepare the necessary amendments to the EIA and EMP approved by ZEMA on 12 May 2014 by coming up with an Environmental and Social Impact Assessment (ESIA) report that incorporates an Environmental and Social Management Plan (ESMP).

With regards to the ESIA and the ESMP the consultants has ensured that the EIB Environmental and Social Standards as they relate to (i) environmental and social impacts; (ii) pollution prevention and abatement; (iii) biodiversity and ecosystems; (iv) climate related standards; (v) cultural heritage; (vi) involuntary resettlement; (vii) the rights and interests of vulnerable groups and individuals; (viii) labor standards; (ix) occupational and public health, safety and security; and (x) stakeholder consultations and engagement, are fully addressed.

4.2.3. Resettlement Action Plan (RAP)

Based on RDA decision to apply the statutory 100m ROW also for the Mpika-Chinsali section, a census and a socio-economic baseline survey and assessment have been conducted between Mpika and Chinsali, to assess the impact of the 100m road reserve on the people and properties. Urban sections of the trunk road, as defined in the design report, should be clearly delineated in the assessment and the statutory ROW of 36m applied in accordance with the Public Roads Act of 2002. The socio-economic baseline survey and assessment have been used to update the Resettlement Action Plan Framework Report (RPF) and a project specific Resettlement Action Plan (RAP) has been prepared. The work was undertaken with a view to securing compliance with national legislation; RDA policies and procedures; alignment with EU environmental and social legislation and policies; and compliance to the EIB Environmental and Social Standards.

4.3. Construction phase

The following activities will be undertaken during the construction phase:

- Clearance of existing land, vegetation and buildings;
- Pre-construction investigations e.g. boreholes, soil testing;
- Construction works (earth works, works on civil structures, superstructure);
- Temporary sites used for construction works or housing of construction workers;
- Above ground buildings, structures or earthworks, including linear structures, cut and fill or excavations;
- Facilities for storage of goods or materials;
- Facilities for treatment or disposal of solid wastes or liquid effluents;
- Facilities for long term housing of operational workers;
- New road traffic (access roads) during construction or operation;
- Closure or diversion of existing transport routes or infrastructure leading to changes in traffic movements;
- Impoundment, realignment or other changes to the hydrology of watercourses or aquifers, rivers, stream crossings when building bridges;
- Cutting of living spaces (habitat fragmentation);
- Transport of personnel or materials for construction, operation or decommissioning;
- Usage of natural resources such as land, water, materials or energy;
- Resettlement of people or demolition of households facilities;
- Production of solid wastes during construction; and
- Usage, storage, transport, handling or production of substances or materials which could be harmful to human health or the environment.

4.4. Raw & Construction Materials & Sources

Construction and raw materials will be required mainly for following construction activities:

- Earthworks;
- Civil works;
- Pavement construction

New materials will be required for the construction of the new pavement for the main road, access roads, civil structures, and utility services. Soil required for earthworks must meet the requirements of Soil classification based on grain size.

Concrete required for works on civil structures will generally be made using alkali Portland cement (with less than 0.6% sodium equivalents). Detailed characteristics of concrete to be used will be given in the technical documentation of the main design.

4.4.1. Concrete Batching Plants

Concrete batching plants produce ready mixed concrete. This is made to a set recipe, and then would be delivered to the workplace/worksite. Transit mixers are used for transportation. The Contractor/s will decide whether to use stationary or mobile concrete batching plants. From an environmental point of view, stationary plants are more favourable. During the previous periodic maintenance of 2012-2014, two concrete-aggregate plants were used per each ten kilometres. Locations previously used could be considered for this Project.

During further stages of the Project the exact locations of concrete batching plants will be defined and necessary consents sought. Concrete batching plants will be located in areas where they will not pose a hazard to the environment or the wellbeing of the local communities. Batching plants will be sited on land that is not prone to flood. Current and future proximity of sensitive land uses will also be considered.

The estimation of the temporary land take for the needs of concrete batching plants is 6,000m^2. In total 16 concrete plants (maximum 1,000 m^2 land take for each plant) will be required it is currently estimated.

4.4.2. Aggregate Crushing Facilities

Sand, gravel, and crushed stone are the main types of natural aggregate and they are essential resources for use in construction. Along with Portland cement and water, they are an essential ingredient in concrete making.

There are no existing aggregate crushing facilities in the road corridor. The closest aggregate crushing facilities are located in 65Km south of the starting point of the project at Mununga Qualry.

The area's geology, land ownership, land use, and transportation infrastructure are factors that affect aggregate supply. Although potential sources of sand, gravel, and crushed stone

are widespread and large, land-use choices, economic considerations, and environmental concerns may limit their availability.

Contractor/s will decide from which aggregate crushing facilities they will obtain aggregates.

Operations associated with aggregate extraction and processing are the principal causes of environmental concerns about sand, gravel, and crushed stone production, including increased dust, noise and vibrations, increased truck traffic near aggregate operations, visually and physically disturbed landscapes and habitats or affected surface or groundwater. However, effects such as dust, noise, and vibrations are typical of nearly any construction project. These impacts commonly can be controlled, mitigated, or kept at tolerable levels and restricted to the immediate vicinity of an aggregate operation by using available technology.

4.4.3. Haulage Routes

The establishment of haulage routes will be required along the road line. The required width of the haulage road will be 3.5 m with locations for passing. The project will need to be established. The haulage roads are needed for accessing the construction sites of bridges.

Measures to reduce the impact of haulage roads on local residents, local business and traffic will be addressed in the CTMP (Construction Haulage Management Plan) to be developed during the further stages of the Project.

The construction of access and haul roads necessary for the proper execution of the work under the contract will be at the Contractor's expense. A construction with suitable grades and widths is expected; sharp curves, blind corners, and dangerous cross traffic will be avoided. The necessary lighting, signs, barricades, and distinctive markings for the safe movement of traffic will be provided. The method of dust control, although optional, will be to be adequate to ensure safe operation at all times. Location, grade, width, and alignment of construction and haulage roads will be subject to approval by the Contracting Officer. Lighting will need to be adequate to ensure full and clear visibility for the full width of haulage road and work areas during any night work operations.

4.4.4. Labour & Workforce Numbers, Facilities & Accommodation

4.4.4.1. Labour & Workforce Numbers

During the previous RDA periodic maintenance from 2012-2014 the workforce was around 500-700 personnel for the project. The same estimate of workforce is anticipated for the construction works to be carried out in the three Lots of this road Project, taking into account that the modernization of construction machinery should contribute to a decrease in the need of workforce, although the scope of work the current project would be more, which may result in the same numbers

Employment on the site will vary depending on the stage of construction and programme of works scheduled by the Contractor/s.

4.4.4.2. Facilities & Accommodation

It is expected that the Contractor's approach will be to recruit a significant size of the workforce locally through subcontractors. Small camps may be required for temporary accommodation of specialist workers.

The location of these camps will be on sites out of the villages. This will be done in order to prevent potential adverse impacts on the local community.

Any such facilities to be located within sensitive area would need to be fully justified. In the vicinity of sensitive habitats construction sites will be clearly delineated so as to avoid damage in non-working areas.

Besides these camps, along the alignment, there are some other small camps used during construction Period 1994- 2004, which are property of construction companies. The possibility of reutilizing these camps for this Project could also be considered.

All facilities for accommodation of workers will be designed and operated in accordance with the provisions of the IFC Workers Accommodation Guidance. This guidance document provides guidance and benchmarking standards over the range of topics related to the provision and management of worker's accommodation, covering following topics:

1) General living facilities (including topics such as drainage, heating, ventilation, lighting, water, sanitation, waste disposal);
2) Room/dormitory facilities (including bed arrangements and storage facilities);
3) Sanitary and showering facilities;
4) Canteen, cooking and laundry facilities;
5) Food safety and nutritional standards;
6) Medical facilities, doctors;
7) Leisure, social and telecommunication facilities;
8) Management of the accommodation;
9) Community relations and consultation;
10) Fees and charges for the facilities and services;
11) Health and Safety on site;
12) Accommodation and local community security;
13) Workers' rights, rules and regulations; and
14) Workers' consultation and grievance mechanism.

Prior to building any workers' accommodation, a comprehensive assessment of the local housing market is to be conducted by RDA in cooperation with the municipalities for identifying the different types of housing available in the surrounding communities.

The key principles of note regarding the provision of worker's construction compounds which will be considered in the development of accommodation for the Project are summarized below:

a) Workers' must enjoy their fundamental human rights and freedom of association in particular, workers' accommodation arrangements should not restrict workers' rights and freedoms.
b) Housing standards must include special attention to minimum space allocated per person, supply of safe water in the workers' dwelling in such quantities, adequate sewage and garbage disposal systems and appropriate protection against heat, cold, damp, noise, fire, and disease-carrying animals, and, in particular, insects.
c) For facilities located in hot weather zones, adequate ventilation and/or air conditioning systems must be provided. Both natural and artificial lighting must be provided and maintained in living facilities.
d) A separate bed for each worker must be provided. The practice of "hot bedding" should be avoided.
e) The minimum space between beds should be 1 meter. Double deck bunks are not advisable for fire safety.
f) Canteen, cooking and laundry facilities must be built in adequate and easy to clean materials. Canteen, cooking and laundry facilities are kept in a clean and sanitary condition. If workers wish to cook their own meals, kitchen space will be provided separate from sleeping areas.
g) There must be management plans and policies especially in the areas of overall operation of the facility, health and safety (with emergency responses), local community and security.
h) A security plan including clear measures to protect workers against theft and attack is implemented.
i) Security staff must be checked tonsure that they have not been implicated in any previous crimes or abuses.
j) Processes and grievance mechanisms for workers' to articulate their grievances must be provided and clearly explained to workers.
k) Community representatives must be provided with an easy means to voice their opinions and to lodge complaints to the management. There must be a transparent and efficient process for dealing with community grievances.

4.4.5. Construction Laydown Areas & Contractor Facilities

4.4.5.1. Structures

The temporary land take needed for the site facilities for bridges depends on local site conditions, construction method and the Contractor. Space will be needed for the following elements:

- Site offices, staff rooms, workshops, storage, etc.
- Concrete batching plant (750 – 1,000 m2);
- Installation site with crane for beams etc. (> 1,200 m2); and
- Circulation area, stabling and parking.

Depending on the importance of the structures, the area required is estimated for a bridge to be between 6,500 to 15,000 m^2. Small structures, such as culverts and retaining walls, may use the site facilities/installations of adjacent structures

4.4.5.2. Contractor Facilities

Usually, contractor facilities are located near the accommodation for workers. Construction project trailers as storage or office space, with or without utilities, could be located outside the worker camps.

Prior to the start of construction works, the Contractor shall submit a site plan showing the locations and dimensions of temporary facilities, including layouts and details, equipment and material storage area (onsite and offsite), and access and haul roads, avenues of ingress/egress to the fenced area and details of the fence installation, locations of safety and construction fences, site trailers, construction entrances, trash dumpsters, temporary sanitary facilities, and worker's parking areas.

The minimum working conditions and systems that will need to be provided within the Contractor facilities are listed below:

- Safe premises-surfaces, structures and installations should be easy to clean and maintain, and not allow for the accumulation of hazardous compounds. Buildings should be structurally safe, provide appropriate protection against the climate, and have acceptable light and noise conditions;
- Safe machinery and materials;
- Safe systems of work;
- Information, instruction, training and supervision;
- A suitable working environment and facilities (that means the workplace should be equipped with lavatories and showers, potable water supply, clean eating area);
- Access to first aid;
- The frequency of monitoring shall increase in case of receipt of a complaint from the workers on inadequate workplace conditions through operation of the grievance mechanisms for workers;
- The workplace should be designed to prevent the start of fires through the implementation of fire codes applicable to industrial settings. Other essential measures in terms of fire precautions include:
- Equipping facilities with fire detectors, alarm systems, and firefighting equipment. The equipment should be maintained in good working order and be readily accessible. It should be adequate for the dimensions and use of the premises, equipment installed, physical and chemical properties of substances present, and the maximum number of people present;
- Provision of manual firefighting equipment that is easily accessible and simple to use; and
- The frequency of monitoring shall increase in case of receipt of a complaint concerning worker accidents.

4.4.6. Borrow pit

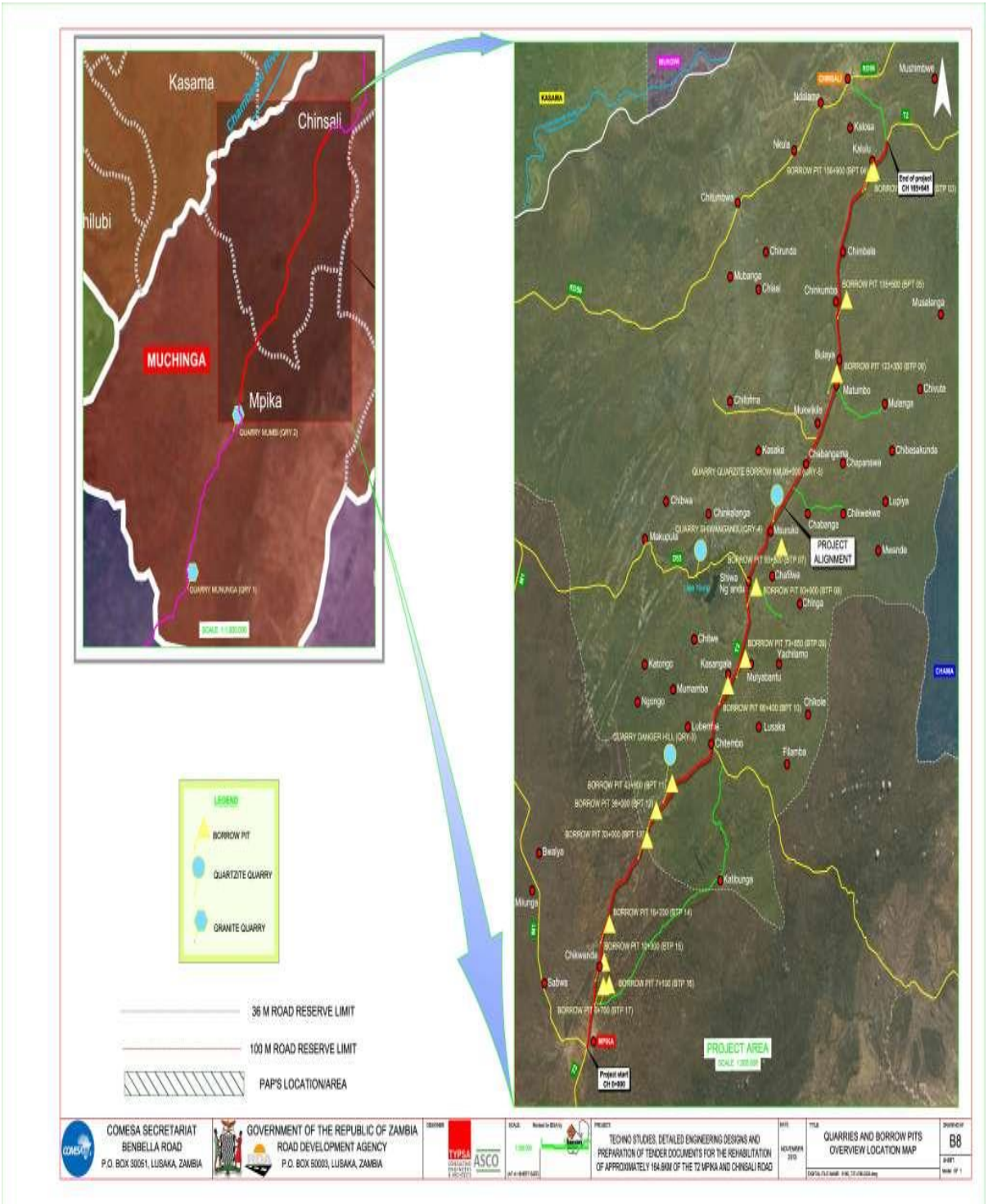
Existing borrow pits along the route will be used. New borrow pits may have to be established where existing borrow pit material is not suitable or enough. Designated borrow pit areas will be identified once current design review has been completed on the proposed project. The establishment of borrow pits will be done in consultation with the District Environment Officers and the Community however an Environmental Project Brief (EPB) will be prepared and submitted to ZEMA for Approval before extraction of construction material.

There are a number of sources of materials for the construction of the road. These are located in various places as described in the table below.

According to the Material Report conducted by COWI, the project area provides sufficient and specification compliant materials for subgrade, sub-base and crushed stone base layers including materials for asphalt works and concrete works and all sources are within acceptable hauling distances. The materials in the existing borrow pits are enough for the project activities and it is unlikely that new borrow pits will be opened up. All borrow pits are considered as confirmed sources for subgrade material base on the laboratory test data. Seven borrow pits are considered as confirmed sources for sub-base material;

In terms of draw backs for the use of these borrow pits, the following are the minor challenges, which need to be taken into consideration:

- Borrow pit at Km 6+700 RHS has existing church and adjoined newly constructed houses;
- Borrow pit at Km 7+100 RHS has two (02) houses nearby;
- Borrow pit Km 16+200 LHS has an Aerial power line;
- Borrow pit at Km 83+900 RHS has Installed barbwires fence; and
- Borrow pit at Km 123+350 LHS is located in land used for farming.


Kasama
Chinsali
MUCHINGA
Mpika
LEGEND
BORROW PIT
QUARTZITE QUARRY
GRANITE QUARRY
36 M ROAD RESERVE LIMIT
100 M ROAD RESERVE LIMIT
PAP'S LOCATION/AREA
PROJECT ALIGNMENT
PROJECT AREA
COMESA SECRETARIAT
BENBELLA ROAD
P.O. BOX 30051, LUSAKA, ZAMBIA
GOVERNMENT OF THE REPUBLIC OF ZAMBIA
ROAD DEVELOPMENT AGENCY
P.O. BOX 50003, LUSAKA, ZAMBIA
TECHNO STUDIES, DETAILED ENGINEERING DESIGNS AND PREPARATION OF TENDER DOCUMENTS FOR THE REHABILITATION OF APPROXIMATELY 164.80M OF THE T2 MPIKA AND CHINSALI ROAD
QUARRIES AND BORROW PITS OVERVIEW LOCATION MAP
B8

#	Chainage	Coordinates	Access	Comments	Photo
3	Km 157+800 RHS	S 10.69812, E 32.10134	Unpaved road for 500m	Type of materials: Fine Quartz + Gravel + Silty sand Status: In use Overburden: Top soil Drawbacks: None Method of excavation: Mechanical excavation Estimated quantity: 93,750 m³	
04	Km 156+900 RH	S 10.70083 E 32.09568	Unpaved road for 600m	Type of materials: Fine Quartz + Gravel + Silty sand Status: In use Overburden: Top soil Drawbacks: None Method of excavation: Mechanical excavation Estimated quantity: 93,750 m³	

#	Chainage	Coordinates	Access	Comments	Photo
05	Km 135+500 RHS	S 10.87063 E 32.03690	Unpaved road for 200m	Type of materials: Quartz + Gravel + Silty sand Status: In use Overburden: Top soil Drawbacks: None Method of excavation: Mechanical excavation Estimated quantity: 10,000 m³	
06	Km 123+350 LHS	S 10.96996 E 32.01359	Unpaved road for 1.2Km	Type of materials: Gravel + Silty sand Status: In use Overburden: Top soil Drawbacks: ***Passing through a cultivated areas*** Method of excavation: Mechanical excavation Estimated quantity: 120,000 m³	

#	Chainage	Coordinates	Access	Comments	Photo
07	Km 93+500 RHS	S 11.20146, E 31.88332	Unpaved road for 4Km	Type of materials: Quartz + Gravel + Silty Sand Status: In use Overburden: Top soil Drawbacks: None Method of excavation: Mechanical excavation Estimated quantity: 1,350,000 m	
08	Km 83+900 RHS	S 11.25471, E 31.82349	Unpaved road for 800m	Type of materials: Quartz + Gravel + Silty sand Status: Temporary closed Overburden: Top soil and trees Drawbacks: Installed barbwires fence Method of excavation: Mechanical excavation Estimated quantity: 180,000 m³	

#	Chainage	Coordinates	Access	Comments	Photo
09	Km 73+850 LHS	S 11.35071, E 31.79771	Unpaved road for 600m	Type of materials: Gravel + Silty sand Status: Not in use Overburden: Top soil Drawbacks: None Method of excavation: Mechanical excavation Estimated quantity: 2,700,000 m³	
10	Km 66+400 RHS	S 11.38648 E 31.75680	Unpaved road for 300m	Type of materials: Quartz + Gravel + Silty sand Status: In use Overburden: Top soil Drawbacks: None Method of excavation: Mechanical excavation Estimated quantity: 100,000 m³	

#	Chainage	Coordinates	Access	Comments	Photo
11	Km 43+900 LHS	S 11.51688 E 31.62520	Unpaved road for 400m	Type of materials: Laterite + Gravel + Silty sand Status: In use Overburden: Top soil Drawbacks: None Method of excavation: Mechanical excavation Estimated quantity: 1,620,000 m³	
12	Km 38+000 LHS	S 11.55318 E 31.58781	Unpaved road for 50m	Type of materials: Ferricrete + Silty sand Status: In use Overburden: Top soil Drawbacks: None Method of excavation: Mechanical excavation Estimated quantity: 3,000 m³	

#	Chainage	Coordinates	Access	Comments	Photo
13	Km 33+300 RHS	S 11.59175 E 31.56573	Unpaved road for 50m	Type of materials: Shale + Silty sand Status: In use Overburden: Top soil with residual clay Drawbacks: None Method of excavation: Mechanical excavation Estimated quantity: 300,000 m³	
14	Km 16+200 LHS	S 11.70469 E 31.47687	Unpaved road for 100m	Type of materials: Laterite + Gravel + Silty sand Status: In use Overburden: Top soil Drawbacks: Aerial power line Method of excavation: Mechanical excavation Estimated quantity: 270,000 m³	

#	Chainage	Coordinates	Access	Comments	Photo
15	Km 10+300 RH	S 11.75567 E 31.46418	Unpaved road for 50m	Type of materials: Laterite + Silty sand Status: In use Overburden: Top soil Drawbacks: None Method of excavation: Mechanical excavation Estimated quantity: 180, 000 m³	
16	Km 7+100 RHS	S 11.78625 E 31.47592	Unpaved road for 1.6Km	Type of materials: Quartz + Gravel + Silty sand Status: In use Overburden: Top soil Drawbacks: 2 houses nearby Method of excavation: Mechanical excavation Estimated quantity: 20,000 m³	

#	Chainage	Coordinates	Access	Comments	Photo
	Km 6+700 RHS	S 11.78803, E 31.462.13	Unpaved road for 100m	Type of materials: Fine Gravel + Silty sand Status: In use Overburden:, Top soil and few small trees Drawbacks: *Existing church and adjoined newly constructed houses* Method of excavation: Mechanical excavation Estimated quantity:15,000 m³	

4.4.7. Stones for Aggregate & Crushed Stones-

Local quarries have been investigated within the project. During the implementation process, any quarry which is near the sections and enables a comfortable exploitation would be under priority; further quarries are also under consideration in case of material insufficiency.

The possible uses of material extracted from identified quarries are presented in the table below: Table 4-1 shows the Quarries, Location, material description, and possible uses. In principle, and in accordance with laboratory test results, material from Danger Hill Quarry could be used as aggregate for bituminous layers, and for forming the crushed stone base layer. The values obtained of resistance to crushing; of aggregate's shape and water absorption satisfy the requirements fixed in SATCC Specifications.

Table 4-2: Quarries, Location, Material description and possible uses

Quarry	Location	Type of material	Possible uses	
			Aggregate	Crushed stone base layer
Mununga	110 km to the south from chainage 0+000	Granite	×	✓
Kaole (Mumbi)	18 km to the south from chainage 0+000	Granite	×	✓
Danger Hill	2.2 km from chainage 47+950	Quartzite	✓	✓
Shiwang'andu	Chainage 87+500	Quartzite blocks	×	≈
Quartzite borrow, chainage 99+000	On chainage 99+000	Quartzite blocks	×	≈

4.4.8. Water for construction activities –

With regard to sources of running water that can be used for construction purposes, Table 4-2 has identified the streams and rivers, which are all perennial and have adequate quantity of water to meet both the construction needs and the communities.

The communities downstream of each of these 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. However, the proposed project is perceived to have manageable impacts which will not alter downstream water uses.

Table 4-1: Perennial Sources of Running Water along the Mpika to Chinsali Road

No	Chainage	River Name	Comment
1	5+296	Malashi	
2	8+847		
3	9+569		
4	11+434		
5	11+837	Lwitikila	Largest River in area
6	21+922	Lufune	
7	22+380		
8	24+310		
9	25+983		
10	28+136	Mwateshi	
11	35+530		
12	38+832	Mukungwa	
13	46+269	Namulenga	
14	58+346	Lwanya	2nd Largest River in area
15	95+687	Chiseko	
16	110+803	Kabangama	Swampy area

4.4.9. Bridge Improvements and culvert Installation

Although the project road from Mpika to Chinsali Road has no bridges according to the definition contained in the SATTC Specification Clause 1106, the proposed project will include making improvements to the two multi-pipe culverts (Lwitikila River ch 11+837; 3x5000 diameter and Lwanya River ch 58+346; 2x3200 diameter). In addition, the project will include installation of several new and bigger (diameter) culverts.

4.4.10. Road Construction

Road construction activities such as earthworks, the construction of pavement layers (preparation of sub-base, surfacing, drainage structures (culverts, side ditches and offshoots), bridge structures and ancillary works) are foreseen for this project. The work will be done in accordance to the Ministry of Works Housing and Communication standard specifications for Road and Bridge Works. Road furniture including; Road marking, Sign posts, warning signs and Guardrails for safety of the road users shall be put in place when construction has been completed.

4.4.11. Site Cleaning and Rehabilitation

Site cleaning and rehabilitation involves removal of structures of the camp site, waste material generated during construction, regressing and replanting of the exposed areas. All waste material must be removed from site and disposed of appropriately once construction is complete. If the location of some of the structures was agreed upon with the local authorities and the communities, some structures can be left to benefit the farmers or be used as community school etc.

4.4.12. Facilities, equipment and Installations

The contractor will use various machines and equipment which is expected to be stored in campsites and roadsides. There will be no major installations except for water and electricity in campsites and signposts along the new road. Since this is a public project, there will be no offsite investments involved.

4.4.13. Project personnel and working conditions

The Project will benefit both indigenous workers and migrant workers. It is expected that the project will employ more than 1,000 people including professional, skilled, semiskilled and unskilled staff. Staff may be changed with time and place of operation.

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 T2 road from Mpika to Chinsali road 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

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.

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.

3. ***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. ***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; and
    - An aftercare monitoring and corrective action program will be developed and implemented based on examining the bio-restoration process Periodically after reinstatement.

4.5.2. 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 rehabilitation and maintenance programme. Everyone expects such conditions to prevail for many years and RDA is expected to observe that.

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 his 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

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

There will be two phases during demobilization, namely disbanding of the camp and decommissioning. During closure of the camp, the solid wastes likely to be produced will include rubble, iron sheets and wooden materials (such as roofing woods, door frames and panels). Unless it has been decided that the camp will be used for another purpose, such as a school or dispensary, the produced wastes will re-used for other building purposes. There will likely be damaged vehicles which will need to be moved from site. Contracts will be made between the contractor and collectors of scraps for recycling. Otherwise, the materials will be treated in accordance with the 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 that the road will be decommissioned. From the completion of construction, the only probable solid waste to be encountered along the roadway will be excavated materials from damaged sections that require maintenance or rehabilitation.

4.6.2.3. 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 Environmental 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.

4.6.2.4. 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.

4.7. Process and technology

For vegetation clearing along the road reserve, earth moving equipment such as bull dozers and graders will be used. Cleared material will be loaded onto trucks using front-end loaders for off-site disposal at designated landfill sites regulated by the Mpika and Chinsali Councils.

Preparation of the roadbed for the new Mpika-Chinsali Road will involve the use of graders to level the in-situ material, water bowsers to moisten the material and rollers to compact the roadbed.

Construction of pavement support layers will involve the use of tipper trucks delivering gravel and cement to the site, graders to spread and shape the material, water bowsers to water the material and rollers to compact the materials to specified levels. Off-site, gravel will be borrowed using excavators and front-end loaders.

The construction of the surface wearing course will involve bitumen distributors spraying hot bitumen at the required spray rate, chip spreaders placing crushed stones at the required rate, rollers compacting the stones into the bitumen and brooming equipment to remove loose stone.

Other construction operations include the fabrication of concrete kerbs and barriers which will either be formed in place with shutters, or pre-cast off site. For in-place construction, concrete mixer trucks will deliver mixed concrete from the mixer plant to be established by the contractor in his yard or from commercial suppliers. Poker vibrators will be used to compact the concrete in the formwork.

Final activities will include road marking with thermal plastic paint applied with automatic sprayers.

4.8. Analysis of the Project Alternatives

4.8.1. Introduction

The road ear-marked for rehabilitation is an existing road and therefore there are no alternatives to the route for the road. No alternative routes were investigated for the project as the RDA's TOR stipulated the rehabilitation of the existing route. No realignments are anticipated, so no alternatives were available to discuss realignment options either.

This section therefore will only compare 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 construction corridor that covers the construction width plus a verge either side of the road, and
- Pavement Alternatives.

4.8.2. Alternative Mode of Transportation-Option 1

There are no alternatives to this road that fulfill the functions of providing relatively fast, cheap and transportation. The only other alternatives are Air and Rail. Transportation by air is unlikely to either complement or to substitute for roads or highways in the short to medium term.

The TAZARA Rail is potentially an important alternative mode of transport should its capitalisation and management be improved. Since a significant proportion of the axle loading on the T2 comes from tanker, container and heavy bulk cargo carriers, TAZARA is a possible future consideration but this too is unlikely to either complement or to substitute for the project road in the short to medium term.

4.8.3. 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 deteriorates further. The poor air quality as a result of dust generation would also remain or worsen.

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.

4.8.4. Pavement Alternatives-Option 4

Three design alternatives for the pavement structure were considered for this project, namely:

- ***Option 1*** -HMA overlay laid directly with tack coat on the actual surface. Based on the results from pavement analysis 12-18 cm overlay. Current 2-4 cm chip and seal surfacing works as anti-crack layer.
- ***Option 2 –*** New granular base and HMA overlay, considering the existing CTB as cemented subbase layer. Pavement section as per SATCC Code of Practice for the

Design of Road Pavements, increased to compensate for possible insufficiencies in the existing CTB. Reinforcement of 15 cm base course and 15-17.5 cm HMA.

- ***Option 3*** - Rip the existing pavement down to under the sub grade and reuse the material as much as possible in fill. Then prepare the road bed and come up with improved sub grade, cement stabilized sub base and crushed stone base with wearing layer of 50 mm AC. The thick ness of the layers depends on the overall E Modulus remaining in the road structure after it is ripped. This option also allows for raising the road which helps taking the critical pavement layers outside the permanent moist zones.

The different rehabilitation or partial reconstruction options (i.e. 1& 2) also interferes in a higher or lower degree in the different alternatives studied for road widening, where the first two alternatives would preferably be widened on only one side whilst the third alternative would maintain the actual centre line. Other main differences with the three options studied are found in cross section pavement homogeneity, possibilities to achieve designed geometry, earth works quantities, traffic interference during construction and need of deviation roads.
The alternative finally adopted for Final Design is Alternative 3, considering the reconstruction of the cemented base layer (CTB) into a cemented subbase layer and the construction of new crushed stone base layer and asphalt base and surfacing layers.

4.8.5. Raw Material Alternatives

Existing borrow pits along the route will be used. New borrow pits may have to be established where existing borrow pit material is not suitable or sufficient. Designated borrow pit areas will be identified once detailed design work has been carried out on the proposed project. The establishment of borrow pits will be done in consultation with the Department of Mines and Minerals Development and Zambia Environmental Management Agency, according to Environmental Management Act and EIA Regulations pertaining to borrow pits and their rehabilitation. In terms of the EIA Regulations No 28 of 1997, the operator is liable for remediation of environmental damage. However, the RDA would still be liable for the rehabilitation of the mining site should the Mining Operator not be in a position to do so.

4.8.6. Technology Alternatives

The RDA is aware of different noise levels associated with different pavement (road) surfacing. This will be taken into account during the engineering design in order to minimise the effect of noise to adjoining landowners and residents. Similar applications of technology will prevail for the following:

- Discharge of water from the road;
- Provision of cross accesses where required;
- Construction techniques to limit dust and other air pollution issues;
- Erosion protection of embankments;
- Stability of cut and fill slopes; and
- Width of construction where applicable.

CHAPTER FIVE

ASSESSMENT METHODOLOGY & SCOPING ASSESSMENT

5.1. GENERAL APPROACH TO THE ASSESSMENT

The ESIA Methodology is based on extensive experience and knowledge of the:

a) Environmental and Social Impact Assessment procedure in Zambia;
b) International environmental and social policies and performance requirements (e.g. EIB and IFC);
c) Environmental impact assessment techniques and methods (e.g. national and EU Guidance on EIA procedures, Scoping Check Lists, Geographical Information Systems GIS), Environmental auditing questionnaires etc.);
d) National and EU environmental and social legislation relevant to the Project, see Chapter 2 (and the understanding of the important gaps existing between National & EU legislation);
e) Multilateral Conventions that Zambia has ratified, including those focused on transparent and open public disclosure processes (see Chapter 2);
f) Importance of public involvement at the earlier phases of project preparation in order to ensure open discussion and public participation in the decision making process.

The aim of an Environmental & Social Impact Assessment (ESIA) is to identify the potential environmental and social impacts of a project and to evaluate mitigation and management measures to avoid, reduce or remediate potential impacts. The general approach to the assessment of the Mpika-Chinsali Road Rehabilitation Project has been developed on the basis of the standard ESIA practice defined in the following steps:

- ***Define the Project & Consider Alternatives*:** Define the proposed Project activities, timeframe and details which are likely to affect the surrounding environment and communities, along with considering the alternatives;
- ***Scoping:*** Define the scope of the assessment based on the issues which have the potential to cause significant effects on the receiving environment and communities, and from the Scoping Opinion of the regulatory authority in this regard;
- ***Study Area(s):*** Establish the study areas, including both the spatial and temporal boundaries;
- ***Baseline Conditions:*** Define the existing baseline social and environmental conditions of the study area along the route and within the potential area of influence of the Project. The baseline seeks to identify the environmental and social receptors and resources within the study area in order to understand and determine the value (or sensitivity) of these receptors and resources *(see Chapter 6)*;
- ***Identify Potential Social & Environmental Impacts of the Project:*** Define (*for relevant aspects*) the value (or sensitivity) of the receptors and resources likely to be impacted. Identify the potential environmental and social impacts, (including cumulative, synergistic and transboundary impacts). Determine the magnitude of potential impacts (i.e. change) from the Project on the environmental and social

baseline conditions (including the receptors and resources). Determine the likely significance of the effect of these impacts **before mitigation measures are applied** (i.e. Significance of Effects (**without mitigation**)); *(Chapter 7);*

- ***Detail Appropriate Mitigation Measures*:** Detail appropriate mitigation measures to address predicted negative effects and enhancement measures to maximise anticipated benefits *(see Chapter 8)*;
- ***Assess the Residual Effects of the Project and Determine Level of Significance:*** Determine significance of residual effects (including any residual cumulative, synergistic and transboundary effects) after consideration of the effectiveness of the design and committed mitigation measures. Therefore this stage of the assessment determines the likely significance of any residual effects **following the application of mitigation measures** (i.e. Significance of Effects **(with mitigation)**) by considering the Significance of Effects **(without mitigation)** along with the **probable success of mitigation measures**; *(see Chapter 7)*.
- ***Plan Environmental & Social Management & Monitoring Arrangements, including Stakeholder Engagement;*** *(see Chapter 8)*.

This Chapter of the ESIA provides a description of the assessment methodology for the proposed road rehabilitation of the T2 road from Mpika to Chinsali. Chapter 4 of the ESIA outlines the Project Description and Consideration of Alternatives, based on the current knowledge of the Project and previous project preparation activities.

Baseline environmental and social conditions are described within Chapter 6. Potential environmental and social impacts, mitigation measures and residual effects are presented within Chapters 7 and 8, respectively. The environmental and social management and monitoring arrangements for the Project have being described in the Environmental Social Management Plan (ESMP), which has been submitted as a stand-alone document to this ESIA.

The ESIA procedure in Zambia, which follows the requirements of EU Directives on ESIA, consists of 4 main steps:

- A ***Screening*** process (in which the need or not to subject a particular project to full ESIA procedure is determined);
- A ***Scoping*** process (where the authority and Project Proponent (*in this case the ZEMA &RDA)* establishes the content and extent of the matters and critical issues to be covered in ESIA study);
- The ***Preparation of the ESIA*** study itself (according to the guidelines established in the legislation and the requirements set in the scoping decision); and
- The ***Decision-making process to grant or reject the project implementation consent*** (based on the analysis of the adequacy of the ESIA study to demonstrate the environmental and social performance of the project, and the input of the stakeholders resulting from the stakeholder engagement process that has taken place during the ESIA procedure). After project implementation, the procedure is to continue by monitoring the environmental and social performance of the project.

5.2. Screening

The "rehabilitation of the T2 road from Mpika to Chinsali falls under Part II Clause 7 (2) of the Zambian EIA Regulation, which indicate 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*".

Similarly, according to the EIB categorization of the financed projects based on environmental and social criteria reflecting the level of potential impacts, nature and level of assessments, information disclosure and stakeholder engagement, the Project falls under the Appendix 1: Category A projects, sub-category 7: Construction of motorways, express roads and lines for long-distance road traffic.

Therefore a participatory assessment process has been undertaken following the EIB Performance Requirements given in the EIB's environmental and social requirements outlined in their Environmental and Social Practices Hand (Version 2: 24/02/2010). The development of the Mpika to Chinsali's ESIA has been consolidated into one process and documented in this single report.

5.3. Scoping Opinion & Assessment

A scoping assessment has been undertaken to identify the environmental and social aspects which are likely to be potentially affected by the Project in order to determine the areas of the assessment that should be focused on. The scoping process considered the following matters:

- the scoping opinion and guidance provided by the ZEMA & RDA;
- Stakeholder Scoping; and
- Scoping matrix: a scoping matrix has been used to take account of the potential interaction between the project activities and the various environmental and social aspects.

5.3.1. Scoping Opinion & Guidance from Regulator (ZEMA)

According to the Zambian ESIA procedure, RDA through the consultant held discussion with the EIA Department of ZEMA on the scoping opinion to identify the types of environmental impacts to be investigated in more detail and to be reported in the ESIA Study. ZEMA provided guidance and recommended that a full ESIA be undertaken especially that three years had elapsed from the time the agency had approved the same project under the COMESA proposal. As for the scope of the study, besides the questions included in the Checklist for determination of the scope of the study for evaluation of the project's impact on the environment, RDA was required to elaborate in detail the following issues:

- Visual aspects: the physical characteristics and visual effects of the road infrastructure related to the acceptability of the new landscape of the region by the local population and other receptors, especially in the operational phase, should be included;
- Biological diversity: the study should include an analysis of the biological diversity of the region, possible presence of protected and affected types of habitats, presence of protected areas, areas envisaged to be put under protection, presence of ecosystems, as well as the potential impacts of the project's execution;
- Cumulative impacts: an analysis of the cumulative impacts should be included in case there are projects / installations with a potential for similar impacts on the environment in the surrounding of the proposed project; and
- Socio-economic aspects: a review of the potential direct and indirect effects of the project on the local economy and the social conditions in the region should be included.

These issues and all other relevant socio-economic and environmental issues have been covered as well, according to the ZEMA EIA regulations on ESIA Study Content.

5.3.2. Stakeholder Scoping Meetings

In order to ensure stakeholder engagement early in the environmental and social appraisal process, Scoping Stakeholder Meetings were organized during February to May 2016 with all identified stakeholders (the Stakeholder Matrix is given in the Stakeholder Engagement Plan (SEP), which is submitted as a separate document to this ESIA report.

The objectives of the meetings were to:

- Disclose relevant project information;
- Understand better the local circumstances regarding the social and economic development of the region/municipalities, and opportunities for further development after the project implementation;
- Discuss the possible environmental sensitive areas along the road corridor and any "hot" environmental issues already identified within the strategic environmental planning documents; and
- Discuss the best suitable consultation methods and ways in which the public can participate in open, proactive manners.

All the main findings, concerns and recommendations provided by the various stakeholders during the scoping meetings were taken into consideration in the scoping assessment.

5.3.3. Scoping Matrix

The potential environmental and social impacts of the planned rehabilitation and construction project activities and the enforcement of the road reserves were reviewed in the Scoping Matrix for the main project phases to identify the likely environmental and social aspects which will be impacted by them. The Project activities that have been considered as part of the Scoping Matrix include those to be undertaken during the design, rehabilitation,

construction and operation of the project road. These phases are described below and include:

- The ***Construction Phase*** (including design) activities considered in the scoping phase and where relevant within the subsequent impact assessment includes all those undertaken during the time of building and construction of all road elements for the entire Project. This would include all construction activities and decommissioning of the temporary construction ***facilities.***
- ***The Operational Phase*** assessment considers all operational activities including: Operation of the road, which may potentially result in impacts such as the generation of noise and vibration, release of chemicals, fuels or hazardous substances leakage from the traffic vehicles, killing of crossing animals, generation of various waste streams; and Maintenance activities of the road, which may potentially result in impacts such as on the occupational health and safety for the workers that will perform routine and Periodic maintenance of the road and public safety during the maintenance.
- ***Decommissioning*** of construction sites and temporary facilities is also considered within the scope of the assessment as part of the Construction Phase activities. However, decommissioning of the road itself has not been considered within the ESIA at this stage due to both limited information being available at this stage with regard to the ceasing of operation of the road and given the intention is with maintenance the road will continue to operate beyond its design life. In the event that the project road ceases operation and needs to be decommissioned relevant approvals will be sought and if required an ESIA produced for this phase.

The potential impacts (adverse and positive) of all planned project activities have been identified and the interaction among the project activities in all these phases and the natural/physical environment and social-economic life of the population was addressed.

5.3.4. Conclusions to Project Scoping Assessment

Based on the scoping process, which has considered the findings from the Stakeholder Scoping Meetings, the scoping opinion and guidance provided by the MoEPP and from the Scoping Matrixes to identify the potentially affected environmental and social aspects, the assessment of impacts in the ESIA has focused on the following issues:

- Soil and waste;
- Surface and ground water;
- Air emissions and air quality including climate change;
- Landscape and visual effects;
- Noise and vibration;
- Habitats;
- Flora and Fauna;
- Protected and Designated areas;
- Natural, cultural and archaeological heritage;
- Job creation;
- Income opportunities;

- Labour and working conditions including OH&S standards;
- Community safety and health;
- Livelihood;
- Living conditions;
- Road accidents;
- Development of local, regional and national economy.

5.4. Spatial & Temporal Scope

5.4.1. Spatial Study / Investigation Area

The spatial scope of the study/investigation area for the assessment has been determined for each of the environmental and social aspects/topics on a case by case basis in order to reflect both the:

- potential area of influence of the Project; and
- the surrounding environment over which significant effects could reasonably occur both from the Project and in combination with any other relevant projects/developments in the area.

For the majority of the environmental and social aspects/topics, the strip of land adjacent to the road alignment has been considered for the assessment of impacts. However, where sensitive receptors and resources are located beyond the immediate area along the route, this has been considered where appropriate to be part of the study area for certain environmental and social topics. The results of the consultation with stakeholders (e.g. Stakeholder Scoping Meetings) have been considered when determining the relevant spatial study area for specific environmental and social topics.

Where relevant, consideration is given to the potential 'regional' and 'local' effects of the Project in determining the study areas. Therefore, where appropriate, for some topics, and specifically the social ones, a Regional Study Area (RSA) and a Local Study Areas (LSA) have been adopted. The social topics (including socio-economic and land use Local Study Area were determined by consideration of the potential effects on local communities. Given the wider regional and national influence of the T2 road, a Regional Study Area (i.e. the three districts affected by the project road was considered relevant for certain elements of the socio-economic assessment. The environmental topics study areas were determined by consideration of potential effects on the physical and natural environment per environmental topic.

Both potential direct and indirect effects are considered in the impact assessment and in determining the appropriate study areas. Each topic has considered the areas where direct effects are likely to occur (i.e. generally within the Project footprint with a relevant buffer) and the area where indirect and cumulative effects are likely to occur on the surrounding area and the communities that live and work in the area from the proposed Project activities during construction and operation of the project road.

CHAPTER SIX

6.0. ENVIRONMENTAL AND SOCIAL BASELINE STUDY

6.1. THE PHYSICAL ENVIRONMENT

The biophysical environment in the area of influence of the T2 road from Mpika to Chinsali is a modified one where human activity has essentially altered the area's primary ecological functions.

6.1.1. Climatic conditions

The Zambian Meteorological Service's station at Mpika is the nearest meteorological monitoring station for the road project area and therefore climatic data from the Meteorological Station in Mpika has been applied to the road corridor. In addition, review of different studies has supplemented the climatic data contained in this report.

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 (23° 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.

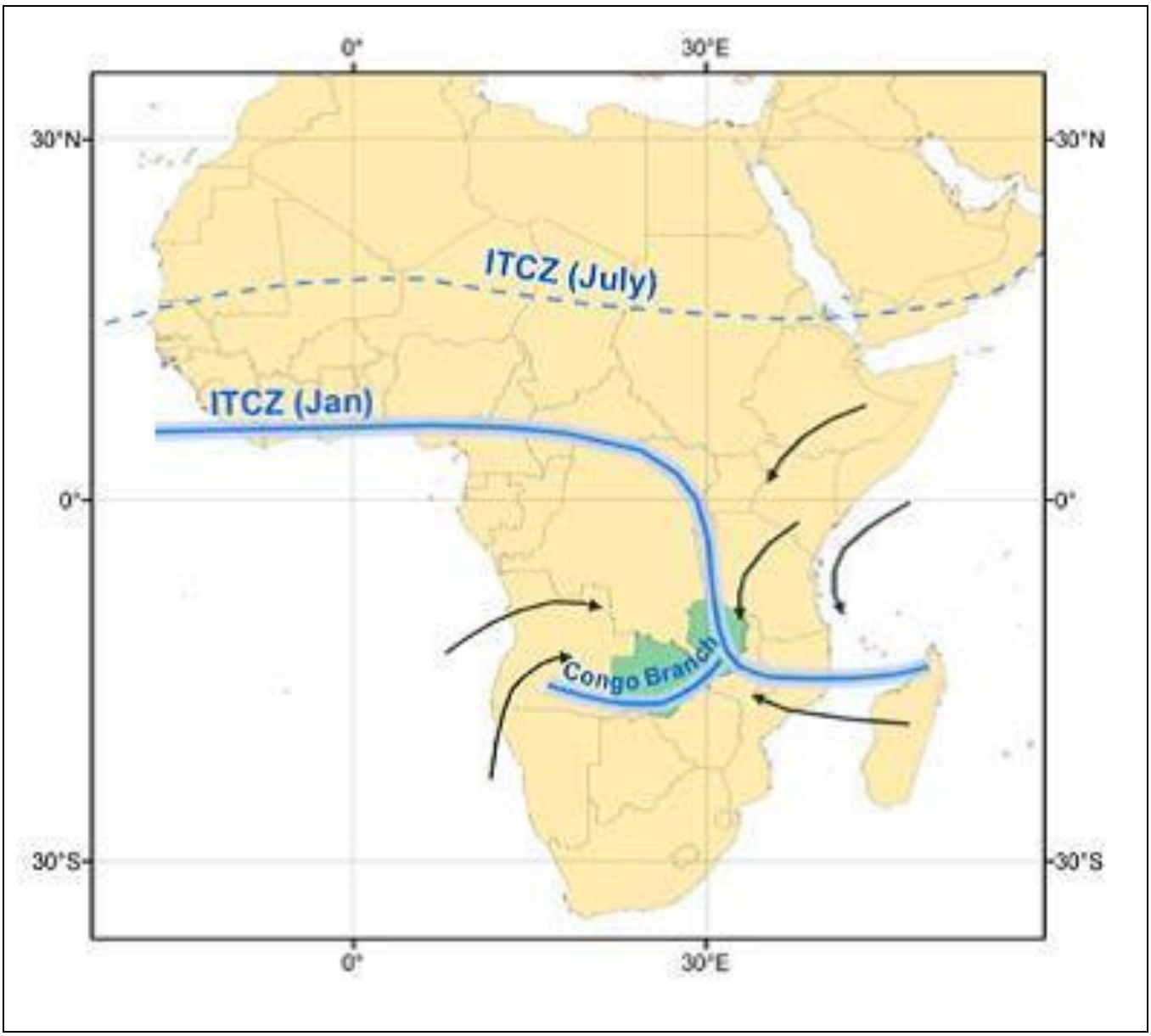


Figure 6-1: Approximate position of ITCZ[6]

The climatic conditions of the areas along the project road have been accurately described as a tropical continental highland climate7. 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

[6]Figure 6-1: Approximate position of the ITCZ during the Southern Hemisphere winter (dashed line) and summer (thick line) and predominant wind directions during summer (arrows).

[7] 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.

clear division into a dry and a rainy season, the predominance of the diurnal cycle over the seasonal, and large daily ranges of temperature.

According to the Food and Agriculture Organization (FAO), Zambia can be divided into 4 agro-climatic regions:

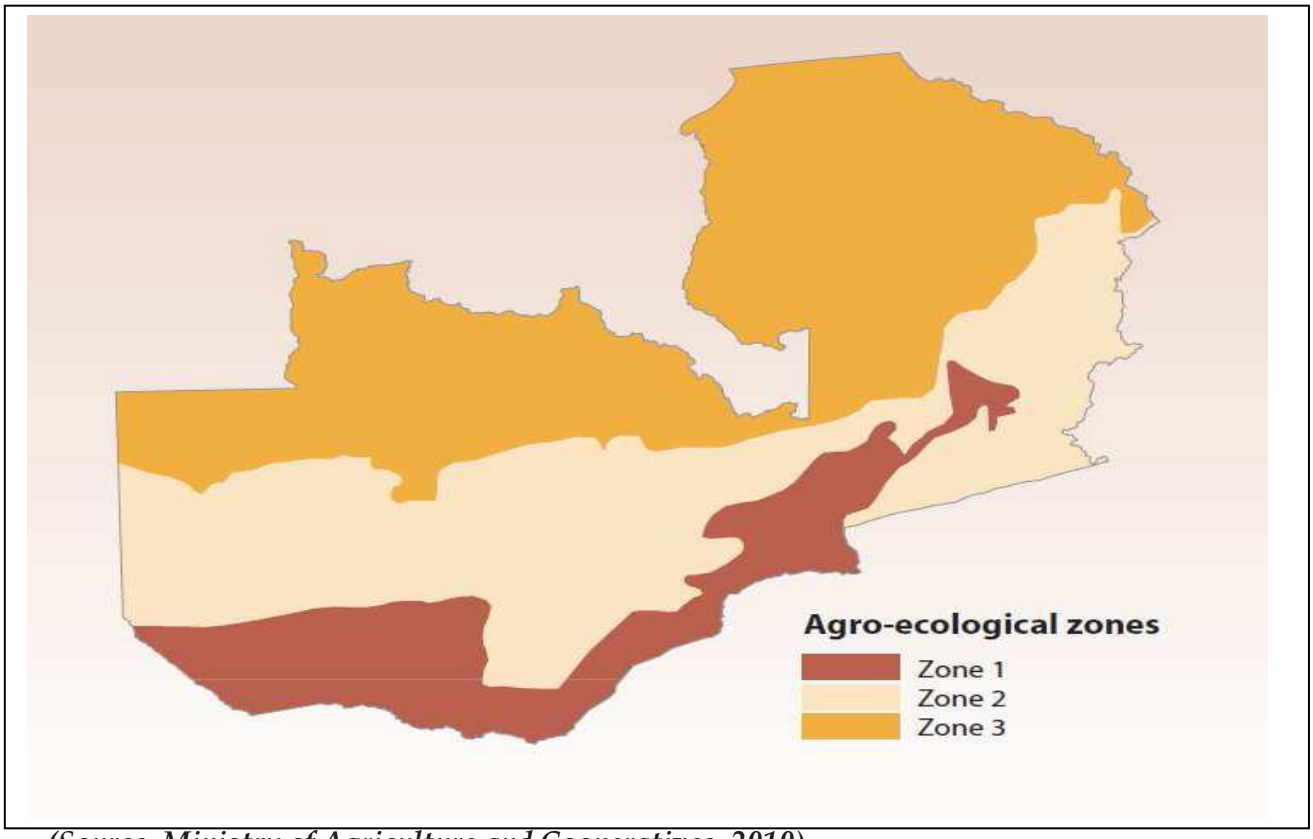
- I – the Zambezi and Luangwa valley with low rainfall (less than 700mm per year) with poor soil Zone 1 covers 23% of Zambia, and includes the major valleys (Gwembe, Lunsemfwa and Luangwa). It has the lowest agricultural potential, with rainfall of less than 800 mm per annum, a short growing season of between 80–120 days, and a medium to high risk of drought.
- II – The Central plateaus with rainfall of 800mm to 1,000mm, with more productive soil.
- IIb – The Western plateau with rainfall of 800 to 1,000mm with poor soil, Zone 2 covers the Sandveld Plateau, the Kalahari Sand Plateau and the Zambezi floodplains of the Western Province. Rainfall is between 800–1,000 mm per annum, and the growing season is 100–140 days. It has a medium to low risk of drought. 87% of the area is suitable for agriculture, but only half of this is accessible, as the remainder is in national parks, game management areas and forests and
- III – the North and North-western plateaus characterised by high rainfall between 1,000 to 1,800mm. Zone 3 has a mean annual rainfall of 1,000 mm and a growing season of 120–150 days. The risk of drought is almost nil. However, only 52.7% of the land is suitable for cultivation due to the soils being highly leached. Very little of this zone is in national parks, game management areas and forests.

The Mpika-Chinsali section of the Great North road is located wholly in the homogenous agro-climate zone III. Climatic conditions vary but have generally been typical of Agro-ecological Zone III until recently when the area has suffered symptoms of climate change. Some areas are now exRDAencing delay in the onset of rains and early cessation.

Commonly three seasons are distinguished:

1. **The Rainy Season**, which lasts from November to April, the temperatures range is 12 to 32 degrees Centigrade, humidity varies from 66% to 96% and the usual rainfall range is 500 to 1500mm, however up to 600mm has been recorded in a single month.
2. **The Cool-Dry Season**, which lasts from April to August, the temperature range is 1 to 29 degrees Centigrade and humidity varies from 32% to 86%.
3. **The Hot-Dry Season**, which lasts from September to November, the temperature range is 9 to 36 degrees Centigrade and humidity varies from 25% to 67%.

There is the trend that rainfall is higher in the North at 1400mm and lower in the South at 700mm. The temperature depends on altitude and does not vary significantly across Zambia.



(Source, Ministry of Agriculture and Cooperatives, 2010)

Figure 6-2: Agro-ecological zones of Zambia

6.1.1.1. Temperature and Sunshine

The area between Mpika and Chinsali experiences one of the highest diurnal temperature ranges. Mean annual regional temperatures for the road corridor area range 21.1°C – 27.4°C.

6.1.1.2. Rainfall

The road corridor is located in agro-ecological region 3 whose average rainfall is over 1,000mm. Most of the rain falls between October and April, with December and January as the wettest months.

The regional rainfall patterns associated with the above classification equally determine the duration of the growing season as follows:

- Region I: 80 – 120 days,
- Region II: 100 – 140 days and
- Region III: 120 – 150 days.

6.1.1.3. 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.

6.1.1.4. Humidity

For the past three years, the average annual relative humidity has been 60% (Figure 6-2). 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 12°C[8].

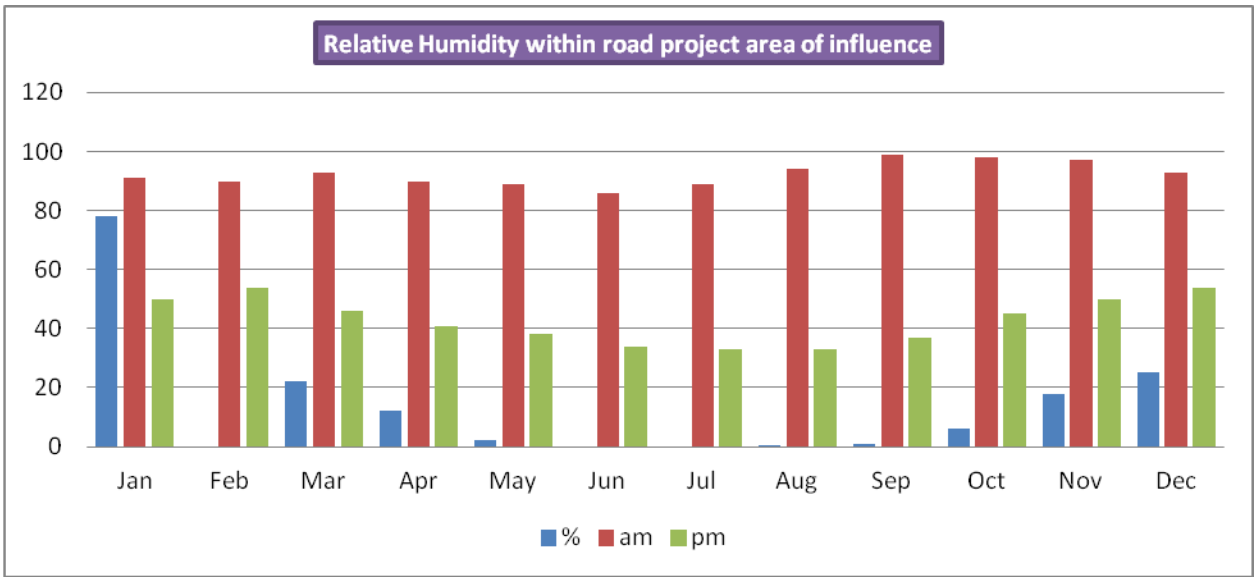


Figure 6-3: Average Relative Humidity

6.1.1.5. 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 behavior 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.

The average wind speed at Isoka is 2.6 m/s (Figure 6-3). A significantly high frequency of light and calm winds occurs at Isoka, 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 at Isoka, with more than 38% of winds less than 3.4 m/s9.

It is reasonable to assume that the wind experienced along the road project corridor is very similar to that at Isoka considering the same controlling synoptic meteorology, relatively close proximity of the two and the relatively flat terrain between the two locations.

Of importance to the project construction is that wind speeds are highest in the dry season, which also corresponds with the peak construction Period.

Figure 6-4 shows the wind speed and direction common along the two sections of the project road.

[9] Ibid

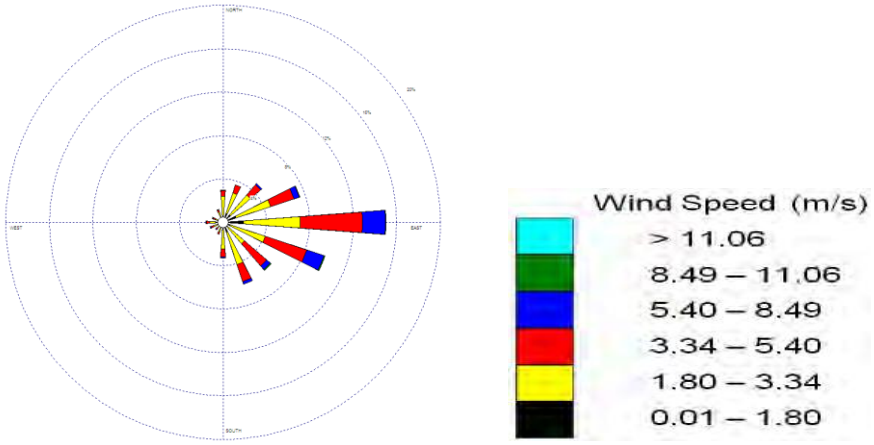


Figure 6-4: Wind Speed and Direction at Mpika Weather Station

6.1.2. Topography

The T2 road from Mpika to Chinsali Road project follows the water shed between the Luangwa and the Chambeshi/Luapula Rivers, and the road alignment is crossed by only a few rivers or streams.

The landscape is dominated by small hills and slopes included in the unit: Level to undulating plateau. Locally there are some reliefs that correspond to hills defined by the quartzite layers, and this is the Hills ridges and minor escarpments units. In some depressed areas there are places with lacking drainage that represent the Swamp areas. The areas of dissected plateau that represent the escarp to higher areas are located east of the road location. Figure 3-3 shows typical landscape of the project road corridor.

Figure 6-5: Typical Landscape of the project road corridor

6.1.3. Geological Setting

6.1.3.1. Land-forming Processes

The landscape of northern Zambia has developed in three main phases. Firstly, the ancient landscape of folded basement rocks – granite, gneiss and schist – was split into blocks by tectonic movements. Some of the blocks subsided, others rose, forming plateaux such as Namatinji Ridge (1460-1682 m asl and Chapalapata (1,400m-1,682m). The 'Congo Basin' in the north covers about 25% of the country, and an area of internal drainage occurs in northern Zambia where the largest stream is the Chambeshi (Source: E.M. Bridges; 1990: World Geomorphology). Erosion and sedimentation modified the faulted surface. The valleys were filled in, often with sand products due to downlifting, weathering and erosion.

The area between Mpika and Chinsali is predominantly elevated plateaux and isolated hills and escarpments; It is part of the Luangwa Trough complex forming the southern extension of the Great Rift Valley, with characteristic Rift Valley features notably 3400m to 1000m below the plateau surface are Karroo beds including Bataka basalts; (source Ibid). Figure 3-4 shows the Regional Geological Map of Project Site.

6.1.3.2. Geology of the Road Corridor

The Mpika-Chinsali road traverses a region characterised by basically two geological formations of the Muva Period, consisting of meta-quartzites of various ages and quartzite-pelite sequences with sandstone. Only in the area of Chinsali there are granite rocks. Figure 3-4 shows detail of Geological Map for the project road.

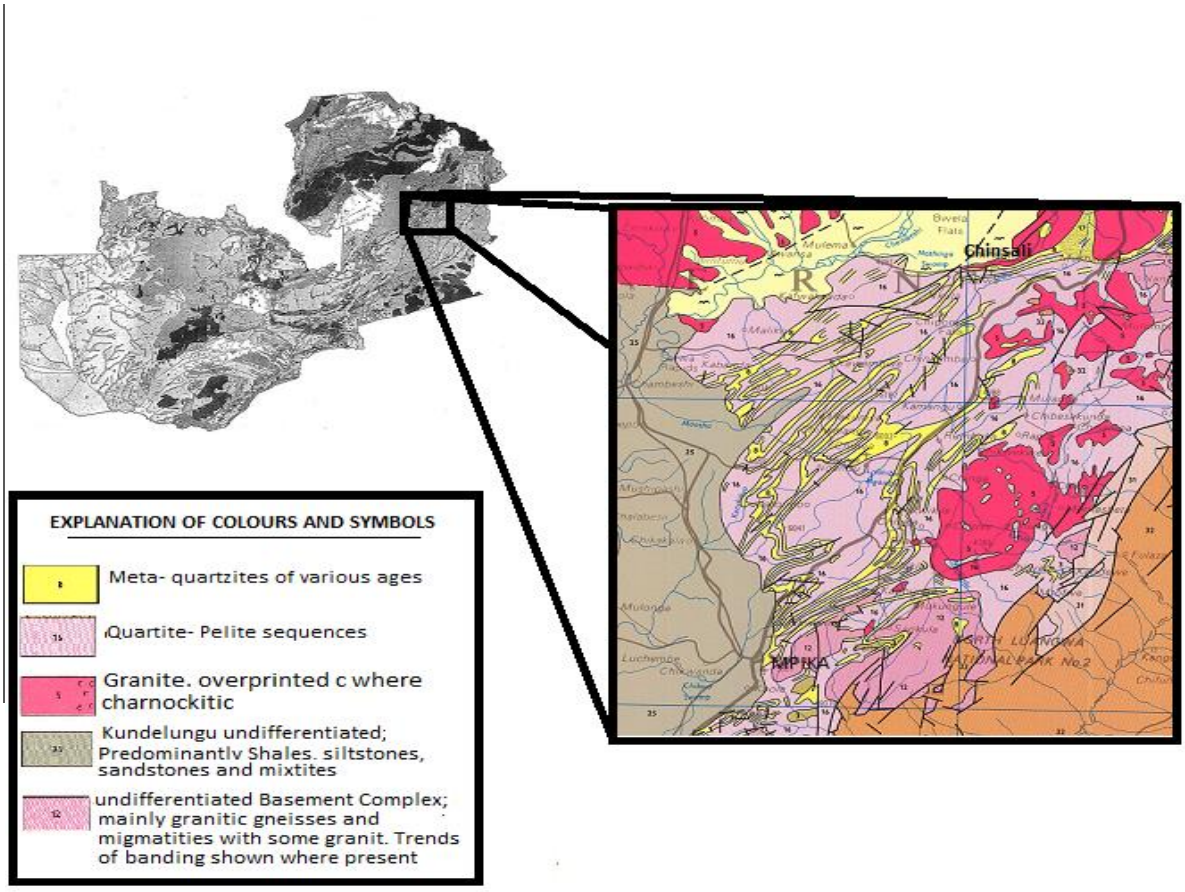


Figure 6-6: Regional Geological Map of Project Site

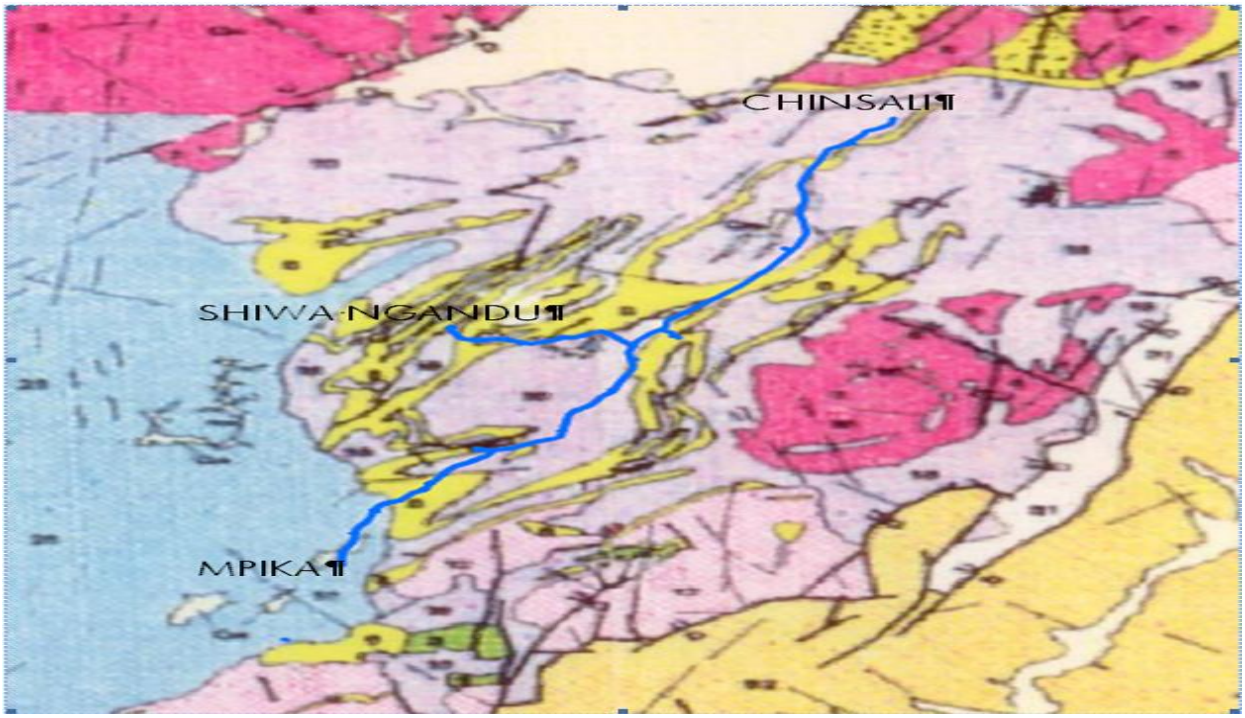


Figure 6-6.0-7: Detail of Geological Map (project road and some side roads in blue).

6.1.3.3. Soils

The Mpika-Chinsali 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 transform into sandy soils dotted with rock fragments deep into the profile.

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).

The mix of partially altered rock and lateritic soils with iron has been excavated in some areas and is being used as a source of construction materials.

Figure 6-8: Typical Soil types along project road corridor

6.1.4. Hydrology and Water Resources

6.1.4.1. Introduction

Accurate information is required to improve the understanding of the water situation not just along the road corridor but the country as a whole. Zambia's current water resources use cannot be accurately determined since comprehensive water use data is generally not adequate due to poor data records kept by different users as well as the inadequate regulatory capacity to monitor the various water uses. This is true for both surface water and groundwater (which had not been regulated until the enactment of the Water Resources Management Act in 2011 and the start of its implementation in 2012). The previous Water Act empowered Government through the Water Board to control surface water allocations but the Board had limited capacity to enforce the regulations.

Generally, Zambia considers itself abundantly-endowed with water resources. The potential of its available surface water is relatively well understood and is contributed by Zambezi and Congo River Basins.

The Zambezi Basin covers three-quarters of the country and comprises three sub-basins – Zambezi, Kafue and Luangwa. The main water bodies are within the watersheds of Zambezi and Congo rivers with their tributaries of Kafue, Luangwa, Luapula and Chambeshi, and Lakes Tanganyika, Bangweulu, Mweru and Mweru wa-Ntipa including the manmade lakes of Kariba and Itezhi-Tezhi.

The project road corridor lies between two major tributaries for the two basins namely: the Chabeshi and Luangwa Rivers which are tributaries of the Congo and Zambezi Basis respectively.

Figure 6-9 shows the two river basins of Zambia with their tributaries while Table 6-1 shows the basin area of the six main river systems in Zambia.

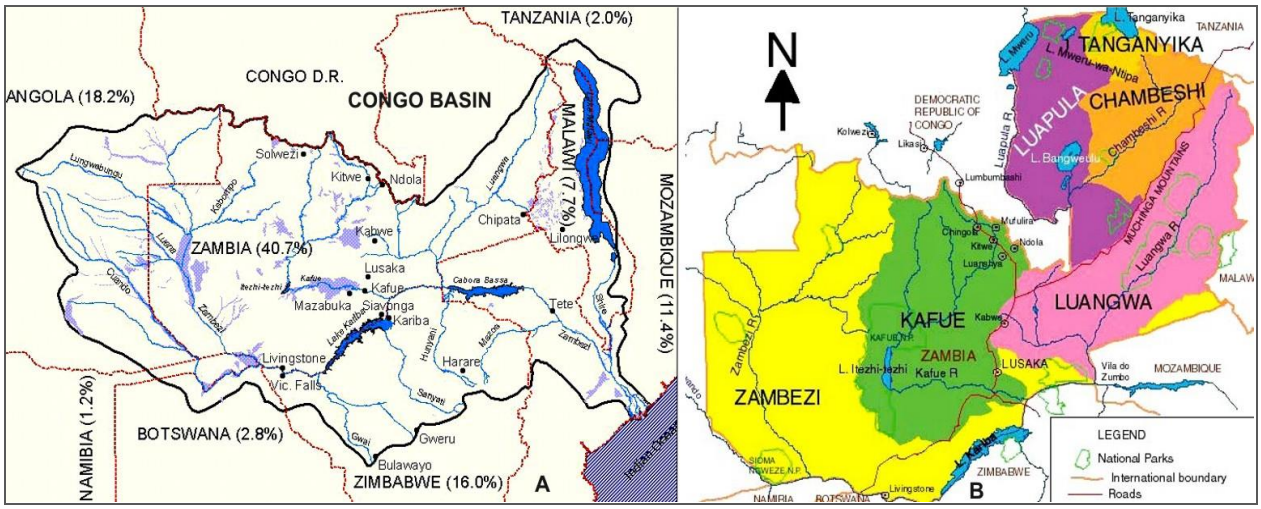


Figure 6-9: (A) the Zambezi and Congo River Basins, and (B) The Zambezi and Congo

The different sub-basins in the Zambezi and Congo Basins have different contributions to the country's surface and groundwater resources. Table 6-1 shows their lengths in Zambia; their total areas (in Zambia and outside Zambia); their contribution each to surface water potential and their annual run-off. In a high rainfall hydrological year, annual runoff can be as high as 130 Km3 per year, while during severe drought years, it can drop to as low as 68 Km3, in turn, affecting the amount of surface water.

Table 6-1: River Length and Basin Area of six Main River Basins

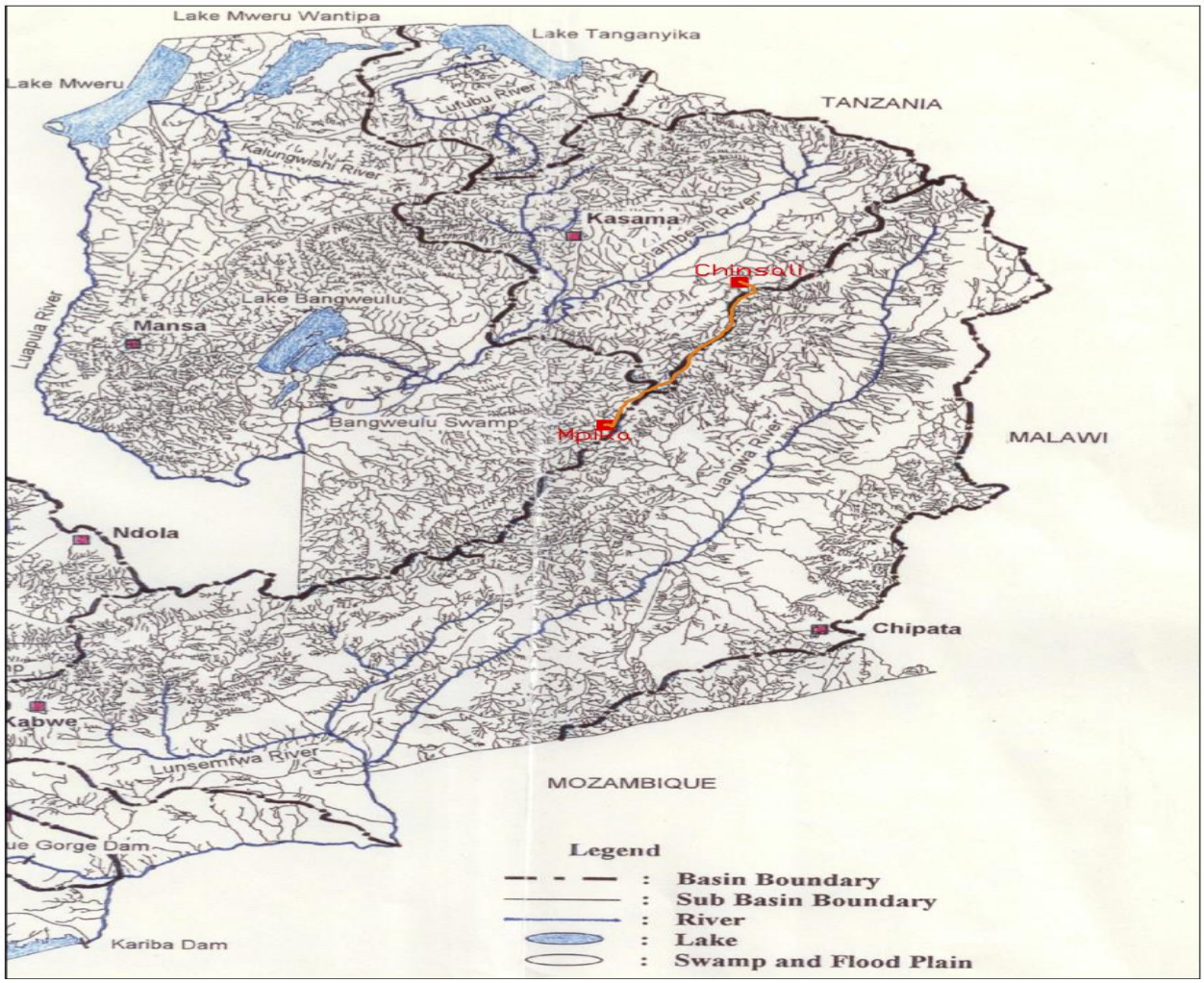
Sub-Basin	Length in Zambia (km)	Basin area (km²)			% contribution to surface water potential	Annual Run-off (km³)
		Total	In Zambia	Outside Zambia		
Zambezi	1,700	687,049	268,235	418,814	36.36	41.75
Kafue	1,300	156,995	156,995	-	8.40	9.88
Luangwa	850	147,622	144,358	3,264	19.44	22.32
Chambeshi	560	44,427	44,427	-	7.62	8.75
Luapula	615	173,396	113,323	60,073	26.25	30.14
Lake Tanganyika	250	249,000	15,856	233,144	1.73	1.99
Total	**5,272**	**1,458,489**	**743,194**	**715,295**	**99.8**	**114.83**

6.1.4.2. Surface Water

The T2 road from Mpika to Chinsali road corridor is drained by two major rivers, namely the Chambeshi on the western side and the Luangwa on the east side of the road. The project road corridor therefore separates two basins namely the Luapula and Zambezi Basins. The region lies at fairly high altitude, debouching its waters partly into the Indian Ocean via the Luangwa River and into the Atlantic Ocean via the Chambeshi through the Luapula River.

It must be noted however that the project road corridor is not close to any of the major rivers in Zambia and the Chambeshi and Luangwa Rivers, which are the closest major rivers to the project road.

It can be seen from the map below that the Mpika to Chinsali Road runs parallel to the Luangwa and Chambeshi Rivers and along the boundaries of their respective drainage basins.



The project corridor therefore only has perennial streams of which the major ones are the Lwitikila, Lufune and Luanya Rivers. Due to the Muchinga escapement on the eastern side of the project road, rivers and streams crossed by the road project flow in the north-west direction, draining into the Chambeshi River.

Table 6-2: Names of the major rivers crossed by the project road.

Chainage	River	Catchment Area A (km²)	Area of Culvert (m²)	Flow Q (m³/s)
11+837	Lwitikila	80	115	56
21+922	Lufune	10	6.5	14.5
58+346	Lwanya	20	16	21.35

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.

Figure 6-10 shows typical surface water bodies (rivers) crossed by the project road

Figure 6-10: Rivers crossed by project road at Lufune and Luwanya

In terms of surface water usage, villages along the project road corridor use both surface and groundwater for their water supply including drinking. Surface water is mainly drawn from streams. Surface water is used mostly for irrigation in the dambo areas. Hand dug irrigation channels were observed in the area fed by flood drainage. Surface irrigation water is sometimes supplemented with artesian groundwater due to the presence of a high water table and perched ground water. Cultivations in dambo areas (commonly maize and garden vegetables) are irrigated from the dambo streams.

Figure 6-11 shows typical use of surface water for irrigation along project road corridor

Figure 6-11:Use of surface water for irrigation at Kabangama area along project road corridor

6.1.4.3. Quality of Surface Water

All the run-off from the project area will eventually be discharged into the Cambeshi River the three main rivers crossed by the project road (i.e. Lwitikila, Lufune and Lwanya Rivers).

The communities downstream of each of these rivers (i.e. Lwitikila, Lufune and Lwanya 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. 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 6-3. These values have been compared to the World Health Organization (WHO) Drinking Water Standards.

Water samples were collected from the Lwitikila, Lufune and Lwanya Rivers, and at proposed locations for drainage construction (i.e. Box culverts). 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 did not pose a danger to the surrounding communities, as they were within permissible limits for drinking water.

The Lwitikila River and Lwanya stream 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.

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 6-3 shows surface water analysis results for the water bodies along the project road corridor.

Table 6-3: Surface water analysis results

Sample Name	Lufune River	Lwitikila River	Lwanya River	WHO guidelines
Parameter				Maximum permissible value for drinking water
pH	6.61	7.67	7.76	6.2-8.5
Total Dissolved Solids (mg/l)	163	257	141	1000
Conductivity (µS/cm)	329	514	284	1500
Total Suspended Solids (mg/l)	2.2	5.6	3.2	-
Turbidity (NTU)	4.08	18.70	7.06	1-5
Calcium Hardness (as mg $CaCO_3$/l)	76	100	76	-
Calcium (mg/l)	30.4	40.0	30.4	-
Chlorides (mg/l)	10.0	7.0	10.0	250
Sulphates (mg/l)	<0.01	<0.01	<0.01	250
Total Phosphates (mg/l)	<0.01	<0.01	<0.01	-
Lead (mg/l)	<0.01	<0.01	<0.01	0.01
Nitrates (as mg NO_3 –N mg/l)	<0.01	<0.01	<0.01	50
Ammonia (as mg NH_4- N mg/l)	<0.01	<0.01	<0.01	-
Biochemical Oxygen Demand (as mg O_2 mg/l)	10.0	10.0	9	-
Chemical Oxygen Demand (as mg O_2 mg/l)	19	21	18	-
Copper (mg/l)	<0.003	<0.003	<0.003	2
Cobalt (mg/l)	<0.005	<0.005	<0.005	-
Potassium (mg/l)	2.02	1.52	2.22	-
Sodium (mg/l)	6.60	4.72	6.62	-
Manganese (mg/l)	<0.01	2.17	2.02	0.5
Mercury (mg/l)	<0.002	<0.002	<0.002	0.006/0.001
Magnesium (mg/l)	29.76	36.98	21.60	-
Zinc (mg/l)	<0.001	<0.001	<0.001	3
BACTERIOLOGICAL RESULTS				-
Total coliforms (#100ml)	40	55	48	0
Feacal coliforms (#100ml)	21	24	15	0

Source: Environmental Engineering Laboratory- UNZA

6.1.4.4. Ground water

Groundwater is a major source of water in many parts of the country. It sustains river flows especially during the dry season for perennial rivers and streams and can contribute to between 30 and over 90 percent of the total flows. JICA-MEWD (1995) estimated the average renewable groundwater potential to be 49.6 Km3. This is based on an average of 8 percent of the rainfall, which is the main source of renewable water in Zambia at an average annual total rainfall of 1000 mm. However, due to lack of data, it is difficult to accurately assess the groundwater potential of the country.

From a hydrogeological point of view, the geology of Zambia is classified into simplified lithostratigraphic units indicating the main aquifer lithologies, their relative groundwater productivity and percentage occurrence in the country as shown in Table 6-4.

Table 6-4: Classification of Aquifers

Lithostratigraphic Unit		Main Aquifer Lithology	Productivity of Groundwater
Cenozoic Supergroup	Alluvium	Sand, gravel	Medium-High
	Kalahari	Sand	Medium-High
Karoo Supergroup	Upper Karoo	Basalt	Low
		Sandstone	Medium-High
	Lower Karoo	Mudstone	Low
Katanga Supergroup	Kundelungu	Carbonate Rock	High
	Undifferential Kundelungu	Shale	Low
	Upper Roan	Dolomite	High
	Lower Roan	Quartzite, Dolomite	Medium-High
	Mine Series	Quartzite, Shale	Low-Medium
Muva Supergroup		Shale	Low
Basement Complex		Gneis, Migma-tites, Schist	Low-Medium
Granite		Granite	Low-Medium
Other Igneous Rocks		Basic-Igneous Meta-Igneous	Low
Metamorphic Rocks		Metasediment, Metavolcanics	Low

1. ***Aquifer where groundwater flow is mainly in fissures, channels or discontinuities:*** Groundwater occurs in secondary rock features and structures such as weathered zones, faults, joints, fractures and solution features that usually extend to around 30m to 40m in depth within consolidated hard rocks and often extend to more than 90m in depth. Such aquifers may be subdivided into two, namely:
    I. Highly productive aquifers: These include Upper Roan Dolomite and Kundelungu Limestone (1-70 ls^{-1}), but have limited and very narrow area of distribution. These aquifers are distributed in Copperbelt, Lusaka, North-Western and Central provinces and cities such as Lusaka, Ndola and Kabwe are located on them.
    II. Locally productive aquifers: The Lower Roan Quartzite, Muva sediments, granites and undifferentiated Kundelungu formations (0.1-10 ls^{-1}). These aquifers are distributed largely in Northern, Luapula, Central, North-Western and Copperbelt Province.
2. ***Aquifers where intergranular groundwater flow is dominant:*** These are found in the Alluvial formations, Kalahari Group and Karoo Supergroup. These aquifers are distributed mainly in the Western, and parts of Southern and along Luangwa River in Eastern Zambia. They are also distributed around Chambeshi River in Northern Province and Lake Bangweulu in Luapula Province (0.1 – 15 ls^{-1})

3. ***Low yielding aquifers with limited potential:*** These include the major part of Argillaceous formations, Karoo basalts and older Basement Complex. These aquifers are mainly distributed in Eastern and Southern parts of Zambia (0-2 ls^{-1}) as well as parts of Northern, Luapula, Central Copperbelt, Lusaka and North-Western provinces.

The project road corridor falls within the Lower Roan Quartzite, Muva sediments, granites and undifferentiated Kundelungu formations, which has medium high groundwater productivity. 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 areas and rivers.

Most streams starts from flat vlei (dewatering will not have any effect on these natural water facilities). Similarly, most shallow wells gets water from these flat-areas covered with clay. Sampling to know the quality of water in the area was conducted from local wells (see Table 6-5) and from the results, it was concluded that the groundwater in the project area is of good quality.

Table 6-5:Ground water analysis results

Parameter	Water from Traditional well in Luanya	Water from traditional well in Kabangama	Zambian Drinking water Standards
pH units	7.1	7.3	6.5-8.0
Conductivity (mS/m at 25°C)	18.5	11.1	2300
Turbidity (NTU)	0.98	0.86	10
Hardnes (CaCO3)	24	32	500
Zinc (Zn)	<0.2	<0.2	5
Nitrate (N)	<0.2	<0.2	10
Nitrite	<0.01	<0.01	1
TDS	88	43	1500
Chloride (Cl)	0.56	0.87	250
Sulphate (SO4)	11	20	400
Selenium (Se)	<0.01	<0.01	0.01
Fluoride (F)	<0.2	<0.2	1.5
Silver (Ag)	<0.05	<0.05	0.05
Mercury (Hg)	<0.001	<0.001	0.001
Calcium (Ca)	11	5	200
Magnesium (Mg)	3	7	150
Aluminium (Al)	<0.02	<0.02	0.2
Cobalt (Co)	<0.05	<0.05	0.5
Manganese (Mn)	<0.05	<0.05	0.1
Copper (Cu)	<0.05	<0.05	1.0
Iron (Fe)	0.392	<0.05	1.0
Arsenic (As)	<0.05	<0.05	0.05
Cyanide (CN)	<0.05	<0.05	0.1

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.

Figure 6-12 shows the typical sources of groundwater along the project road corridor.

Traditional, protected wells and boreholes are major sources of ground water along project road corridor

Figure 6-12:Typical sources of groundwater along the road corridor

6.1.4.5. Wetlands

The project road corridor has some small wetlands such as the Lwitikila and Kabangama, which are mostly used for farming activities mainly vegetable production in the dambos and fish

farming. However, these wetlands are not listed on the national and international list importance and there are no habitats of important fauna and flora species.

Zambia has eight wetlands of international importance or Ramsar sites. Table 6-6 below shows the Ramsar sites in Zambia and their relative size. As mentioned earlier, none of these Ramsar sites is any close to the project road. These wetlands are habitats of several important fauna and flora species including some endemic and endangered species. (COP 12 Wetlands National Report, 2015). The Wetlands National Report to the Twelfth Session of the Conference of Parties (COP 12) held in Uruguaay in 2015 indicates improved status of the Lukanga swamps, Bangweulu swamps and Liuwa Plains. However, the report does not give details of the scope of improvement but attributes the improvement to the attention these wetlands have received from the private sector engagement in their conservation regimes.

Table 6-6: Ramsar sites in Zambia

Name of Ramsar Site	Area (km^2)
Bangweulu Swamps	11,000
Busanga Swamp	2,000
Kafue Flats (includes Lochinvar & Blue Lagoon NPs)	6,005
Lake Tanganyika (portion in Zambia)	2,300
Luangwa Floodplains	2,500
Lukanga Swamp	2,600
Mweru-Wa-Ntipa Swamps	4,900
Barotse Floodplain	9,000
Total	**40,305**

Areas along project road corridor with elements of wetlands at Kabangama

Figure 6-13: Typical small wetlands common along project road corridor at Kabanagama area

6.1.5. Ambient Air Quality

The construction works for the proposed road rehabilitation of the T2 road from Mpika to Chinsali are expected to generate dust pollution during the construction phase. It was therefore important that baseline parameters are set with the view of developing mitigation measures to help minimize dust generation during the construction phase and to set measures that will help control air pollution from construction vehicle emissions.

Particulate matter with PM10 (particles with a diameter of 10µm or less) was considered for the baseline survey. PM10 are particles that are able to reach the lower regions of the human respiratory tract and are responsible for most of the adverse health effects associated with suspended particulate pollution. Concerns to human health are mainly effects on breathing and the respiratory system, while other safety concerns are loss of visibility which could result in traffic accidents.

Air pollution as a result of dust was monitored by employing the use of a Microdust Pro meter (Casella 712k) at Chikwanda, Mukwikile and Kanakashi. The sampling process included time intervals ranging from ten minutes (00:10 to thirty minutes (00:30).

The results obtained show that the concentration of dust was within the WHO Ambient Air Quality Guidelines (50µm/m3 = 0.05mg/m3). The yellow line in the Figure below represents

the measured concentration of dust particles while the green line represents the concentration of dust particles at which prolonged exposure poses a risk to human health.

Figures 6-14 to 6-16 represent the results obtained during the monitoring Period. From the results obtained, it is clear that the concentration of the dust particles was very low and prolonged exposure would not pose any health risks.

Field observations indicate that exhaust emissions from vehicles travelling along the T2 road from Mpika to Chinsali disperse rapidly and are very localised.

According to information from local communities, grassland and forest fires, charcoal burning and traditional Chitemene slash and burn agriculture during the dry season generates smoke and dust. This air pollution hangs over the area and forms a distinctive haze. The haze layer is mainly visible from the air and worst during the coolest months (June and July) when temperature inversions tend to trap the smoke near ground level. The haze lasts until the arrival of the rains in November. Localized and temporal air quality deterioration is also associated with village domestic fires.

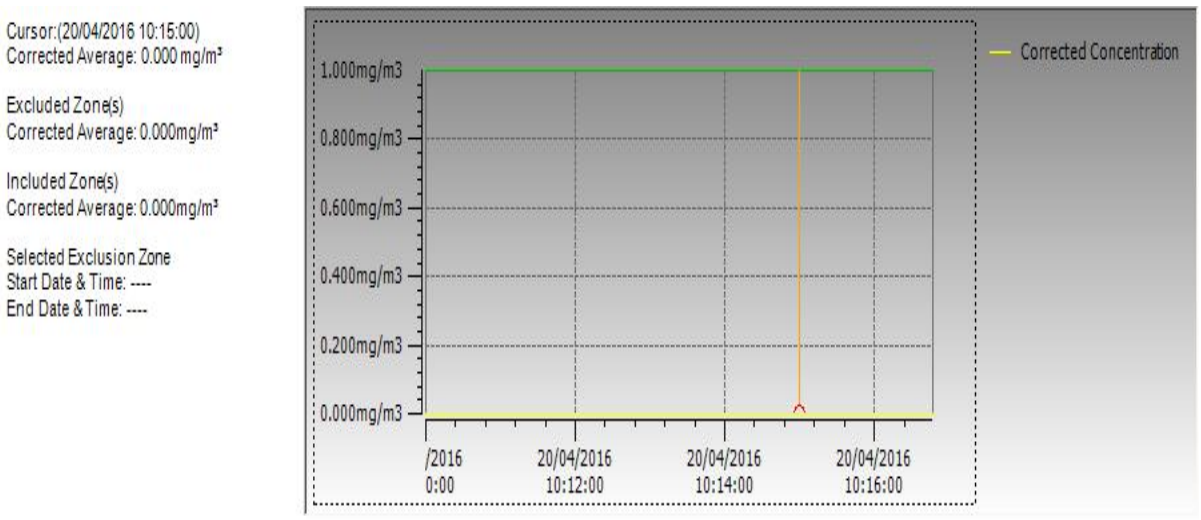


Figure 6-14: Dust concentration recorded at Chikwanda area

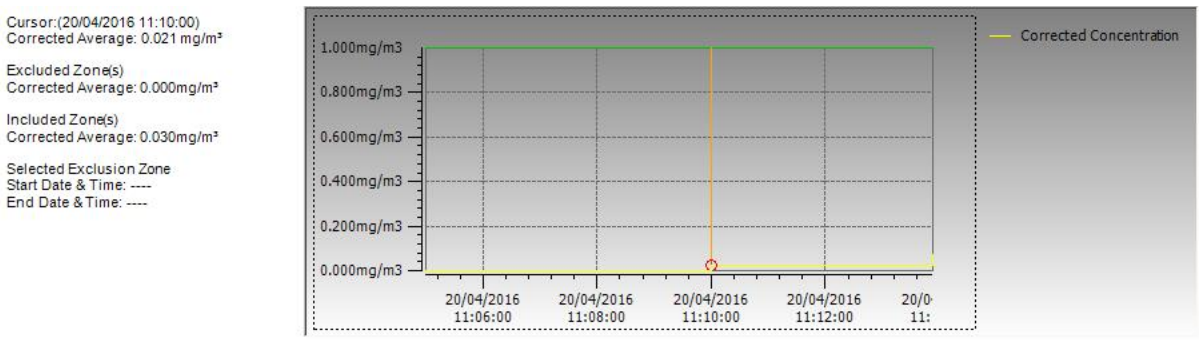


Figure 6-15: Dust concentration recorded at Mukwikile area

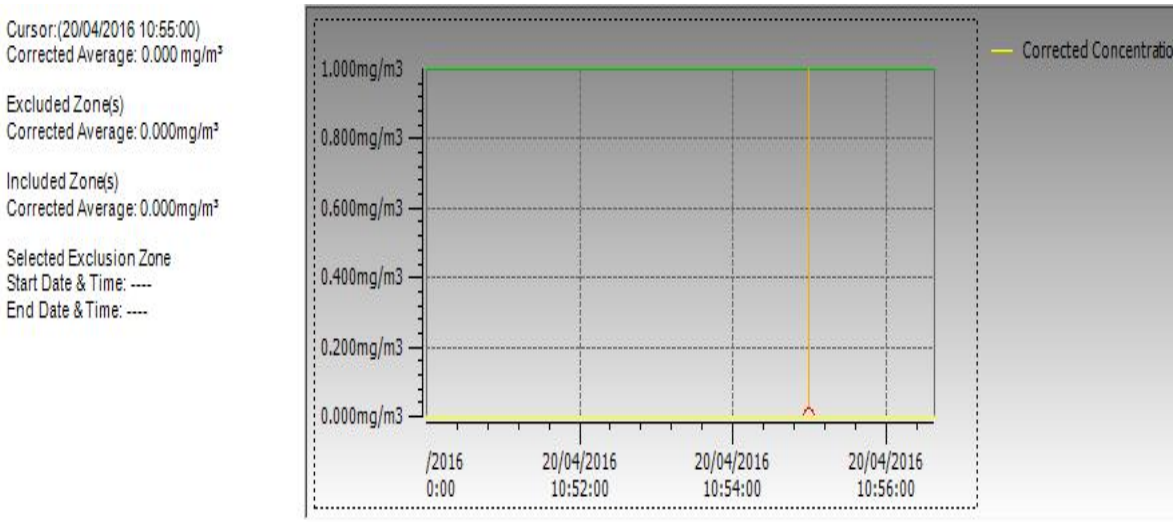


Figure 6-16:Dust concentration recorded at Kanakashi (Matumbo area)

6.1.6. Noise and Vibrations

Noise in the project area is mainly caused by the movement of vehicles and other activities. Noise monitoring was evaluated in terms of ambient noise levels as was the case in air pollution. The method employed was the use of a sound level meter (Casella 63x) at Chikwanda, Mukwikile and Kanakashi areas.

The results obtained indicated variations in noise levels depending on the movement of vehicles on the road. During vehicular movement in the project area, the results indicated LAeq values of 60.3 dB, 65.3dB, and 93.4 dB, which were above the World Health Organization (WHO) residential guidelines value (55dB).

The project road is a busy road and is characterized by constant movement of vehicles, resulting in higher levels of sound, with values above the WHO recommended levels.

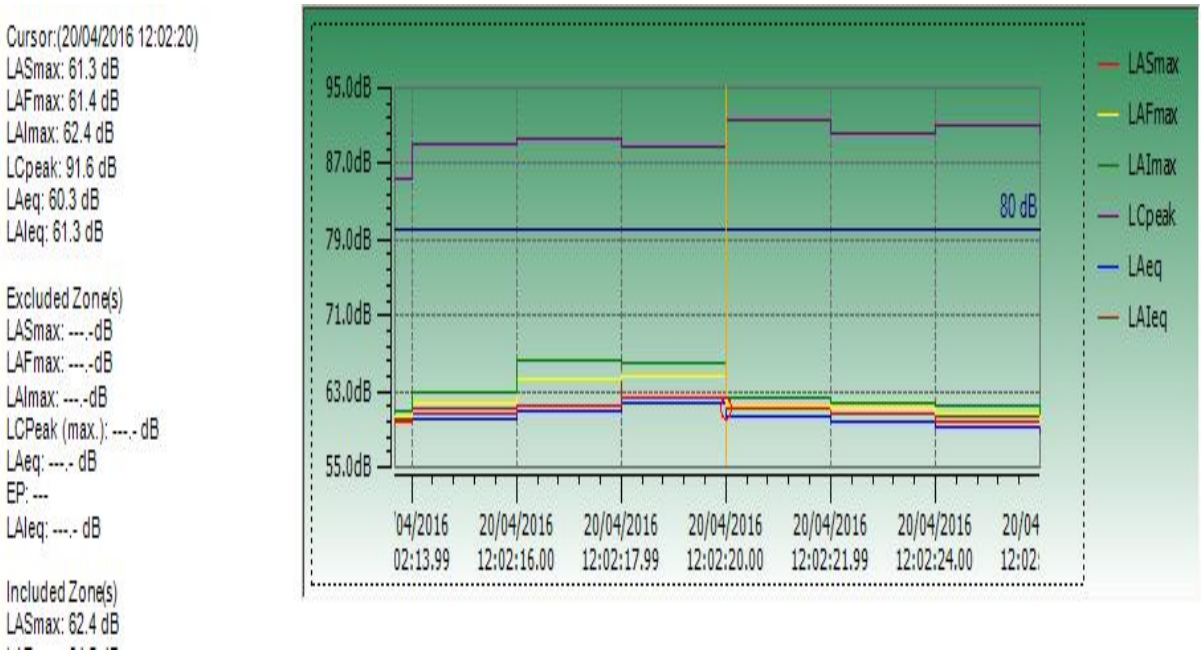


Figure 6-17: Noise levels recorded at Chikwanda area

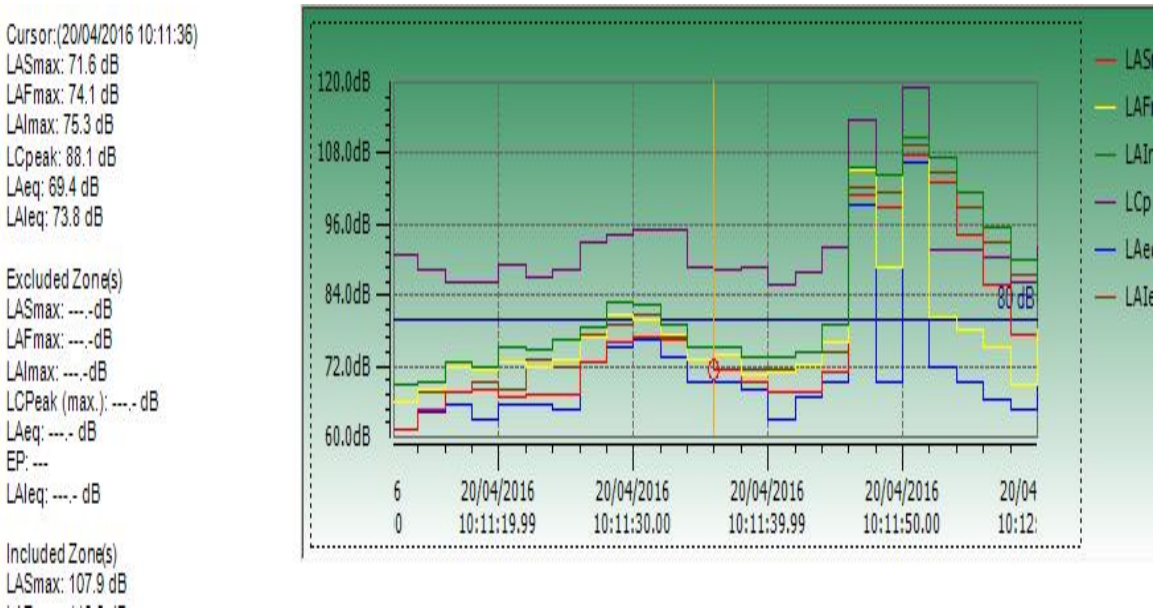


Figure 6-18: Noise levels recorded at Mukwikile area

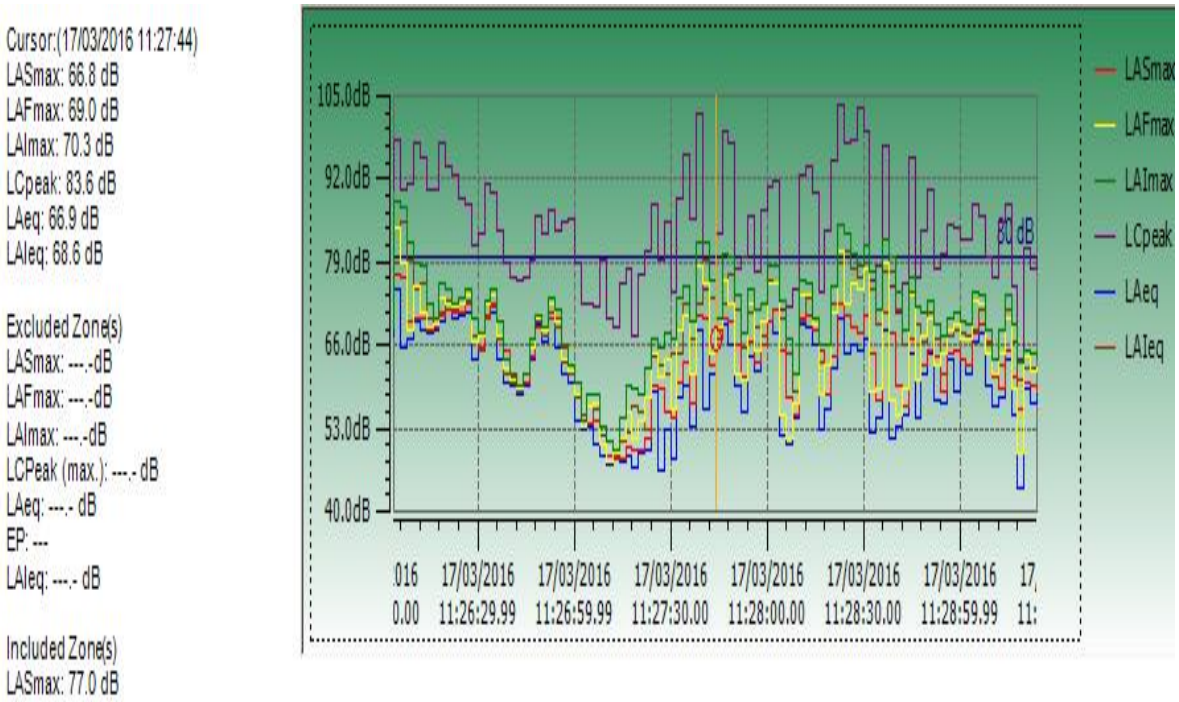


Figure 6-19: Noise levels recorded at Kanakashi area

6.2. BIOLOGICAL ENVIRONMENT

6.2.1. Introduction

The project road corridor Zambia is endowed with abundant natural resources and a fairly rich biological diversity. Like other parts of the country, the population along the project road corridor is highly dependent on the exploitation of its biological resources for the livelihood.

Along the project road corridor and at the ecosystem level, forests and agro-ecosystems are probably the key ecosystem components that have a relatively greater bearing on the natural system integrity upon which the local economy and the livelihoods of the population along project road corridor depend.

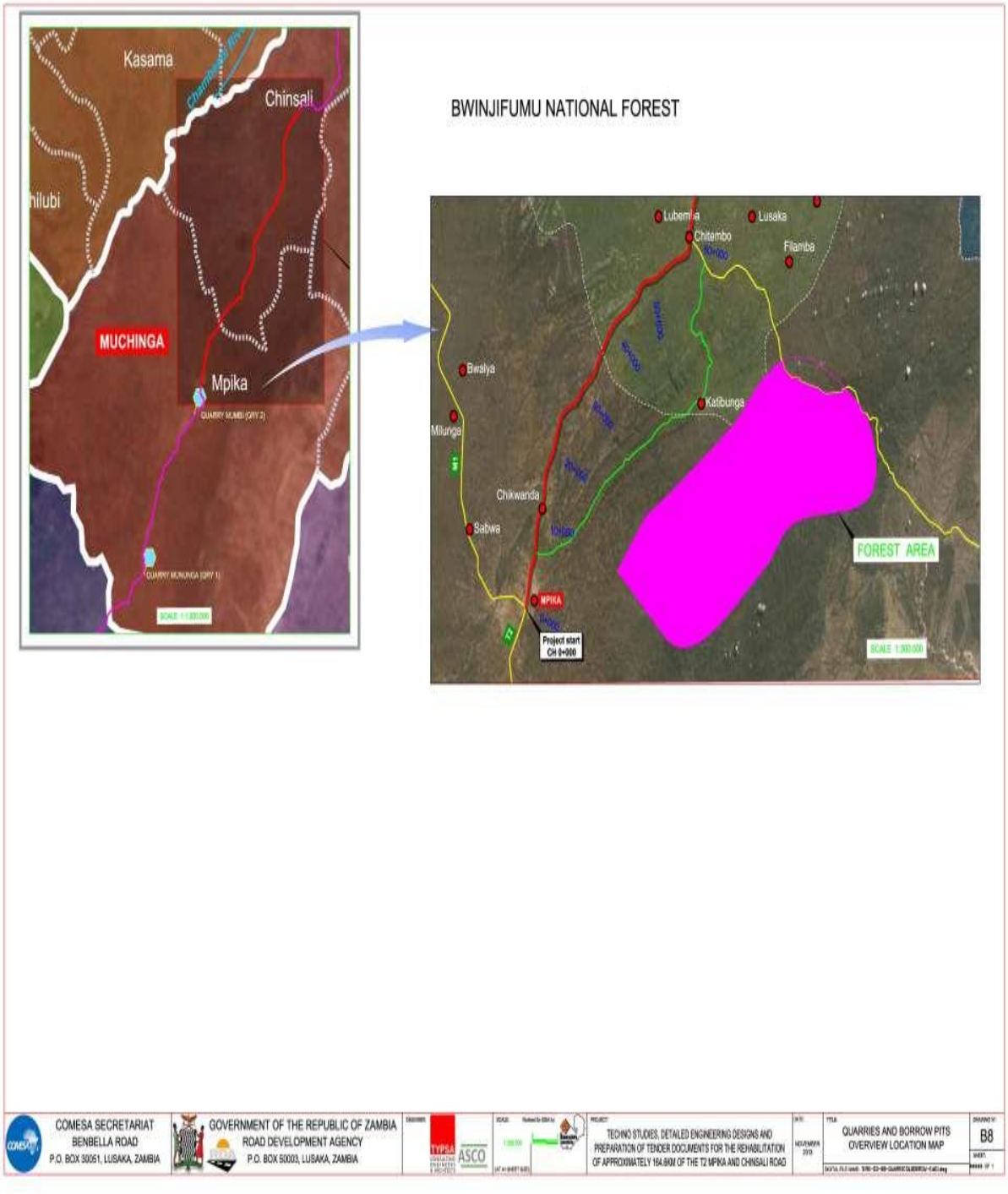
Overall the biological status along the project road corridor is that of a semi-natural habitats and is essentially been modified by human activities such as traditional agriculture on which majority of the people depend on for their livelihood.

Baseline information presented in this section of the report has been gathered through literature review, consultation with the local communities and field surveys.

6.2.2. Vegetation Types and Protected Ecosystems

Majority of the land along the project road corridor from Mpika to Chinsali are predominantly an agricultural system, with patches of shrubs and miniaturize tress distributed along the length the road. The present use of the land area will explain why the existing ecosystems are characterized by relatively "low" to "very low" diversity of species and impaired rates of ecological functioning due to severe human interventions and disruptions due to several various farming activities. The proposed road project corridor and its surrounding areas represent a region of "low" ecological significance or importance in terms species diversity.

It must be noticed that the project road is close to the project road. This forest is an important national forest as most of the streams have their sources in this catchment area. However, the national forest is highly encroached (estimated at 40%) and the whole length of the project road located in the forest is heavily disturbed by human activities.


Kasama
Chinsali
MUCHINGA
Mpika
BWINJIFUMU NATIONAL FOREST
Lubemba
Lusaka
Chitambo
Filamba
Bwalya
Katibunga
Milunga
Chikwanda
Sabwa
MPIKA
Project start
CH 0+000
FOREST AREA
COMESA SECRETARIAT
BENBELLA ROAD
P.O. BOX 30051, LUSAKA, ZAMBIA
GOVERNMENT OF THE REPUBLIC OF ZAMBIA
ROAD DEVELOPMENT AGENCY
P.O. BOX 50003, LUSAKA, ZAMBIA
TECHNO STUDIES, DETAILED ENGINEERING DESIGNS AND PREPARATION OF TENDER DOCUMENTS FOR THE REHABILITATION OF APPROXIMATELY 164.8KM OF THE T2 MPIKA AND CHINSALI ROAD
QUARRIES AND BORROW PITS OVERVIEW LOCATION MAP
B8

The project road corridor from Mpika to Chinsali falls within the ecoregion known as the Central Zambezian Miombo Woodland. It is one of the largest ecoregions in Africa, ranging from Angola up to the southern shores of Lake Victoria.

The road corridor is therefore dominated by trees of the subfamily Caesalpinioideae, particularly species belonging to the general *Brachystegia, Julbernardia, and Isoberlinia*, which seldom occur outside Miombo. In this ecoregion, mature miombo woodland trees are usually 15 to 20m tall, with a broadleaf shrub and grass understory beneath. Although trees in this area are primarily deciduous, this area has a much higher proportion of evergreen trees than drier Zambezian miombo.

Species along project road corridor includes nearly all the miombo dominants, such as *Brachystegia floribunda, B. glaberrima, B. taxifolia, B. wangermeeana, Marquesia macroura, Julbernadia globiflora, J. paniculata*, and *Isoberlinia angolensis*.

Analysis of the ecological surveys conducted along project road corridor from Mpika to Chinsali resulted in the identification of four major vegetation units.

The following vegetation units were identified:

1. Isoberlina angolensis Hill Miombo woodland
2. Isoberlina angolensis – Uapaca kirkiana eastern footslopes and undulating plains
3. Open Brachystegia boehmii woodland on deep sandy-loam soils
4. Closed Miombo Forest associated with ravines

6.2.2.1. Isoberlina angolensis hill miombo woodland

This vegetation mainly occurs on the part of the moderately steep hills, outcrops and ridges occurring between Chikwanda and danger hill areas. Common tall trees are mostly *Brachystegia longifolia, B. spiciformis, B. wangermeeana, Isoberlinia angolensis* and *Julbernardia paniculata*. Small trees are occasional at best as seen in photograph 2. Shrubs are chiefly *Acrocephalus rupestris,Schistostephium artemisiifolium* and *Uapaca pilosa.* Subshrubs are mainly *Aloe chabaudii, Sphenostylis marginata, Strobilanthopsis linifolia* and *Vellozia equisetoides*.

Figure 6-20 shows typical hill miombo woodlands occurring in some sections of the project road corridor.

Figure 6-20: Hills Miombo Woodland in the wet season (February 2016)

6.2.2.2. Isoberlina angolensis – Uapaca kirkiana footslopes and undulating plains

This vegetation unit occurs on the slightly undulating footslopes and valleys surrounding the hill miombo woodland along project road corridor. Along the project road corridor, this type of vegetation is mainly found around Mukungwa area. The woody layer forms dense, tall woodland with a more prominent shrub layer compared to the hill miombo woodland. Common tall trees include *Brachystegia boehmii, B. floribunda, B. longifolia, B. spiciformis, B. wangermeeana, Erythrophleum africanum, Isoberlinia angolensis, Julbernardia paniculata and, locally, Marquesia macroura.* Small trees are chiefly *Bauhinia petersiana, Dalbergiella nyasae, Diplorhynchus condylocarpon, Pseudolachnostylis maprouneifolia, Syzygium guineense subsp. macrocarpum, Uapaca kirkiana and U. nitida. Common shrubs include Baphia massaiensis subsp. obovata (on sandy soils), Hymenocardia acida, Kotschya strobilantha, Protea angolensis, Tricalysia angolensis and Uapaca pilosa.*

The herbaceous layer forms dense, tall stands of Hyparrhenia bracteata and medium tall Themeda triandra in areas where veld fires have impacted on the grass layer. The substrate varies from being shallow and gravelly soils to deep, sandy soils. Soils in general have a low water holding capacity due to the low clay content and high permeability.

Isolated termitaria bushclumps occur in this vegetation unit. These miombo termitaria are characterized by *Albizia amara, Boscia angustifolia, Cassine aethiopica, Combretum molle, Commiphora mollis, Erythrina absyssinica, Euphorbia candelabrum and Ziziphus mucronata in their upper storey.*

6.2.2.3. Open Brachystegia boehmii woodland on deep sandy-loam soils

This vegetation unit occurs on slightly undulating to flat plains along the western section of the study area as indicated in the vegetation map. The woody layer is characterised by open tall woodland dominated by Brachystegia boehmii trees. 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 this type of 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.

Smaller tree species such as Terminalia and Combretum species are more prominent in the woody layer. Typical woody species occurring on the sandy loam arenosol soil type of these woodlands other than Brachystegia boehmii include RDAcopsis angolensis, Pterocarpus angolensis and Combretum adenognoium.

The sandy soils within this plant community are somewhat leached due to the high rainfall (800 - 1000mm) and highly permeable soils, resulting in the specific species composition and open habitat type. Some isolated termitaria bushclumps occur in the more clayey patches. The grass layer is dominated by tall grass species such as Hyparrhenia bracteata and Themeda triandra.

Traditionally, the project road section of the T2 from Mpika to Chinsali is mainly dominated by Bemba speaking people who traditionally have been practising the cut and bum method of cultivation locally known as "Chitemene". The problem is further made worse by charcoal burners, which is also very common along the project road corridor and especially between Matumbo and Chinsali section of the project road. This has led to the reduction in the number of other common tree species found in typical miombo woodlands such as Brachystegia spiciformis (Muputu), Brachystegia longifolia (Muombo), Brachystegia wangermeeana (Masamba), Brachystegia floribunda (Musompa), Julbernardia globiflora (Mpasa), Julbernardia paniculata, Parinari curatellifolia, Uapaca kirkiana (Masuku) Brachystegia and Isoberlina (umutobo). The other common species of miombo woodlands are basically of secondary generation.

Figure 6-21 shows typical open brachystegia boehmii woodland common along road corridor.

Figure 6-21: Open Brachystegia boehmii woodland along project road corridor

6.2.2.4. Closed Miombo Forest associated with ravines

Although minimally represented, the Riparian Forest type of vegetation is quite common along the project road corridor. This is especially true because the project area is a highly drained with numerous streams and rivers and flowing throughout the year. These rivers and streams are covered with Riparian Forests. Riparian vegetation is important for prevention of excessive evaporation, soil erosion, river bank stability, shelter for aquatic life (fish, crabs) and addition of oxygen and minerals.

There are numerous broad and very wet dambos, some riparian forests and thickets, brackenbriar and several patches of tall mushitu along some streams and rivers (Figure 11). *Combretum zehyeri* and *Cassipourea mollis* are species associated with dambo edges. Interestingly, there are also some small patches of *Afromontane* forest comprising trees such as *Croton, Macrostachys, Ficalhoa laurifolia, Olea capensis, Podocarpus latifolius* and *Polyscias fulva*.

Riparian forests support biodiversity in that they host many plant species which are beneficial to both human beings and wild animals. They also host many small mammals, birds and reptiles. They also provide building materials such as poles, timber and tying fibre.

Colonies of riparian palm known as ifibale (Raphia farinifera) are found along some streams and rivers and local people use it for making different types of basket ware and other types of handcrafts.

However, riverine riparian forests in the project area are threatened by human activities. People in the projects area are cutting down the forests to make gardens for vegetable and sugarcane growing as the soils have been found to be more fertile than the soils upland. This practice poses a serious threat to the very survival of the affected rivers and streams and the biodiversity which the riparian forests support.

Figure 6-22 shows typical closed miombo forest associated with ravines.

Figure 6-22: Typical closed Miombo Forest associated with ravines along project road

6.2.2.5. Endangered Species

The species found within the project road corridor occur abundantly to all the Miombo eco-region (Northern Region of Zambia) and as such, none of these species require conservation priority as they are neither endangered nor threatened or rare.

Table 6-7 below is a listing of species observed during onsite investigation along project road corridor.

Table 6-7: List of flora in along project road corridor)*2

No.	Scientific name	Common name in English/Local language	Family	Conservation status*1	Description of habitat
1	*Afzelia quanzensis*	Umusafwa	CAESALPINIACEAE	*(Not listed)*	Terrestrial
2	*Albizia antunesiana*	Musase	LEGUMINOSAE	*(Not listed)*	Terrestrial
3	*Amblygonocarpus andongensis*	Umunye	MIMOSACEAE	*(Not listed)*	Terrestrial
4	*Anisophyllea boehmii*	Umufungo	ANISOPHYLLEACEAE	*(Not listed)*	Terrestrial
5	*Bauhinia petersenia*	Umupo	FABACEAE	*(Not listed)*	Terrestrial
6	*Brachystegia boehmii*	Umusamba	LEGUMINOSAE CAESALPINIOIDEAE	*(Not listed)*	Terrestrial
7	*Brachystegia bussei*	Mwansamasaka	FABACEAE	*(Not listed)*	Terrestrial
8	*Brachystegia floribunda*	Kasabwa, Chifwanga	FABACEAE	*(Not listed)*	Terrestrial
9	*Brachystegia spiciformis*	Umuputu (Bean-pod tree)	BRACHYSTEGIA SPICIFORMIS	*(Not listed)*	Terrestrial
10	*Bridelia micrantha*	Umushiminwanongo/ Ubukuku	EUPHORBIACEAE	*(Not listed)*	Riverine
11	*Burkea africana*	Icipangala	LEGUMINOSAE	*(Not listed)*	Terrestrial
12	*Chrysophyllum magalismontanum*	Umusambya	SAPOTACEAE	*(Not listed)*	Riverine
13	*Combretum molle/Combretum celastroides*	Umontamfumu	COMBRETACEAE	*(Not listed)*	Terrestrial
14	*Cryptosepalum exfoliatum spp.pseudotaxus*	Umukuwe	DETARIEAE	*(Not listed)*	Terrestrial
15	*Dalbergia nitidula*	Akalongwe	PAPILLIONACEAE	*(Not listed)*	Terrestrial
16	*Diplorhynchus condylocarpon*	Umwenge	APOCYNACEAE	*(Not listed)*	Terrestrial
17	*Ekebergia benguelensis*	Mubundikwa	MELIACEAE	*(Not listed)*	Terrestrial
18	*Erythrina abyssinica*	Nachisungu	PAPILLIONACEAE	*(Not listed)*	Terrestrial
19	*Faurea spp*	Saninga	PROTEACEAE	*(Not listed)*	Terrestrial
20	*Isoberlinia angolensis*	Umutobo	LEGUMINOCEAE-CAESALPINIACEAE	*(Not listed)*	Terrestrial
21	*Julbernardia paniculata*	Mutondo	LEGUMINOCEAE	*(Not listed)*	Terrestrial
22	*Khaya nyasica*	Umululu	MELIACEAE	*(Not listed)*	Terrestrial
23	*Lannea spp*	Kabumbu	ANACARDIACEAE	*(Not listed)*	Terrestrial
24	*Monotes spp*	Chimpampa	DIPTEROCARPOIDEAE	*(Not listed)*	Terrestrial
25	*Oncoba spinosa*	Umusangwa	FLACOURTIACEAE	*(Not listed)*	Terrestrial
26	*Ozoroa reticulata*	Mabelemabele	ANACARDIACEAE	*(Not listed)*	Terrestrial
27	*Parinari curatellifolia*	Mupundu	CHRYSOBALANACEAE	*(Not listed)*	Terrestrial
28	*Protea cynaroides*	Shinsashinsa	PROTEACEAE	*(Not listed)*	Terrestrial
29	*Pseudolachnostylis maproneufolia*	Umusolo (Kudu berry)	EUPHORBIACEAE	*(Not listed)*	Terrestrial
30	*Pterocarpus angolensis*	Mukwa/Umubanga	FABACEAE	*(Not listed)*	Terrestrial
31	*Raphia farinifera*	Ifibale	ARECACEAE	*(Not listed)*	Riverine
32	*Rauvolfia caffra*	Umubimbi	APOCYNACEAE	*(Not listed)*	Terrestrial
33	*Steganotaenia araliacea*	Nakundachabusha/Umupeela	APIACEAE	*(Not listed)*	Riverine
34	*Strychnos spinosa*	Sansa	LOGANIACEAE	*(Not listed)*	Terrestrial
35	*Swartzia madagascariensis*	Umulundu	LEGUMINOSAE-PAPILIONOIDEAE	*(Not listed)*	Terrestrial
36	*Syzygium cordatum*	Umukute	MYRTACEAE	*(Not listed)*	Riverine
37	*Uapaca kirkiana*	Umusuku	EUPHORBIACEA	*(Not listed)*	Terrestrial
38	*Uapaca sansibarica/nitida*	Musokolobe	EUPHORBIACEA	*(Not listed)*	Terrestrial
39	*Videx doniana*	Akafifi	LABIATAE	*(Not listed)*	Terrestrial

6.2.3. Fauna and Protected Ecosystems

The network of Zambia's statutory protected areas is composed of 20 National Parks (NPs) covering 63,630 km², 36 Game Management Areas (GMAs) covering about 167,557 km² and 490 Forest Reserves (FRs) covering 74361 km².

The T2 road from Mpika to Chinsali Road corridor has no National Park (NP) or Game Management Area (GMA). The closest protected area to the project corridor is the North Luangwa National Park, and the closest point of the national park to the project road is located about 50Km east of the road at Luanya.

Some members of the local communities believe that there could be some migratory corridors traversing certain areas of the road to allow for the migration of animals but this information is speculative as officers from the Wildlife Department in Mpika disputed the existence of such corridors because of the large number of settlements in the area which have deprived fauna of its natural habitat.

The project road corridor from Mpika to Chinsali has been affected by clearing of woodlands to create farmland and settlements. These activities coupled with increased human presence, have led to:

- Increased poaching activities within the area;
- Fragmentation of wildlife habitats through unplanned land clearing, affecting animal movements;
- Loss of breeding and sheltering sites especially for avian species; and
- Destruction of woodland habitats by use of late fires for hunting and shifting cultivation by local people.

Illegal hunting is considered by the local people who were interviewed to be the main cause of wildlife depletion along the project road corridor.

6.2.3.1. 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 EIA 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.

However, small species of animals of no economic importance such as rabbit (*Poelagus marjorita*) are occasionally spotted. Also reported are some reptiles e.g the green mamba (*Dendroaspis angusticeps*), and soil micro-invertebrates belonging the Phyla Annelida, Mollusca and Arthropoda families are common place.

Table 6-8: 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
9	Chibundi	Honey badger	Mellivora capensis	Common	Least Concern

6.2.3.2. Bird species diversity

Zambia is known to have around 757 species of birds as of June 2013; this is a comparatively rich measure of avifauna for a landlocked country dominated by a single biome. Leonard, (2005) documents proof that at least 470, of the 757 bird species, breed in Zambia. In addition to that, well over 600 of the species are resident or Afrotropical migrants. Furthermore, about 100 are non-breeding migrants or vagrants from the Palearctic region and the remainder comprise nonbreeding Afrotropical migrants and vagrants.

Out of 757 species, 15 are listed as either endangered, vulnerable or near threatened on the IUCN red list as of 2014, which indicates an increase from 13 in 2010. The majority of these are raptors, viz. vultures. Of the fifteen listed species four are endangered, ten are vulnerable and one is near threatened[10]. Table 6-9 below shows the listed species found in Zambia.

[10] *Ministry of Lands Natural Resources and Environmental Protection; United Nations Convention on Biological Diversity-Fifth National Report*

Table 6-9: Listed Birds species found in Zambia

Common Name	Scientific Name	Status
Grey-crowned Crane	*Balearica regulorum*	Endangered
Ruppell's Vulture	*Gyps rueppelli*	Endangered
Hooded Vulture	*Necrosyrtes monachus*	Endangered
White-backed Vulture	*Gyps africanus*	Endangered
Zambian Barbet	*Lybius chaplini*	Vulnerable
Wattled Crane	*Bugeranus carunculatus*	Vulnerable
Slaty Egret	*Egretta vinaceigula*	Vulnerable
Taita Falcon	*Falco fasciinucha*	Vulnerable
Black-cheeked Lovebird	*Agapornis nigrigenis*	Vulnerable
Shoebill	*Balaeniceps rex*	Vulnerable
Blue Swallow	*Hirundo atrocaerulea*	Vulnerable
White-headed Vulture	*Trigonoceps occipitalis*	Vulnerable
Cape Vulture	*Gyps coprotheres*	Vulnerable
Lappet-faced Vulture	*Torgos tracheliotos*	Vulnerable
Lesser Flamingo	*Phoeniconaias minor*	Near Threatened

Source: Ministry of Lands Natural Resources and Environmental Protection; United Nations Convention on Biological Diversity-Fifth National Report

Along the T2 project road from Mpika to Chinsali, birds were intensively searched for by walking along meandering transects in selected areas of the project road corridor at Danger hill, Mukungwa and Kanakashi areas. The bird surveys were searched through actual visual sightings of the different bird species whilst walking through and linking different types of feathers picked to the type of bird species associated to the feather. Mixed foraging parties of birds were followed until the full species composition of each group had been ascertained. All species both seen and heard within an estimated 100m radius of the observer were recorded, using Swarovski 10 x 42 EL binoculars and a Sanyo Microcassette Recorder species of birds seen or heard were recorded. The information was captured and marked in the data sheet indicating the presence or absence of a particular bird species. Figure below shows a bird sited along the project road within the selected areas of the project road corridor at Danger hill, Mukungwa and Kanakashi areas.

During the short faunal survey 76 species were recorded, including most of the common resident species. Characteristic miombo woodland birds present included *Guinea fowl (Numida melegris), francolin (Francolinus swainsonii), Fish eagle (Heliaeetus vocifer), Kingfisher (Alcedo cristata), Crow (Corvus albus), Sunbirds (Nectarinia amethystine and loveridgei), Pygmy Kingfisher (Ispidina picta), Swallow (Hirundo albigularis), Canary (Serinus canicollis), Hornbill (Tockus hemprichii), Blackeyed bulbul (Pyconotus barbatus), Black-collared barbet (Lybius torquatus), Starling (Onychognathus morio), Wagtail (Motacilla clara and maguimp), Three-streaked tchagra (Tchagra jamesi), Coucal (Centropus senegalensis) , Emerald-spotted wood dove (Turtur chalcospilos), Shrike (Prionops plumata), Purple grenadier (Uraeginthus ianthinogaster), Red-eyed dove (Streptopelia semitorquata), Ring-necked dove (Streptopelia capicola), Blue capped cordon-bleu (Uraeginthus cyanocephalus,) Nubian nightjars (Caprimulgus nubicus), and little Sparrow hawk (Accipter minullus).*

The absence along the project road corridor of many bird species that have been recorded from the Northern region of Zambia is due, in part, to the shortness of the survey Period. However, others may be absent from the project road corridor because of the lack of suitable habitat, or were seasonally absent.

Certain guilds of birds, common in uninhabited regions, were absent or very rare in the study area. These included reedbed-nesting passerines (many weavers, bishops, etc), game birds (francolin, spurfowl, quail, etc), storks, plovers and waterfowl, etc. Their absence is best explained by a long history of subsistence hunting targeting larger birds for food. Due to their conspicuous nests and communal breeding, weavers are easily extirpated by overharvesting of eggs and fledglings by rural communities. In addition, increased fire regimes when hunting cane rats or preparing grazing for cattle can also lead to local extinctions of bird roosting and breeding sites.

Figure__ shows common birds seen along project road corridor.

Figure 6-23:Typical Birds common within the project road corridor

6.2.3.2.1. Birds of Special Concern

Relatively few threatened birds are found in the study region, and include:

- Wattled Crane Bugeranus carunculatus VU
- Corn Crake Crex NT
- Great Snipe Gallinago media NT
- Grimwood's Longclaw Macronyx grimwoodi DD

None of these species were observed along the project road corridor greater region during the faunal survey. Moreover, suitable habitats for Wattled Crane and Grimwood's Longclaw are absent along road corridor, although dambos and grasslands may be used for short-term movements between more suitable habitats.

No birds are strictly endemic to the study road corridor.

No	Common Name	Scientific Name	Family Name	Recorded During Fieldwork	Notes
1	African Fish Eagle	Haliaaetus vocifer	Accipitiridae	X	Anecdotal record
2	African Golden Oriole	Oriolus auratus	Oriolidae	X	Visual
3	African Hawk Eagle	Hieraaetus spilogaster	Accipitiridae	X	Recorded by sound
5	African Masked Weaver	Ploceus velatus	Ploceidae	X	Visual
6	African Mourning Dove	Streptopelia decipiens	Columbidae	X	Recorded by sound
7	African Red-winged Starling	Onychognathus morio	Sturnidae	X	Visual
8	African Scops Owl	Otus senegalensis	Strigidae	X	Sound
9	Arnot's Chat	Myrmecocichla arnoti	Turdidae	X	Anecdotal record
10	Arrow-marked Babbler	Turdoides jardineii	Timaliidae	X	Recorded by sound
11	Barn Owl	Tyto alba	Tytinidae	X	Anecdotal record
12	Bat Hawk	Macheiramphus alcinus	Accipitiridae	X	Sighted
13	Bateleur	Terathopius ecaudatus	Accipitiridae	X	Anecdotal record
14	Bearded Woodpecker	Thripias namaquus	Picidae	X	Visual
15	Black-bellied Seed-cracker	Pyrenestes ostrinus	Estrildidae	X	Visual
16	Black-breasted Snake Eagle	Circaetus pectoralis	Accipitiridae	X	Visual
17	Black-collared Barbet	Lybius torquatus	Lybiidae	X	Recorded by sound
18	Black-crowned Tchagra	Tchagra senegalus	Malaconotidae	X	Visual
19	Black-eyed (Common) Bulbul	Pycnonotus barbatus	Pycononotidae	X	Anecdotal record
20	Bronze Mannikin	Spermestes cucullata	Estrildidae	X	Visual
21	Brown Snake Eagle	Circaetus cinereus	Accipitiridae	X	Anecdotal record
22	Bully (Brimstone) Canary	Serinus sulphuratus	Fringillidae	X	Visual
23	Cape Turtle Dove	Streptopelia capicola	Columbidae	X	Visual
24	Cardinal Woodpecker	Dendropicos fuscescens	Picidae	X	Visual

No	Common Name	Scientific Name	Family Name	Recorded During Fieldwork	Notes
25	Cattle Egret	Bubulcus ibis	Ardeidae	X	Sighted
26	Chinspot Batis	Batis molitor	Platysteiridae	X	Recorded by sound
27	Cinnamon (Lemon) Dove	Aplopelia larvata	Columbidae	X	Visual
28	Collared Sunbird	Anthreptes collaris	Nectariniidae	X	Visual
29	Dickinson's Kestrel	Falco dickinsoni	Falconidae	X	Visual
30	Double-banded Sandgrouse	Pterocles bicinctus		X	Anecdotal record
31	Dusky Indigobird	Vidua purpurascens	Estrildidae	X	Visual
32	Emerald-spotted Wood Dove	Turtur chalcospilos	Columbidae	X	Visual
33	Fiery-necked Nightjar	Caprimulgus pectoralis	Strigidae	X	Recorded by sound
34	Fiscal Shrike	Lanius collaris	Malaconotidae	X	Visual
35	Fork-tailed Drongo	Dicrurus adsimilis	Dicruridae	X	Visual
36	Greater Blue-eared Starling	Lamprotornis chalybaeus	Sturnidae	X	Visual
37	Green Indigobird	Vidua codringtoni	Estrildidae	X	Visual
38	Green-Backe Heron	Butorides striata	Ardeidae	X	Anecdotal record
39	Grey Lourie	Corythaixoides concolor	Musiphagidae	X	Visual
40	Grey-headed Bush Shrike	Malaconotus blanchoti	Laniidae	X	Visual
41	Half-collared kingfisher	Alcedo semitorquata	Alcedinidae	X	Recorded by sound
42	Hamerkop	Scopus umbretta	Scopidae	X	Visual
43	Hoopoe	Upupa epops	Upupidae	X	Recorded by sound
44	House Martin	Delichon urbicum	Hirundinidae	X	Visual
45	House Sparrow	Passer domesticus	Ploceidae	X	Visual
46	Jameson's Firefinch	Lagonosticta rhodopareia	Estrildidae	X	Anecdotal record
47	Little Bee-eater	Merops pusillus	Meropidae	X	Anecdotal record
48	Little Spotted Woodpecker	Campethera cailliautii	Picidae	X	Visual
49	Little Swift	Apus affinis	Apodidae	X	Visual

No	Common Name	Scientific Name	Family Name	Recorded During Fieldwork	Notes
50	Long-tailed (Mountain) Wagtail	Motacilla clara	Motacillidae	X	Anecdotal record
51	Miombo Double-collared Sunbird	Cinnyris manoensis	Nectariniidae	X	Anecdotal record
52	Miombo Pied Barbet	Tricholaema frontata	Lybiidae	X	Visual
53	Miombo Rock Thrush	Monticola angolensis	Turdidae	X	Visual
54	Miombo Scrub-Robin	Cercotrichas barbata	Turdidae	X	Recorded by sound
55	Namaqua Dove	Oena capensis	Columbidae	X	Visual
56	Northern Grey-headed Sparrow	Passer griseus	Ploceidae	X	Anecdotal record
57	Racket-tailed Roller	Coracias spatulata	Coraciidae	X	Anecdotal record
58	Red-backed Shrike	Lanius collurio	Malaconotidae	X	Visual
59	Red-billed Firefinch	Lagonosticta senegala	Estrildidae	X	Visual
60	Red-billed Oxpecker	Buphagus erythrorhynchus	-	X	Vulnerable
61	Red-eyed Dove	Streptopelia semitorquata	Columbidae	X	Visual
62	Red-faced Mousebird	Urocolius indicus	Collidae	X	Visual
63	Shikra (Little Banded Goshawk)	Accipiter badius	Accipitiridae	X	Recorded by sound
64	Southern Grey-headed Sparrow	Passer diffusus	Ploceidae	X	Visual
65	Southern Puffback	Dryoscopus cubla	Malaconotidae	X	Visual
67	Spectacled Weaver	Ploceus ocularis	Ploceidae	X	Visual
68	Tree Pipit	Anthus trivialis	Motacillidae	X	Recorded by sound
69	Trumpeter Hornbill	Bycanistes bucinator	Bucerotidae	X	Recorded by sound
70	Village Indigobird	Vidua chalybeata	Estrildidae	X	Visual
71	Wattled Starling	Creatophora cinerea	Sturnidae	X	Visual
72	White-necked Raven	Corvus albicollis	Corvidae	X	Visual
73	Woodland Kingfisher	Halcyon senegalensis	Alcedinidae	X	Visual

6.2.3.3. Amphibians; Reptiles and Insects

The topography of the project road corridor area provides for the formation of a wide variety of habitats. Time of study was not sufficient to cover all the habitats; river systems, grasslands and woodlands as all these 'house' snakes, lizards, Skinks, Chameleons, Tortoises and frogs of different species; in varying numbers in different seasons and habitats

1. **Amphibians**

   The diversity of Amphibians (frogs and toads) in Zambia is estimated at 74 species and there is no discernible geographical gradient in species richness. A total of 13 species are rare having been recorded in one locality only. For example, the Northern part of Zambia, it is only the Nyika dwarf toad (Bufo nyikae) which is considered a vulnerable specie due to its restricted range, in Nyika plateau and this area is not close to the project area.

   The search for amphibian species along project road corridor was searched through actual visual sightings. At certain points shells of a millipede and snail were observed during field work as seen earlier. Ten (10) other amphibian species were recorded along project road corridor based on the field work, anecdotal record and interviews as shown in Table 6-10 below.

Table 6-10: Typical Amphimbians common within project road corridor

Common Name	Scientific Name	Family	Recorded During Field Work	Notes
Bubbling Kassina	Kassina senegalensis	Hyperoliidae	X	Anecdotal record
Cinnamon Tree Frog	Leptopelis cynnamomeus	Hyperoliidae	X	Captured
Clawed Frog	Xenopu laevis petersii		X	Anecdotal record
Dwarf Puddle Frog	Phrynobatrachus parvulus	Ranidae	X	Visual
Grey Tree Frog	Chiromantis xerampelina	Hyperoliidae	X	Anecdotal record
Power"s Rain Frog	Breviceps poweri	Microhylidae	X	Anecdotal record
Puddle Frog	Phrynobatrachus natalensis	Ranidae	X	Visual
Ringed Frog	Ptychadema oxyrhynclus		X	Anecdotal record
Square-Marked Toad	-	-	X	Anecdotal record
Square-Tailed Toad	Bufo gutturalis	Bufonidae	X	Visual

2. **Reptiles**

   The diversity of reptiles (lizards, snakes and tortoises) in Zambia is estimated at 156 species. A total of 45 species are considered rare because they have been recorded in only one locality.

   A search for the types of reptile species within the project road corridor was conducted through actual visual sightings, signs of marks of their movements on the ground, literature review, interviews and anecdotal record information. The information was captured and marked in the

data sheet indicating the presence or absence of a particular reptile specie. The field sampling technique used for reptiles is illustrated below.

Tracks of snakes were observed across paths and snakes common to the area were cited during interviews with local people. *Cobras (Naja spp.), Spitting cobra (Naja nigricollis), and Blind snake (Typhlops schlegelii mucruso), Mambas (Dendroaspis spp.), Vipers (Bitis spp.), Adders (Causus spp.), Booslangs (Dispholidus spp.) and the African python (Python sebae natalensis)* were cited during interviews as common snakes in the project area. During the survey, *savannah Monitor, House Gecko, Striped Skink and Chameleon (Chamaeleo dilepis dilepis)* were seen. Reptiles reported to be common in the project road corridor include *Rainbow skink (Mabuya qumquetaeniata margaritifer), Striped skink (Mabuya striata wahlbergii), Bibron's gecko (Pachydactylus bibronii), House Gecko (Hemidactylus mabonia mabonia), Black line plated lizard (Gerrhosaurus nigrolineatus), Monitor lizard (Vavanus niloticus niloticus and Vavanus exanthematicus albigularis) and the Common Lizard*.

Two types of tortoises were reported to be in the area: Leopards tortoise (Geochelone pardalis babcocki) and the Bell hinged (Kiniys belliana spekii).

Table 6-11:Typical reptiles common within project road corridor

Scientific Name	Common name	Family	*Conservation Status*	Description of habitat
Varanus albugularis	Monitor lizards	VARANIDAE	*(Not listed)*	
Naja anchietae	Cape Cobra	ELAPIDAE	*(Not listed)*	Underground burrows
Bitis arietans	African puff Adder	VIRDADAE	VU	Underground burrows
Python sebae	Python	ELAPIODAE	*(Not listed)*	Underground burrows
Dendroaspis polylepis	Black mamba	ELAPIODAE	*(Not listed)*	Terrestrial/burrows
Lamprophis inornatus	African house snake	Colubridae	*(Not listed)*	Underground burrows/crevices
Lamprophis inornatus	African house snake	Colubridae	*(Not listed)*	Underground burrows/crevices
Python sebae	Python	ELAPIODAE	*(Not listed)*	Underground burrows
Typhlops schlegelii mucruso	*Blind snake*	ELAPIODAE	*(Not listed)*	Terrestrial/burrows
Mabuya qumquetaeniata margaritifer	*Rainbow skink*	ELAPIODAE	*(Not listed)*	

6.3. CULTURAL ENVIRONMENT

The study for cultural and heritage 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.

6.3.1. Cultural Heritage

According to the National Heritage Conservation Commission11 in Kasama, other than anthropological features, all the forms of cultural heritage are not known to exist along the road corridor. This section of the report therefore only focuses on Anthropological heritage (i.e. traditional ceremonies and cemeteries).

6.3.1.1. Traditional Ceremonies

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 Bemba and the Bisa People under three traditional chiefs (i.e. Chief Chikwanda, Chief Mukwikile and Chief Chibesa Kunda).

Historically, the two major tribes along the project road corridor (Bembas and Bisas) are basically one and the same people and both migrated at the same time from Kola Kingdom as one group, but as they moved into Northern Province, differences emerged over mushrooms. As a result of these differences, the Bisa people migrated to areas which had a lot of animals and fish while the Bemba moved to uplands12.

Today all the Bisa people including those found along the road corridor under Chief Chibesa Kunda celebrate a ceremony called "Ichinama nongo" which is meant to showcase the reasons why their forefathers moved into areas they currently occupy. Each year, the Bisa people are allowed to kill some animals from protected areas mainly from the Bangweulu plain, which they prepare in a traditional pot known as "inongo". The "Ichinama nongo" therefore is basically meant to

[11] Personal Interviews with Mr. Lishiko-Director
[12] Imilandu Sha Ba Bemba,

commemorate the "good" old days when animals were in abundance in their territories. This ceremony takes place at Senior Chief Kopa's palace in Mpika District.

For the Bemba people along the road corridor under Chief Chikwanda and Chief Mukwikile, the "Kusefya Pa'gwena" Ceremony of Paramount Chief Chitimukulu is their traditional ceremony. The "Kusefya Pa'gwena is meant to show case the migration of the Bemba people from Kola to Mungwi in Northern Province.

According to the oral tradition of the Bemba court recalls a migration of chiefs from the country of the Luba (Kola). The king of Kola, Mukulumpe, married a woman who belonged to the Crocodile Clan (Abena Ngandu) and had ears like an elephant. She had three sons—Katongo, Chiti, and Nkole—and a daughter, Chilufya.

According to the elders consulted along project road corridor, Katongo, Mukulumpe's eldest son enticed villagers during a drinking spree that they need to fortify their village in order to thwart enemies' attacks. This fortification was a failure and killed a lot of people. The move angered Mukulumpe, a fierce ruler who ordered that Katongo's eyes be plucked out as punishment for his miscalculation action. Mukulumpe as a way of exerting his authority and instilling fear in his irate sons also tried to kill his two other sons Chiti and Nkole but failed because their blind brother Katongo warned them using a small drum called Umondo or talking drum.

Nkole and his younger brother Chiti fled from their father, taking with them their sister Chilufya Mulenga and were joined by their half-brothers Chimba, Kapasa and Kazembe and trekked for many years from the Luba Kingdom to save their lives from the wrath of their father. Along the way, their only sister was made pregnant by Kapasa of the Bulombwa area and gave birth to a son who was named after her mother.

Upon the death of Chiti Muluba and Nkole after an encounter and eventual fight with Mwase, a Ngoni chief, Chilufya Mulenga's son succeeded both his uncles and named himself Chiti Mukulu Chilufya Cha Mata Yabili. It was Chiti Mukulu Chilufya who established Ng'wena Villiage at the confluence of Kalungu wa Lubemba and Milando Rivers.

The decision to settle at the site was arrived at after two of the chief's counsellors; Kayayi and Kabwe found a dead crocodile on the banks of the river and believed that it was a message from ancestors that the Bembas should not keep wandering about. Katongo, Nkole, Chiti and Chilufya Mulenga's mother Mumbi 'Lyulu' Mukasa were the entire crocodile totem. This, therefore, means the Bembas are from the Crocodile clan and the finding of the dead crocodile was strongly believed as a message from their ancestors.

Other than show casing the might migration of the Bemba people from Kola to Mungwi in Northern Province, the "Kusefya Pa'gwena" ceremony is also used as time for the paramount chief

and other chiefs of the province paying homage to ancestral shrines. Once at the shrines, Chief Chitimukulu in the company of other Bemba chiefs pray to the spirits of ancestors for protection, peace and good rains which ensure a good yield. In all, there are 37 shrines in the whole of Ulubemba created by previous Bemba chiefs long dead. The shrines are where the dead chiefs had their houses and the place where embalming of a dead chief was done.

Paying homage to ancestral spirits is an important aspect of the Bemba tradition. It is actually believed that the practice is responsible for the peace and good rains the province is enjoying, resulting in sufficient food for the people. This belief is supported by the fact that there used to be widespread hunger and droughts in the Bemba land, which are no longer experienced right from the time that traditionalists started paying homage to the spirits of their ancestors.

The ceremony is characterised by songs and dances in praise of the chief who brought them this far, with both women and men performing their distinctive Bemba dances.

6.3.1.2. Burial Sites

Another aspect of cultural heritage which is still practised along the road corridor is the respect accorded to burial sites. These are considered as protected areas, as no cutting of trees can take place, apart from when burying the dead. These sites are kept forested and many of these are seen along the road sides.

6.4. HUMAN ENVIRONMENT

6.4.1. Study Goals and Objectives

The goal of this study is to identify the social impacts, risks and opportunities of the proposed road rehabilitation of the T2 Road from Mpika to Chinsali and to help avoid, minimize and where residual impacts remain, to compensate/offset for risks and impacts to workers and affected communities.

The study provides a strategic analysis of the local social assets envisaged by the construction and operation of the road project. This will become the framework for making recommendations regarding optimization and mitigation of the predicted impacts.

Subsequently, the SIA study's objectives are:

- To develop a socio-economic profile characterizing the project road corridor from Mpika to Chinsali;
- To ensure the rehabilitation of the road and enforcement of the road reserves for the project road fosters full respect for the human rights, dignity, aspirations, cultural and natural resource-based livelihoods of the indigenous people along the project road corridor;
- To define and analyze the potential socio-economic impacts on the communities located along the project road corridor from Mpika-Chinsali;
- To collect the views of the communities along project road corridor on the project and to integrate their contributions into the design and implementation of the project; and
- To recommend possible mitigation measures for adverse socio-economic impacts.

6.4.2. Administrative Set Up

The T2 project road from Mpika to Chinsali is located in Muchinga Province. It traverses through three districts namely Mpika, Shiwang'ndu and Chinsali. Administration setup along the project road corridor is similar to the other districts in the country and is divided into political and traditional administration.

6.4.2.1. Political System and Governance

Political governance of the districts connected by the project road, and indeed the road corridor, is that areas are divided into constituencies and wards. Thus, the ward is the lowest political administration.

The T2 project road from Mpika to Chinsali cuts across three constituencies namely (i) Mpika Central; (ii) Shiwang'andu and (iii) Chinsali. The political wards through which the project road traverses include Lwitikila; Mukungwa, Muchinga, Mukumbi, Chandaula and Munwakabili. The people in these constituencies and wards are represented by members of parliament and ward councillor respectively.

The office of the District Commissioner (DC) in each of the three districts the district is charged with the responsibility of coordinating government activities at district level. This office provides government leadership at district level. In carrying out district activities, the District Commissioner does this in consultation with the council secretary who is the Chief Executive Officer of the Council and charged with the responsibility of providing services in the district.

Given the fact that settlements within the project area of influence is mainly along the road project, the wards traversed by the Mpika to Chinsali will be the ones to fall within project direct impacts.

6.4.2.2. Traditional System and Governance

In terms of traditional administration, the T2 road from Mpika to Chinsali cuts across three chiefdoms of Chief Chikwanda, Chief Mukwikile and Chief Chibesakunda. The functions of these Traditional Chiefs have been legalised and limited by the government, although they retain a certain degree of independence.

The main responsibilities of the chiefdoms/chieftaincies can be summed up as follows:

- To conserve natural resources for the benefit of present and future generations;
- To provide every subject with suitable land for building a home and farming;
- To allow every subject to utilise the specific natural resources according to laws, rules and regulations pertaining to utilisation of the specific natural resource;
- To distribute previously unallocated land to subjects who are short of land and to newcomers;
- To repossess all land which has been abandoned or for which family heirs cannot be traced;
- To make laws, rules and regulations;
- To prosecute people found to be contravening laws, rules and regulations; and
- To adjudicate land disputes and other related cases.

6.4.3. 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 Mpika 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 the three chiefs (i.e. Chief Chikwanda, Chief Mukwikile and Chief Chibesakunda) are responsible for land administration.

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 located along project road corridor gain access to land. Access to land is based on the important traditional principle that all residents of a particular 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 recognize 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.

Along the project road corridor however, none of the PAPs have titles or claimed to have stated the process of converting their plots from traditional to leasehold. Among the PAPs, there are only three properties which were on title in Mpika urban and the rest of the affected households have no titles to their lands.

6.4.4. Settlement Patterns, Culture and Tradition

6.4.4.1. Settlements and Settlement Patterns

The settlement pattern along the T2 road from Mpika to Chinsali is greatly influenced by livelihood systems and population growth dynamics. Overall however, the settlement pattern is linear along the T2 road. Other pull factors that have influence on settlement patterns along the road corridor include location of social institutions and streams.

6.4.4.2. Culture, Social and Tradition Practices

During the baseline studies, the following traditions and cultural practices were discussed with the PAPs along the project road corridor:

6.4.4.2.1. Spiritualism

During FGDs held at Luanya, it was explained that unlike the western political system, the social and political organization of the communities along project road corridor is based on spiritualism and probably this is not just the case for the project road corridor but is the case throughout much of the rural sections of Zambia.

It was further explained that the traditional political organization was based on spiritualism shrouded in secrecy because there was belief information should be released to people as and when they were ready for it. The reasoning was that information should not be released to a person all at

once, but only when they were ready for it as they reached each stage. This was why there are rituals at different stages of a human development from birth to death.

Under the current changed socio political setup, there is a problem with this philosophical foundation of spiritualism because the spiritual dimension now falls under the realm of fundamental rights, a concept that states that each person has right to choose their spiritual path.

As a result of this changed socio political scenario, it was clear from the discussion held along project road corridor that it has become difficult for spiritualism to continue playing a continuing unifying role as it used to be in the past.

6.4.4.2.2. Lineage

The Bemba and the Bisa people are the two major tribal grouping along project road corridor. However, Bemba language is mostly spoken throughout the road corridor. The culture of these two major tribes does not vary much and is highly influenced and governed by complex lineage system of matrilineal.

Matrilineal is a lineage system where succession is through the mother. It is usually based on agriculture. The mother figurehead of the Queen is associated with land, and the fertility of the womb to that of the soil. This system is justified on ground that there is no dispute regarding the relationship of the children since they all came from the same umbilical cord, and they all fed from the same breast. Thus women are regarded as the foundation of the traditional matrilineal political system.

Another aspect of interest is that in this type of lineage the man used to move to the woman's village in a marriage and the children are considered to be woman's, while the uncle was regarded as the social father to the children and took responsibility of looking after them.

During the FGD, it was recognized that the foregoing practices were waning due to the alternative of Christianity and western democracy. However, there is still a strong community bond running in the communities along project corridor based purely on the matrilineal principles.

6.4.4.2.3. Marriage

Another traditional concept discussed with the PAPs was marriage. Along project road corridor, marriage is the basis of a family, the smallest unity of society. Great importance therefore is attached to the processes that lead to the constitution of marriage. Along project road corridor and indeed in much of Zambian society, a family is not just spouses and their children, but included brothers, sisters, cousins, aunties, uncles, nephews, nieces, their spouses and children, parents, grandparents and great grandparents, if still living.

During the FGD, it was established that communities along project road corridor do not have a specific age for marriage in their customary laws. Puberty is the determining factor for a girl to marry, with some household allowing a little longer time after a girl becomes of age.

It is clear that this custom is a source of concern because it has resulted in legalizing child marriages. This customary practice has created conflict between the written law and customary law because the former prescribes the minimum age of marriage as 16 years. Any carnal knowledge of a girl under the age of 14 years is defilement that makes the offender liable to life imprisonment, at least on the statute book. Under the penal code, marriage to a girl under age is a criminal offence.

It was also observed along project road corridor that while there has been some flexibility in the adaption of the confinement tradition to accommodate school going for girl child, this however has not been the case regarding marriage and the evidence along project road corridor tend to show that this custom is being used disrupt the girl child's education especially in the context of poverty and the payment of lobola.

The custom with a boy is slightly different in that although there is no definite age for marriage; consideration is given to the boy's maturity to undertake marriage responsibility. What is interesting is that while there a test for young man's ability to carry out marriage responsibility, such similar test appears vague for girls and the key informants interviewed from the health sector pointed out that a similar objective test relating to the girl's ability to, especially bear children at attender age should have been similarly adopted. According to the Care Givers13 interviewed, the biological test of puberty is no longer appropriate for girls because puberty now days come too early for girls compared to old days. Girls tend to reach this stage as early as 12 years compared to olden days when girls would reach puberty much later around 17 or 18 years. This means that the continued use of biological test (puberty) for girls to be given into marriage only works to disrupt the girl child education too early.

Another important aspect of marriage along the project road corridor is that of "Lobola"14 and other payments. Marriage payments along the project road corridor underlie the essential requirements of a valid marriage.

First and foremost money is paid to a girl family for "Nkobekela and Nsalamu" or engagement. The amount ranges from ZMW1, 000 to ZMW10, 000. In the past, it used to be a hoe or necklace of beads. In the past nsalamu was usually received by the go-between for the maternal uncle who decided how it is to be shared. The trend now is that the bride's parents decide how to share it.

[13] Personal Interview with Mrs. Margret Chitembo-Care Giver at Phillip Village on 23rd May, 2016
[14] Lobola"

The legal significance once the girls' parents accepted the payment was that a marriage was created. Majority of the PAPs interviewed on this topic agreed that these payments, especially Lobola or bride wealth, be regulated. It was agreed that we should revert to the old system where only a token payment was made.

6.4.4.2.4. Property Rights in Marriage

This section on property rights in marriage is intended to show the type of property that forms the wealth of the perties to the marriage, and how control of the property is shared. Property is here used in a lose sense and includes land.

According to the results of the FGD held with women at Kabangama area, it was revealed that women maintains her right to her property she came with into marriage, which in most part, are chattles. However, all that is acquired during the subsistence of marriage is assumed to belong to the husband, including the house.

The women who participated in the FGD agreed that men have full access and control of ost property. Women's property acquired from outside marriage is theirs and is not brought into the marriage. This shows that a woman can own property as an individual. Hwever, in practice she has no opportunities to acquire her own property as a marriage woman.

On the other hand, men's property acquired before marriage remains solely theirs also. Men also acquire property rights overall the property acquired during marriage on account of them being the head of the family and "owning" the home.

The concept of headship was discussed with men in a different FGD held at Kamangu village and it was noted that headship connotes responsibility that the husband is assumed to have for the family as a provider and protector of the family. The head is supposed to be responsible for all the consequences of his decision for the family, even as it his decisions that finally prevails. This means that while men accepted the idea of consulting other family members ultimately the man has the final say on all family decision and this according to the men is a "prerogative of the head of a family".

The women who participated in the FGD at Kabangama were on the view that husbands are not always responsible and this has caused abuse of headship with women working hard to provide and keep the family together while everything is attributed to the husband. This has caused women to lose out on divorce or death of the husband.

One of the properties which were extensively discussed in both FGD with men and women is that of land. This was so because of its higher economic value than all the other properties owned by households along project road corridor.

Land here has been dealt with just in relation to property rights in marriage. Reference has been made to the real property, houses and land in the property profile.

During the FGD with both men and women, it was established that people along project road corridor own and control land they occupy. There is land which an individual may own and land which may be owned with other people or communally. A chief or headman holds land in trust for his subjects. People from outside his domain may go to him to ask for land for settlement, and the chief may repossess it fi the person proves to be of bad character or conduct. It is under this authority that private investors have obtained land from chiefs. However, the customary laws of Zambia preserve land ownership to men. Women have hitherto, not owned any land under customary law. Since 1994 Land Act, however, any person with customary tenure can apply and obtain title to piece of land. This means that women too can apply for title to the land they use to cultivate crops.

According to the women in the FGD at Kabangama, the foregoing is more favorbale to unmarried women, as married ones live in their husband's village to whom land reverts upon divorce or death. Marriage women's interest in land, therefore, depends on the subsistence of the marriage.

Although under the current Lands Act Chapter 184 of the Laws of Zambia, men and women can acquire customary land and obtain title to it, provided the procedure has been followed, the women participants doubted that women's applications can be favourably considered. This is because it is not customary to allocate land to women. Land ownership symbolizes status, and the fear seems to be that such empowerment of rural women in particular may stabilize marriages. However, this notion was discarded by some women key informants who were of the view that women in rural areas just need a lot of sensitization in order for them to change their attitude and take advantage of the Lands Act Law.

6.4.4.2.5. Children's welfare

The findings from the FGD held along project road corridor indicate that people along project road corridor generally do not make a separation between care and control and maintenance. According to the results, the one who takes the children is also responsible for maintaining them. This person is also the parent to the children. The general observation is that this lack of separation between care and control and maintenance creates unnecessary hardship for children since the one prepared to keep the children may not be able to economically cater for all their needs.

Along the project road corridor, traditionally the children go with the mother on death of their father or on divorce. It is the mother and her family who take care and control of the children, and who maintain them. The father is cut out. This practice is quite rampant among the divorced men along project road corridor and the consultant met six divorced men whose children are with their mothers and the men renders very little support. However, the overall finding of the study is that there is a trend towards paternal practices along project road corridor and increasing more families

are leaving responsibility for the children to the father. This also speaks of the movement towards a nucleus family.

6.4.4.2.6. Gender Based Roles and Responsibilities

The issue of gender inequality along the project road corridor, just like is the case elsewhere in the country, is 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.

According to the key informants interviewed along the road corridor, most women 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).

Another finding from interviews with Chief Chikwanda's 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.

During the baseline survey for the proposed road upgrade, the consultant sought to find out the roles and responsibilities of women, men, and the youth; under whose control are the resources and who has the overall decision-making power over these resources.

At Kabangama village, 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 youth remain dependents on parents, running family errands but they have no decision – power over family assets.

Table 6-12: Activity Profile and Decision-Making

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

6.4.5. Population Dynamics

6.4.5.1. National/Provincial/District/Ward Level-Population

Zambia has an estimated population of 13, 046, 508 persons and has been growing at an average annual growth rate of 2.8 percent between 2000 and 2010. Since the T2 road from Mpika to Chinsali is located in Muchinga Province of Zambia and in three districts of Mpika, Shiwang'andu and Chinsali, the parameter of discussion for population dynamics is restricted to the Muchinga Province and the affected districts.

Muchinga Province is the newest Province and was created in 2011. Before then, the province used to be part of Northern Province. It has its provincial headquarter in Chinsali while other districts of the province include, Chama, Isoka, Mafinga, Mpika, Nakonde and Shawang'andu.

According to the CSO Population and Housing Census of 2010, Muchinga Province has an estimated population of 711,657, of which 349,872 are males and 361,785 are females.

Within Muchinga Province, about 104Km of the project road is located in Shiwang'andu District while 31Km and 27Km are located in Mpika and Chinsali Districts respectively.

The 2010 Population and Housing Census estimates that Mpika, Shiwang'andu and Chinsali Districts had estimated population of 203,379; 59,795 and 146,518 respectively. In terms of households, it is estimated that Mpika, Shiwang'andu and Chinsali Districts have 39,956; 12,648; and 19,420 households respectively. Further analysis of the CSO census shows that majority of households in the three districts are male headed as 80%; 75% and 76% of the total households in Mpika, Shiwang'andu and Chinsali Districts respectively are male headed households.

Table 6-13 shows the provincial population and the number of households in the province including that of the three affected districts along project road corridor highlighted.

Table 6-13: Provincial & District Population & Household Numbers

Provincial & District Population & Household Numbers						
Provincial						
				Households		
	Male	**Female**	**Total**	**Male**	**Female**	**Total**
	349,872	361,785	711,675	108,853	29,930	138,783
Districts						
Chinsali	**72,526**	**73,992**	**146,518**	**14,691**	**4,729**	**19,420**
Chama	50,856	53,038	103,894	14,691	4,729	19,420
Mpika	**100,267**	**103,112**	**203,379**	**31,558**	**8,398**	**39,956**
Isoka	35,314	36,876	72,189	10,876	3,260	14,136
Nakonde	58,874	60,834	119,708	19,196	4,759	23,955
Mafinga	32,035	33,934	65,969	9,495	3,153	12,648
Shiwang'andu	**29,611**	**30,184**	**59,795**	**7,543**	**3,432**	**10,975**

Source: CSO 2010: Muchinga Provincial Census of Population and Housing-Descriptive Tables

As mentioned in Section 6.4.2.1; districts in Zambia are further divided into constituencies and wards and the latter is the lowest level of political administration. The project road corridor from

Mpika to Chinsali passes through eight political wards namely: - (i) Lwitikila; (ii) Mukungwa; (iii) Muchinga; (iv) Mukumbi; (v) Chandaula; and (vi) Munwakubili. The population estimates for these eight political wards are presented in Table 6-14.

Generally, the female population slightly dominates the general population. Further analysis of the general population indicates that the population of the three districts is young with majority of the people (74%) along the road corridor being below the age of 35 years. This finding is consistent with the Zambia Demographic Health Survey (DHS) Report of 2013 and the 2015 Living Condition Monitoring Survey (LCMS), which have both indicated that Zambia's population is young. Overall, the population statistics for the three districts indicate that proportions decline as age increases, which create a population pyramid. Table 6-14 shows the population by ward, 5 year age groups.

6.4.6. Baseline Socio-Economic Status of Project Affected People

In the following section, we describe the salient socio – economic characteristics of the households affected by the project. These include household size and composition, age, gender and education of the household head, household asset endowment and household income and income sources. In addition, information on quality of life indicators: food security, condition of the main house, water and sanitation and sources of cooking and lighting energy is provided. Further, access to infrastructural facilities and agricultural productive services are also explored.

The outline of results of the socioeconomic survey is summarized in Table 6-14 below while detailed summary are also provided in Table 6-15.

Table 6-14: Summary results of the socioeconomic survey

Category	Number
Project Affected People	
number of PAPs	4,090 PAPs
number of people consulted	619
number of affected households	619
number of households to be physically resettled	345
number of PAPs to be physically resettled	2,373
number of households surveyed	619
number of vulnerable people	25
Number of Project Affected People by demographics of gender/ age	
Male	1,799 (44% of 4,090)
Female	2,291 (56% of 4,090)
Age Range 0-15	941 (23% of 4,090)
Age Range 16- 64	2,944 (72% of 4,090)
Age Range 65 and above	205 (5% of 4,090)
Land Acquisition	
Volumes of land acquired	88,115.336 square meters or 8.8 Ha
Types of land	Traditional land
Number of structures acquired	1,034
Types of structure	1. Residential houses; 2. Road side shops;

	3. Traditional Kitchens "Insaka"; 4. Traditional Toilets; 5. Churches; and 6. Water points

6.4.7. Number of Project Affected Households (PAPs) and Project Affected People (PAPs)

The findings reflect impact data for 43 villages in the 165 kilometer stretch. The census identified a total of 619 Project Affected Households (PAH)15 comprising of 4,090 persons (PAPs)16. As shown in the Appendices, an estimated 1,034 different structures are affected by the project with majority of the 619 PAHs losing more than one structures (i.e. a PAH may lose a combination of different structures).

6.4.8. Number of Project Affected Households (PAHs) to be physically resettled

The enforcement of the road reserves for the T2 road from Mpika to Chinsali will include physically relocating households from their current sites in the road reserve to new sites outside the road reserves. However, the project is adopting the concept of a "push back", which means that the households to be physically relocated will not necessary move to new sites away from their current locations but will only rebuild their affected structures outside the road reserve but within the same locality.

In terms of the number of households to be physically resettled outside the road reserve, the census data revealed that of the affected 619 PAHs, 55.9 percent or 344 households will incur impact on their residential properties and these 344 PAHs will need to be physically relocated outside the road reserve but within the same locality.17

It should be noted that the number of project affected households is higher (619) compared to the number of households who will be resettled (344). This is so because some of the project affected households are only impacted by the project through the loss of other types of structures other than residences such as shops, traditional kitchens, toilets, water points and fruits. These households will not be physically resettled but instead will only receive full compensation at replacement cost and will rebuild their affected structures outside the road reserve. This means that the project is only resettling PAHs whose residential structures are falling inside the road reserve as discussed above.

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15 *A PAH is a household that includes one or several project-affected persons and usually comprises a head of household, their spouses, children and other dependents (for example, parents, grandchildren).*

16 A PAP is a*ny person who, as a result of the implementation of the project, loses the right to own, use, or otherwise benefit from a built structure, land (residential, agricultural, pasture or undeveloped/unused land), annual or perennial crops and trees, or any other fixed or moveable asset, either in full or in part, permanently or temporarily. Affected people might be displaced either physically ("Physically Displaced People") or economically ("Economically Displaced People").*

17 It is important to note that the number of affected residential structures is more (415) compared to the number of affected households in this category. This is because some PAHs have more than one affected residential structures.

6.4.9. Number of Project Affected People (PAPs) to be physically resettled

As discussed in the previous section, there are 344 PAHs who will be physically resettled outside the road reserve although in the same localities.

When data is segregated for the number of PAPs among households losing residential structures, the Census Survey results show that the 344 households have an estimated population of 2,373 PAPs.

6.4.10. Sex of PAPs and Household Size

Household size is an important variable especially as it rates to poverty issues. Different studies have shown that generally poor families tend to have large families. The household questionnaire administered among the PAHs revealed that there are 4,090 household members, of which 2,291 are female (56%) and 1,799 are male (44%).

Among the household heads, the survey results indicate that there were a total of 619 heads of households of which majority are male (83.4%) compared to 16.6% female who are heads of households.

The survey results further show that the average household size is 6 members per household. These findings are consistent with both the National statistics, which shows that on average the population of female tend to be slightly higher than that of male while household sizes are in the range of 5.8 and size of 6.118.

Among the Project Affected Households who will be physically resettled, the census data revealed similar trends with more male heads of households among the 344 households to be physically resettled. The results indicate that 81.3 percent of the PAHs to be physically resettled are headed by male while 18.7 percent are female headed households.

In terms of sex distribution among the PAPs to be physically resettled (2,373), the female sex was slightly more than the male sex with 52 percent (1,234) being female PAPs and 48 percent (1,139) being male PAPs.

6.4.11. Age Distribution of PAPs

Among the general population of the project affected people (4,090), the age group of 15-35 years (41%) dominated the results followed by those younger than 15 years old (23%), indicating that the youth population is higher than the adult population. This also shows availability of young people to be employed by the road project, especially during the construction phase of the project.

Given the fact that 23% of the PAPS population is in the age distribution of 0 to 15 years while 5% of the PAPS are over 65 years, which is the retirement age in Zambia, it can be inferred that population in the age group of 16-65 of the population constitute the economic productive age group of the age pyramid.

The implication of these findings is that 28% of the PAPs are dependent on the economic productive age group of those between 16-65 years. This means that 28 is the dependence ratio

[18] *CSO 2010: Muchinga Provincial Census of Population and Housing-Descriptive Tables*

among the PAPs. This also indicate that for every 100 productive age people (15-65 years old), some 28 people are non-productive (0-15 and 65+).

Table 6-15: Age Distribution of PAPs

AGE DISTRIBUTION OF PAPS	NUMBER			PERCENTAGE	
	TOTAL	FEMALE	MALE	FEMALE	MALE
0-15	941	532	409	13	10
16-25	859	450	409	11	10
26-35	818	450	368	11	9
36-45	654	409	245	10	6
46-55	327	164	163	4	4
56-65	286	164	122	4	3
>65	205	122	83	3	2
TOTAL	**4,090**	**2, 291**	**1,799**	**56**	**44**

6.4.12. Marital status of PAPs

The marital status of HH members was also analysed and the survey results showed that of the total number (3,149) adult PAPs (>15year), 58 percent (1,826) of this adult population were married, while 29 percent of this adult population (913) were single and have never married before. The divorced only made up 7 percent (220) of the adult PAPs while the widowed/widower category accounted for 6 percent (189).

Female household heads were mostly widows in comparison to unmarried or single women. A few elderly female household heads were encountered and these were often grandparents looking after grandchildren orphaned by HIV/AIDS. These constitute part of a "vulnerable category". Figure 7-2 shows the marital of the adult PAPs.

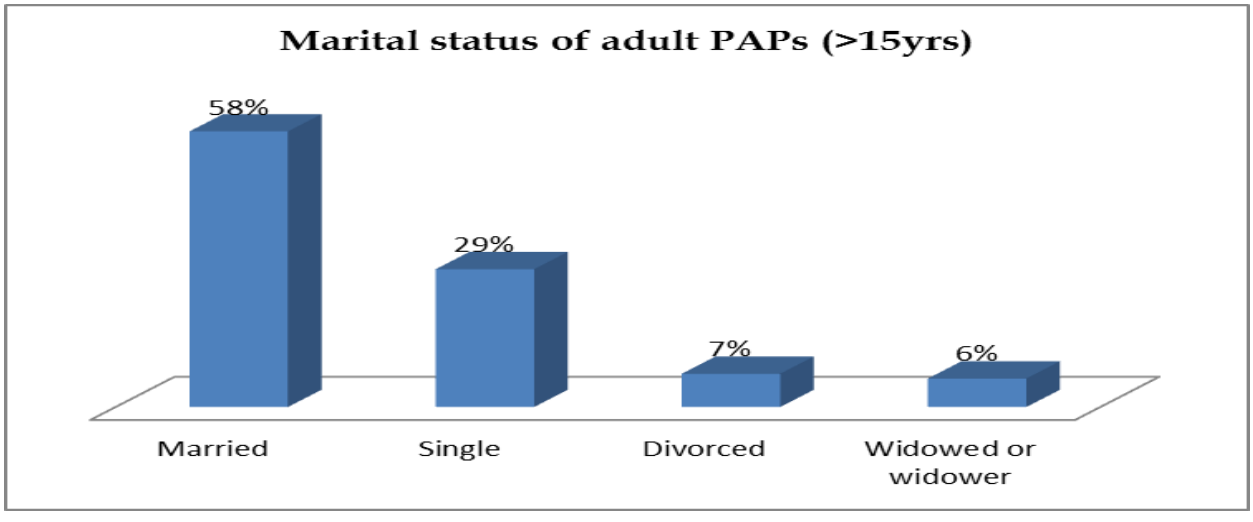

Figure 7-24: Marital status of adult PAPs (>15 yrs)

6.4.12.1. Educational Levels of Household Heads

As regards the educational attainment of the PAHs heads, Table 7-4 shows that out of the total population of 619 persons, (22.43%) are illiterate. From among the 77.57% literates, 46.84% have attained some primary level of education, (19.67%) have some basic secondary level of education, 7.14% have attained some secondary level, and less than four percent have some tertiary level of education.

Table 6-16: Level of education attained by household heads among PAHs

Level of education attained by household heads among PAHs				
Educational Level	**Male**	**Female**	**Total**	**Percentage**
Illiterate	66	73	139	22.43%
Up to Lower Primary	72	86	158	25.59%
Upper Primary	77	55	132	21.25%
Basic School	70	52	122	19.67%
Higher Secondary	27	17	44	7.14%
Graduate	14	10	24	3.92%
TOTAL	**326**	**293**	**619**	**100**

Among the general population of household members (4,090), household survey results indicate, majority of the PAPs have had some sort of formal education with approximately 45 percent having undertaken primary schooling, 18% Middle School and less than 20% High school and Middle technical School, while 17% of the PAPs have not been to school either they were too young to start school (72%) or adult people who have not been to school in their entire lives (28%).

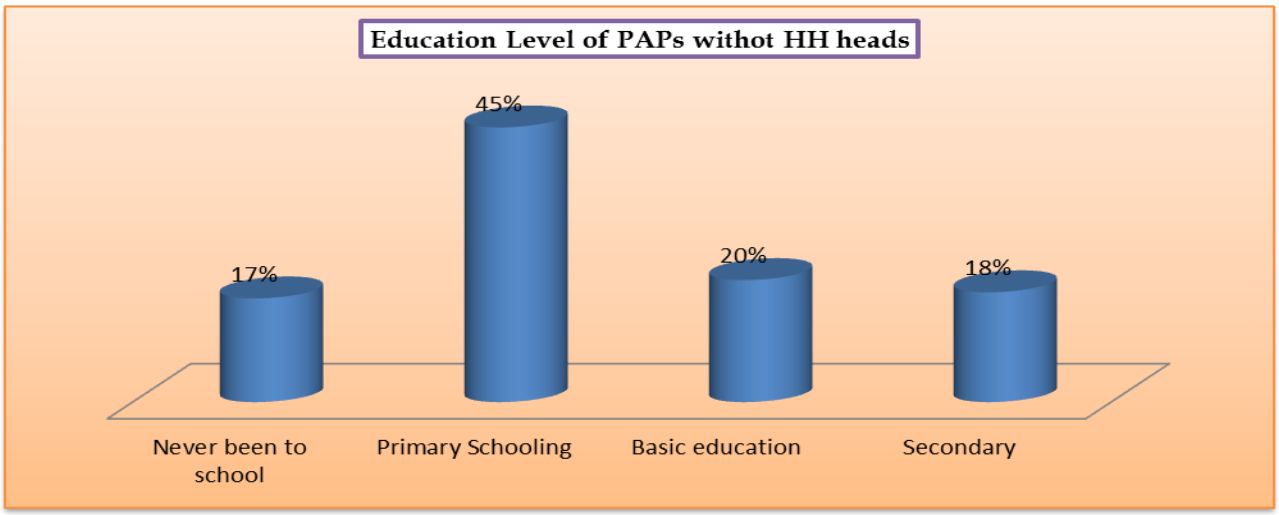

Figure 7-25: Education level of PAPs

It is clear from the educational indicators of PAPS that while majority of PAPs have attended some primary education, progression to higher grades (beyond primary schooling) is very low. This low level of progression to higher education could be attributed to the education system in Zambia which demands that selection examinations be held at grade seven, grade nine and grade twelve levels. At each of these levels, a lower number of pupils make it to the next higher grade due to several factors but prominent among them being limited school places. Even more important is that most of the areas along the project road corridor have few schools that offer education beyond grade seven, thus there are fewer opportunities to advance beyond this level and pupils will have to cover long walking distances to access the few available places beyond grade seven.

6.4.12.2. Sources of Livelihood in Project Affected Households

Subsistence farming is the principal source of livelihood in all the 619 affected households with 63 percent regarding farming as their major or number 1 source of source of income. However, even those households who regard other sources of income than farming such as trading (21%) still regarded farming as their second source of income. This means that most project affected households are dependent on earned income from subsistence agriculture. Subsistence agriculture in the project affected households comprised of cultivation of maize, millet, cassava, beans, sweet potatoes, and ground nuts. Figure 7-5 shows the major sources of livelihood for the project affected households.

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. It appears that own livelihood or economic activities play an important role in day-to-day living of the project affected households with more than 80% dependent on it.

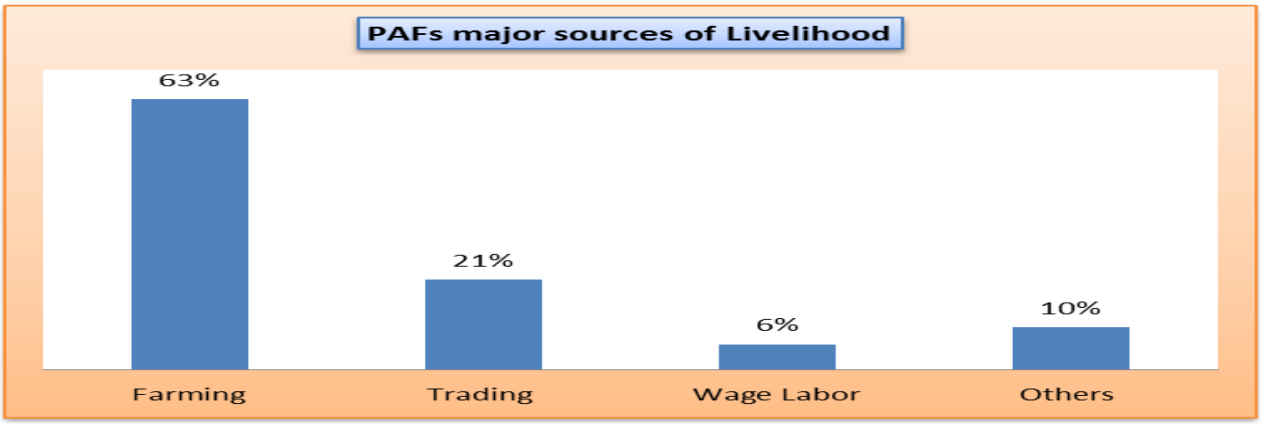

Figure 7-26: PAFs major source of livelihood

6.4.12.3. Agricultural Production and Marketing

Agriculture is an important economic activity among all project affected households. The survey took the 2014/2015 farming season as the base year for assessing the production and marketing of agricultural products among PAPs. By October 2016 when the field work for the study was being undertaken, the marketing season had not yet ended. Thus it the 2014/2015 agricultural year was taken to be more realistic.

Maize is the only crop, which PAFs were able to accurately account for in terms of production and sales. Therefore, the survey analysis has only discussed maize production and marketing even if

PAFs are engaged in the production of other crops except that these other crops such as cassava, millet, sweet potatoes are difficult to quantify since most of these crops are grown for home consumption among PAFs.

During the same, period, 580 project affected households (94.7%) engaged in crop production and together produced an aggregated figure of 621 metric tonnes of maize of which 78% (484 metric tonnes) were marketed at a value of ZMW726, 000.

6.4.12.4. Available skills among PAPs

In contrast to the low levels of education among PAPs, there were high levels of skills within households. Figure 7-6 below presents the aggregated data on skills prevalence in the 1,039 project affected households. The survey results shows that natural resource based skills are the most common skills among the PAPs. The commonality of skills amongst the PAPs tends to follow a certain pattern. The commonest skill (grass thatching) is less dependants on formal education and is based on grass, a readily available natural resource. Other common skills including traditional craft making, carpentry and brick making also depend on readily available natural resources. The very uncommon skill of welding depends on exotic non natural resources usually expensive metallic materials.

It is clear therefore that PAPS tend to develop skills that are based on utilization of inexpensive readily available local resources.

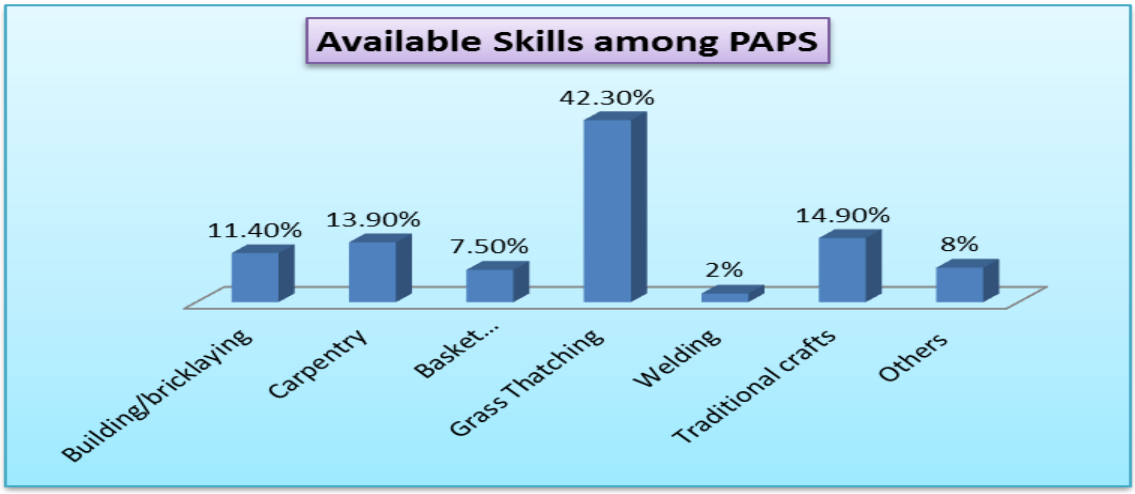

Figure 6-27: Available skills among PAPs

6.4.12.5. Levels of income in PAFs

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 project road corridor, the baseline survey requested the actual household income per month among the project affected households. People generally tend to underreport their incomes, and it is likely that the reported figures for the socio-economic survey is even further underreported, given that many of these project affected households produce some food for household consumption.

Despite these limitations, subsistence agriculture was noted to be a significant source of livelihood for the project- affected households in the villages.

The household survey results show that generally earnings in the project affected households are low with a significant number of PAFs (20.7%) earning less than ZMW500 per annum while majority of PAFs earning between ZMW500-1,000 per annum accounted for 38.6 percent and PAFs earning above ZMW1,500 per annum accounted for 15.8 percent .

Table 6-17: Agriculture income levels among the PAFs

	Range of revenue from agriculture (ZMW) per Month				
	less than 500	**500-1,000**	**1,000-1,500**	**above 1,500**	**Total %**
Female (%)	17.30%	23.50%	16.70%	10.30%	67.80%
Male (%)	3.40%	15.10%	8.20%	5.50%	32.20%
Total	**20.70%**	**38.60%**	**24.90%**	**15.80%**	**100%**

6.4.12.6. Cash availability in Project Affected Households

The Cash availability among the project affected households presents a seasonality pattern in which cash is differentially variable during various seasons. This reflects on household's engagement in and pattern of income generation based economic activities. Activities include crop production, trading, sale of livestock and to an extent exploitation of natural resources such as honey harvest.

According to the survey results, the season during which majority of PAFs (36.6%) have cash is March to August. During this period, many households engaged in crop production would have marketed their produce. This period is followed by September to October season (31.6%), which reflects a continuation of agricultural products (crops) marketing. Very few PAFs have cash available in their homes during the November to February period and this lack of cash availability among PAFs during this period was mainly attributed to the fact that households spend much of their cash on faming inputs.

It should however be noted that although availability of cash has been alluded to PAFs, the levels of income are very low to make any significant changes to their livelihoods. What is being referred to as available cash is for minimal survival purposes, including use for small household needs such as salt and soap.

Figure 6-29 shows the seasonality of cash availability in project affected households.

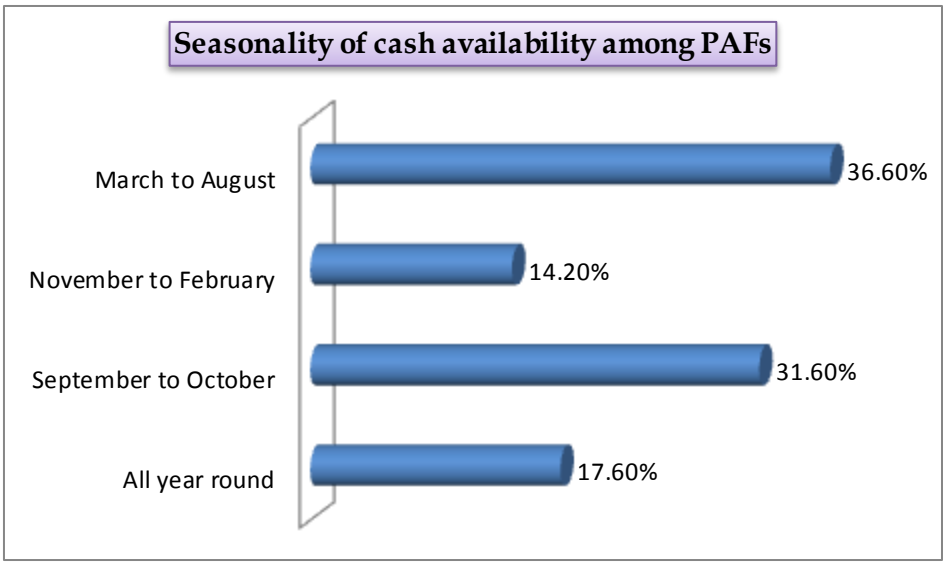

Figure 6-28: Seasonality of cash availability among PAFs

6.4.12.7. Income Expenditure Patterns

The income expenditure pattern of the project affected households is spread across ten (10) expenditure areas, as shown in Figure 6-7.

The survey results show that PAPs tend to commit the larger share of their income on expenditure related to their welfare such as clothing (14.3%), education 17.3%), health (15.2%), transport (16.4) and food (14.0%).

The lowest areas of expenditure are investment (2.1%), and social activities (1.3%). The other areas in which little income is dedicated are banking (1.3%) and purchase of livestock (0.17%). Banking refers to keeping some amount of money in commercial banks. The low levels of investment are a reflection of the fact that these are resource poor communities usually without extra income for investment. The lack of skills in business is another contributing factor. In addition, there was no indication during focus group discussions with the project affected communities of capacity to identify and exploit opportunities for investment in their areas, including exploitation of natural resources.

The relatively high expenditure on transport (16.4%) is explained by the distances to medical facilities and which are very few along project road. Medical expenses were noted high due to a lack of adequate healthcare facilities (clinics and drug stores) in the affected area. There are only 5 rural health centers for the whole 165Km stretch and referral hospitals are only located in the two towns of Mpika and Chinsali (i.e. 165km apart). However, due to inadequate services at the health centres, many people were reported to move long distances to referral hospitals in search for better services. In absence of affordable public transport, proximity to trading centers, which are the sources of employment, goods and services, are essential for the project-affected people. If affected persons relocate further from settlements with such facilities such as health centers, they might suffer higher cost of living resulting from higher transport costs.

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.

6.4.12.8. Ownership of Productive Assets among PAFs

Ownership of minimum household assets among the PAFs is presented in Table 6-7. The asset base of the PAFs was varied. According to the household survey results, all the 619 households own some agricultural equipment, while natural resource assets are owned by 73.2% of the PAFs. Access to land was also another asset which was reported to be owned by 87.8% while Livestock assets and Fruits trees were reported to be owned by 79 percent and 71.2 percent of PAFs. It is obvious that the basic agricultural assets (i.e. hoes and axes) were widely owned by the PAFs.

6.4.12.9. Access to Land

Inadequate access to land is not only denial of access to the basic factor of production and is in many respects responsible for inappropriate land use patterns. This facilitates rapid environmental damage and loss of natural reources and effectively compromise the basic livelihood and incomes which depend on them and perpertuates poverty.

The household survey therefore collected information on access to land among the project affected households and the survey results show that 87.8 percent have access to some land, while 12.2 percent of the PAFs reported that they are landless. When the 543 PAFs who have access to land were asked about the type of land they possess, majority 97.2 percent have access to traditional land and only 2.8 percent reported to have titles to their land on 99 year lease period.

It is interesting to note the number of household who reported to have no access to land given that traditional land is almost available to community members through various traditional channels. The common response provided by this group of PAFs on their lack of land was that they have been using family land and therefore cannot claim to posse land on their own as an individual family since land belongs to a wider and extended families.

6.4.12.10. Energy Sources

Firewood is the principal source of energy for cooking among PAFs which was reported by 87.5 percent of PAFs. There is also usage of charcoal but it is limited to a small proportion of households (13.2%). This finding on the low use of charcoal is rather surprising given the fact that charcoal is abundantly sold along the project road corridor. Proportions of PAFs using other types of fuels like electricity are almost negligible.

Prevalently, PAFs use paraffin (27.3%), candles (29.5%) and the battery lamps (36.4%) for indoor night lighting and only about 6.5% of households had access to grid electricity for lighting.

6.4.12.11. Vulnerable Groups

Vulnerability is the degree to which a population, individual or organization is unable to anticipate, cope with, resist and recover from the impacts of misfortunes (WHO, 2002). Children, elderly people, malnourished people, and people who are ill or immune compromised, are particularly vulnerable. Poverty – and its common consequences such as malnutrition, homelessness, poor housing and destitution – is a major contributor to vulnerability.

A number of households with vulnerable PAPs, headed by the terminally ill, widows, elderly, orphans, female headed households or disabled people were identified with a number of challenges. There are 25 PAFs who have been regarded as vulnerable households and would need additional assistance:

a. 5 of the 25 vulnerable households are due to old age (above 75 years and stays with grandchildren;
b. 12 of the 25 vulnerable households are female headed households who supports single orphans children;
c. 3 of the 25 vulnerable households female headed households who supports chronically ill patients; and
d. 25 vulnerable households are disabled heads of households.

Such vulnerable homes might need special assistance during compensation and resettlement process.

6.4.12.12. Common Diseases among PAPs

Malaria fever was the most prevalent disease in project affected households followed by respiratory ailments (coughs and flu). Although most PAPs were reluctant to give their HIV/AIDS status, a few responses from several people who were frank about their socio-status confirmed high prevalence of HIV/AIDS along the road. Other common ailments included waterborne diseases like cholera and dysentery attributed to lack of safe drinking water. Common diseases among the PAPs are presented in Figure 6-30.

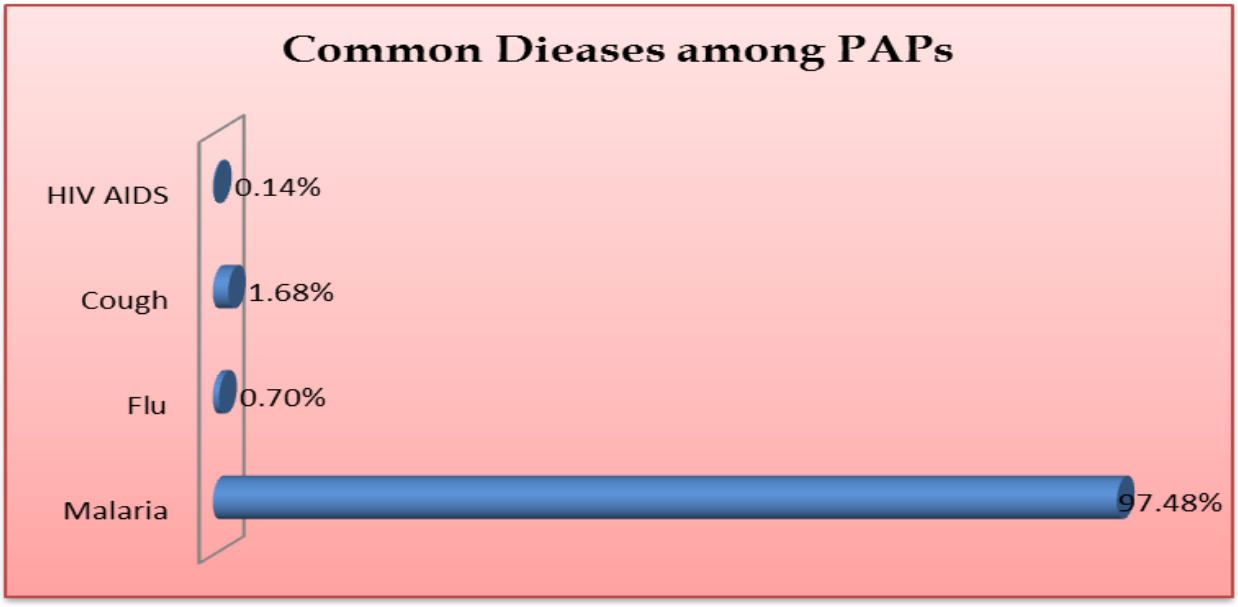

Figure 6-29: Most common diseases among the households

Most PAPs (97% of PAFs interviewed) in the project areas were aware of HIV/AIDS and how it is spread. Their main sources of information are health centres (55.3%), local radio stations (14.6%) and NGOs involved in HIV/AIDS prevention programs (29.1%). Qualitatively, female-headed households were found to be more vulnerable to HIV/AIDS than male-headed counterparts because of poverty which lead them to sexual exploitation for material favours from men.

The few health centres along the project road corridor and major hospitals (Mpika and Chinsali District Hospitals) play a central role in the fight against HIV/AIDS and provide treatment, nutrition, free testing and counselling including other outreach programmes like community sensitization through drama, music and sports. However, it was reported that most health centres lack drugs, have inadequate staff, and lack space to accommodate a large numbers of patients.

6.4.12.13. Disabilities and Chronic Disease Cases

The proportions of disabilities and chronic disease cases in the project affected household are presented in Figure 6-31.

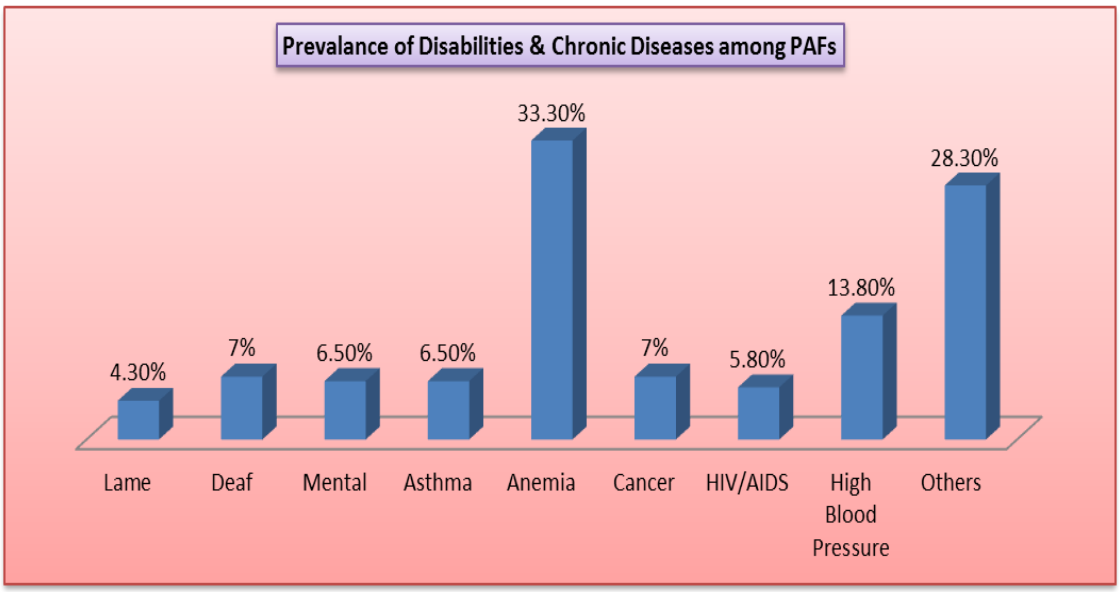

Figure 6-30: Prevalence of disabilities & chronic diseases among PAPs

6.4.12.14. Source of Drinking Water

It was observed that around 59 percent of PAFs access their drinking water from communal boreholes or traditional wells while a significant number of PAFs access their drinking water from surface water bodies along project road corridor. Only 11.9 percerent of the PAFs access piped water and this is mainly in one community at Kasoma Mulenga or Danger Hill village where there is piped water for the villages currently been implemented as a pilot project by JICA and the Ministry of Local Government. Table 6-21 shows the types of drinking water sources among project affected households

Table 6-18: Types of drinking water sources among PAFs

Water source	Proportion (%)
Communal boreholes/ hand dug wells	59.4
Rivers/Streams	28.7
Standpipes	11.9

6.4.12.15. Sanitation

Access to good sanitation is very crucial to the health of the population. Poor sanitation poses one of the greatest threats to health. Among the project affected families or households, majority of

household (83%) use traditional pit latrines for human waste disposal and only an insignificant number (2.3%) of household have access to the Ventilated Improved Pitlatrines (VIP). The number of PAFs with no access to latrines is also significant (14.7%) and a source of concern as these households tend to relieve themselves in the bush. Therefore keeping the area clean is a challenge because of the poor hygiene practices in the communities.

6.4.12.16. Waste Disposal Infrastructure

There are no designated waste management sites in the project affected area and households discard rubbish in the nearest bush or a compost pit in the backyard. Primary data shows that a majority of respondents (51.4%) dispose their waste in their gardens while (36%) dispose it in a compost pit at the back yard. Only 12.6% of respondents burn their waste.

6.4.12.17. HIV/AIDS

Recent data indicates that the incidence of HIV/AIDS in 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 from Chinsali to Nakonde, 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 three districts along the project road corridor (Chinsali, Isoka and Nakonde) 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 Chinsali, the HIV epidemic along the project road corridor is driven by the following major factors:

- Multiple concurrent sexual partnerships,
- low condom use, low circumcision uptake,
- mobility and labour migration fuelled by creation of new job opportunities,
- vulnerable and marginalized groups,
- vertical transmission from mother to child,[5] and
- Alcohol and drug abuse.

The mobile workforce includes Brief Case Traders, fishermen, charcoal burners, seasonal caterpillar harvesting, migratory labourers on Road constructions, farms, 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.

[5] Zambia Demographic Health Survey 2007

6.4.12.18. Factors that promote the spread of HIV/ AIDS

A large number of different factors contribute directly or indirectly to the spread of HIV in the Districts and these include the following:[20]

- **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 rechanneling their energies, especially the youths, to healthy recreational activities.
- **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.
- **Increased mobility of people.** Being along the line of rail, there is a marked increase in labour migration either in or out of the districts and these usually come back sick. The most vulnerable groups are the fish mongers and fishermen in the Chambeshi swamps. These leave their spouses behind and usually engage in illicit unprotected sex with infected partners. Fishermen who move from one fishing camp to another and at times out to urban areas thus increasing their vulnerability to HIV infection. **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.

[20] Documented by the Provincial HIV/AIDS Task Force in Chinsali

CHAPTER SEVEN

ASSESSMENT OF POTENTIAL ENVIRONMENTAL AND SOCIO-ECONOMIC IMPACTS

7.1. INTRODUCTION

Chapter 7 addresses potential impacts (adverse and positive) of all planned project activities during the Construction and Operational Phases which were initially identified by means of the Scoping Matrixes. The Scoping Matrix where the interactions between relevant project activities and the natural/physical environmental aspects and the social aspects were considered to determine whether the interaction may create a potential impact.

The main findings and description of the potential environmental impacts and Significance of Effect (without mitigation) are presented in Section 7.2 where these are discussed for the following affected receptors: a) land use, b) surface and ground waters, c) air quality, d) soils, e) landscape and visual aspects, f) acoustic quality (noise and vibrations), g) generation of waste and appropriate waste management needed, h) biodiversity, including habitats, flora, and fauna, i) natural, cultural and archaeological heritage.

The main findings and description of the positive and negative social impacts and significance of effect (with mitigation) are presented in Section 7.3, where the following issues are addressed: a) land and property, b) Community health and safety, c) Community tensions d) Access and severance effects, e) Disruption of utilities, f) Economic impacts, g) Employment impacts, h) Education and training, i) Vulnerable groups, j) Workforce related impacts and issues, k) Local Communities and their "Quality of life".

7.2. POTENTIAL ENVIRONMENTAL IMPACTS

The following Section presents the assessment of the impacts on each environmental resource/receptor identified. For each resource/receptor, impacts have been identified and assessed distinguishing between those that occur during the construction phase and those that occur during the operational phase of the road project. In some cases, where the impact is first created during construction, but it persists along the operational phase (e.g. landscape), the assessment is presented for both phases together.

The assessment in this Section is made without considering the application of preventive and corrective measures that could attenuate the magnitude of the impact. Mitigation measures for each impact assessed are presented in Chapter 8, where the effectiveness to attenuate the impact evaluated before reassessing the impact with the mitigation measures.

In this chapter, the information on the assessment of the impacts is organized in subchapters for each environmental resource/receptor impacted. In each subchapter, the value or sensitivity of the resources present in the road project area are first evaluated with regards to their value or sensitivity and then the potential impacts and their likely significance is determined.

The resources/receptor for which impacts have been identified and are assessed in this chapter are soil, surface water, groundwater, air, noise and vibrations, landscape, habitats, flora, fauna, protected and designated sites and cultural heritage. Impacts on resources such as geomorphology

have not been assessed because no relevant features of these resources are expected to be impacted by the project.

7.3. SOURCES OF BIO-PHYSICAL IMPACTS

Main construction activities which will give raise to negative impacts for the Mpika Chinsali road rehabilitation are:

1. ***Road Works***:-The project road will involve rehabilitating and expanding the road width of 11m for the roadway and 12m for the roadbed, formed by the following elements: (i) Roadway: 7.00 m divided into two 3.50 m wide lanes (the actual carriageway is 6.20 m wide), (ii) Shoulders: 2.00 m each side, except in zones with climbing lanes or bus bays, where the width will be 1.00 m. The construction will involve ripping the existing pavement down to under the sub grade and reuse the material as much as possible in fill. Then prepare the road bed and come up with an improved sub grade, cement stabilized sub base and crushed stone base with wearing layer of 50 mm AC.
2. ***Bridge Improvements and culvert Installation***:-Although the project road from Mpika to Chinsali Road has no bridges according to the definition contained in the SATTC Specification Clause 1106, the proposed project will include making improvements to the two multi-pipe culverts (Lwitikila River ch 11+837; 3x5000 diameter and Lwanya River ch 58+346; 2x3200 diameter). In addition, the project will include installation of several new and bigger (diameter) culverts.
3. ***Main activities:-***
    - Activity of construction sites;
    - Activity of construction equipment, machines;
    - Activity of means of material transport; and
    - Activity of workers.

7.3.1. Potential Impacts on Soil

7.3.1.1. Assessment of Soil Resources

For the assessment of soil resources, the emphasis has been placed on the ecological functions that natural or semi-natural soil types have in natural and human environments, including their capacity to: produce biomass, ensuring food, fodder, and raw materials; influence in the water cycle at the earth surface; accumulate water as well as filtering and cleaning of percolated waters; buffer contaminant effects; carry out gas exchange between terrestrial and atmospheric systems and be a central link in the biotransformation of organic carbon. They are also a living space for a specialized biocenosis of a large variety of small animals and micro-organisms.

Therefore, if the sensitivity of soils is evaluated from the stand view of the potential loss of their ecological functions, soil types occurring in the project road corridor are evaluated as follows:

Type of Soil	Sensitivity
Natural and semi-natural soils occurring in steep areas, prone to erosion	Very high
Natural and semi-natural soils occurring in flat areas	High
Anthropogenic influenced soils that still have natural soil functions (e.g.soils used for agriculture)	Medium
Contaminated natural and semi-natural soils	Low
Totally converted and destroyed soils like infill soils	Negligible

The soils encountered along the road corridor are as follows and have the following sensitivities.

LOT/LOCATION	Predominant type of soil in project road corridor	Sensitivity
LOT 1		
Ch0+000-7+760	Urban area of Mpika Town	Negligible
LOT 2		
Ch7+760-22+200	Natural soil on flat areas	High
Ch22+200-59+400	Natural and semi natural soils on flat or gently hilly areas	High
Ch59+400-86+800	Natural soil on flat areas	High
LOT 3		
Ch86+800-135+750	Natural soil on flat areas	High
Ch135+750-165+500	Natural and semi natural soils on flat areas	High

7.3.1.2. Potential Impacts and Likely Significance

Soils have important ecological functions in nature and represent an important resource for agricultural utilization and for forestry. Soil is a non-renewable resource, once destroyed natural soils cannot be restored quickly taking decades or longer to develop.

Soils may be affected in several ways during the construction and the operational phases.

Soils may become contaminated during construction works due to leaks and accidental spills of hydrocarbons from construction vehicles and machinery, as well as of other hazardous substances handled during the construction activities, such as lubricants, paints, solvents, resins, or acids. These leaks and spills could occur either at the construction site or at the storage sites for products and waste. Also, contamination of soils may occur if already contaminated soils are encountered during construction works (e.g. soils that could have been contaminated by spills of hazardous substances in the previous construction Period 2012-2013). In this case, the inadvertent mobilization of pollutants from the contaminated area could contaminate clean areas of soil.

During road operation, soils may also be subject to contamination from diffuse release of inorganic and organic substances due to leaks of lubricants and greases from the passing vehicles, lubricants and other hazardous substances used for road maintenance.

The clearance operations, the removal of topsoil and earthworks can result in the loss of soil through erosion by water or wind, particularly on the steeper sections of cuttings and

embankments. Erosion risks will remain through the operational life of the road if the soil is left unprotected and/or devoid of vegetation. The risk of landslides in steep areas has also been considered. However, this impact is not likely to occur because the engineering design of the road already takes into account this risk in the design of berms and benches, bridges, foreseeing their stability. Therefore, this potential impact is not evaluated.

The impacts on soils that are evaluated in this Section are:

a) Construction phase

- Impairment of soil quality (soil contamination) due to the introduction of pollutants;
- Soil erosion due to clearance of vegetation and earth movements;
- Destruction of fertile top soil.

b) Operation phase

- Impairment of soil quality (soil contamination) due to the introduction of pollutants from trains;
- Soil erosion in earth banks devoid of vegetation.

7.3.1.3. Construction Phase

7.3.1.3.1. Impairment of soil quality (soil contamination) due to the introduction of pollutants

The construction works required will have a high intensity with a heavy traffic of vehicles and machinery that could release relatively insignificant amounts of contaminants to the soil, mainly through leaks of oil and lubricants. Potential spills from this equipment and in hazardous materials storage areas could cause a more serious effect, but these events are more unlikely given adequate storage.

Estimation of the magnitude

Because the time at a given construction area is limited and the potential leaks from vehicles, machinery and from other activities using hazardous substances are expected to be small, it is considered that a distinguishable low level of soil contamination could occur at certain areas, but not severe enough to alter the key characteristics of the soil. The magnitude of the impact is low.

Once the magnitude of this impact has been estimated, the other criteria to assess this impact are as follows.

Criteria	Assessment Thresholds	
	Threshold	Descriptions
Characterization of impacts	Negative	Not desirable
Type of Impact	Direct/Cumulative	Soil contamination occurs from materials and emissions generated by construction
Reversibility	Reversible	Soil contamination can be remediated by natural means if contaminants are biodegradable and are in low concentrations. For severe contamination episodes, an active remediation would be needed.
Geographical Extent	Local	Limited to the footprint of the project
Time when the impact occurs	Immediate	Soil contamination occurs as the pollutants are released
Duration	Medium-term	As long as soil contamination is not severe, the soil self- depuration will eliminate contaminants in relatively short Periods of time (weeks to years).
Likelihood of appearance	Probable	The impact has a medium likelihood of occurring
Magnitude	Low	See above

Considering that the soil resource in the project road corridor have an overall high sensitivity, using the significance matrix presented in Chapter 4.6.3, the initial significance of this impact, without mitigation measures is slight.

7.3.1.3.2. Soil erosion due to clearance of vegetation and earth movements

Most of the construction works in Lot 2 will take place on hilly terrain. Therefore, it is anticipated that there is a significant risk of erosion, particularly during rainy or windy days.

Estimation of the magnitude

Erosion processes are anticipated to be important in Lot 2, but more severe at Danger Hill area (Km22+200); and Mukungwa area (Km38+500) where the road alignment passes through a more mountainous area. Erosion will mainly occur in the areas where the permanent way will run on the side of the hills, which is where the cuttings will expose large surfaces of soil. Some exposed soil will also occur at the areas of the abutments and pillars of box culverts again in Lot 2 at Lwitikila (Km11+837) and Luanya (Km58+346). Because of the steep morphology of the terrain, a relatively short length of the corridor will be exposed to erosion.

Soil erosion during the construction of Section 3 will be clearly visible, but will be limited to relatively small areas and the overall magnitude of the impact on the soil resources in this Section is considered medium.

The other criteria to assess this impact are as follows:

Criteria	Assessment Thresholds	
	Threshold	Descriptions
Characterization of impacts	Negative	Not desirable
Type of Impact	Direct/Cumulative	Soil contamination occurs from materials and emissions generated by construction equipment/activities.
Reversibility	Reversible	Soil contamination can be remediated by natural means if contaminants are biodegradable and are in low concentrations. For severe contamination episodes, an active remediation would be needed.
Geographical Extent	Local	Limited to the footprint of the project
Time when the impact occurs	Immediate	Soil contamination occurs as the pollutants are released
Duration	Medium-term	As long as soil contamination is not severe, the soil self-depuration will eliminate contaminants in relatively short Periods of time (weeks to years).
Likelihood of appearance	Probable	The impact has a medium likelihood of occurring
Magnitude	Low	See above

Considering that the soil resource in the project area have an overall high sensitivity, the initial significance of this impact, without mitigation measures is slight.

7.3.1.3.3. Destruction of top soil

The proposed rehabilitation works for the project road from Mpika to Chinsali will mostly go through open land covered with rich natural and semi natural soils with well preserved ecological functions. This impact is relevant for two main reasons, because soil is rendered useless and it is unavoidable, although corrective measures are available. It generally implies a large amount of rich top soil removed that cannot be given another use (there is no market or use for excess top soil in this area of Zambia.

Estimation of the magnitude

Implementation of the project is expected to generate an estimated total quantity of spoil in the range of 275,332.359 m^3; where: (i) Lot 1:- from Weighbridge to Mazingo (Km0 – Km7): *5,506.647m^3*; (ii) Lot 2:- (From Km 7+100 to Km 86+770): Mazingo to Shiwan'gandu Junction (D53/T2 Junction) – 82.7 km: *137,666.175m^3*; and (iii) Lot 3 – (Km 86+770 to Km 165+646) Shiwan'gandu Junction (D53/T2 Junction) to Chinsali Junction – 78.8km: *132,159.532m^3*.

Of these 275,332.359 m^3 soils, it is estimated that 50% will be top soil and of this top soil about 82% corresponds to high and very high sensitivity natural and semi natural soils, 10 % corresponds to medium sensitivity agricultural soils, and the rest to urban soils with negligible sensitivity.
The destruction of top soil will be distinguishable and measurable, will affect most of project road corridor, but be restricted to a narrow strip of land, it will not affect the integrity of the resource in the area. Therefore the magnitude of the impact is considered medium.

The other criteria to assess this impact are as follows:

Criteria	Assessment Thresholds	
	Threshold	Descriptions
Characterization of impacts	Negative	Not desirable
Type of Impact	Direct	Loss of top soil occurs because of land take needed to construct the project road.
Reversibility	Irreversible	Rich top soil is removed to construct the permanent way and the right of way and cannot be replaced.
Geographical Extent	Local	Limited to the footprint of the project
Time when the impact occurs	Immediate	Top soil is lost when clearance and earth works start
Duration	Long-term	Top soil underneath the road alignment will be lost for ever
Likelihood of appearance	Certain	Top soil needs to be removed to construct the road
Magnitude	Medium	See above

Considering that the soil resource in the project road corridor has an overall high sensitivity, the initial significance of this impact, without mitigation measures is Moderate.

7.3.1.3.4. Excavation and embankment

Excavation and embankment will cause erosion and sedimentation in soil environment as follows:

- Filling agricultural land area; and
- Local inundation

A1. Filling agricultural land area

As assessed in the previous part, total quantity of excavation and embankment is 2,757,106m^3. While waiting for embanking or transporting, soil may slid to agricultural land area on both sides of the road, filling crops and effecting crop output. At construction sites, heaped spoil may also slid to the cultivated land area in wet season. In addition, due to erosion of the road surface and the bridge improvements, culvert construction site, its products in the agricultural land area may change its inherent physio-chemical properties.

A2. Local inundation

Local inundation may occur in the depressed land area on both sides of the road because excavation and embankment obstruct natural flow or change natural topography. Local inundation may occur in the following areas:

- Stream bridge building position;
- Cross-culvert building position (298 positions).

7.3.1.3.5. Soil pollution due to waste

1. ***Solid wastes***-Solid wastes such as concrete, broken bricks, mortar or gravel, nylon waste and domestic waste will arise at construction sites. Beside, waste asphalt concrete, gravel and stone exist in building road surface. All wastes will cause impairment of soil quality. Scope of effect:
   - Spatially, adjacent agricultural land area around 16 construction sites;
   - Land strip of 50m along two road-sides;

- Duration of effect: over 36 months.

2. ***Normal liquid wastes***-Total volume of waste water from the batching plants for 36 months is 23,975m3 (about 19.2m3/day). Waste water of the batching plants has high pH, causing impairment of soil quality if directly discharging to environment. The affected scope is the area around 16 construction sites. Duration of effect: over 36 months of construction.

3. *Lubricant bearing waste*-Total quantity of waste lubricant emitted for 36 months of construction is 168,308 litters, averaging about 3,506 litters/ month. Waste lubricants from construction machines in maintenance, lubricants leaked from construction machines and temporary fuel stores can pollute agricultural land area for a long time. The affected area includes 30m on both sides of the road. Duration of soil pollution is 36 months but its effect after pollution lasts longer.

4. *Erosion and sedimentation*-Constructing and improvements of the bridges and culverts may cause 429m3 soil eroded and washed to the field and river/stream. About 20% (grain composition < 0.02 mm) is deposited in the downstream agricultural land area at the eroded position. For normal land area, cash crops are significantly damaged by thick sedimentary layer, effecting growth and development of crops. This effect is only likely to occur in the narrow cultivated area on both sides of the bridge and lasts 1 crop. For spoils containing bentonite, in case of overflowing the fields, with its swelling property, a rather thick cover on the fields affects the crops. Attention would need to be paid to erosion of river banks in the bridge building position to significantly mitigate by techniques in the design such as turf on the slope, stone embankment on two sides of the river in the bridge building position.

7.3.1.4. Operational Phase

7.3.1.4.1. Impairment of soil quality (soil contamination) due to the introduction of pollutants

During road operations, various contaminants are released in the road permanent way and right of way, which cause soil contamination. This contamination, however, would be expected to be limited in extension because of the construction characteristics of the substructure of the road. The compacted soil increases load bearing capacity, prevents soil settlement, provides stability, reduces water seepage, swelling and contraction, and reduces settling of soil. In addition, for proper drain off, the underneath subsoil should have an inclination of 2.5 % to the outside.

Thus, during operations the greater concern is the contamination of surface water from road runoff.

7.3.2. Potential Impacts on Surface Water

7.3.2.1. Assessment of Surface Water Resources

The sensitivity or importance value of the surface water resources along the project road corridor has been assigned according to the following criteria (Table 7-1), and taking into account that generally, except in the areas near urban settlements, the quality of the surface water is considered to be good, ranked in classes I or II).

Table 7-1: Identification of importance of the water courses

Sensitivity Value	Assessment Criteria
Very high	Natural rivers with unlimited retention capacity and constant water flow
High	Natural streams with unlimited retention capacity and constant natural
Medium	Natural rivers and streams with unlimited retention capacity and Periodic water flow Limited natural rivers and streams with and without retention and constant water flow. These are water courses that have partially lost their naturalness (e.g. in urban areas)
Low	Natural rivulets with unlimited retention capacity and Periodic water flow.
Negligible	Unnatural water channels without retention capacity

The assigned sensitivity values to the surface water courses existing along the road corridor are as follows

Table 7-2: The surface water courses sensitivity values along the road corridor

Name of the water course	Type of the surface water course	Km at which water course is crossed	Sensitivity value assigned
Malashi	Small stream	5+296	Medium
Lwitikila	Small River	11+837	High
Lufune	Seasonal stream	21+922	Negligible
Mwateshi	Seasonal stream	28+136	Negligible
Mukungwa	Small stream	38+832	Medium
Namulenga	Seasonal stream	46+269	Negligible
Lwanya	Small River	58+346	High
Chiseko	Seasonal stream	95+687	Negligible
Kabangama	Swampy/ Seasonal stream	110+803	Medium

7.3.2.2. Potential Impacts and likely Significance

All surface water bodies are vulnerable to pollution that reduces water quality and to changes in the flow characteristics (level and volume) from the project activities, both during the construction and the operational phases.

Construction activities have a potential to introduce pollutants into surface waters including sediment, fuel and lubricants. These compounds directly impact the physical and chemical quality status of the water and indirectly influence the living organisms in water.

During the construction phase, the most likely effect is the contamination of streams and rivers closed by the Mpika Chinsali Road where construction activities are taking place by the arrival of suspended solids swept by storm water runoff from the construction site devoid of vegetation. Suspended solids may also originate in products such as concrete, bentonite or grout used in the construction of bridges, containing walls, etc., which are either accidentally released or dumped during cleaning of the equipment that has held these products. The washout from concrete mixing plants or ready mix concrete vehicles is particularly damaging due to the highly alkaline nature of uncured concrete. The release of significant volumes of sediments to the water bodies by storm water runoff or direct disposal, can lead to changes in the flow patterns of the water course (biota will be affected as well, but this effect is addressed with the impacts on fauna).

Another source of surface water pollution during construction is leaks and accidental spills of hydrocarbons from construction vehicles and machinery, as well as of other hazardous substances handled during the construction activities, such as lubricants, paints, solvents, resins, acids, or uncured concrete. These leaks and spills could occur either at the construction site or at the storage sites for products and waste. The contamination of the water body may occur either directly (e.g. if the construction site is taking place very close to or on the river or stream) or indirectly, though soil and groundwater transport to the surface water body.

Changes to the existing drainage network may also occur due to the interception and redirection of the natural watercourses in order to construct drainage structures or the substructure of bridges. The effects of these activities are likely to last throughout the operational phase.

Finally, another effect that could take place (more unlikely) during construction is an increased surface water flow due to the discharge of large volumes of groundwater if dewatering was needed in the course of the construction or a cuttings because of the potential interception of the groundwater table.

The main construction activities associated to the current road project that may affect surface water bodies are summarized in Table 7-3.

Table 7-3: Type of construction activities that may affect surface water along the road alignment

Activities that provide a pollution source	• Uncontrolled sediment erosion and contaminated silt runoff caused by removal of vegetation and destruction of soil and gravel rocks into small fractions, which could cause water turbidity, sediment deposition on stream beds and banks, and accumulation on the slopes of rivers. Mainly caused by blasting, excavation and earthworks.
	• Leaks and accidental spills from the use of concrete, bentonite and grout during the construction of bridges. Cleaning of equipment holding these products.
	• Leaks and accidental spills of fuel, lubricants and other hazardous substances at product and waste storage areas
	• Leaks and accidental spills of fuel and lubricants from construction machinery and vehicles at construction site
	• Leaks and accidental spills from use at construction site of hazardous products (solvents, paints, acids, resins, etc.) during the construction of, bridges, permanent way)
	• Discharge of potentially contaminated groundwater from dewatering of potentially contaminated sites (if contaminated sites were detected and dewatering would be necessary)
Activities that cause a variations in natural flow	• Accumulations of excessive amounts of sediments in watersheds from increased runoff from cleared areas or cleaning of equipment (e.g. concrete mixing plant)
	• Changes to the existing drainage network, including interception and redirection of watercourses
	• Discharge of groundwater to surface water, if the groundwater table is intercepted.
Activities that provide a pollution pathway	• Blasting, excavation, earthwork
	• Vegetation clearing
	• Cleaning of equipment
	• Artificial water recharge activities

The following potential impacts on surface water have been identified and are subject to assessment for the construction and operational phases of Project Road Corridor from Mpika to Chinsali:

Construction phase

- Impairment of water quality due to the introduction of pollutants

Operation phase

- Impairment of water quality due to the introduction of pollutants; and
- Alteration of flow patterns and sediment deposition during flooding Periods.

7.3.2.3. Construction Phase

7.3.2.3.1. Impairment of water quality due to the introduction of pollutants

The reconstruction/rehabilitation and construction works of the road project are expected to have an impact on the surrounding water courses along the road corridor, since the alignment crosses them at several points.

Estimation of magnitude

The impact assessment was made based on the following considerations:

- The Intensity of the project activities that are expected to be performed in the surroundings of the water courses.
- In this regards, it is considered that the works to be performed in Lot 2 will have a high intensity and will have greater possibilities of releasing contaminants to the soil and surface water than construction works for Lot 1 and Lot 3.
- The sensitivity of the water courses to the pollution in the area of the construction works.

The overall magnitude of the impact is considered to be medium.

Once the magnitude of this impact has been estimated, the other criteria to assess this impact are as follows:

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Characterization of impacts	Negative	Not desirable
Type of Impact	Direct/ Cumulative	Water pollution generates due to emissions and contaminated effluents generated by the construction
Reversibility	Reversible	Water bodies have a self-purification capacity that allows the return to natural conditions
Geographical Extent	Local	The alteration of water quality is limited to the footprint of the project
Time when the impact occurs	Immediate	The alteration of the water quality occurs as the road construction takes place and contaminated effluents reach
Duration	Short-term	At each location it will last the time the construction activity takes place.
Likelihood of appearance	Probable	The execution of the construction works generate effluents and emissions to soil that may reach water bodies if care is
Magnitude	Medium	See above

7.3.2.3.2. Water pollution due to increase in suspended solids density

During construction of the project road, surface water source will be polluted by the following factors:

- ***Land erosion***:-As assessed above, total quantity of eroded soil in the whole route is about 2,660m^3, of which about 21% of eroded soil (corresponding to 532m^3) is deposited in the distance of 1,00m–3,000m from the road route; the remaining is deposited in rivers and streams in the distance of several kilometers downstream has total suspended solids (TSS) higher than the current background level (TSSbackground = 18.1 – 49.4 mg/l; averaging 32.9 mg/l) and water sources have TSS exceeding the allowable value for B1 class surface water under WHO on quality of surface water (allowable value for B1 – for purpose of irrigation is 50 mg/l). Due to the road route across many streams, quality of surface water is likely to be impaired and alluvial content will be higher than the background content in wet season. This will require taking mitigative measures.
- ***Directly receiving construction waste water***:-Total volume of waste water from the batching plants for 36 months of construction is 23,975m^3 (about 19.2m3/day). This waste water contains suspended residues, 4-6 times high and pH is often higher than the allowable value, resulting in increase in suspended solids content in water in areas directly receiving waste source. This effect, together with effect from eroding and washing the road base in wet season, will reduce water quality in most of the streams in the project area. This potential risk lasts 36 months of construction, and requires taking mitigative measures.

7.3.2.3.3. Receiving waste oil in machinery maintenance:

Total quantity of waste oil emitted for 36 months of construction is 168,308 litters, averaging about 3,506 litters/ month. Harmful waste discharging to the surface water sources pollutes for a long time on a large scale. As a consequence, aquatic organism and species in the oil spreading area die and pollute deposits. Spatial effect of this waste depends on a volume of oil overflowing to water source. Risk of oil pollution is potential during 36 months of construction but its effect after pollution will last longer and therefore will require to taking mitigative measures.

7.3.2.3.4. Receiving storm water overflowing on the construction route:

Storm water composition overflowing on the road surface and at construction site may contain lubricant pollutants due to leakage from construction machines. Lubricants spreading at the construction site can cause serious pollution of surface water source and aquatic system. Risk of oil pollution is potential during 36 months of construction but its effect after pollution will last longer and therefore it require taking mitigative measures.

7.3.2.3.5. Receiving domestic waste water:

Total average quantity of domestic waste water is about 112m3 and 105,190m3 in the whole construction phase. Loading volume of pollutants daily discharged to environment from workers and pollutant concentration in waste water are assessed. Pollutant concentration in domestic wastewater at the construction site is high. Untreated domestic wastewater discharged directly to surface water system causes water pollution as follows:

- Increase organic content and reducing saturated oxygen content, effecting on living conditions of shrimp, fishes and other aquatic species;
- Increase content of nutrients, result in eutrophication, create outbreak of alga and seaweed; and negatively affect development of aquaculture and irrigated water supply;

- Increase harmful microbe (cholera, dysentery, typhoid ...) and affect human health;
- Facilitate microbial decomposition, causing bad smell and effecting on landscape and tourist development.

7.3.2.3.6. Receiving overflowed storm water

Storm water overflowing the domestic waste dump with easily decomposed organic substances causes surface water pollution with the similarities as domestic water. Potential risk of water pollution lasts 36 months. It is required to take mitigative measures.

7.3.3. Potential Impacts on Groundwater

7.3.3.1. Potential Impacts and Likely Significance

The road construction is expected to have short-term impacts to groundwater resources primarily related to construction activities that may cause potential groundwater contamination or dewatering.

Potential pollution of groundwater could occur as a consequence of leaks or accidental spills at the construction site of hydrocarbons from construction vehicles and machinery, as well as of other hazardous chemicals handled for various purposes in executing the construction works (e.g. lubricants, solvents, acids, paints, resins). Accidental leaks and spills of hazardous materials may also occur at product storage areas and hazardous waste storage areas. Leaked or spilled hazardous contaminants most often will reach groundwater indirectly leaching through the soil or, for some construction activities, directly when the groundwater table is exposed to the atmosphere.

The main construction activities of the road project that may affect groundwater are summarized in the table below.

Table___: Type of road construction activities that may affect groundwater along the alignment

Activities that provide a pollution source	• Leaks and accidental spills of fuel, lubricants and other hazardous substances at product and waste storage areas
	• Leaks and accidental spills of fuel and lubricants from construction machinery and vehicles at construction site
	• Leaks and accidental spills from use at construction site of hazardous products (solvents, paints, acids, resins, etc.) during the construction of road bridges,
	• Works in contaminated sites (if present)
Activities that cause a variations in natural flow	• Piling
	• Boreholes
	• Excavations
Activities that provide a pollution pathway	• Dewatering activities during excavations, earthworks

7.3.3.2. Construction Phase

7.3.3.2.1. Impairment of water quality due to the introduction of pollutants

The susceptibility of an aquifer to surface pollutants is based on the degree of protection provided by geological materials overlying it. This is dependent on the vertical travel time required for a waterborne contaminant release at or near the land surface to enter the groundwater. Vertical travel time is primarily controlled by the permeability of the sediments and their thickness.

7.3.4. Potential Impacts an Climate and Air Quality

7.3.4.1. Assessment of Air Quality Receptors

The air quality receptors will be the people using the areas adjacent to both sides of the road alignment, namely the residents of the urban settlements in Mpika and the several small villages along the project road corridor.

The criteria used for the assignment of sensitivity values to air quality receptors are as follows:

- Health facilities and schools are always assigned a very high sensitivity value;
- Residential, recreational and commercial areas are assigned a low to high sensibility value. The sensibility increases with the degree of pollution to which the inhabitants are subject, and the density of population;
- Industrial areas are assigned a negligible to low sensibility value. The sensibility increases with the degree of pollution and the degree of industrialization.

7.3.4.2. Potential Impacts and Likely Significance

For this ESIA, the air emissions and their effects on air quality will be due to the construction of the project road, generated by the outdoor machinery, equipment and transportation vehicles, and to the operation with diesel machines during.

The following potential impacts on air quality have been identified for the construction and operational phases of T2 road from Mpika to Chinsali:

<u>Construction phase</u>

- Impairment of air quality due to emission of construction borne air pollutants

<u>Operation phase</u>

- Impairment of air quality due to emission of air pollutants from:

7.3.4.3. Construction Phase

7.3.4.3.1. Impairment of air quality due to emission of construction-borne air pollutants

The construction activities will generate dust and combustion gases from fuel powered machinery and vehicles (PM_{10}, $PM_{2,5}$, CO_2, NO_x, PAH, SO_2).

Dust will mainly be generated from earth movements blasting, excavation, levelling, dumping), wheels of trucks and machinery moving /travelling along unpaved surfaces, handling and transport of soil, wind erosion from exposed surfaces, and crushing plants.

In addition, the construction works will most likely be the cause of traffic congestion, particularly in the larger urban settlements of Mpika urban, Shiwang'ndu; Matumbo and Chinsali turnoff. Traffic jams that may occur when streets and local roads are fully or partially closed during construction will increase combustion air emissions from cars.

The construction camps, which will host a work force, could be another additional source of air emissions, particularly in winter, if heating systems are fuel powered or workers make camp fires for heating with wood collected around the camp.

An initial step in the construction phase will be the demolition of objects (buildings, houses, fences, etc.) located on the path of the road route. In the case of buildings and houses, their demolition implies the risk of finding asbestos containing materials that might have been used for their construction. If this happened a highly dangerous asbestos air contamination could occur. Because this is a very sensitive issue, the risk or air borne asbestos fibres and the dust control and mitigation measures to be implemented during the demolition works to minimize this risk as well as that of other harmful substances is addressed in detail in further below.

At the construction site, the possible impacts are expected across the axis of the road (at a distance of ± 100 m). The dispersion area of exhaust and dust (up to standard levels of air quality) depends on the concentration of machinery and equipment at the site and the capacity of their engines.

7.3.4.3.2. Dust generation

Upon demolishing old works including buildings within the road reserve in the scope of site clearance, a significant volume of dust will arise. It is difficult currenelty to quantify the volume of dust that shall be emitted from this activity. In fact, this volume of dust will be subject to method of demolishment and weather conditions. So, it is difficult to quantify satisfactorily. In empirical practice, dust concentration upon demolishing houses often exceeds 2-3 times as the allowable limit under WHO in a radius of 30-40m and Dust effect lasts 5-10 minutes after demolishment.

Sub-grading the construction plan will also generate a significant volume of dust, especially on sunny days and wind speed of V > 1 m/s. In a range of 20m from the site boundary windward, dust concentration is likely to often exceed twice as the allowable limit under WHO in the sunny and windy weather condition.

Dust and toxic gas will also come from the following activities: (i) Excavation and embankment of road-base, culvert improvements; (ii) Transport of soil, rock and materials on the roads; and (iii) Means of construction.

a. **Total quantity of excavated and embanked soil:** Total quantity of excavation and embankment for the project are estimated to be in the range of (i) 1,609,741m^3 from digging; and (ii) 1,047,365m^3 from filling; which will give an estimated total quantity of excavation and embankment to be around 2,757,106m^3
b. **Total quantity of transported soil:** Total quantity of soil and sand transported in the whole project is 1,365,746 tons.

c. **Dust emission coefficient:** According to the statistical figures of WHO (1998), dust emission coefficient in loading and transporting materials is as follows:
   - Loading materials generates 0.17 kg dust/ ton soil;
   - Transporting materials generates 0.134 kg dust/ ton soil.

d. **Total quantity of dust emitted:**
   As the figures above, total quantity of excavation and embankment are 2,757,106m^3 (corresponding to 2,757,106tons – average density of 1.2 t/m^3) and total quantity of transport of construction material is 1,365,746 tons.

   It is therefore expected that the project will emit an estimated 468,708kg of dust as a result of scooping up of earth and an estimated dust of 183,010Kg.

7.3.4.3.3. Dust and toxic gas emitted by transport of construction materials

a. **Total quantity of construction materials transported:**
   The expected quantity of construction materials to be used in the project will be transported to the construction place in an average length (for 1 truck) as listed in Table 7-4. Therefore, total length of transport of construction materials is calculated for 1 truck:

Table 7-4: Expected quantity and length for transport of material in the project

No.	Items of job	Average stretch of road(km)	Amount (ton)	Total of stretch of road(km)
1	Transportation of plastic concrete	6	76,580	91.896
2	Transportation of plastic concrete	27	334,255	1,804,974
3	Transportation of plastic concrete	32	246,275	1,576,158
4	Transportation of plastic concrete	54	39,844	430,316
5	Transportation of filling earth	10	672,184	1,344,368
6	Transportation of filling earth	15	233,007	699,020
7	Transportation of filling earth	25	150,357	751,783
8	Transporting longitudinal aggregate to fill	5	13,127	13,127
9	Transportation of rejected earth	7	179,883	251,836
10	Transportation of rejected earth	10	469,743	939,485
11	Transportation of rejected earth	13	74,588	193,930
12	Transportation of sand, rock	10	116,035	232,070
13	Transportation of sand, rock	15	1,011,705	3,035,116
14	Transportation of sand, rock	20	212,554	850,216
15	Transportation of iron, steel and others	12	10,485	2,5164
16	Transportation of iron, steel and others	25	10,460	52,298
17	Transportation of iron, steel and others	30	4,507	27,044
	Total of stretch of road/ unit of transportation			**12,318,800**

b. Total quantity of dust and toxic gas emitted:

In the transportation of construction materials, dust emission for the project will come from two (02) main sources:

- Loading from the road surface; and
- Emitting from internal combustion engine.

Dust emitted from road surface due to transport of material:

Dust emitted from the road surface is evaluated in the following formula:

$$E = 1.7K(s/12)(S/48)(W/2.7)0.7(w/4)0.5)[(365 - p)/365] \quad (3.1)$$

Where:

E – Dust volume emitted (kg/truck/km);
K – Coefficient considering dust size (K = 0.3 for dust < 10µm);
s – Coefficient considering the road surface (urban road s = 5.7);
S – Average speed of the truck (S = 30 km/h);
W – Weight (ton);
w- Tire;
p – Average rainy days in the year.

Apply the formula above for the truck W = 10 tons, number of tires w = 6, coefficient considering dust size K = 0.3; Coefficient considering the road surface s = 5.7; Average speed of the truck S = 30 km/h; p = 125 for the project implementation area, dust intensity emitted from the road surface and total dust emission volume during the operating truck are assessed in Table 7-5.

Table 7-5: Loading of emission volume from road surface due to transport of material

Strength of waste arising E (kg/vehicle/km)	Total of stretch of road VC. (km)	Total of waste arising (kg)
0,3936	12,318,800	4,848,930

Dust and toxic gas emitted from internal combustion engine:

The quantity of dust and toxic gas emitted from internal combustion engine of the construction material trucks is assessed based on the emission coefficient announced by World Health Organization (WHO) for trucks using DO lubricant and weighting 10 tons. According to WHO, the quantity of dust and toxic gas emitted from 10ton truck in the length of 1,000 km is 0.9 kg dust; 2.075 S kg SO2; 14.4 kg Nox; .9 kg CO and 0.8 kg HC, S = 0.05% - is the limit of sulfur content in diesel). Emission from internal combustion engine of the construction material truck during construction phase is listed in Table 7-6.

Table 7-0-1: Total emission volume from internal combustion engine of transportation vehicles

Order number	Pollutant	Amount of waste/1.000 km (kg)	Total of stretch of road (km)	Total of waste (kg)
1	SO_2	2,075 S	12,318,800	12,78
2	NO_x	14,4	12,318,800	177,391
3	CO	2,9	12,318,800	35,725
4	HC	0,8	12,318,800	9,855
5	Dust	0,9	12,318,800	11,087

7.3.4.3.4. Dust and toxic gas emitted from means of construction

a. Quantity of motor vehicles used in construction:

Emission coefficient:

- The following emission coefficients are used for 1 liter of diesel (*Source: US. EPA, Locomotive Emissions Standard, Regulatory Support Document, April, 1998):* HC – 2.83 g/l; CO – 7.25 g/l; Nox – 66.0 g/l; PM10 – 1.80 g/l.

Total dust and toxic gas emitted:

- Emission of construction machines is assessed from the emission coefficient and fuel consumption. The figures are listed in Table 7-6.

Table 7-6: Total exhaust volume in a production shift of equipments

Machine	Fuel (litre/shift)	Total of waste/shift(g)			
		HC	CO	Nox	PM10
Grader 110 CV	46.20	131	335	3048	83
Bladder 110 CV	38.88	110	282	2565	70
Grader 140CV	58,80	166	426	3880	106
Compressor 25T	54.60	155	396	3602	98
Machine	**Fuel (litre/shift)**	**Total of waste/shift(g)**			
		HC	**CO**	**Nox**	**PM10**
Compactor 10T	26.40	75	191	1742	47
Tyre roller 16T	37.80	107	274	2494	68
Vibrating roller 25T	67.20	190	487	4434	121
Spreader 50 - 60 m^3/h	33.60	95	244	2217	60
Spreader 130 - 140 CV	50.40	143	365	3325	91
Truck watering tar 7T	45.90	130	333	3028	83
Compressor 600 m^3/h	38.40	109	278	2534	69
Excavator 1.65 m^3	75.24	213	545	4964	135

mixing station 60 T/h	1836.00	5197	13309	121137	3303
Digging machine 1.6 m^3	113.22	320	821	7470	204
Watering truck 5 m^3	22.50	64	163	1485	40
Rammer	3.57	10	26	236	6
Craning K33-60	232,56	658	1686	15344	418
Pneudraulic machine 240m^3/h	27,54	30	77	704	19
Pneudraulic machine 360m^3/h	34,56	98	251	2280	62
Pneudraulic machine 660m^3/h	38,88	110	282	2565	70
Sprocket craning 25T	47,00	159	408	3710	101
Sprocket craning 16T	45,00	158	404	3677	100
Digging machine 0,8 m^3	64,80	30	76	693	19
Digging machine 1,25 m^3	82,65	161	412	3748	102
Borer VRM	51,60	97	249	2262	62
Sprocket craning 63T	56,25	115	296	2690	73
Electric generator kW	45,00	195	499	4541	124

7.3.4.3.5. Assessment of dust and toxic gas emission in the air

✓ ***Dust and toxic gas emitted by excavation, embankment and transport of construction materials.*** Emission relating to excavation, embankment and transport of construction materials is continuously contributed on the whole route. Therefore, it is considered that emission source is the basis for assessing transmission of pollutants windward.

Dust and toxic gas concentration in a distance x at the end of windward from the road source is assessed in the adapted model of Sutton as follows:

$$C(x) = 0.8E\{\exp[-(z+h)^2/2U_z^2]+\exp[-(z-h)^2/2U_z^2]\}/(U_zV) \quad (3.2)$$

Where:

C(x) – Concentration of air pollutant in a distance x (mg/m^3);
E - Emission, mg/ (m/s);
z - Elevation (m);
U_z - Diffusion coefficient in axis Z; with atmospheric stability B: $U_z = 0.53x^{0.73}$;
V – Average velocity (m/s);
h – Height of road surface (m).

Construction duration is 36 months (26 working days per month). Parameters in the model are assessed as follows:

- Total volume of dust emitted = dust from excavation, embankment + Dust emitted from road surface due to transport of material + dust emitted from truck engine = 5,672,655 kg;
- Total volume of emission from truck engine is taken from Table 7-7;
- Other parameters of the model: Point elevation z = 1.5 m; average velocity V = 3m/s; height of road surface above two sides of ground h = 0.2 m.

Total emission strength for road sources is listed in Table 7-8.

Table 7-8: Total emission strength for road sources

Order Number	Agent	Total of waste *(kg)*	Strength of waste source *(mg/m/s)*
1	Dust	5.672.655	0,7611
2	SO_2	12,78	0,000002
3	NO_x	177.391	0,0238
4	CO	35.725	0,0048
5	HC	9.855	0,0013

Dust concentration in the air relative to the fair wind distance is at 1.5m height in the model and results are listed in Table 7-9 and Table 7-10.

Table 7-9: Dust concentration in the air relative to the fair wind distance at 1.5m height (wind velocity V = 3 m/s)

Distance x (m)	5	10	20	40	60	80	100	120	140	160
Concentration (mg/m^3)	0,161	0,124	0,082	0,051	0,038	0,031	0,026	0,023	0,021	0,019

Table 7-10: Gas emission concentration in the air relative to the fair wind distance at 1.5m height (wind velocity V = 3 m/s)

Distance (m)	5	10	15	20	25	30	35	40	45
SO_2 (mg/m^3)	3,6E-07	2,8E-07	2,2E-07	1,8E-07	1,6E-07	1,4E-07	1,3E-07	1,1E-07	1,1E-07
NO_x (mg/m^3)	0,0050	0,0039	0,0031	0,0026	0,0022	0,0019	0,0017	0,0016	0,0015
CO (mg/m^3)	0,00101	0,00078	0,00062	0,00051	0,00044	0,00039	0,00035	0,00032	0,00029
HC (mg/m^3)	0,00028	0,00022	0,00017	0,00014	0,00012	0,00011	0,00010	0,00009	0,00008

Comments:

- Dust concentration in the air significantly increases in construction compared to background dust concentration before construction (background dust concentration in a range of 0.012 – 0.106 mg/m3; average dust concentration of 0.038 mg/m3). However, in a distance of > 5m from the road edge, dust concentration is 0.20 mg/m3 smaller than the allowable value in 24 hours under
- Dust emitted from road surface due to construction material trucks is about 85% of total dust from 3 main emission sources.
- Gas concentration in the air from the construction material trucks is smaller than the allowable value under.

7.3.5. Potential Impacts of Noise and Vibration

7.3.5.1. Assessment of Noise and Vibration Sensitivity

The project road from Mpika to Chinsali passes through or near several settlements, including the urban area of Mpika and several villages, which, following what is established in noise regulations may correspond to areas with degree I (health care), II (residential), III (mixed residential and commercial uses) or IV (industrial uses) of noise protection (*see table below).*

Noise and vibration effects during the road construction and operational phases will be important in high sensitive areas (residential areas and areas with health institutions, and school). This will be particularly so during the operational phase, when long- term noise and vibration disturbances during the day (7 am – 7 pm), evening (7 pm – 11 pm) and night (11 pm – 7 am) may occur.

In order to prepare this assessment the noise and vibration receptors that might be affected by noise and vibrations from the road activities (construction and operation) have been identified and assigned to a sensitive category. The identification was made for the nearest settlements along the road corridor, in all three lots, on the left and right sides of the alignment.

The minimum and maximum distances of the first row of buildings/houses in each settlement, as well as the number of rows affected, were defined using the topographic maps. The minimum distance of the first row of objects (building/house) was found to vary from 8 to70 m on the right side and 10 to 300 m on the left side. A very important value is the length of the row of objects affected by noise and vibration in order to later prescribe the mitigation measures, if needed.

The next step was the assignment of the baseline noise levels to each receptor settlement. The two main sources of information used were:

- The noise measurements performed at several points along the project road corridor route in June 2016 by the Consultant. These measurements were used to assign baseline noise levels to all the settlements where measurements were made.
- For some villages where no measurements were performed, the baseline noise levels were assigned taking into account the similarity of these villages in term of density of population, density of houses, land configuration, proximity of other noise sources, etc. with the villages where the noise measurements were performed.

Thus, there are two receptors, Phillip Kabangama Primary Schools, with very high sensitivity. The rest are all residential areas and will be considered to have a high sensitivity, including those in which there may be mixed uses, like, for instance, in Mpika urban, Shiwang'andu, Matumbo and Chinsali Turnoff. In these cases it has been considered that, unless the area is clearly commercial, the residential use should prevail over the commercial or industrial use and therefore the assigned sensitivity has been high.

The overall sensitivity of the noise and vibration receptors is high.

7.3.5.2. Noise

Noise is defined as unwanted sound and is perceived as a pollutant and an environmental stressor. Sound is what we hear when our ears are exposed to small pressure fluctuations in the air. Noise

can be described in terms of three variables: a) amplitude (loud or soft), b) frequency (pitch), c) time pattern (variability).

Noise is generally considered as an annoyance, defined by the World Health Organisation (WHO) as "a feeling of displeasure evoked by noise". However, noise is more than just a nuisance: in Europe, around 40% of the population is estimated to be exposed to noise levels that are potentially dangerous to health. At least 170 million Europeans are seriously affected by noise in their residential areas.

Noise affects nervous and hormonal systems, which can increase the risk of cardiovascular disease and damage to cognitive function. Health effects of noise pollution may include:

- Sleep disturbance, including loss of sleep quality, and awakening. Disturbed sleep and tiredness can lead to loss of concentration, more accidents and injuries.
- Disrupted learning, understanding and memory (especially in children).
- Annoyance, leading to stress and reduced quality of life.
- Tinnitus (perception of sound within the human ear in the absence of corresponding external sound).
- Heart disease, including heart attacks, and other problems as a result of raised blood pressure.

Figure 7-1 illustrates the increasing severity of health effects of noise pollution and its distribution among populations (number of people affected vs severity).

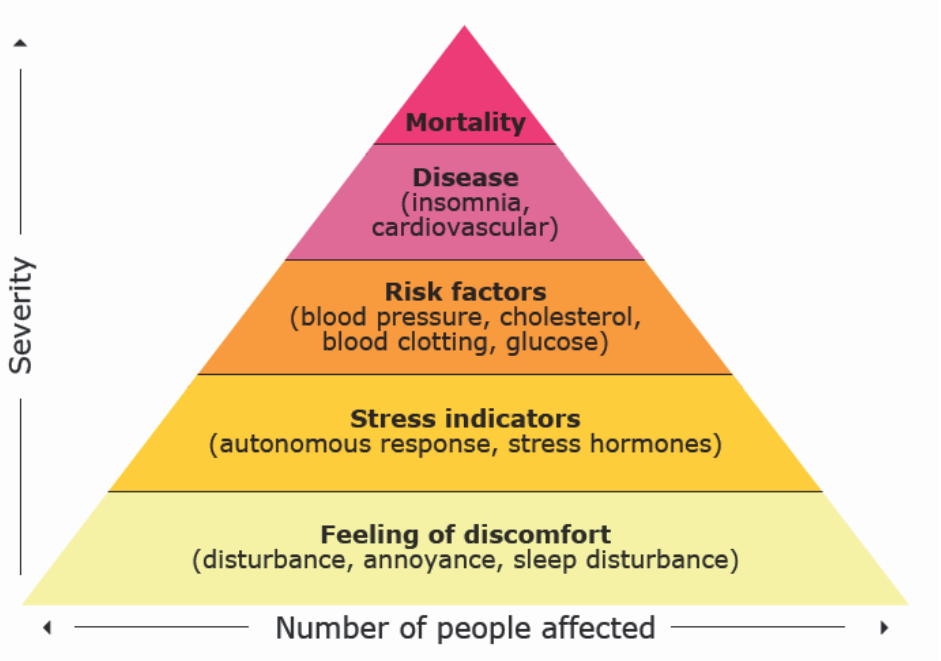

Figure 7-1: Pyramid of effects (WHO 1972 – modified);
Source: EEA Good practice guide (2010)

In contrast to many other environmental problems, noise pollution continues to increase. Traffic noise from roads, airports and roads is the most widespread source and increasingly recognized as a key environmental cause of physical and mental health impacts.

7.3.5.3. Vibration

Ground-borne vibration can be a serious concern for residents. The effects of ground-borne vibration include perceptible movement of building floors, interference with vibration sensitive instruments, rattling of windows, shaking of items on shelves or hanging on walls, and rumbling sounds.

Vibration consists of rapidly fluctuating motions. However, human response to vibration is a function of the average motion over a longer (but still short) time Period, such as one second. In contrast to airborne noise, ground-borne vibration is not a phenomenon that most people exeperience every day.

The background vibration level in residential areas is usually 50 VdB or lower, well below the threshold of perception for humans, which is around 65 VdB.

Most perceptible indoor vibration is caused by sources within a building such as the operation of mechanical equipment, movement of people, or slamming of doors. Typical outdoor sources of perceptible ground-borne vibration are construction equipment, steel-wheeled trains, and traffic on rough roads.

The following potential impacts on noise and vibration have been identified for the construction and operational phases of proposed rehabilitation of the T2 road from Mpika to Chinsali:

Construction phase

- Impairment of acoustic quality due to noise emissions from construction vehicles and machinery.

Operation phase

- Impairment of acoustic quality due to traffic noise emission;
- Annoyance to residents and damages to buildings due to vibrations from vehicle n traffic.

7.3.5.4. Construction Phase

7.3.5.4.1. Impairment of acoustic quality due to noise emissions from construction vehicles and machinery

During the construction phase, different outdoor machinery and equipment is applied in the process, which cause rather high noise and vibration emissions to the environment, affecting the population inhabiting the surrounding area. The camps and the auxiliary areas will also be busy areas that will generate noise.

Noisy construction operations (earth movements and bridges construction, demolition, dredging, production of gravel and concrete, transport of materials in and out the construction site, etc.) will take place in areas which are currently very quiet, with several small villages along the route.

Estimation of magnitude

The magnitude of the noise impact from the outdoor equipment will depend on the machinery, mechanization vehicles, transportation vehicles and tools intended to be used during construction works, their noise emission levels (noise specification of equipment should be declared by the manufacturer based on the noise certification), the location where the equipment will be positioned during the work, the number of the equipment used at one place at the same, and the distance from the sensitive receptors.

Table___ shows average noise level specifications for the outdoor equipment most commonly used for different purposes in the construction of civil works. The different elements of this equipment usually will be dispersed along the alignment under construction and not all machines will work at the same time.

Table 7-12: Common used outdoor equipment during extraction and excavation works on road projects with noise specifications

Type of equipment (extraction-discharge work)	Sound level (dB)A	Time of duration	Type of equipment (excavation –earth work)	Sound level (dB)A	Time of duration
Bulldozer	90	long-term	Distributor	83	long-term
Compressor	80	short-term	Finisher	83	long-term
Grader	83	long-term	Trampling machine	90	long-term
Water jet machine	87	long-term	Truck	85	linear
Truck	85	short-term	Watering machine	87	long-term
Trampling machine	90	long-term	Electrical welding machine	95	short-term
Drilling machine	85	short-term	Metal plate cutting machine	95	short-term
Concrete pump	110	short-term	Pneumatic drill	85	short-term

Because the noise energy dissipates in the air as it propagates, the noise levels will be attenuated as the distance to the source increases. Noise will also be dissipated by objects, walls, hills, buildings, etc. as well as by temperature and wind, but the attenuation due to distance is the primary estimator of the drop in noise level in an outdoor setting.

Considering the noise from the construction works at a given site as a point source, the attenuation of the noise level with distance can be estimated with the equation below:

$$\text{Noise level at receptor} = 20 \text{ Log10 } (DS/DR)$$

Where DS is the reference distance to the source (normally 1 meter or 10 meters from the source emitting the sound) and DR is the distance between the source and the receptor.

This relationship can be simplified with the rule of thumb that the noise level drops 6 decibels when the distance doubles.

As an example, in table below noise level decreasing trend is presented as a result of increasing of the distance from the construction site (various construction activities) to the nearest noise receptors.

Table 7-13: Noise levels at various distances from the construction site during ground extraction, transportation and earth work stage.

Distance from the construction site to the receptors [m]	Sound equivalent level [(dB) A}	Distance from the construction site to the calculation point [m]	Sound equivalent level [(dB) A}
40	81	40	73
60	78	60	71
80	76	80	68
100	74	100	66
200	68	200	60
300	64	300	57
400	62	400	54
500	60	500	52

In order to assess the noise impact during the construction works of the project road, it has been taken into account that construction works be constructed over its entire length; therefore, heavy, noisy machinery will be required along the entire length of the project road.

With these considerations, it has been assumed a value of 105 dB (A) has been assumed. With these assumptions, the expected increases on noise levels at the locations of the most sensitive residential receptors living along the alignment (residents) have been calculated.

Table 7-14: Change in noise levels magnitude of impacts

Noise change, LA10,18h	Magnitude of Impact
0 – 0.9	Negligible/No
1 – 2.9	Low
3 – 4.9	Medium
5+	High

It is observed, that for most of the receptors in any LOT Section that live nearer to the road alignment, the impact on noise from construction will be high. Once the magnitude of this impact has been estimated, the other criteria to assess this impact are as follows:

Criteria	Assessment Thresholds	
	Threshold	Descriptions
Characterization of impacts	Negative	Not desirable
Type of Impact	Direct	Impairment of the acoustic environment will occur because of the execution of construction works
Reversibility	Reversible	Noise levels will return to baseline levels when the construction works are over.
Geographical Extent	Local	Noise increases will be limited to the footprint of the project
Time when the impact occurs	Immediate	Noise levels will increase as soon as vehicles, machinery, equipment enter the construction site.
Duration	Short term	During the time construction works take place at a given location
Likelihood of appearance	Certain	Construction vehicles and equipment are sources of outdoor noise.
Magnitude	High	See above

Considering to the high sensitivity of receptors, the initial significance of this impact, without mitigation measures is Large.

7.3.6. Potential Impacts related to waste

7.3.6.1. Construction Phase

Waste in the construction phase of the project will include soil, dust and toxic gas, solid waste, waste water and waste lubricant. These sources of waste for the project have been evaluated in detail as follows:

7.3.6.1.1. Wastes from demolishing and forming the construction plan

In the road reserve clearance, it is required to demolish a number of structures (717) of all kinds in the three lots of the project *(i.e. lot 1= 12; Lot 2= 343 and Lot 3= 262)*, resulting in stone and soil wastes. Main compositions are bricks, stones, and concrete and construction wastes … suitable to sub-grade. Besides, other materials such as milled wood, waste sheets and steel of kinds arise in this phase but it is difficult to quantify because the houses to be demolished are built with different materials. In general, volume of stone and soil wastes is little; all waste materials are reusable and non-toxic. They only make landscape bad-looking if not being cleaned.

In the site clearance, it is also expected that the project will cut down trees; which will result in a significant volume of wastes such as tree-trunks, branches and leaves. At the time of preparing this ESIS, the construction sites for various facilities such as construction camps were not yet identified. However, it is estimated that 16 construction sites will be established for the entire project and vegetation will need to be cleared in these construction sites. Normally, they are used for different

purposes; however, small branches and leaves and milled wood will remain much at the position and will be collected to ensure landscape and environmental sanitation.

Spatially, these wastes will be distributed throughout the road corridor/route. These wastes will arise within about 10 days at each position.

7.3.6.1.2. Wastes from preparation of the construction site

Wastes will arise mainly from cleaning construction sites, installing power and water supply systems, constructing material storage, steel processing shops, beam casting yard and site hut for workers.

Main compositions of these wastes are milled wood, papers, steel and iron, bags and nylon … Its volume is difficult to evaluate because of diversification of machines and skills of workers. They are solid wastes and except for nylon bags, most of them are nontoxic and reusable.

Spatially, it is not clear currently where these construction sites will be located as this will be determined by the three contractors but as mentioned earlier, it is anticipated that 16 construction sites will be constructed for the project and most of these will be in Lot 2 and 3.

7.3.6.1.3. Solid waste

Types of solid waste expected from the project during construction phase are listed in Table 7-15.

Table 7-5: Solid waste arising during construction phase

No.	Activities of construction	Type of hard waste	Note
1	*Road construction*		
-	Road and intersection	wood, rubbish	Hard waste of Construction
-	Drain construction	Concrete, brick, wood….	
2	*Bridge/Culverts*		
-	Construction lower part	Steel, iron, rubbish	Hard waste of Construction
-	Construction upper part	Rubbish, waste	Hard waste of Construction
3	*Relevant activities*		
-	Concrete mixing station	packages, waste	
-	Machines for work	rag with oil for cleaning machine	Dangerous waste
-	Machine maintain	rag with oil for cleaning machine	Dangerous waste
-	Camps for employee	Rubbish from living	

Solid waste from the project will include construction wastes such as milled wood, concrete, broken brick, material bags, steel and iron… It is difficult to forecast waste quantity subject to many factors during construction phase. In fact, traffic road projects show that this type of solid waste is much less than soil and rock of kinds.

7.3.6.1.4. Domestic solid waste

According to recent assessments, average volume of domestic wastes of a Zambian person is about 0.5 kg/person/ day (except big urban areas).

With the number of workers of 1,124 people/ day, the average volume of domestic solid waste of the workers is about 562 kg/day. It averages 35 kg/day at each construction site.

Besides normal waste, domestic wastes emit toxic substances from organic components easily decomposed and bacterium which may enter surface water sources in case of ineffective solid waste management and treatment.

7.3.6.1.5. Hazardous solid waste

Hazardous solid waste arising during construction phase will mainly be normal solid waste adhering to lubricant such as wipers, lubricant bearing wastes due to leakage ... It is impossible to quantify this waste, but in the empirical fact, this type of waste is insignificant.

7.3.6.2. Waste water

Waste water expected from the project during construction phase is listed in Table 7-16 below.

Table 7-16: All types of sewage during construction phase

Order number	Activities of construction	cared components in waste	Note
1	*Works*		
	Concrete mixing station	High Level pH	Waste water of construction
	Camps for employee	Objects of physical chemistry, bacillus coliform	Waste water for living
	Machine maintain	Waste oil	Dangerously waste water
2	Machines for work	Leak out oil	Dangerously waste water

7.3.6.2.1. Waste water from the batching plant

Waste water will mainly be from the batching plants at construction sites. Currently, construction sites are not yet established but are in the range of 16 construction sites to be arranged along the route. Arranging the batching plants and specific capacity at construction sites has not clearly determined in this phase. Therefore, total volume of waste water for each phase and average volume of waste water for the construction sites are assessed. Calculation of emission volume is based on quantity of necessary concrete for the project and rating of the batching plants (the batching plant needs 87m^3 of water to wash aggregate and 10m^3 water to mix concrete; in which 80% used to wash aggregate is reused). Figures of emission from the project for 36 months are listed in Table 7-17.

Table 7-17: Sewage from batching plants in project

Amount of concrete (m^3)	Amount of water used (m^3)	Total of waste (m^3)	Average waste per day (m^3)	Amount of works	Average per work (m^3/day)
68.695	37.714	23.975	19,2	16	1,2

This waste water contains suspended residues, 4-6 times as high as the allowable value under WHO (compared to column B) and pH is often higher than the allowable value.

7.3.6.2.2. Domestic waste water

The number of workers on the construction route is about 1.124 people/ day. Average volume of domestic water consumed at construction sites is about 100 litters/ person/ day.

Daily loading of pollutant volume into water environment is listed in Table 7-18.

Table 7-8:Daily loading of pollutant volume into environment for one person

Order number	Pollutants	Tonnage (g/person/day)
1	BOD_5	45 - 54
2	COD	(1,6 - 1,9) x BOD_5
3	Total of hard material	170 - 220
4	Hanging hard material	70 - 145
5	Oil	10 - 30
6	Alkali (Following $CaCO_3$)	20 - 30
7	Clod (Cl^-)	4 - 8
8	Total Nitro (N)	6 - 12
9	Free Amani	3,6 - 7,2
10	Total Phosphor	0,8 - 4
	Bacillus	**Total amount in 100ml of waste water**
11	Total Bacillus	10^9 - 10^{10}
12	Coliform	10^6 - 10^9
13	Faecal	10^5 - 10^6
14	Helminth	~ 10^3
15	Virus	10^2 - 10^4

From the above statistic figures, daily loading of pollutant volume into environment is listed in Table 7-19.

Table 7-0-29: Loading volume and concentration of pollutants discharged by workers into environment

Order number	Objects of pollution	Amount of amount(kg/ day)	Concentration of waste in Water (mg/l)	(mg/l)
1	BOD_5	289 - 346	450 - 540	50
2	COD	10 - 12	780 - 945	-
3	Total dissolving hard material	1091 - 1411	1.700 - 2.200	1000
4	Hanging hard material	449 - 930	700 - 1.450	100
5	Non-mineral lubricant	64 - 192	100 - 300	20
6	Alkali (following $CaCO_3$)	128 - 192	200 - 300	-
7	Clod (Cl^-)	26 - 51	40 - 80	-
8	Total Nitro (N)	38 - 77	60 - 120	-
9	Total Phosphor	5 - 26	8 - 40	-
10	Coliform (in 100ml)		10^6 - 10^9	5.000

Comments:

Pollutant concentration in domestic wastewater at construction sites is expected to be much higher than the allowable limit. If a large number of workers concentrate on any place and untreated wastewater is discharged directly to the receiving source, this will cause local pollution of surface water sources in the area.

7.3.6.2.3. Hazardous waste water

Hazardous waste water includes lubricants periodically replaced and wastewater mixed with lubricants in maintaining motor vehicles. Quantity of lubricants in the project area is subject to the following factors:

- Number of motor vehicles at construction sites;
- Periodic replacement of lubricants and maintenance of machinery;
- Quantity of lubricants per replacement/ maintenance.

Results of waste lubricant survey in some areas are as follows:

- Quantity of waste lubricant from means of transport and motor vehicles is 7 liter/ replacement.
- Lubricant replacement and machine maintenance average 120 shifts (80-160 shifts for lubricant replacement subject to operational strength and means of transport).

Results of assessing waste lubricants are listed in Table 7-20.

Table 7-20:Quantity of lubricants discharged from maintenance activities for construction machines

Total machine shift	Cycle of changing (Shift)	Times of changing	Total lubricant (lít)	Average per month (litre per month)
2.885.227	120	24.044	168.308	3.506

7.3.7. Potential Impacts on Habitats

7.3.7.1. Assessment of Habitats' Sensitivity

7.3.7.1.1. Methodology for assigning habitats 'sensitivity

Based on the description of current situation of biodiversity (habitats and related species) in Chapter 6, and using nationally and internationally recognized criteria, the sensitivity of habitats was assessed. In order to facilitate the subsequent assessment of the impacts on habitats of road construction and operation, the most sensitive, valuable sites were then highlighted with regards to their natural or human induced values.

Habitat's sensitivity was assessed using a matrix that was specifically designed for this purpose. The matrix was used to evaluate the sensitivity of natural habitats and also that of those of an anthropogenic origin. In order to generate the matrix, the ecosystems/sites (presented in the rows of the matrix table) were evaluated against the criteria (presented in the columns of the matrix table).

Eleven different criteria were applied in order to evaluate the sensitivity of the habitats:

1. Habitat Directive (habitats);
2. Rare communities in Zambia;
3. Well preserved natural communities;
4. Presence of species from IUCN Global Red List;
5. Presence of threatened birds;
6. Presence of endemic species;
7. Biocorridor function;
8. Landscape value;
9. Economic value;
10. Erosion prevention; and
11. Pollution prevention value.

The criteria were selected in order to demonstrate national and international (European and global) importance of the habitats and their species composition as it can be found in the area of the project interest. The highest criteria values can be applied to the habitat, the more sensitive it will be. The description of the criteria is as follows:

- Criterion 1: Habitats Directive (Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora). The list of important habitats is given in Annex I- Natural habitat types of community interest whose conservation requires the designation of special areas of conservation.
- Criterion 2: Rare communities in Zambia. Rareness of the community was estimated on the basis of experts' experience and current knowledge about distribution of the community.
- Criterion 3: Well preserved natural communities. The degree of naturalness, i.e. the extent of human intervention and land use pattern was evaluated on the basis of expert judgment.
- Criterion 4: Presence of species listed in IUCN Global Red List. The number of species listed on IUCN Global Red List in the habitat determines the value. The categories of the

IUCN Red List used for this purpose are Critically Endangered (CR), Endangered (EN) and Vulnerable (VU).

- Criterion 5: Presence of threatened birds. This criterion is based on several conventions.
- Criterion 6: Presence of endemic species. This criterion evaluates the number of endemic species present in the habitat. The score presented in the matrix table is the average of the scores for endemic species of flora and fauna.
- Criterion 7: Biocorridor function. This criterion is related to migration movement of animals (and wild plants) throughout the landscape. It evaluates the size and growth pattern of the habitat patches as well as naturalness of the habitat. Natural, dense and old forests that cover large areas will have greatest value (natural stands – offer more food resources to animals). Natural grasslands in forested areas were also considered important since they serve as foraging habitats for ungulates.
- Criterion 8: Landscape value. The landscape value was estimated based on several characteristics: structural and functional importance of certain landscape, aesthetic value, rarity in Zambia, etc.
- Criterion 9: Economic value. The importance of the ecosystem for human economy is considered in this criterion. The most important economic values in the project area concern forestry, water potential and livestock breeding.
- Criterion 10: Erosion prevention. One of the important features for the preservation of the natural conditions is the erosion prevention potential of the habitat. The presence of natural riparian vegetation in natural streams is considered as erosion preventive.
- Criterion 11: Pollution prevention value. The absorption capacity for pollutants is a very important feature of the ecosystems. The evaluation was based on expert judgment.

For each criterium, a scoring value from 0 to 3 was applied, with the following meaning:

1. - No occurrence/importance
2. - Low occurrence/importance
3. - Medium occurrence/importance
4. - High occurrence/importance

The sum of scores for a habitat determines its sensitivity. The highest possible score is 36. The rating of sensitivity was performed on the basis of the following ranges:

- 0 - 3 - negligible sensitivity (ns)
- 4 - 9 - low sensitivity (ls)
- 10-17 - medium sensitivity (ms)
- 18-27 - high sensitivity (hs)
- 28-36 - very high sensitivity (vhs)

7.3.7.2. Potential Impacts and Likely Significance

The following potential impacts on habitats have been identified for the construction and operational phases of proposed Mpika to Chinsali road rehabilitation:

Construction phase

- Habitats loss
- Temporary severance of riparian biocorridors

Operation phase

- Habitats fragmentation

7.3.7.3. Construction Phase

7.3.7.3.1. Habitats Loss

The construction of the project road involves the clearance of the land strip. This means the elimination of the vegetation cover and earth movements to prepare the corridor and, therefore, the destruction and loss of the habitats along the land strip along the project road corridor. In addition, there will be land temporarily used for the installation of construction camps were vegetation will also be cleared and earth movements carried out.

Estimation of magnitude

The magnitude for the Loss of Habitat impact will be estimated by determining the total surface of high sensitive and medium sensitive habitats that is intersected by the project road corridor.

With regards to the high sensitive habitats, the broad road corridor comprises the following habitats: protected forest-although highly encroached (i.e. Bwinjimfumu National Forest); Miombo woodlands, Hill pastures, Rivers and streams, and swampy areas. Of these habitats, all of them will be intersected by the construction of the road, except for the riparian forests and belts along the rivers and streams.

As for the belts along the rivers and streams, these habitats will be crossed by means of bridges and although there may be some occupation of these habitats to build these structures, it has been considered that the surface occupied will be negligible. Moreover, this type of habitat will be thoroughly considered in the impact on Temporary severance of corridors.

For certain types of habitats like Hill pastures, it has been taken into account that although the road route stretches through a large portion of different types of hill pastures: dry grasslands, grasslands with shrubs and grasslands on stony and rocky ground, most of these are encountered at parts of the alignment

Overall, the magnitude of the impact on loss of habitat is low.

Once the magnitude of this impact has been estimated, the other criteria to assess this impact are as follows:

Criteria	Assessment Thresholds	
	Threshold	Descriptions

Characterization of impacts	Negative	Not desirable
Type of Impact	Direct	The loss of habitat derives directly from the land clearance needed for the construction of the road
Reversibility	Irreversible	Except for the construction camps, the loss of habitat will be, for practical purposes, irreversible on the long term
Geographical Extent	Local	The loss of habitats is limited to the footprint of the project
Time when the impact occurs	Immediate	The loss of habitat occurs as soon as land clearance is executed
Duration	Long-term	It will last during the operational life of the project and later
Likelihood of appearance	Certain	The land will necessarily be cleared for the road construction
Magnitude	Low	See above

Considering a medium to high sensitivity of the receptor, the initial significance of this impact, without mitigation measures is Slight to Moderate.

7.3.7.3.2. Temporary severance of riparian biocorridors

This impact refers to those areas that will be occupied during construction and which not necessarily will remain permanently occupied by the road. These areas generally correspond to valleys of permanent or stationary water courses that are crossed by means of bridges.

Water courses and their banks provide shelter and food to animals of the riparian habitat and of adjacent habitats, and are used as natural corridors in their movements to search for foraging, breeding or nesting areas. The construction of the pillars of bridges and viaducts requires punctual elimination of the vegetation at the area where the pillars will be constructed, but above all it is the presence of extraneous elements (workers, moving vehicles and machinery, deposits of construction materials) what will frighten wild animals, causing them not to use the biocorridor. An even more severe severance effect will occur in the areas to be used as landfills, where the original riparian habitat will be buried during the construction phase, even if the area is later rehabilitated, and a riparian habitat reproduced.

The temporary severance impact may be extended to those areas where habitats will be destroyed to install temporary facilities that will be abandoned upon completion of the road construction (e.g. material storage areas, construction camps), and to the very same construction front areas where the presence of construction workers, vehicles and machinery will keep away the fauna that using the corridor.

Estimation of magnitude

The magnitude of this impact has been evaluated in a qualitative manner. For this, the areas of vegetation belts along the rivers and streams crossed by the project road have been considered as areas that are likely to be used as biocorridors. Moreover, the types of the other habitats

existing in their proximities have also been considered so as to estimate the usage of the riparian biocorridors by wild animals. Thus, those corridors that are in or close to populated areas of low sensitivity (urban or rural settlements and ruderal and agricultural lands) would be expected to have a lesser usage than those that connect high and medium sensitive habitats.

Using this approach, it is observed that LOT 2 is the one where the road corridor crosses the larger number of riparian biocorridors (8), compared to LOT 1 (0) and LOT 3 (4). There are also differences in the expected usage of the biocorridors. In LOT 1 of the project road corridor, which is a densely populated area compared to LOT 2 and 3, there are very few areas of biocorridors located in this urban areas. In sections 2 and 3, most of the riparian biocorridors, are surrounded by high or medium sensitive habitats, where wild animals are likely to found optimal conditions for their movements.

For those landfills that will occupy riparian biocorridors, the impact will be over larger extensions of habitats than that of the simply occupation of the biocorridor to execute the construction works of road substructures. This has been taken into account in estimating the magnitude of the impact since some of the landfills are in highly sensitive habitats with an important function as biocorridors, such as beech forests and thermophilous oak forests.

The magnitude of the impact temporary severance of riparian biocorridors is estimated as Medium due to:

- There is a high number of riparian biocorridors with optimal conditions for wild animals movements that will be affected, particularly in LOT 2 3; and
- There will be a loss in the availability of wild animals to use their biocorridors, and also a loss of resource due partial destruction of the biocorridor habitats (in the construction of pillars, in the landfilling of inert wastes), but
- Because these losses are expected to be limited to the time the construction works take place at the spot under construction (or landfilling), minor adverse effects on the movements of wild animals are expected to occur.

Criteria	Assessment Thresholds	
	Threshold	Descriptions
Characterization of impacts	Negative	Not desirable
Type of Impact	Direct	The unavailability to use the biocorridor arises from the execution of the construction works in the affected
Reversibility	Reversible	The biocorridor will be usable again as the construction works abandon the biocorridor. In the areas used as inert
Geographical Extent	Local	The severance effect is limited to the footprint of the project
Time when the impact occurs	Immediate	The severance effect starts with the arrival of construction works to the spot.
Duration	Short term	The presence of the construction works at a given biocorridor will be limited to a few weeks or months. In the case of
Likelihood of appearance	Certain	The biocorridors needs to be occupied to carry out the construction works
Magnitude	Medium	See above

The initial significance of this impact, without mitigation measures, is Moderate.

7.3.8. Potential Impacts on Flora

7.3.8.1. Value of Vegetation

Vegetation communities along the project road corridor are numerous and varied.

For the assessment of relevant flora, in the absence of a national red list of threatened plants, current international documents and lists (IUCN Global Red Lists, IUCN European Red Lists, EU HD Annex II and Annex IV, Bern Convention) were used to identify threatened species among the plant species included in the inventory of plants prepared for this ESIA. The results of this search showed that none of the species in the inventory are included in any of these lists as rare or threatened.

In the absence of this criterion, the degree of preservation of vegetal communities found in the road corridor was used, based on criterion as above for the assignment of sensitivity values to habitats. This criterion measures the degree of naturalness (i.e. the extent of human intervention) and was evaluated on the basis of expert judgment. Given that the habitats along the corridor represent distinct types of plant communities, the use of this criterion is considered to be relevant for the assessment of impacts on vegetation. For this assessment habitats have been considered as plant communities.

7.3.8.2. Potential Impacts and Likely Significance

One of the most important impacts during the construction phase of a project road is the destruction of the vegetation cover along the strip of land. In some cases it may occur that individuals of threatened plant species are present in this strip and are also destroyed, which further aggravates the risk of extinction of the species. For the impact regarding destruction of

plant communities, it is considered that this impact is already evaluated under the impact habitats loss and therefore will not be assessed here. With regards to the potential destruction of sensitive species, the baseline study on flora has not indicated the presence of threatened species in the area of the road corridor.

7.3.9. Potential Impacts on Fauna

7.3.9.1. Value of Fauna Receptors

A fairly large number of fauna species have been identified in the baseline study that are present or may be present in the area of the project road corridor. This presence is based on the indicative species known to be present in each of the habitats identified along the project road corridor and survey observations of the actual corridor to check habitat conditions are adequate to host the species, and record their actual presence through visual contacts, acoustic signals, tracks, and other traces left by wild animals.

In order to carry out the assessment of impacts of the road on these receptors, a reduction in the number of species to be considered in the assessment was deemed necessary to facilitate the assessment procedure.

A selection process was undertaken to identify the most sensitive animal species among all the species that may be present in the area of the road corridor. The sensitivity of species was evaluated in accordance to their level of threat and, therefore, need for protection. It was considered that if relevant species can be adequately protected from adverse impacts that might arise from the project, then all the fauna as a group will be protected.

For this purpose, and since the Republic of Zambia has not yet published red lists of endangered fauna species, the current international lists of endangered species were used. The particular lists utilized are shown in the following sections describing the value assessments performed for each fauna class.

7.3.9.1.1. Birds

In addition to the red lists of UICN and the Bern, Bonn and CITUS Conventions, the species value assessment for birds was based on the lists contained in EU Bird Directive, BirdLife International Species of European Conservation Concern (SPEC) list, BirdLife International European Threat Status (ETS) list, and the Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA).

7.3.9.1.2. Fishes

The assessment of species value for fishes has been done according to the IUCN European Red List and the Habitat Directive.

7.3.9.1.3. Amphibians and Reptiles

The assessment of species value for amphibians and reptiles has been done according to the international conventions and legislation for protection of threatened species at European and Global levels. The same lists as the ones used for mammals were used.

7.3.9.1.4. Insects

The assessment of species value for insects has been done according to the international conventions and legislation for protection of threatened species at European and Global levels, including the IUCN red list, the Bern Convention and the Habitats Directive.

7.3.9.2. Potential Impacts and likely Significance

The following potential impacts on fauna have been identified for the construction and operational phases of proposed road rehabilitation of the Mpika to Chinsali:

Construction phase

Decrease in animal populations due to:

- Killing of animals by vehicles and machinery/illegal hunting by construction workers;
- Destruction of nests, burrows, and other animal sheltering/breeding structures;
- Animals moving away from the area due to the presence of humans and running vehicles and machinery.

Operation phase

Decrease in animal populations due to:

- Killing of animals by vehicles; and
- Animals moving away from the area due vehicle traffic.

7.3.9.3. Construction Phase

7.3.9.3.1. Decrease in animal populations

Right-of-way construction activities along road alignment may adversely affect wild animal populations, including terrestrial, aerial and aquatic species.

For terrestrial and aerial species (mainly birds and several species of insects), the main deleterious effects that may reduce local wildlife populations would come from:

1) Traffic of construction vehicles and machinery in the construction areas and access roads, which may cause death or damage to individuals due to collisions or crushing;
2) Destruction or loss of nesting sites and other animal sheltering/breeding structures. These may include bird nests in trees to be cut, or rocks/earth to be removed/buried in the construction of cuttings and embankments; bat roosts in hollows, crevices, foliage, or ground burrows of hare, mice, and other medium to small mammals, which can be destroyed with earth movements. Some species of amphibians and reptiles that have underground burrows or develop their Periods of hibernation or aestivation buried may also be affected. Reptiles tend to bury their spawn in the surface layers of sand, earth or among plant debris, so the site preparation work may affect their position;
3) Illegal hunting and poaching that could be practiced by construction workers while not on duty;
4) Visual and auditory disturbance due to the presence of machinery, construction workers, and associated equipment may cause the avoidance of the area by most of the wild animal, which prefer quite areas;
5) Destruction of habitats (already discussed in Section 6.2.9.3).

As for the bat species, since it can be assumed that their shelters can be found in various habitats, including bridges, natural or artificial caves, rock crevices, tree holes, roofs of houses,

etc., construction works are likely to affect them. Bats usage of these sites may be as maternity sites (where babies are born and raised to independence), hibernation sites (where bats may be found during the winter), mating sites (where males and females gather during the autumn), feeding sites (where bats rest between feeding bouts during the night but are rarely present by day), transitional or swarming sites (where bats may be present during the spring or autumn) or summer roost (used by males and non-breeding females).

The most significant impact of road construction upon bats will be the destruction of these sites during the clearance phase of the scheme, namely tree felling, the removal of hedgerows and other vegetation, during the execution of earth movements for making embankments, cuttings and during demolition of buildings.

For birds, several nests of various birds are recorded to exist in the proximity of the road corridor. Therefore, it could be possible that nests of sensitive species were encountered during the construction of the road or in the construction area.

For aquatic species, the adverse effects contributing to the reduction of local animal populations would mainly come from the construction works to be carried out in rivers and streams, and would include:

- Disruption of flow in watercourses for the construction of drainage structures and bridge pillars (excavation of earth, stones and rocks and filling with construction materials). This may destroy shelter, spawning and nursery sites for aquatic mammals, fishes and other hydrobionts;
- Increase in turbidity of surface water and disruption of the waterbed by deposition of sediments from soil erosion due to construction works and storm water runoff. The disturbance to the stream bed may hinder salmonid spawning; turbidity may affect fish gills and make breathing difficult; it also may make the benthic macroinvertebrates that serve as food to salmonids to flee away;
- Water pollution from spills of vehicles and construction machinery, in particular oils and lubricants, which could result in a high mortality of hydrobionts;
- Water pollution with domestic sewage effluents from a 200 population workers, which could give rise to eutrophication, changes in biocenosis composition, and mortality of most sensitive species;
- Illegal fishing by workers.

Estimation of magnitude

The magnitude of this impact has been evaluated in a qualitative manner. For this purpose, the construction works to be and the potential presence of relevant sensitive species in the habitats along the project road corridor have been considered. Riparian and river habitats and terrestrial habitats are addressed separately, as the species affected and the effects that might generate the decrease in their populations are different.

In considering the magnitude of the impact, the local and temporary characteristics of the effects are taken into account. This is, the killing of animals or destruction of/affection to their nesting/sheltering sites will occur at the specific location where the damaging construction activities take place, and during the time this activities take place at this location.

The magnitude of this impact during construction works in LOT 1is estimated to be negligible for most of this section of the project road because of the poorer biodiversity in this area dominated by commercial developments.

The highest intensity of the impact is expected to occur in LOT 2 and in LOT3, which has much of the natural areas available except in settlement areas. The main works will comprise of the execution of earthworks and drainage.

The construction works will be affecting populations of various species, especially of smaller animals, including sensitive species potentially present in this area such as grasshopper Paracaloptenus caloptenoides.

The impact to bird populations will also be more important, as trees as well as other sites where they make their nests (a depression or a burrow dug into the ground, a pile of vegetation and earth) may be destroyed as the vegetation is cleared and earth movements executed. The same may occur with bat roost sites, which are often made in cavities and crevices of trees and rocks.

The disturbance of river and riparian areas for the construction of bridge pillars or through erosion and polluted influents from the nearby road construction works may affect the populations of sensitive fishes like the trout (salmo Trotta), and mammals like otter (Lutra lutra).

The overall magnitude of impact decrease in animal populations during construction is considered as low. The effects that may generate the decrease in animal populations are not expected to adversely affect their integrity; they will occur for a short Period of time at the site of the construction front and the populations have the capability to recover their numbers once the construction front passes the site.

The criteria thresholds to assess this impact are as follows

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Characterization of impacts	Negative	Not desirable
Type of Impact	Direct / Cumulative	The decrease of local animal population results from killings and destruction of nesting/sheltering sites produced by the construction activities.
Reversibility	Reversible	The animal populations have the capability to recover after construction works. This will happen for populations associated to aquatic environments under bridges.
Geographical Extent	Local	The decrease will affect local populations in the footprint of the project
Time when the impact occurs	Immediate	The effects will occur while the construction works take place.
Duration	Short term	The effects will last the time the construction works take place at a given location
Likelihood of appearance	Probable	Killing and destruction of nesting/sheltering sites are unavoidable; therefore, there are chances that animal

Magnitude	Low	See above

For fauna receptors having a medium sensitivity, the initial significance of this impact, without mitigation measures, is Slight.

7.3.10. Potential Impacts on Cultural Heritage

7.3.10.1. Value of Cultural Heritage Receptors

The project road corridor has only two cultural heritage sites – the Lwitikila Falls and the Chipoma Falls. However, all these sites are located more than 1Km from the road corridor. Consultations made by the consultant to the Provincial National Heritage Conservation Commission (NHCC) in Chinsali, have confirmed there is no other known archaeological sites in the vicinity of the project road corridor.

Any known or yet to be known archaeological site provides valuable information to better know the past human life and culture of the region and hence is considered to have a high value.

7.3.10.2. Potential Impacts and Likely Significance

The following potential impacts on cultural heritage have been identified for the construction and operational phases of the proposed Mpika Chinsali Road:

Construction phase

- Destruction of non-identified buried archaeological sites

Operation phase

- Plundering of archaeological sites

7.3.10.3. Construction Phase

7.3.10.3.1. Destruction of non-identified buried archaeological sites

The fact that there are no known archaeological sites along the project road corridor does not mean they do not exist. Construction works, and particularly earth movement operations might expose previously unknown buried archaeological (also paleontological) sites and destruct them.

To a greater or lesser extent, this impact may occur in all three LOTs of the project road corridor.

Estimation of magnitude

Should the destruction of archaeological sites occur, the magnitude of the impact would depend on the importance of the site as assessed by an expert archaeologist. Assuming the findings were to have a high value and were destroyed by construction works, the magnitude of the impact would be high, as the integrity of the resource would be lost. The criteria thresholds to assess this impact are as follows:

Criteria	Assessment Thresholds	
	Threshold	Descriptions
Characterization of impacts	Negative	Not desirable
Type of Impact	Direct	The destruction of the archaeological site results from earth movements carried out during construction.
Reversibility	Irreversible	Once destroyed, the site cannot be recovered
Geographical Extent	Local	The destruction will affect to sites in the footprint of the project
Time when the impact occurs	Immediate	The effects will occur while the construction works take place.
Duration	Long term	If destruction occurs it will be for ever
Likelihood of appearance	Probable	The abundance of archaeological sites in the area and its rich history increases the likelihood to find other sites.
Magnitude	High	See above

Considering the potential low value of the archaeological site and the potential low magnitude of the impact, the initial significance of this impact, without mitigation measures, is low.

7.3.10.4. Operational Phase

7.3.10.4.1. Plundering of archaeological sites

The easier access to the area brought by the improved road will attract visitors from other areas of the Republic of Zambia and from neighboring countries. Among these visitors, the presence of individuals dedicated to the poaching of archaeological sites is possible. These individuals would be knowledgeable of the currently known archaeological sites as well as new ones that might appear.

Estimation of the Magnitude

The magnitude of this impact has been considered medium, as the effect of poaching would result in a partial loss of the resource, but not affecting to the integrity of the site; the limited number of poachers and the probably relatively long walking distances to the archaeological sites would prevent the sites from being devastated.

The criteria thresholds to assess this impact are as follows:

Criteria	Assessment Thresholds	
	Threshold	Descriptions
Characterization of impacts	Negative	Not desirable
Type of Impact	Indirect	The plundering of archaeological would result from an increased in the affluence of visitors induced by the easier access to the area brought by the train.

Reversibility	Irreversible	Stolen artefacts will hardly be returned to the site.
Geographical Extent	Local	Plundering would mostly affect to those sites close to the road through which visitors have access to the area
Time when the impact occurs	Immediate	Plundering would start as soon as visitors have access to the area when train operation will start.
Duration	Long term	The effect will continue throughout the operational life of the road.
Likelihood of appearance	Probable	Poachers are aware of the existence and location of unprotected archaeological sites.
Magnitude	Medium	See above

Considering the potential low value of the archaeological site and the potential low magnitude of the impact, the initial significance of this impact, without mitigation measures, is low.

7.4. POTENTIAL SOCIAL IMPACTS

7.4.1. Introduction

This chapter assesses the impacts that project activities will have on the different socio-economic and land use receptors/resources which were identified in the social baseline conditions. The assessment considers effects on the following: Land and Property, Community Health and Safety, Community Tensions, Access & Severance, Utilities, Economy, Employment, Education & Training, Vulnerable Groups, Workforce related effects and "Quality of Life" .

7.4.2. Potential Impacts on Land and Property

7.4.2.1. Summary of Resources/Receptors

For the enforcement of the road reserves a permanent land take of 50m on both sides of the existing centerline for the rural sections will be acquired while in the urban sections 18m on each side of the existing centerline will be required. This is in accordance with the Public Roads Acts.

In this regard a total of 681,100m^2 of land will have to be expropriated. Most of the land is only used for construction of structures such as houses and other structures such as shops and traditional kitchens (insaka) and this land need to be expropriated, which accounted for 476,770m^2. The rest of the land is distributed for mainly agricultural (156,653m^2) land of will need to be expropriated and forest land of which 20,433m^2 will need to be expropriated. Within the agricultural land affected crop fields; Fruits 20,805m^2 of gardens 19,783m2. The remaining 13,199m2 comprise of old roads, dry streams and similar.

The assessments concluded that 239 residences in total will be affected by the enforcement of the road reserves. In terms of lots, there are no houses in Lot 1, which will be demolished. In Lot2, 122 houses are found within the road reserve while in Lot3 117 houses are found within the road reserve and will need to be demolished. The enforcement of the mandatory road reserves will also affect 209 shops currently used as road side shops. Of these shops, 12 shops are found in Lot1, 127 shops are found in Lot2 while 69 are found in Lot3.

During construction works, most land to be utilized will be of a temporary nature and is a result of requirements for construction of compounds and working sites along or close to the line, in addition to space for storage of plants, materials and site offices etc. Contractors' may temporarily also require land for Borrow Pits & Landfills. Necessary agreements and consents will be secured for any temporary land required for the Project.

7.4.2.2. Assessment of the Sensitivity of Land and Property

During establishing of the sensitivity of Land & Property resources the following criteria were applied:

- Monetary value;
- Size;
- Location;
- Sentimental value;
- Possibility for regular income (renting, agricultural activities, etc).

For each criterion a scoring value from 0 to 3 was applied with following meaning:

- 0 – no importance;
- 1– Low importance
- 2– Medium importance
- 3 – High importance

The sum of scores was used to determine the sensitivity. The rating of sensitivity was performed on the basis of the following ranges:

- 0-3 – low sensitivity (ls);
- 4-7 – medium sensitivity (ms);
- 8-11 – high sensitivity (hs)
- 12-15 – very high sensitivity (vhs)

The sensitivity of sub receptors was assessed according to the described methodology. The results are presented in table:

	Monetary value	Size	Location	Sentimental value	Possibility for regular income (renting,	Sensitivity
Houses	3	3	3	3	2	14
Agricultural land	2	3	2	3	3	13
Orchards	2	2	2	3	2	11
Forest	2	1	2	3	1	9
Gardens	3	2	2	2	2	11

The results from sensitivity estimation matrix determined the following:

TYPE OF LAND / PROPERTY RESOURCE	VALUE (SENSITIVITY)
Houses	Very high sensitivity
Agricultural land	Very high sensitivity
Pastures	High sensitivity
Vineyard	High sensitivity
Orchards	High sensitivity
Forest	High sensitivity

Houses have high importance in regards to their monetary value, size, location and sentimental value. The people living in the houses have through their lives there invested in them and they are of high monetary value to them. Although sentimental value cannot be measured or compensated it is of big importance since the families have lived in their houses generally for many years and may have probably been born there as houses are normally inherited property.

Based on importance from different criteria it can be concluded that the sensitivity of this sub receptor is very high.

Agricultural land has medium importance in regards with the monetary value and location. In this part of the region, the value of land is lower compared with land in developed agricultural areas where the monetary value is constantly increasing. However, for the owners of the agricultural land, the value is very important if they want to be financially compensated. The location of the land is close to the river in the lower part of the area and is mostly away from local settlements. Most of the land has traditionally been with the families for many generations and the sentimental value has thus high importance. Off-farm income possibilities are limited and agriculture may be the families' sole source of income. The sensitivity of this sub receptor is considered to be very high.

Forest is a typical land use for this area. The monetary value is of medium importance due to the limited possibility for selling timber. There is no limitation for substitution of forest adequately with similar forest therefore the importance in regards with the size and location is medium. Since land including forest is inherited within families the sentimental value is of medium importance. The sensitivity of this sub receptor is considered to be high based on importance of the various criteria.

7.4.2.3. Potential Impacts and Likely Significance

The following potential impacts related to the acquisition of Land and Property have been identified for the construction and operational phases of proposed rehabilitation of the T2 road from Mpika to Chinsali:

Construction Phase

- Temporary land loss
- Livelihoods (FROM TEMPORARY LAND LOSS)
- Effects on residents from loss of gardens and community land and effects on agricultural production/activity (FROM TEMPORARY LAND LOSS)
- Loss of housing (including physical displacement)
- Permanent land loss

Operational Phase

- Effects on livelihood (START AT THE CONSTRUCTION PHASE)
- Effects on residents from loss of gardens and community land and effects on agricultural production/activity (START AT THE CONSTRUCTION PHASE)

7.4.2.4. Construction Phase

7.4.2.4.1. Temporarily Land Loss

The temporary use of land during construction works is estimated to be 681,100m^2. The placement of borrow pits and landfill sites have already been decided while workers compounds are yet to be decided. The placement of these will follow legal requirements and agreements to be reached with affected landowners. The limited number and fairly short lengths of access roads to be constructed means that limited impacts are expected from increased access. Most of the land needed for construction purposes will be on a temporary basis.

Estimation of magnitude

Most of the temporary land loss will occur during Construction Phase. It is expected to have a low level of impact on social aspects. It is expected that some changes in resource or its quality will occur but the impact is reversible. After completion of construction activities, the majority of the land will be returned into its previous condition. Due to minor loss of or alteration in a short-time Period, the magnitude of this impact could be estimated as low. Once the magnitude of this impact has been estimated, the other criteria to assess this impact are as follows:

Criteria	Assessment Thresholds	
	Threshold	Descriptions
Characterization of impacts	Negative	Impact will disrupt usage of land for other purposes like stock feeding, limited hunting activities
Type of Impact	Direct	Construction activities will have direct impact upon receptor
Reversibility	Reversible	The effect caused by impact is reversible. Situation can be returned into previous condition
Geographical Extent	Local	Impact is limited to communities that are on the closest distance to the road
Time when the impact occurs	Immediate	Effect will occur immediately following project activities
Duration	Medium- term	Based on estimation for construction activities duration it is estimated impact to last in medium-term (between two and ten years)
Likelihood of appearance	Certain	There is a high likelihood this impact to occur
Magnitude	Low (construction phase)	During construction phase alteration of the receptor will occur

The initial significance of this impact, without mitigation measures, is slight negative. The impact will result in small change in socio-economic conditions, locally limited with a short to medium-term duration. Temporary land loss is too small it is considered to result in a diminishing quality of life.

7.4.2.4.2. Livelihoods (FROM TEMPORARY LAND LOSS)

Temporary land take will cause removal of livestock from grazing areas during Periods of blasting or heavy equipment operations near work crews because of construction noise, dust, and visual intrusions. In forest areas, construction activities could result in long-term loss of timber production due to need of removing trees. Construction works will restrict these kinds of activities which will result in adverse impacts on the livelihoods of affected people. The area is rich in terms of forest food and local people traditionally harvest the fruit and leaves for food and similar, and sometimes for selling. It can be expected that this activity will be affected. Movement in this area will be restricted during the construction phase.

Estimation of magnitude

People from the communities that are closest to the road line will have limited access to areas where construction activities will occur and location where construction facilities will be located, in terms of disturbance to their stockbreeding activities, forest food harvesting or recreational

activities. Because of the very limited size of land required and available land around the construction area where these activities could be relocated, a small number of individuals within the local population will be affected. Following construction, livelihood effects should be able to be restored and thus the magnitude of the impact can be estimated as low. Once the magnitude of this impact has been estimated, the other criteria to assess this impact are as follows:

Criteria	Assessment Thresholds	
	Threshold	Descriptions
Characterization of impacts	Negative	Impact will cause disturbance of livelihood
Type of Impact	Indirect	It is indirect impact on receptor through impact on local communities livelihood
Reversibility	Reversible	Livelihood when impact duration will end can be reversed to previous condition
Geographical Extent	Local	Impact will be limited to specific individuals or population groups at or close to road
Time when the impact occurs	Immediate	Impact will occur immediately following project activities
Duration	Medium- term	Impact it is expected to last during construction Period (from 2 to ten years)
Likelihood of appearance	Certain	There is a high likelihood this impact to occur
Magnitude	Low	Only alteration of receptor will occur

The initial significance of this impact, without mitigation measures, is slight negative. The impact will result in small change in livelihood, locally limited with medium-term duration. Change of livelihood is not sufficiently large to result in a material effect through diminishing the quality of life since the replacement of temporary land loss could be made in the near vicinity in the area.

7.4.2.4.3. Effects on residents from loss of gardens and community land and effects on agricultural production/activity (FROM TEMPORARY LAND LOSS)

During construction phase, loss of gardens and community land will cause effects on residents and on agricultural production/activity. During the operational phase conditions will be returned to the previous situation.

Pastures and forest that are state property are used by the local community and those people might be affected through limitation of stockbreeding activities and forest food harvesting across the whole three sections. No other type of community land is going to be affected along the alignment. Haulage routes could cause fragmentation of some agricultural land.

It is tradition that local people have gardens in front of their houses where they have fruit trees, plant small quantities of vegetables for their needs and flowers for their pleasure. Temporary land take for construction facilities could occupy some agricultural land but for that purpose prior legal agreement must be reached between the owner and contractor/s and renting of that land will be financially compensated. However, it may mean minimal increases in local journey times as a result of the construction activities which could affect agricultural production (travel time to the field).

Estimation of magnitude

There will be impacts on community land (i.e. pastures and forest) but there is the possibility for other community land to be utilized. Most of the land loss will occur in unsettled and agriculturally undeveloped area. The impact will cause small changes in agricultural activities in the area in terms of travelling times, even if it could appear to look like sustained and widespread it is not considered it will be disruptive to normal socio-economic life. These effects could raise local concerns but are unlikely to be important for the decision making process for the Project and its approval. The general feedback from local people is, that they are fully aware of the impacts that construction activities have on their activities with regards to their agricultural activities. The sensitivity of the communities along the route could be measured as low when it is question of their resilience to impacts such as restrictions on access, or loss of local community land or land used by the community. Based on the above mentioned the estimated magnitude of this impact is medium. Once the magnitude of this impact has been estimated, the other criteria to assess this impact are as follows:

Criteria	Assessment Thresholds	
	Threshold	Descriptions
Characterization of impacts	Negative	Impact will cause disturbance of normal activities in regards with agricultural production
Type of Impact	Indirect	It is indirect impact on receptor through impact on local communities activities
Reversibility	Reversible	When impact duration will end can be reversed to previous condition
Geographical Extent	Local	Impact will be limited to specific individuals or population groups at or close to road
Time when the impact occurs	Immediate	Impact will occur immediately following project activities
Duration	Medium- term	Impact it is expected to last during construction Period (from 2 to ten years)
Likelihood of appearance	Certain	There is a high likelihood this impact to occur
Magnitude	Medium	Only alteration of receptor will occur

The initial significance of this impact, without mitigation measures, is considered to be slight negative. The impact will result in a small change in agricultural production; it will be locally limited with medium-term duration. However, the change of the receptor due to this impact is not sufficiently large to result in a material effect through diminishing the quality of life.

7.4.2.4.4. Loss of Structures (i.e. housing, shops etc)

Due to the enforcement of the mandatory road reserves (i.e. 100m and 36m), a number of private properties will be affected. (i) ***Loss of residence-*** People who will be displaced by having to move their place of residence to allow for the preservation of the road reserve, construction camps, access roads, or any other associated infrastructure. The enforcement of the mandatory road reserves will affect 239 structures currently used as residences. In terms of lots, there are no houses in Lot 1, which will be demolished. In Lot2, 122 houses are found within the road reserve

while in Lot3 117 houses are found within the road reserve and will need to be demolished. (ii) ***Loss of Roadside Shops and business*** – People who will be displaced by having to move their places of business to allow for the construction of the road related infrastructure. These are business shops and selling points etc. The enforcement of the mandatory road reserves will affect 209 shops currently used as road side shops. Of these shops, 12 shops are found in Lot1, 127 shops are found in Lot2 while 69 are found in Lot3.

Estimation of magnitude

The families will lose their present private houses and shops with associated auxiliary structures, such as, fencing, etc. In the process of resettlement, people will be provided with full compensation and transitional costs, including transportation, and other expenses. To ensure that the affected families are duly compensated for all their belongings and expenses connected with being resettled, a Resettlement Action Plan (RAP) has been prepared as a stand alone report for the project.

The residents who will have to be resettled by the enforcement of the road reserve may experience additional impacts such as:

- Changes in type and tenure of housing;
- Disconnection with their precious memories related with their homes which has high sentimental value;
- The resident's present social relationships will be disrupted and they will have to establish new relationships in a different social environment. This may cause social and psychological impacts.

During preparation of Stakeholder Engagement Plan, local authorities' representatives stated that local residents are fully aware of this impact. From February 2016, the affected people are in constant preparedness for rehabilitation works and enforcement of the road reserves.

The magnitude of this impact is estimated as very high since it will cause loss of resources. Once the magnitude of this impact has been estimated, the other criteria to assess this impact are as follows:

Criteria	Assessment Thresholds	
	Threshold	Descriptions
Characterization of impacts	Negative	Impact is not desirable since people are losing their homes
Type of Impact	Direct	Project activities results in a direct impact upon receptor
Reversibility	Irreversible	Cannot be returned into previous condition
Geographical Extent	Local	Impact will be limited to specific individuals or population groups at or close to road
Time when the impact occurs	Immediate	Impact will occur immediately following project activities
Duration	Medium- term	Impact it is expected to last during construction Period (from 2 to ten years)

Likelihood of appearance	Certain	There is a high likelihood for this impact to occur
Magnitude	High	Loss of receptor will occur

The initial significance of this impact, without mitigation measures, is large negative. Effects from this impact result in awareness or concern among affected stakeholders and materially affect the wellbeing of defined population. This effect is likely to be important for local administrative level in terms of regulatory objectives. Change of receptor due to loss of houses is sufficiently large to result in a material effect through diminishing the quality of life, although some replacement can be made in the locality or be compensated for.

7.4.2.4.5. Permanent land loss

This impact will occur during the construction phase. The planned enforcement of the road reserves will mostly go through the open land and according to the preliminary assessments, a total of 681,100m^2 of land will have to be expropriated. The land is under traditional arrangement and majority of the PAPs have no titles to their lands.

Estimation of magnitude

While the expropriation will compensate the owners with the cash value for the land, the long term negative impacts are the permanent loss of all or a significant part of a number of peoples land used for farming activities. The owners/farmers are depriving themselves for a piece of land which could be used either for subsistence farming in difficult economic situations with no work available or for selling the crops in times with high prices on agricultural products.

In general, farmers in the project road corridor are not happy to sell the land on which they grow crops. Moreover, if they have to, people whose livelihoods are land-based give preference to land-based resettlement strategies (land-for-land rather than cash-for-land).

Farmers are in general are much more willing to sell fields with cereals, vegetables or fodder. Planting is usually done in the month of December while harvesting takes place in April-June. Thus, July to October would be the best time in the year to make the expropriation of farming land. Land owners/farmers will be compensated duly in accordance with the Resettlement Action Plan (RAP). Special attention should be given to orchards where investment lasts for 20 years.

The affected area is with very limited possibility for substitution of the land. The impact will cause loss of resource and quality of resource. Based on that, it can be estimated that the magnitude of the impact is high. Once the magnitude of this impact has been estimated, the other criteria to assess this impact are as follows:

Criteria	Assessment Thresholds	
	Threshold	Descriptions
Characterization of impacts	Negative	Impact is not desirable since people are losing their land
Type of Impact	Direct	Project activities results in a direct impact upon receptor
Reversibility	Irreversible	Cannot be returned into previous condition
Geographical Extent	Local	Impact will be limited to specific individuals or population groups at or close to road
Time when the impact occurs	Immediate	Impact will occur immediately following project activities
Duration	Medium- term	Impact it is expected to last during construction Period (from 2 to ten years)
Likelihood of appearance	Certain	There is a high likelihood this impact to occur
Magnitude	High	Loss of receptor will occur

The initial significance of this impact without mitigation measures, is large negative. Effects from this impact result in awareness or concern among affected stakeholders and materially affect the wellbeing of the concerned population. This effect is likely to be important for local administrative level in terms of regulatory objectives. The change of the resource/receptor due to the loss of land is sufficiently large to result in a material effect through diminishing the quality of life locally although some replacement can be made in the locality or be compensated for.

7.4.2.5. Operation Phase

7.4.2.5.1. Effects on livelihood (START AT THE CONSTRUCTION PHASE)

During the Operational Phase changes that occurred during the Construction Phase will return the livelihood into previous conditions. Except those Contractor/s who will decide to leave there construction facilities like Concrete Batching Plants for the need of some future projects in the region most of the land will be abandoned and returned to its previous condition. Some haulage routes that go through community land maybe will be used as access roads possibly by local citizens. Activities like stockbreeding, hunting, recreational activities and forest food harvesting could continue after several years from the end of construction works.

For the permanent land take expropriation will compensate the owners with the cash value for the land, or land for land. People who will get new land they will start with setting new gardens and new agricultural production. The operation of the road will cause change in agricultural activities in the area in terms of travelling times and maybe also crops grown.

Estimation of magnitude

Due to the very limited size of road belt area that will be occupied, a small number of individuals within the local population will be affected. The change in the receptor is insignificant, with minor loss of resource. Estimation of magnitude of this impact can be estimated as low.

Once the magnitude of this impact has been estimated, the other criteria to assess this impact are as follows:

Criteria	Assessment Thresholds	
	Threshold	Descriptions
Characterization of impacts	Negative	Livelihood will be limited within the road belt
Type of Impact	Direct	Project activities results in a direct impact upon receptor
Reversibility	Irreversible	Cannot be returned into previous condition
Geographical Extent	Local	Impact will be limited to specific individuals or population groups at or close to road
Time when the impact occurs	Delayed	Impact will last during whole operational phase
Duration	Long-term	Impact it is expected to last during operation of road
Likelihood of appearance	Certain	There is a high likelihood this impact to occur
Magnitude	Low	Distinguishable low level impact

The initial significance of this impact, without mitigation measures, is neutral negative. Effects from this impact will not create discernable change in the livelihood socio-economic conditions.

7.4.2.5.2. Effects on residents from loss of gardens and community land and effects on agricultural production/activity

Situation caused from loss of gardens, community land and agricultural production raised by temporary land loss during the Construction Phase will be returned into the previous state during the Operational Phase. However loss of gardens, community land and agricultural production due to permanent land loss during construction phase cannot be returned into previous condition. The owners will be compensated for lost land (with land or financially). For those who have agricultural land without practicing agricultural activities may be expected to choose financial compensation whilst those undertake farming activities will require land for land. That will mean that new gardens will be erased, agricultural activities on new land will start maybe with some different crops.

Estimation of magnitude

During the Operational Phase people who lost their gardens and agricultural production will start with setting their new gardens and new agricultural production on other locations in vicinity. The operation of the road will cause change in agricultural activities in the area in terms of travelling times and maybe also crops grown. The sensitivity of the communities along the route could be measured as low regarding impacts such as loss of gardens and change of agricultural production, changes in traffic routes etc. Based on the above, the estimated magnitude of this impact is low since minor loss and alteration of receptor is expected to occur.

Criteria	Assessment Thresholds	
	Threshold	Descriptions
Characterization of impacts	Negative	There will be changes in agricultural production (on some other location new production will start)
Type of Impact	Indirect	Project activities results in a indirect impact upon receptor
Reversibility	Irreversible	Cannot be returned into previous condition
Geographical Extent	Local	Impact will be limited to specific individuals or population groups at or close to the road
Time when the impact occurs	Delayed	Impact will occur after project activities and during lasting of whole operational phase
Duration	Long-term	Impact it is expected to last during operation of road
Likelihood of appearance	Probable	The impact can be considered to have a medium likelihood of occur
Magnitude	Low	Minor alteration of receptor will occur

The initial significance of this impact, without mitigation measures, is slight negative. Effects from this impact will result in small changes in socio-economic conditions. Land loss is not sufficiently large to result in a material effect through diminishing the quality of life as replacement could be made in locality. Minimal increases in local journey times as a result of the operation of road it is expected.

7.4.2.6. Summary of Potentially Significant Effects

Based on the above mentioned assessment it could be summarized that following impacts will have potentially significant effects:

- Effects on residents from loss of gardens and community land and effects on agricultural production/activity (loss of resource will occur but it will not adversely affect the integrity of receptor);
- Loss of housing (change of receptor due to loss of houses is sufficiently large to result in a material effect through diminishing the quality of life, although some replacement can be made in the locality or be compensated for);
- Permanent land loss (change of receptor due to loss of land is sufficiently large to result in a material effect through diminishing the quality of life, although some replacement can be made in the locality or be compensated for).

7.4.3. Potential Impacts on Community Health and Safety and Security

7.4.3.1. Summary of Resources/Receptors

Projects activities related to the construction of the project road may increase the potential for community exposure to health, safety and security. Health concerns includes exposure to diseases arising from temporary or permanent changes in population; exposure to hazardous materials during construction and transport of raw and finished materials. Safety concerns relate to risk for accidents related to movement of heavy vehicles during construction. During operation health concerns related to increased risks for accidents near road can not be overlooked.

While acknowledging the public authorities' role in promoting the health, safety and security of the public, it is the promoters's responsibility to identify and to avoid or minimize the risks and adverse impacts to community health, safety and security that may arise from project activities.

7.4.3.2. Assessment of the Sensitivity of Health and Safety

During establishing of the sensitivity of this receptor following criteria were applied:

- Location of influence
- Intensity of influence
- Awareness of community
- Awareness of administration

For each criterion a scoring value from 0 to 3 was applied with following meaning:

- 0 – No importance
- 1– Low importance
- 2– Medium importance
- 3 – High importance

The sum of scores will determine sensitivity. The rating of sensitivity was performed on the basis of the following ranges:

- 0-2-low sensitivity (ls)
- 3-6-medium sensitivity (ms)
- 7-9-high sensitivity (hs)
- 10-12-very high sensitivity (vhs)

The sensitivity of sub receptors was assessed according to the described methodology. The results are presented in table:

	Location of influence	Intensity of influence	Community awareness	Administration awareness of	Sensitivity
Community health	3	2	3	3	11
Community safety	3	3	3	3	12
Community security	2	2	3	3	10

The results from sensitivity estimation matrix determined the following:

TYPE OF LAND / PROPERTY RESOURCE	VALUE (SENSITIVITY)
Community health	Very high sensitivity
Community safety	Very high sensitivity
Community security	Very high sensitivity

- **Community health** with regards to the location of influence has medium importance. The health of communities located at or closest to the project road is expected to be affected. The intensity of influence can be estimated to be high importance despite the fact that worker's camps will be located outside the settlements while the construction work will be carried out at and nearby the road. Awareness of community and administration (medical centres, Local self-Government, medias, NGO`s) has high importance for community health. Awareness of both community and administration of potential risks and impacts that project activities could have on community health has very high importance. Based on the very high importance of different criterions, it can be concluded that the sensitivity of this sub receptor is very high.
- **Community safety** has high importance in respect to all four criteria. Due to the heavy mechanization on site and the presence of heavy traffic on roads which connecting the local settlements with the towns, the location and intensity of influence has high importance. Awareness of community and administration is very important. Thus, the sensitivity of this sub receptor is very high due to high importance.
- **Community security** can be threatened if safeguard personnel engaged at the construction site or contractor's facilities are involved in past mistreatments, if they are not trained adequately in the use of force and there are serious indications that they will not behave in an appropriate manner towards the local community. Community security has very high importance both regarding location and intensity of influence due to the distance of contractor's facilities from local settlements and also high importance regarding awareness of community and administration (police). The sensitivity of this sub receptor is very high.

7.4.3.3. Potential Impacts and Likely Significance

The following potential impacts on Community Health, Safety and Security have been identified for the construction and operational phases of proposed rehabilitation of the T2 road from Mpika to Chinsali:

<u>Construction phase</u>

- Impacts from the influx of temporary workers;
- Impacts from increased community exposure to disease;
- Impacts from increased traffic and heavy vehicles on local roads during construction;
- Safety issues associated to the entrance of non-authorized people on the construction site.

<u>Operational phase</u>

- Impacts from better access to the larger towns and health services located in larger towns/cities;
- Safety issues associated with rail track.

7.4.3.4. Construction Phase

7.4.3.4.1. Impacts from the influx of temporary workers

Due to technological developments and investment in labour saving equipment, the skilled workforce needed for the Project is estimated to be in the range of 600-700 workers and on each of the 3 Lots it is estimated that around 50-100 skilled workers will be needed. The skilled construction workers will be imported to the area of construction and will reside in labour camps.

A smaller number of local low-skilled jobs may be envisaged. These will include protection and guarding of the construction companies' properties. Low skilled workers will be hired within 20km radius of road and wider if necessary.

It is expected that the increased number of workers and higher concentration of residents near construction sites will have impact on local communities. Uncontrolled movement of workers will affect residents of affected settlements. Due to this a limited regime of movement of workers in the area around the construction sites and mode of movement must be well organized and defined by agreement between the Employer and the Contractor(s).

Entry of a temporary labour force into an area could cause different negative impacts to the local communities including conflicts between local community members and newly arrived people due to the socio-cultural differences and other issues. The situation when temporary workers come from other regions and they are from different social and cultural backgrounds could easily create conflicts with the local social environment. Due to this, workers must receive training and sign a labour code of conduct, in order not to create conflicts with the local environment.

Influx of temporary workers and their inadequate behavior could cause issues. Contractors will be aware of avoiding where possible these kinds of situations and any effects of such issues must be subject to fair compensation. Despite strengthened measures for impacts reduction, sometimes it is not easy to control workers. Awareness of employees about the measures proposed, as well as negative effects that could occur is essential for the safe implementation of the Project.

A potential increase in crime may be experienced during the construction period if mitigation measures are not introduced. With an increase in construction activities and the possibility of job seekers arriving, it may be more difficult to identify strangers in the area. In addition, the increase in disease associated with the entry of a temporary labour force into an area could also occur.

There may also be negative issues that need to be managed such as increases in local prices, crime, prostitution or alcohol consumption. Entry of a temporary labour force into an area could cause different negative impacts to the local communities including conflicts between local community members and newly arrived people due to the socio-cultural differences and other issues.

Estimation of magnitude

Due to the high level of unemployment in the region, it is expected during construction works that most of the employment opportunities will be for local workers who are coming from affected communities. Having this in mind, the impact from the influx of temporary workers is expected to be limited. Location of worker's camps at some distances from local settlements, managed movement in the area will decrease the negative impacts arisen from different kind of conflicts between temporary workers and local community. The impact magnitude is estimated to be low.

Once the magnitude of this impact has been estimated, the other criteria to assess this impact are as follows:

Criteria	Assessment Thresholds	
	Threshold	Descriptions
Characterization of impacts	Negative	Impact could create worsening over the current situation in community safety
Type of Impact	Direct	Construction activities will have direct impact upon receptor
Reversibility	Reversible	The effect caused by impact is reversible. Situation can be returned into previous condition
Geographical Extent	Local	Impact is limited to communities that are on the closest distance to the road
Time when the impact occurs	Immediate	Effect will occur immediately following project activities
Duration	Medium -term	Based on estimation for construction activities duration it is estimated impact to last in medium-term (between two and ten years)
Likelihood of appearance	Certain	There is a high likelihood this impact to occur
Magnitude	Low	Alteration

The initial significance of this impact, without mitigation measures, is slight negative. The impact will result in a small change in community health and safety. The impact will not be sufficiently large to result in diminishing the quality of life, even if they are sustained and widespread effects they are not considered to be disruptive to the normal socio-economic conditions.

7.4.3.4.2. Impacts from increased community exposure to disease

The presence of a large number of workers can give rise to an increased spread of communicable diseases. Construction projects are commonly associated with social interactions amongst the construction workers and local communities. This among other factors may produce an inherent increased risk of transmission of sexually transmitted diseases, HIV/AIDS and other contagious diseases such TB, pneumonia etc.

Estimation of magnitude

Due to the high level of unemployment in the region a big percentage of unqualified construction workers will be from within the region. Still, a risk of increased community exposure to disease persists, especially to communicable diseases. This impact is expected to result in loss of quality and integrity of receptor thus the impact magnitude is estimated to be high. Once the magnitude of this impact has been estimated, the other criteria to assess this impact are as follows:

Criteria	Assessment Thresholds	
	Threshold	Descriptions
Characterization of impacts	Negative	Impact is not desirable
Type of Impact	Direct	Construction activities will have direct impact upon receptor

Reversibility	Irreversible	The effect caused by impact is irreversible. Situation cannot be returned into previous condition
Geographical Extent	Regional	Impact is originally on local level towards specific individuals or population communities but due to the nature of impact and possibility of spreading could have regional size
Time when the impact occurs	Immediate	Effect will occur immediately following project activities
Duration	Medium-term	Based on estimation for construction activities duration it is estimated impact to last in medium-term (between two and ten years)
Likelihood of appearance	Certain	There is a high likelihood for this impact to occur
Magnitude	High	Loss of quality and integrity of resource

The initial significance of this impact, without mitigation measures, is large negative. The impact will result in significant risks to community health and safety which cannot be easily mitigated, they result in strong concern among stakeholders, and likely they could be important at a regional to national level.

7.4.3.4.3. Impacts from increased traffic and type of traffic on local roads during construction

The traffic related to construction will contribute to reduced road safety on especially on the Mpika urban and also on local roads where some contractor's facilities are located, especially where the traffic passes through settled areas and towns located close to the road. The traffic to construction site will depart from the public roads. Residents from local settlements on these haulage roads will be exposed to increased possibilities for accidents and injuries. Traffic consisting of heavy vehicles and machinery is especially risky.

Estimation of magnitude

Significantly increased traffic especially with heavy mechanisation required for construction activities will change normal traffic which the local communities are used to. This will result in increased risks for accidents and injuries. Due to the loss of quality and integrity of receptor the impact magnitude is estimated to be high.

Once the magnitude of this impact has been estimated, the other criteria to assess this impact are as follows:

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Characterization of impacts	Negative	Impact is not desirable
Type of Impact	Direct	Construction activities will have direct impact upon receptor
Reversibility	Irreversible	The effect caused by impact is irreversible. Situation cannot be returned into previous condition
Geographical Extent	Regional	Impacts extend across the region of Muchinga Province

Time when the impact occurs	Immediate	Effect will occur immediately following project activities
Duration	Medium-term	Based on estimation for construction activities duration it is estimated impact to last in medium-term (between two and ten years)
Likelihood of appearance	Certain	There is a high likelihood this impact to occur
Magnitude	High	Loss of quality and integrity of resource

The initial significance of this impact, without mitigation measures, is large negative. The impact will result in significant risks to community health and safety and although mitigating measures are applied, a risk will persist.

7.4.3.4.4. Safety issues associated with the entrance of non-authorized people in the construction site

Contractor/s and Engineer/s could counter threats to their employees, assets and service delivery. They may face different threats because of the nature of their operations, their location and/or the attractiveness of their assets. Because of their duties or work-related situations to which they are exposed, employees are not immune from oral or written threats or acts of physical violence, for example assault. Theft, fraud, vandalism "malicious activity", accidental or intentional loss or damage could be a result from non-authorized entrance of people into construction site.

Estimation of magnitude

Location of contractor's facilities is usually near worker camps certain distances from local settlements. The design, layout and site location of facilities should facilitate natural surveillance by police and the safeguards engaged by Contractor/s.

Valuable equipment and materials for construction will be located on the site. This could encourage an increased entrance of non-authorized person to the construction site. Due to the loss of integrity of the receptor the impact magnitude can be estimated to be high. Once the magnitude of this impact has been estimated, the other criteria to assess this impact are as follows:

Criteria	Assessment Thresholds	
	Threshold	**Descriptions**
Characterization of impacts	Negative	Impact is not desirable
Type of Impact	Indirect	Construction activities will have indirect impact upon receptor
Reversibility	Irreversible	The effect caused by impact is irreversible. Situation cannot be returned into previous condition
Geographical Extent	Regional	Impacts extend across the region of Muchinga Province
Time when the impact occurs	Immediate	Effect will occur immediately following project activities

Duration	Medium-term	Based on estimation for construction activities duration it is estimated impact to last in medium-term (between two and ten years)
Likelihood of appearance	Probable	There is a medium likelihood of occurring
Magnitude	Medium	Effects are both distinguishable and measurable and will cause material effect to the wellbeing of Contractor/s

The initial significance of this impact, without mitigation measures, is moderate negative. The impact will result in moderate significant risks to community health and safety which can be easily mitigated through regulatory objectives and local governance administration management.

7.4.3.5. Operational phase

7.4.3.5.1. Improvement of access to better health services located in larger towns/cities

The operational road will provide the local residents with new and improved public transport. Villagers of the settlements will in general be able to move more freely e.g. visit relatives. Students, workers, other residents for different needs like education, health treatment, school, work.

Once the magnitude of this impact has been estimated, the other criteria to assess this impact are as follows:

Criteria	**Assessment Thresholds**	
	Threshold	**Descriptions**
Characterization of impacts	Positive	Impact is desirable
Type of Impact	Direct	Impact on receptor quality is going to be direct
Reversibility	Irreversible	The effect caused by impact is irreversible. Situation cannot be returned into previous condition
Geographical Extent	Regional	Impacts extend across the region of Muchinga Province
Time when the impact occurs	Immediate	Effect will occur immediately following project activities
Duration	Long –term	Impacts extends throughout operation of road
Likelihood of appearance	Certain	There is a high likelihood of occurring
Magnitude	Positive	Impact is desirable

The initial significance of this impact, without mitigation measures, is large positive. The impact will result in large significant improvement to community health and safety.

7.4.3.5.2. Safety issues associated with improved road

When the rehabilitation of the T2 road from Mpika to Chinsali is finished and operational, the road will continue to function as a new means of transportation. 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. Driving at unsafe speeds on a newly completed road would pose accident risk with possible loss of life and goods.

Estimation of magnitude

The rehabilitated road could be considered as significant risk of high magnitude to community health and safety resulting in the potential for loss of community lives. Once the magnitude of this impact has been estimated, the other criteria to assess this impact are as follows:

Criteria	Assessment Thresholds	
	Threshold	Descriptions
Characterization of impacts	Negative	Impact is not desirable
Type of Impact	Direct	Impacts results in a direct impact upon receptor
Reversibility	Irreversible	The effect caused by impact is irreversible. Lost lives cannot be returned
Geographical Extent	Regional	Impacts extend across the region of Muchinga Province
Time when the impact occurs	Delayed	Effect delayed and occurs sometime after project actions
Duration	Long -term	Impacts extends throughout operation of road
Likelihood of appearance	Certain	There is a high likelihood of occurring
Magnitude	High	Effect will largely change receptor quality

The initial significance of this impact, without mitigation measures, is large negative. The impact will result in severe damage to receptor.

7.4.3.6. Summary of Potentially Significant Effects

Based on the above mentioned assessment, it could be summarized that following impacts will have potentially significant effects:

- **Impacts from increased community exposure to disease** - initial significance of this impact, without mitigation measures, is ***large negative***. The impact will result in significant risks to community health and safety which cannot be easily mitigated, they result in strong concern among stakeholders, and they could likely be important at a regional and national level.
- **Impacts from increased traffic and type of traffic on local roads during construction** - initial significance of this impact, without mitigation measures, is ***large negative***. The impact will result in significant risks to community health and safety which cannot be easily mitigated, they result in strong concern among stakeholders, and likely they could

be important at a regional to national level.

- **Improvement of access to better health services existing in larger towns/cities - initial** significance of this impact, without mitigation measures, is ***large negative***. The impact will result in large significant improvement to community health and safety.
- **Safety issues associated to crossing of rail track -** initial significance of this impact, without mitigation measures, is ***large negative***. The impact will result in severe damage to receptor.

7.4.4. Potential Impacts on Community Tensions

7.4.4.1. Summary of Resources/Receptors

A potential risk for community tensions prevails with the presence of a number of temporary workers from outside the region in the local communities. Although the numbers of temporary workers are limited to around 200-225 people within each lot, the workers may have different cultural and social background than the local people. This in combination with the disruption to normal life of the local people due to the construction activities creates a ground for increased community tension. The disruption to normal life includes: Loss of livelihood and land, changes in agricultural production, increased transportation time, heavy vehicles on local roads, restricted movement within construction area, presence of workers camps within the community etc. During operational phase communities at or close to the road will mainly be disturbed from and react to noise and vibration caused by vehicles movements in addition to safety regulations related with road operation.

7.4.4.2. Assessment of the Sensitivity of Community Tensions

A potential risk for community tensions prevails with the presence of a number of temporary workers from outside the region in the local communities. The numbers of temporary workers are limited to around 600−700 workers in total, on each of the 3 sections it is estimated that around 200-225 skilled workers will be needed. The workers coming outside the region may have different cultural and social background than the local people. This in combination with the disruption to normal life of the local people due to the construction activities creates a ground for increased community tension. The disruption to normal life includes: Loss of livelihood and land, changes in agricultural production, increased transportation time, heavy vehicles on local roads, restricted movement within construction area, presence of workers camps within the community etc.

During establishing the sensitivity of this receptor the following criteria were applied:

1. Location of influence
2. Intensity of influence
3. Awareness of community
4. Awareness of administration

For each criterion a scoring value from 0 to 3 was applied with the following meaning:

- 0 – No importance/occurrence
- 1– Low importance/occurrence
- 2– Medium importance/occurrence
- 3– High importance/ occurrence

The sum of scores will determine sensitivity. The rating of sensitivity was performed on the basis of the following ranges:

- 0–2-low sensitivity (ls)
- 3-6-medium sensitivity (ms)
- 7–9-high sensitivity (hs)
- 10-12-very high sensitivity (vhs)

The sensitivity of sub receptors was assessed according to the described methodology. The results are presented in table:

	Location of influence	Workers awareness	Community awareness	Administration awareness	Sensitivity
Verbal tensions	2	3	3	3	11
Written threats	1	1	2	2	7
Oral threats	2	2	2	2	8
Physical violence	1	1	2	2	6

The results from sensitivity estimation matrix determined the following:

	VALUE (SENSITIVITY)
Sensitivity of Community	Very high sensitivity

The result of all communities on tensions is very high.

7.4.4.3. Potential Impacts and Likely Significance

The following potential impacts on Community Tensions have been identified for the construction and operational phases of proposed rehabilitation of the Mpika to Chinsali Road:

Construction phase

- Effects from influx of workforce into local communities
- Community reactions due to the disturbance arising from the construction works

Operational phase

- Community reactions due to the disturbance arising from the operation of road

7.4.4.4. Construction Phase

7.4.4.4.1. Effects of influxes of workforce into local communities

The entry of a temporary labour force into an area could cause different negative impacts within the local communities including conflicts between local community members and newly arrived

people mainly due to differences in socio-cultural background. Tensions could arise especially if there is a lack of tolerance. The reactions to this situation could go from verbal fights, to oral and written threats to physical violence. Workers must be aware that although the community supports construction of the road, the disturbance of their normal way of living could be a source to dissatisfaction and complaints. Awareness of administration (Local self Government, medias, NGO`s) has high importance for decreasing verbal tensions. It is very important that both the community and the administration are fully aware of the potential risks and impacts that project activities could have on community tensions and to act towards their avoiding and mitiga ting.

Thus, workers must receive training and guidance in how to avoid conflicts with the local community members and sign a labour code of conduct, in order not to create conflicts with the local environment.

Estimation of magnitude

According to the major construction companies in Zambia, qualified workers are needed for the construction of bridges and these will in most cases be brought in by the assigned construction companies. Due to the high level of unemployment in the region, it is expected that all other jobs related to the construction of the road will be performed by local workers who come from the affected communities. Taking this into consideration it is expected that most families would be tolerant towards people who are coming from outside their region identifying themselves with their social situation. Workers who will be employed from outside of the region are estimated to be around 200 in number for each Lot and will reside in camps outside of the local communities. The impact will only be small and if tensions are created it is expected to be due to the different lifestyles or cultural backgrounds. Having this in mind the impact from influx of temporary workers it is expected to be low. With location of worker's camps at some distances of local settlements and managed movement of the workers in the area, the negative impacts on community tensions should be small and controllable. The impact will cause some adaptation of receptor thus the impact magnitude is estimated to be low. Once the magnitude of this impact has been estimated, the other criteria to assess this impact are as follows:

Criteria	Assessment Thresholds	
	Threshold	Descriptions
Characterization of impacts	Negative	Impact could worsen the current situation in community tension
Type of Impact	Direct	Construction activities will have direct impact upon receptor
Reversibility	Reversible	The effect caused by impact is reversible. Situation can be returned into previous condition
Geographical Extent	Local	Impact is limited to communities that are on the closest distance to the road
Time when the impact occurs	Immediate	Effect will occur immediately following project activities
Duration	Medium -term	Based on estimation for construction activities duration it is estimated impact to last in medium-term (between two and ten years)
Likelihood of appearance	Probable	There is a medium likelihood this impact to occur

Magnitude	Low	Alteration of receptor

The initial significance of this impact, without mitigation measures, is slight negative. The impact will result in small change in community tensions, they are not considered to be disruptive to the normal socio-economic conditions.

7.4.4.4.2. Community reactions due to the disturbance arising from the construction works

During the construction phase, the community living at or close to the road will be disrupted and subject to inconvenience by bypasses, closures of local roads, dust, noise, increased traffic of heavy vehicles on existing roads, changes in the level of services and interference with emergency services. Occasionally, there will also be disturbance caused by vibration from foundation works and movement by heavy traffic. All this together could cause community reactions.

Estimation of magnitude

The contractor's facilities will be located at some distance to the settlements. This will significantly decrease the impacts that construction activities could have on residents. Nevertheless, the heavy traffic on local roads, the bypasses in addition to dust and noise will have a significant direct impact on communities. The impact will cause loss of resources and/or quality and integrity of receptor. Thus the impact magnitude is estimated to be high. Once the magnitude of this impact has been estimated, the other criteria to assess this impact are as follows:

Criteria	**Assessment Thresholds**	
	Threshold	**Descriptions**
Characterization of impacts	Negative	Impact could worsen the current situation in community tension
Type of Impact	Direct/Indirect	Construction activities will have both direct and indirect impact upon receptor
Reversibility	Reversible	The effect caused by impact is reversible. Situation can be returned into previous condition
Geographical Extent	Regional	Impact extends across the entire road corridor
Time when the impact occurs	Immediate	Effect will occur immediately following project activities
Duration	Medium -term	Based on estimation for construction activities duration it is estimated impact to last in medium-term (between two and ten years)
Likelihood of appearance	Certain	The impact can be considered to have a high likelihood of occurring
Magnitude	High	Loss of quality and integrity of resource

The initial significance of this impact, without mitigation measures is large negative. The impact will result in substantive changes in community tensions.

7.4.5. Potential Impacts on Access & Severance Effects

7.4.5.1. Summary of Resources/Receptors

The construction of the road could affect access and have effects of severance of the general public, the community services and the business sector in communities at or close to the road. Local community will be specifically imposed to potential impacts on access and severance effects. Using some access routes which are passing cross nonfunctional road will be impossible during construction and later during operational phase. Affected people must get used to new traffic solution and to utilize new safe access to their homes, neighborhood and towns.

7.4.5.2. Assessment of the Sensitivity of Access & to Severance Effects

During establishing of the sensitive of this receptor the following criteria were applied:

1. Location of influence
2. Intensity of influence
3. Awareness of community
4. Awareness of administration

For each criterion a scoring value from 0 to 3 was applied with following meaning:

- 0 – No importance/occurrence
- 1– Low importance/occurrence
- 2– Medium importance/occurrence
- 3 – High importance/ occurrence

The sum of scores will determine sensitivity. The rating of sensitivity was performed on the basis of the following ranges:

- 0-2-low sensitivity (ls)
- 3-6-medium sensitivity (ms)
- 7-9-high sensitivity (hs)
- 10-12-very high sensitivity (vhs)

The sensitivity of sub receptors was assessed according to the described methodology. The results are presented in table:

	Location of influence	Intensity of influence	Community awareness	Administration awareness	Sensitivity
General public	3	3	3	3	12
Community services	1	1	3	3	8

Business sector	1	1	3	3	8

The results from sensitivity estimation matrix determined the following:

RESOURCE	VALUE (SENSITIVITY)
General public	Very high sensitivity
Community services	High sensitivity
Business sector	High sensitivity

- **The General public**, around 30,000 people will mainly be affected by construction of the road by being limited in their mobility near the construction area. But knowing the fact that the road mostly passes through unsettled areas the impact on restricting accessibility will be very low. However, due to the character of the area there are many roads that could be used as alternative roads. This may increase the time for walking/driving but this impact will be of a temporary character (until finishing of construction works). There will be high occurrence of access and severance effects in communities that are close to the construction sites. Awareness of communities and administrations will have high importance. Based on importance from different criteria it can be concluded that the sensitivity of this sub receptor is very high.
- **Community services** will be affected in terms of alternative access roads and maybe longer travel times as a result of construction activities on site. There are no community's services that will be directly affected since the line goes in the upper part of the town of Kriva Palanka and mostly through forest and uninhabited areas where there are no community services. But due to changes in the access roads and thus traffic, community services access and severance could be indirectly affected. There will be low occurrence of access and severance effects and the importance of the influence intensity will be low. Awareness of community and administration has high importance. Based on importance from different criteria it can be concluded that the sensitivity of this sub receptor is high.
- **The business** sector will not suffer directly from severance impacts by construction of the road. Indirectly business sector will suffer from changes in traffic and changed access which could increase travel time. There will be low occurrence of access and severance effects, and the importance of the influence intensity will be low. Community and administration awareness will have high importance. Based on importance from different criteria it can be concluded that the sensitivity of this sub receptor is high.

7.4.5.3. Potential Impacts and Likely Significance

The following potential impacts on access, due to severance, have been identified for the construction and operational phases of proposed road rehabilitation from Mpika to Chinsali:

Construction phase

- Impacts on access and severance effects

Operational phase

- Impacts on access and severance effects on general public, community services and business sector in communities at or close to the road.

7.4.5.4. Construction phase

7.4.5.4.1. Impacts on access and severance effects

Estimation of magnitude

Access and severance effects will mainly occur during the construction Period due to limited movement at construction sites, and changed access road increasing travel time. Some changes in receptor or its quality is estimated to occur, minor loss of/or alteration of some characteristics of receptor. Impact is estimated to have low magnitude. Once the magnitude of this impact has been estimated, the other criteria to assess this impact are as follows:

Criteria	Assessment Thresholds	
	Threshold	Descriptions
Characterization of impacts	Negative	Impact could worsen the current situation access and severance
Type of Impact	Indirect	Construction activities will have indirect impact upon receptor
Reversibility	Reversible	The effect caused by impact is reversible. Situation can be returned into previous condition
Geographical Extent	Local	Impact is limited to communities that are on the closest distance to the road
Time when the impact occurs	Immediate	Effect will occur immediately following project activities
Duration	Medium -term	Based on estimation for construction activities duration it is estimated impact to last in medium-term (between two and ten years)
Likelihood of appearance	Probable	There is a medium likelihood this impact to occur
Magnitude	Low	Alteration of receptor

The initial significance of this impact, without mitigation measures is moderate negative. The impact will result in loss of receptor but not adversely affecting the integrity of the receptor.

7.4.6. Potential Impacts on Disruption of Utilities

7.4.6.1. Summary of Resources/Receptors

Utilities which are located under and above ground such as water supply, sewerage, cable network and telephone at the construction site will be affected. In addition, the influx of people such as construction workers, employment seekers and service providers will increase pressure on the utilities in the area.

7.4.6.2. Assessment of the Sensitivity of Access &Severance Effects

During establishing the sensitivity of this receptor following criteria were applied:

1. Location of influence
2. Intensity of influence due to influx of people
3. Awareness of community
4. Awareness of service providers/administration

For each criterion a scoring value from 0 to 3 was applied with following meaning:

- 0 – No importance/occurrence
- 1– Low importance/occurrence
- 2– Medium importance/occurrence
- 3 – High importance/ occurrence

The sum of scores will determine sensitivity. The rating of sensitivity was performed on the basis of the following ranges:

- 0-2-low sensitivity (ls)
- 3-6-medium sensitivity (ms)
- 7-9-high sensitivity (hs)
- 10-12-very high sensitivity (vhs)

The sensitivity of sub receptors was assessed according to the described methodology. The results are presented in table:

	Location of influence	Influence due to influx of workers	Community awareness	Administration/service providers awareness	Sensitivity
Underground installations	3	3	3	3	12
Above-ground installations	1	3	1	1	6

The results from sensitivity estimation matrix determined the following:

Utility	VALUE (SENSITIVITY)
Underground installations	Very high sensitivity
Aboveground installations	Medium sensitivity

- **Underground installations**-there is a high possibility for disruptions of utilities in

residential areas where the entry of a temporary workforce will be significant. The influx of people will put more pressure on the utilities in the area. However, this is not expected to disrupt the utilities. Awareness of communities and service providers/utilities will have high importance. Based on importance from different criteria it can be concluded that the sensitivity of this sub receptor is very high.

- **Above-ground installations** will not be affected significantly (except cases where it is necessary for the construction) since most works and operation of road is at the ground level and would not affect installations higher up. Occurrence of disruptions to above-ground installations is of low importance regarding location, awareness of community and administration/service providers and has high importance in connection with the influence due to entry of a high number of people.

7.4.6.3. Potential Impacts and Likely Significance

The following potential impacts on utilities have been identified for the construction and the operational phases of Project Road from Mpika to Chinsali:

Construction phase

- Effects of utility cuts on local businesses and communities

Operational phase

- Effects of diversions of utilities on local businesses and communities

7.4.6.4. Construction phase

7.4.6.4.1. Effects of utility cuts on local businesses and communities

Utility cuts could be mostly affected by construction activities, especially in Mpika urban and Danger Hill Village. In most areas of the project road corridor, there is no under-ground cadastre and it can be expected that some local short-term interruptions could happen which is normal for construction activities of this kind. Before construction activities are initiated, information concerning the whereabouts of most installations can be obtained from the local citizens who are very well aware of the underground installations in their vicinity. Also service providers can provide information in this respect to avoid damages on the utilities.

Estimation of magnitude

Cuts of utilities will occur mainly during construction RDA. It is expected that it will mainly be at Danger Hill Village where water supply will be affected. Since there are no business activities in the vicinity of the road this sector should not be affected by cuts of utilities, short disruptions could however be expected. Some changes in receptor or its quality is estimated to occur, i.e. minor loss of or alteration of some characteristics of receptor. Thus it can be estimated that impact will have low magnitude. Once the magnitude of this impact has been estimated, the other criteria to assess this impact are as follows:

Criteria	Assessment Thresholds	
	Threshold	Descriptions
Characterization of impacts	Negative	Impact could worsen the current situation
Type of Impact	Direct	Construction activities will have direct impact upon receptor
Reversibility	Reversible	The effect caused by impact is reversible. Situation can be returned into previous condition
Geographical Extent	Local	Impact is limited to communities/businesses that are on the closest distance to the road
Time when the impact occurs	Immediate	Effect will occur immediately following project activities
Duration	Medium –term	Based on estimation for construction activities duration it is estimated impact to last in medium-term (between two and ten years)
Likelihood of appearance	Probable	There is a medium likelihood this impact to occur
Magnitude	Low	Alteration of receptor

The initial significance of this impact, without mitigation measures is slight negative. The impact will result in small change in social-economic conditions.

7.4.7. Potential Economic Impacts

7.4.7.1. Summary of Resources/Receptor

During construction phase it is expected that related construction works will have significant impact especially on local economy, Muchinga Province and national economy. During operational phase, new markets will be opened.

7.4.7.2. Assessment of the Sensitivity of Economic Impacts

During establishing the sensitivity of these receptors the following criteria were applied:

- Business opportunities from contracting contractors and subcontractors
- Trading opportunities
- Opportunities for provision of basic and other services for the contractors
- Increased revenue and taxes (VAT) from construction activities
- Revenue from road operation
- Better productivity and market access and increased competitiveness
- Economic Attractiveness
- Tourism boosting

For each criterion a scoring value from 0 to 3 was applied with following meaning:

- 0– No importance/occurrence

- 1– Low importance/occurrence
- 2– Medium importance/occurrence
- 3 – High importance/ occurrence

The sum of scores will determine sensitivity. The rating of sensitivity was performed on the basis of the following ranges:

- 0– 4-low sensitivity (ls)
- 5-11-medium sensitivity (ms)
- 12-18-high sensitivity (hs)
- 19-24-very high sensitivity (vhs)

The sensitivity of sub receptors was assessed according to the described methodology. The results are presented in table in the table below:

	Business opportunities from contracting contractors and subcontractors	Trading opportunities	provision of basic other and services for the	Increased revenue and taxes (VAT) from construction	Revenue from road operation	Better productivity and market access and increase competitivenes s	Economic Attractiveness	Tourism boosting	Sensitivity
Local economy	3	3	3	2	2	3	3	3	2 2
Regional economy	3	3	3	2	2	3	3	3	2 2
National economy	3	3	2	3	3	3	2	3	22
Global economy	3	2	1	1	3	3	2	3	18

The results from sensitivity estimation matrix determined the following:

RESOURCE	VALUE (SENSITIVITY)
Local economy	Very high sensitivity
Regional economy	Very high sensitivity
National economy	Very high sensitivity
Global economy	High sensitivity

1. **Local economy** has high importance as a sub receptor when it comes to business opportunities. The sensitivity of the local economy has high importance regarding trading opportunities. Direct and indirect business opportunities will increase significantly for local contractors and especially subcontractors during construction works. Food and some construction materials will be supplied locally and thus increase local trade. The local economy will also experience opportunities for providing skilled services from e.g. like

craftsmen and hammer mill operators and the sensitivity will be of high occurrence. Increased revenue and taxes that will be accumulated by construction activities will partly be diverted from the state to the local level. During construction phase it could be expected that around 0.1% of estimated investment costs could be inputted in local economy, meaning around ZMW_____. The sensitivity of the receptor in regards with this factor will have medium importance. During operation of road, revenue from national level will also flow to local level with a sensitivity of medium importance. When the road is operational, the local economy will have assumed better conditions for increased productivity and improved market access, be more economic attractive for investments and have possibilities for boosting the tourism in the area. Sensitivity of this sub receptor regarding these criteria is of high importance. Based on importance of the different criteria it can be concluded that the sensitivity of this sub receptor is very high.

2. **Regional economy-**due to the limited capacity of local economy it is expected that demand for materials, services and subcontractors will extend to the entire Muchinga Province. During construction phase it could be expected that around 2% of estimated investment costs could be inputted in regional economy, meaning around ZMW___. Sensitivity of this sub receptor regarding all criteria is similar to that for the local economy. Based on importance/occurrence from different criteria it can be concluded that the sensitivity of this sub receptor is very high.

3. **National** economy is expected to have a high importance in regards with the business opportunities from contracting contractors. Most of the larger construction companies are established at a national level. For some of the material to be used during construction, suppliers from other parts of the country will have to be utilized and thus improve opportunities for trade at national level. This is of high importance. Regarding provision of services, medium occurrence is expected. Sensitivity of national economy in respect of revenue and taxes during construction and later during operation of the road is of high importance. Most of the taxes will end up in the state budget; part will flow to local self governments within Muchinga Province. When the road is operational, the Zambian economy will have improved conditions regarding productivity, market access and competitiveness. Industrial free areas within the region and along the road corridor will be economically more attractive, especially the agricultural sector. The sensitivity of sub receptor in regards with this criterion is medium. In addition, cheaper transport modes will provide possibilities for people to travel more often. It is expected that many tourist from both within the country and from abroad will be attracted to visit places along corridor. The sensitivity of the sub receptor regarding these criteria is expected to be of high importance. Based on importance/occurrence of different criteria it can be concluded that the sensitivity of this sub receptor is very high.

4. **Global economy** will be mostly affected by operational of the project road. During construction phase it is possible that international contractors will be engaged and huge percentage of material to be imported from neighboring countries. During construction phase it could be expected that around 37.5% of estimated investment costs could be inputted in global economy, meaning around ZMW____. Sensitivity of this sub receptor in regards with these criteria has high importance. Global economy may supply some of the construction material and the importance could be estimated as medium. During construction works low importance from revenues and taxes are expected. However global economy sensitivity regarding improved productivity, market access, increased competitiveness, economic attractiveness and tourist boosting will have high importance. Based on

importance/occurrence from different criteria it can be concluded that the sensitivity of this sub receptor is high.

7.4.7.3. Potential Impacts and Likely Significance

The following potential impacts on Economy have been identified for the construction and operational phases of the proposed road rehabilitation of the Mpika to Chinsali:

Construction phase

- Stimulation of economic growth at local levels

Operational phase

- Effects on local economy, Muchinga Province, National economy and Africa Regional economy

7.4.7.4. Construction phase

7.4.7.4.1. Stimulation of economic growth at local levels

The local economy will be directly and positively affected. The construction workers will obtain most of their food and other necessities from the surrounding area. This will create a potential market for the local agricultural producers, fishermen, craftsmen and other small businesses like hammer mills and local shops. This will increase the incomes of the local people which can be invested in other (productive) activities and be used for domestic needs like acquiring new furniture, refurbishing of houses, medical expenses etc. The project will stimulate local economic activities by contracting local entrepreneurs and sub-contractors, providing trading opportunities for local communities and other small enterprises in the province, providing opportunities for provision of basic and other services for the contractors and immediate community. Part of increased revenue and taxes will be redirected to the local communities.

Estimation of magnitude

It is expected that the impacts will result in an improved local economy. Thus it is estimated that the impact will have high magnitude. Once the magnitude of this impact has been estimated, the other criteria to assess this impact are as follows:

Criteria	Assessment Thresholds	
	Threshold	Descriptions
Characterization of impacts	Positive	Impacts is improvement of current situation, it is desirable
Type of Impact	Direct	Construction activities will have direct impact upon receptor
Reversibility	Reversible	The effect caused by impact is reversible. Situation can be returned into previous condition
Geographical Extent	Local	Impact is limited to communities that are on the closest distance to the road
Time when the impact occurs	Immediate	Effect will occur immediately following project activities

Duration	Medium -term	Based on estimation for construction activities duration it is estimated impact to last in medium-term (between two and ten years)
Likelihood of appearance	Certain	There is a high likelihood this impact to occur
Magnitude	High	High improvement of receptor quality

The initial significance of this impact, without mitigation measures, is large positive. The impact should result in substantive changes in the local economy. The impact should be sufficiently large to result in an improvement in the quality of life locally.

7.4.8. Potential Impacts on Employment

7.4.8.1. Summary of Resources/Receptor

Employment at local, within Muchinga Province, national, transboundary and regional level is an important receptor.

7.4.8.2. Assessment of the Sensitivity of the Impacts on Employment

During establishing the sensitivity of these receptors the following criteria were applied:

1. Work on site
2. Skilled workers
3. Non skilled workers
4. Work in trade
5. Work in services
6. Work during operation of the road

For each criterion a scoring value from 0 to 3 was applied with following meaning:

- 0–No importance/occurrence
- 1–Low importance/occurrence
- 2– Medium importance/occurrence
- 3 – High importance/ occurrence

The sum of scores will determine sensitivity. The rating of sensitivity was performed on the basis of the following ranges:

- 0 - 3- low sensitivity (ls)
- 4- 8- medium sensitivity (ms)
- 9 - 13- high sensitivity (hs)
- 14-18 - very high sensitivity (vhs)

The sensitivity of sub receptors was assessed according to the described methodology. The results are presented in table on the following page:

Direct employment will have high occurrence sensitivity during the construction and operational phase of road, especially for the required work on site. The sensitivity of direct employment in regard with the work on site is of high occurrence/importance both for skilled and non-skilled works. Operation of road will create possibilities for opening jobs in road infrastructure and transport

companies, thus the importance in regards with this criteria is going to be high. Based on importance/occurrence from different criteria it can be concluded that the sensitivity of this sub receptor is high.

Indirect employment both for constructional and operational phase of road will be created mainly in trade and with service providers (shops, some crafts services, restaurants, café, bars and similar). The sensitivity of this sub receptor regarding these criteria is going to be of high occurrence. There may be small possibilities for indirect engagement of skilled and unskilled workers on site (for example for repairing of construction equipment) but sensitivity of this sub receptor in this regard is going to be with low occurrence. Based on importance/occurrence from different criterions it can be concluded that the sensitivity of this sub receptor is high.

7.4.8.3. Potential Impacts and Likely Significance

The following potential impacts on Employment have been identified for the construction and operational phases of proposed rehabilitation of the Mpika to Chinsali Road:

Construction phase

- Creation of local employment (direct and indirect)

Operational phase

- Creation of employment (direct and indirect) at local, regional, national and transboundary and global level
- Improvement in access to employment opportunities across the region

7.4.8.4. Construction phase

7.4.8.4.1. Creation of local employment (direct and indirect)

The employment benefits during the construction phase are positive, since it relates to the project activities, induced by increased employee spending. Considering that a bigger proportion of the total population is economically inactive, the project will increase opportunities for a bigger percentage of the population by giving them access to employment opportunities. The employment opportunities will be created for both skilled and non-skilled labour in the community. The community has the capacity to absorb the employment opportunities arising during construction phase.

During construction of the road, employment will be generated mainly for construction workers. Due to technological developments and investment in labour saving equipment, the workforce needed when work will be assumed on the three LOTS is thus estimated to be in the range of 600-700 workers.

It is estimated that around 30% of the skilled construction workers will be recruited locally. Meaning construction works could locally provide 200 employments. Gender distributions in various sectors of employment are markedly skewed with women making up the majority of workers in the health, social affairs, and education sectors and men predominating in construction, mining, transport, and communication. Thus it can be expected that woman could be engaged within work camps and within administration of Contractors (administrative or engineering staff) or with Supervisor (administrative or engineering staff). It can be expected that around 70 women could be engaged in different positions during construction work. For construction of bridges skilled workers will be required who would in most cases be permanent employees of the construction companies. A smaller

number of local low-skilled jobs may be envisaged. These will include protection and guarding of the construction companies' property.

The remaining skilled construction workers will be imported to the area of construction and will reside in labour camps. Although these camps will provide for canteens, it is expected that both the camp management and the workers will spend money locally utilizing the local business community for ensuring supplies for the camps and entertainment and other services for the workers.

Some of the residents have been depended on peasant farming for a long Period of time and not all young people from 18 are taking part in education, training or employment. Economic development will improve overall employment rate and reduce the number of people dependent on state benefits. Tackling this economic exclusion is important for improving the quality of life for the residents.

Thus, a positive spin off effect during the construction Period on the local economy is expected.

Estimation of magnitude

It is expected the construction phase will create employment opportunities and will have a high magnitude. Once the magnitude of this impact has been estimated, the other criteria to assess this impact are as follows:

Criteria	Assessment Thresholds	
	Threshold	Descriptions
Characterization of impacts	Positive	Impacts is improvement of current situation in regards with unemployment, it is desirable
Type of Impact	Direct/Indirect	Construction activities will have both direct and indirect impact upon receptor
Reversibility	irreversible	The effect caused by impact is irreversible. Situation cannot be returned into previous condition
Geographical Extent	National	Impact extends through much of Zambia (national construction companies could be engaged)
Time when the impact occurs	Immediate	Effect will occur immediately following project activities
Duration	Medium -term	Based on estimation for construction activities duration it is estimated impact to last in medium-term (between two and ten years)
Likelihood of appearance	Certain	There is a high likelihood this impact to occur
Magnitude	High	High improvement of receptor quality

The initial significance of this impact, without mitigation measures, is large positive. The impact will result in substantive changes in employment situation. The impact should be sufficiently large to result in potential improvements in quality of life.

7.4.9. Potential Impacts on Education and Training

7.4.9.1. SUMMARY OF RESOURCES/RECEPTOR

Education and training of residents in communities at or close to the road is an important receptor.

7.4.9.2. Assessment of the Sensitivity of the Impacts on Education and Training

During establishing the sensitivity of this receptor the following criteria were applied:

1. Possibility for capacity building during construction phase
2. Ability of local students to commute more easily
3. Increase of employment opportunities
4. Creation of new educational and training centers as a consequence of the economic growth of the area

For each criterion a scoring value from 0 to 3 was applied with following meaning:

- 0–No importance/occurrence
- 1–Low importance/occurrence
- 2– Medium importance/occurrence
- 3 – High importance/ occurrence

The sum of scores will determine sensitivity. The rating of sensitivity was performed on the basis of the following ranges:

- 0-2-low sensitivity (ls)
- 3-6-medium sensitivity (ms)
- 7-9-high sensitivity (hs)
- 10-12-very high sensitivity (vhs)

The sensitivity of sub receptors was assessed according to the described methodology.

	Possibility for strengthening of	Ability of local students to	Increase of employme	Creation of new educational and training centers as	Sensitivity
Educatio n	3	3	3	2	11

The results from sensitivity estimation matrix determined the following

Resource/Receptor	VALUE (SENSITIVITY)
Education &Training	Very high

Sensitivity of education and training in respect of the possibility for strengthening of capacities during construction phase has high importance due to the exposure of local people to new technologies and management methods. Sensitivity of the receptor in regards with these two criteria is of high importance. With regards to the creation of new educational and training centers as a consequence of the economic growth it is expected that overall development and improvement of quality of life will lead to increased demand for new education centers in the region. Due to this, the sensitivity of education and training in this regard is of high importance. Based on importance/occurrence from different criteria it can be concluded that the sensitivity of this receptor is very high.

7.4.9.3. Potential Impacts and Likely Significance

The following potential impacts on Education & Training have been identified for the construction and operational phases of proposed road rehabilitation from Mpika to Chinsali:

Construction phase

- Capacity building through training

Operational phase

- Education & training benefits from employment opportunities; and
- Education & training benefits from improved access to education and employment opportunities.

7.4.9.4. Construction Phase

7.4.9.4.1. Capacity building through training

It is expected that during the construction phase some level of capacity building will be provided (organized and un-organized) through transfer of new technologies and new skills. This will happen mainly as on-the-job training but also as exposure to modern management and logistics procedures and by working with people having international expertise.

Joint venture co-operation between a major international contractors (who has the financial capacity to put up the required performance bonds) and local sub-contractors could result in transfer of skills which should result in strengthening of local capacities.

Estimation of magnitude

It is expected this impact to create minor benefits on education and training including strengthening of some features or elements education and training. Thus it is estimated that the impact will have low magnitude. Once the magnitude of this impact has been estimated, the other criteria to assess this impact are as follows:

Criteria	Assessment Thresholds	
	Threshold	Descriptions
Characterization of impacts	Positive	Impact will improve current situation
Type of Impact	Indirect	Construction activities will have indirect impact upon
Reversibility	Irreversible	The effect caused by impact is irreversible. Situation cannot be returned into previous condition
Geographical Extent	Regional	Impacts extends across Muchinga Province
Time when the impact occurs	Immediate	Effect will occur immediately following project activities
Duration	Medium -term	Based on estimation for construction activities duration it is estimated impact to last in medium-term (between two and ten years)
Likelihood of appearance	Probable	The impacts can be considered to have a medium likelihood of occurring
Magnitude	Low	Minor improvement

The initial significance of this impact, without mitigation measures, is slight positive. The impact will result in minimal strengthening of capacities.

7.4.10. Potential Impacts on Vulnerable Groups

7.4.10.1. Summary of Resources/Receptor

Vulnerable groups which are likely to suffer more in economic and social terms from project activities than the general population have been identified throughout the project road corridor in various villages.

During establishing the sensitivity of this receptor the following criteria were applied:

- Ability of vulnerable groups to cope with impact
- Ability of vulnerable groups to resist impact
- Ability of vulnerable groups to recover from impact

For each criterion a scoring value from 0 to 3 was applied with following meaning:

- 0–No importance
- 1–Low importance
- 2– Medium importance
- 3 – High importance

The sum of scores will determine sensitivity. The rating of sensitivity was performed on the basis of the following ranges:

- 0 - 1- low sensitivity (ls)
- 2- 3 - medium sensitivity (ms)
- 4-6 - high sensitivity (hs)
- 7-9 - very high sensitivity (vhs)

7.4.11. Potential Impacts on Communities Quality Of Life

7.4.11.1. Summary of Resources/Receptors

Communities which are located at or close to the road are an important receptor. The quality of the inhabitants' lives will potentially be seriously affected both during construction of the road due to dust, noise, vibrations, safety issues and alteration of the landscape as well as during the operational phase of the road which will expose the inhabitants to noise and vibrations in addition to electromagnetic fields. The communities close to the road will also be potentially affected by safety hazards and an altered landscape while most other communities in the region will potentially experience improvement in their quality of live following the construction of the road.

7.4.11.2. Assessment of the Sensitivity of Communities Quality Of Life

During establishing of the sensitivity of the community to impacts on their quality of life the following criteria were applied:

- Location of influence;
- Awareness of contractor/s;
- Awareness of rail operator/infrastructure company;
- Awareness of community
- Awareness of administration

For each criterion a scoring value from 0 to 3 was applied with following meaning:

- 0–No importance
- 1–Low importance
- 2– Medium importance
- 3 – High importance

The sum of scores will determine sensitivity. The rating of sensitivity was performed on the basis of the following ranges:

- 0-2-low sensitivity (ls)
- 3-6-medium sensitivity (ms)
- 7-9-high sensitivity (hs)
- 10-12-very high sensitivity (vhs)

Quality of life sensitivity regarding the location of influence has high importance. It can be expected that the quality of life could be seriously impaired for the communities located at or close to the road during construction and operation of the project road. However during operation the quality of life within the project area of influence will be improved. Awareness of contractor/s during construction has high importance. It's very important that communities, contractor/s, and administration are fully aware of potential risks and impacts that project activities could have on quality of life. Based on importance from different criteria it can be concluded that the sensitivity of this receptor is very high.

7.4.11.3. Potential Impacts and Likely Significance

Potential impacts on communities "Quality of Life" have been also been identified for the construction and operational phases of the Project. The following impacts have been identified and assessed under Quality of Life:

7.4.11.4. Construction phase

Construction work will include activities related to site preparation, earthworks, preparation of haulage routes, erection of buildings and structures, application of architectural coa tings, track laying etc. Most of the work will be undertaken outside inhabited areas. Movement of heavy vehicles on local roads, transport of raw materials will impair quality of life of the closest communities due to dust emissions, and potentially high levels of noise and vibration. The local communities close to the construction site will also potentially be negatively affected by safety risks and alteration of the landscape. Access and severance effects which will occur due to the limited movement at construction sites and changed access road arrangements which will increase travel time have already been assessed.

7.4.11.4.1. Dust

Construction operations are a potentially significant source of dust emissions that hold the potential to have a substantial temporary impact on local air quality. Dust emissions during the construction of roads are associated with land clearing, drilling and blasting, ground excavation, and cut and fill operations (i.e., earth moving). Dust emissions can vary substantially from day to day, depending on the level of activity, the specific operations, and the prevailing meteorological conditions. A significant amount of the dust emissions result from construction vehicle traffic over haulage routes at construction sites. When a vehicle is driving on an unpaved road then the force of the wheels on the road surface causes pulverization of surface material. Particles are lifted and dropped from the rolling wheels, and the road surface is exposed to strong air currents in turbulent shear with the surface. The turbulent wake behind the vehicle continues to act on the road surface after the vehicle has passed. The quantity of dust emissions from a given segment of unpaved road varies linearly with the volume of traffic. Dust emissions also depend on source parameters that characterize the condition of a particular road and the associated vehicle traffic.

Estimation of magnitude

Potential air quality impacts including dust, particle emissions and fuel combustion emissions will be minimized through mitigation measures and controls and the implementation of a dust management plan. Most of construction activities as a source of air pollution will be located outside the settlements. Due to this the impact should overall cause only small alteration of Quality of life thus the impact magnitude is estimated to be low. Once the magnitude of this impact has been estimated, the other criteria to assess this impact are as follows:

Criteria	Assessment Thresholds	
	Threshold	Descriptions
Characterization of impacts	Negative	Impact could create worsening over the current situation in quality of life
Type of Impact	Direct	Construction activities will have direct impact upon
Reversibility	Reversible	The effect caused by impact is reversible. Situation can be returned into previous condition
Geographical Extent	Local	Impact is limited to communities that are on the closest distance to the road
Time when the impact occurs	Immediate	Effect will occur immediately following project activities
Duration	Medium -term	Based on estimation for construction activities duration it is estimated impact to last in medium-term (between two and ten years)
Likelihood of appearance	Probable	There is a medium likelihood this impact to occur
Magnitude	Low	Alteration

The initial significance of this impact, without mitigation measures, is moderate negative. The impact will potentially result in small changes in quality of life. The impact will not be sufficiently large to result in diminishing the quality of life, even if they are sustained and widespread effects they are not considered to be disruptive to quality of life.

7.4.11.4.2. Noise

The majority of construction activities along the project road corridor will not produce noticeable levels of noise disturbance due to the distance from most residences. However, some activities such as excavation, rock breaking, rolling and compacting may produce levels of noise that are audible when construction activities are located within 50 meters of residences. Blasting during construction may also be required due to the presence of hard rock within the construction corridor.

During construction works, the primary cause of noise will be the foundation of piles and catenaries masts. Nuisance connected with foundation works will be greater in populated areas and less in the open land where most of the work is going to be performed. However, the duration of the noise related work can be restricted to approximately one day for each residence.

Other typical noisy activities during construction will be connected to the haulage of material, loading and unloading of gravel, supplying broken stone and gravel etc.

Estimation of magnitude

Most of the constructions activities as a source of noise will be located outside the settlements but they will be present on regional and local roads. Due to this, the impact will cause partial loss in Quality of life but it will not adversely affect the integrity. Thus the impact magnitude is estimated to be medium.

The initial significance of this impact, without mitigation measures, is large negative. The impact will

potentially be sufficiently large to result in diminishing the quality of life in unmitigated.

7.4.11.4.3. Vibrations

Measurement of the magnitude of vibrations is difficult. The extent and magnitude of vibrations from construction works depends to a degree on the composition and conditions locally underground. Nuisance from vibrations experienced inside buildings will in addition depend on building material and foundation.

The guiding maximum levels of vibrations are:

- Residences 24 hours, mixed residences and business 6pm – 7 am, day care centers etc: Law = 75 dB
- Mixed residences and business 7am – 6 pm, office building, training rooms etc: Law = 80 dB
- Business area: Law = 85 dB

The above maximum levels of vibrations only concerns nuisance from vibrations for people. Normally, buildings at a distance of 20-30 meters from the area where the foundation of piles and catenaries masts take place will not be exposed to damaging vibrations.

Estimation of magnitude

Most of the constructions activities as a source of vibrations will be located outside the settlements. Due to this, the impact will cause partial loss in Quality of life but it will not adversely affect the integrity. Thus the impact magnitude is estimated to be medium.

The initial significance of this impact, without mitigation measures, is large negative. The impact will be not be sufficiently large to result in diminishing the quality of life.

7.4.11.4.4. Safety

The majority of construction activities along the project road will not produce safety risks to the residence due to the distance of construction site to most of the residences. Construction works on or adjacent to the road can affect the safety of personnel, passengers or the general public, if not managed effectively. Especially dangerous are areas with moving heavy machinery, excavation sites and construction sites. It is a requirement that such work is managed with a level of competence which ensures safety at all times and compliance with all relevant safety legislation.

Construction traffic will have temporary impacts on the traffic network of the area, generating increased traffic risks and accidents. Current road users include local residents and other road users to other parts of the country and neighbouring countries. To ensure public safety special traffic regime must be applied.

Estimation of magnitude

Most of constructions activities as sources of safety risks will be located outside the settlements. However construction traffic will be present on regional and local roads. Due to this, the impact will cause partial loss in quality of life but it will not adversely affect the integrity. Thus the impact magnitude is estimated to be medium.

The initial significance of this impact, without mitigation measures, is large negative. The impact may be sufficiently large to result in diminishing the quality of life.

CHAPTER EIGHT

MEASURES FOR PREVENTION, MINIMIZING OF NEGATIVE EFFECT AND DEALING WITH ENVIRONMENTAL AND SOCIAL PROBLEMS

8.1. INTRODUCTION

Chapter 8 covers detailed appropriate mitigation measures to address predicted negative effects and enhancement measures to maximise anticipated benefits, determine significance of residual effects (including any residual cumulative, synergistic and transboundary effects) after consideration of the effectiveness of the design and committed mitigation measures. Therefore this stage of the assessment determines the likely significance of any residual effects following the application of mitigation measures (i.e. Significance of Effects (with mitigation)) by considering the Significance of Effects (without mitigation) along with the probable success of mitigation measures.

8.2. ENVIRONMENTAL MITIGATION MEASURES AND ASSESSMENT OF RESIDUAL EFFECTS

8.2.1. Soils, Surface Water and Groundwater

8.2.1.1. Mitigations Measures for Soils

Construction Phase

Because chemicals and suspended particles in the soil may be transported by runoff, leaching and erosion processes, mitigation measures aimed at the protection of soil quality and erosion, will also be effective to prevent surface and groundwater contamination. They are, therefore, presented together.

The main mitigation measures during the construction phase to prevent soil erosion and contamination, and also surface water and groundwater contamination would be contained in the following management plans:

- A Sedimentation and Erosion control Plan;
- A Plan for the safe management of hazardous materials and spill prevention program, including emergency response measures in case of accidental spills; and
- A Waste Management Plan.

The **Sedimentation and Erosion control Plan** should be developed in order to identify specific erosion control techniques for use at all the construction sites along the project road corridor he Plan should be based on several principles:

1. Provide the approach by which each site characteristics (topography, soils, drainage patterns, and covers) will be considered when implementing the plan. Wherever possible areas which are prone to erosion should be left undisturbed and undeveloped. Entrance and exits points for runoff should be protected from erosion and equipped with sediment control devices;
2. Minimizing the extent of the disturbed area and the duration of exposure and stabilize

disturbed areas as soon as possible. Typically, if an area is not going to be worked on in more than 45 days, it should be protected by erosion control mats;
3. Minimizing the use of heavy equipment and techniques that will result in excessive soil disturbances or compaction of soils, especially on unstable slopes;
4. Establishing the drainage and runoff controls before starting the site clearance and earthworks. The existing vegetation should be retaining as much as possible;
5. Where water would need to be removed from excavations, it should be transferred at the minimum practical distance to be discharged;
6. Keeping runoff velocity as low as possible. For drainage ways such as ditches, high velocity can be reduced by a series of rock check dams which break the flow velocity. Overland flow velocity can be reduced by minimizing slope length and steepness;
7. Diverting concentrated flows wherever possible away from sensitive areas;
8. Using sediment control devices such as sediment control ponds to retain sediments from leaving the site;
9. Selecting and implementing the most effective erosion control devices: i)temporary seedlings; ii)temporary mulching; iii) permanent sodding; iv)temporary or permanent erosion control blankets; v) permanent vegetative buffer strips;
10. Selecting and implementing sediment control devices such as: i) site fencing; ii) straw bales; iii) sediment basins or traps; iv) storm inlet traps; vi) rock check dams and vii) interception berms/swales;
11. Decompacting and restoring disturbed areas once construction is completed at a site, all areas that are not going to be occupied by permanent structures by tilling the land before proceeding to the vegetation reinstatement.

The **hazardous materials management and spill prevention plan** should address issues such as:
1. Keep all roads and hard standings clean and tidy to prevent the build-up of oil and dirt that may be washed into a watercourse or drain during heavy rainfall;
2. Keep spill kits close to the construction sites in case there is an incidental spill off, so that it can be immediately cleaned up;
3. Do not permit any refueling, storage, servicing or maintenance of the equipment within 100m of drainages, water courses, alluvial plains or other sensitive environmental resources. If these activities have to be done at the construction site, all precautionary measures shall be taken to prevent leaks or spills from reaching the soil or nearby water courses;
4. Do not allow ready-mix concrete trucks containing alkaline cement or residues of cement to enter any watercourse. Washout of the concrete trucks shall be performed at the concrete batching plant camp, where appropriate facilities will be provided. If the washout of concrete trucks were necessary at or near the construction site, this shall be done at distance greater than 200m of any watercourse and never in a very high or high habitat sensitivity area. The washout area will be clearly signposted and drivers shall be aware of the designated locations for washout;
5. Avoid setting up camps on alluvial terrains because of the high levels of the underground water table and the risk of pollution;
6. Organize proper handling and storage of lubricants, solvents as well proper usage of construction equipment;
7. Minimize the storage of substances that are harmful to soils and waters (e.g. fuels for construction machinery) on the construction site. All hazardous substances either products to be used or waste, shall be stored in adequate places, far from sensitive areas (e.g. water

courses, habitats with a rich biodiversity) and adequately equipped to prevent any soil, surface water or groundwater contamination);
8. Undertake regular preventive maintenance of vehicles and construction machinery so as to reduce leakages of lubricants, motor oil and fuel.

The **Waste Management Plan** shall include the following tasks:

1. Identification and classification of the different waste types that could be generated at the construction site (due to the materials used and waste generated in different sections) according to the national List of Waste (Official Gazette no.100/05) on hazardous and non-hazardous waste streams;
2. Completely separate hazardous from non-hazardous waste streams at the construction site should be done;
3. Immediate removal of waste material (concrete, iron, rocks, etc.) accidentally deposited, from highly sensitive habitats;
4. Collection and treatment of municipal solid alike waste generated in the construction site and camps (food, beverages, packaging waste such as paper, bottles, glass, etc., glass bottles, batteries) according to national legislation (separation of recycling waste materials from the waste stream that will be disposed of in the solid waste municipal landfill). Recyclable waste should be given to an authorized recycling company;
5. Signing a contract with the company for waste collection and transportation for the collection and transport of the waste generated at the construction site to the nearest municipality landfill;
6. Construction of inert waste landfills according to specifications set in the national and EU requirements;
7. Establishing and implementing the Closure Plan for the closure of the inert landfills taking into account the need for cultivation of the landfills area;
8. Ensuring that the contracts signed with the companies dealing with waste recycling and recovery will take delivery and acceptance of the waste streams is performed on a frequent basis so that the construction sites remain clean at any time;
9. Reusing excavated soil and construction waste as much as possible;
10. The separate collection of possible hazardous waste (motor oils, vehicle fuels) and sub-contracting an authorized collector and transporter to transport , recovery or finally dispose the hazardous waste;
11. Establishing the Temporary Hazardous Waste Storage Points according the national legislation on handling, labelling, storage and management with hazardous waste;
12. Establishing and following the hazardous waste management procedure;
13. Ensuring that the hazardous waste is packaged and labelled showing the R and S phrases (risk and safety statements of the hazardous waste) and it is temporary stored on safety storage facility equipped with adequate ventilation, fire resistant conditions especially if there are VOC emissions, mercury containing lamps, asbestos materials from demolition works;
14. Ensuring that the access to these temporary hazardous waste storage points be only allowed for trained and equipped staff, and entrance prohibited for untrained workers and public;
15. Promptly cleaning up All waste spills;
16. Making available for inspections full records of the type of waste stream generated, quantity composition, origin, disposal destination and method of transport for all different waste streams;

17. The reporting on waste management on a regular basis to the particular municipality and the legal obligation is for further reporting by the municipality to the MoEPP through the Annual Reports;
18. Immediately removing any waste material (concrete, iron, rocks etc.) accidentally deposited in highly sensitive habitats;
19. Undertaking the selective removal and storage of top soil;
20. The removal of topsoil from the soil surface so as to serve for reuse in the restoration of disturbed areas not occupied by the road;
21. The reuse of topsoil to restore cuttings, embankments, wildlife crossings, construction and workers camps, landfills, and borrow pits;
22. Locating the temporary storage areas along the strip of land along the alignment, near the sites where the soil was removed from, so that it can be reused in those same areas;
23. Placing the layers of the excavated top soil on to the established storage areas in the same order as the original soil levels. The topsoil removed will be collected on ridges to be built in flat areas so as to avoid the loss of the organic and biotic properties of the soil, and protected it from weather agents, mainly wind and rain, which cause the erosion of the soil ridge. The ridges shall be signaled and maintained in proper condition until the reutilization of the topsoil.

Construction workers will be given training sessions, prior and during construction works, to make them aware of the importance of soil, surface water and groundwater as valuable resources for humans and nature, and the need for protecting them.

8.2.1.2. Mitigation Measures for Surface Water

Construction Phase

The construction of drainage culverts and bridges in water courses will be carried out during the dry season.

The areal extent of the construction area next to water courses will be only as large as that which is strictly necessary to adequately perform the construction works. Bridges will be designed and constructed so to limit effects. River & Stream Crossing Plans will be prepared for the management of works at any crossings.

The following guidelines will be taken into account in the construction of bridges:

1. Single span bridges are the preferred structure for crossing streams as they cause the least disturbance to the waterway both hydraulically and environmentally;
2. Multiple span bridges are acceptable on wide streams. Acceptable arrangements include:
    - Piers located outside the normal low flow stream width. In this regard, a three span bridge would be preferable to a two span bridge. The spans do not need to be of equal length;
    - Piers aligned parallel to the direction of flow;
    - Riprap provided around the piers to mitigate local scouring;
    - If piers/piles have to be constructed inside the normal low flow stream width, they should occupy less than 5% of the cross sectional area so as not to cause a significant change to the available waterway.
3. The bridge abutments should be located so they do not significantly encroach into the

waterway and thereby reduce the available waterway area. Abutments should also be located so as to avoid obstruction of movement of terrestrial fauna along the riparian zone (i.e. allow free movement of animals along the river banks);

4. Rock beaching will be used on the batters to protect against abutment scour, as this area will generally not revegetate due to inadequate light and lack of rainfall. Beaching should generally extend 3 metres upstream and downstream of the bridge abutments;
5. The batter is to be excavated to the depth of the beaching to maintain the waterway area. The slope of the batters should be in the range of 1V:1H to 1V:2H. In general, the beaching should extend at least 600 mm below the toe of the bank to mitigate undermining. Where the stream banks are stable, rock beaching may not be required.

The road drainage shall be directed to retention basins or grassed filter zones to trap sediments and other contaminants, rather than discharging directly to the water courses. These sediment and contaminant retention structures shall be constructed in the areas where habitats of very high or high sensitivity are located along the alignment or in a close location downstream of the effluent discharge point.

Domestic type wastewater generated in the construction camps will not be allowed to be discharged untreated into natural water courses. The camps will be provided a wastewater treatment system to treat effluents to admissible levels for discharge in the water body. The construction sites will be provided with chemical portable toilets and the waste adequately managed.

Operational Phase

Regular control and maintenance of drainage structures and retention basins shall be conducted to check they do not become clogged with debris or sediments.

8.2.1.3. Mitigation Measures for Groundwater

Construction Phase

In the eventual case of hitting the groundwater table during the excavation, cutting, the intercepted area will be sealed as soon as possible so as to avoid any major alterations to the natural groundwater levels and flow in the area.

The hazardous materials management and spill prevention plan to be developed (see mitigation measures for soil) should address the potential for indirect and direct groundwater contamination. Direct impacts could occur where the groundwater is encounter e.g. during the construction of pillars near a water course.

Operational Phase

The implementation of the mitigation measures defined above for soils and surface water will serve to protect groundwater during the operational phase.

8.2.1.4. Assessment of Residual Effects

The mitigations measures described above in sections 8.2.1.1, 8.2.1.2, and 8.2.1.3 are intended to avoid or minimize the impacts on soil, surface water, and groundwater. They also contribute to mitigate indirect effects on flora, fauna, habitats, and protected and designated areas that occur from contamination of soil, surface water and groundwater, as well as from erosion and sedimentation processes. The mitigation for each identified impact is as follows:

Construction phase

Soils

Impairment of soil quality (soil contamination) due to the introduction of pollutants

- The magnitude of this impact without mitigation measures was estimated to be low and the probable success of the mitigation measures is considered to be high. The magnitude of the impact with the implementation of mitigation measures is even lower. Therefore the significance of the residual effect is considered to be Slight.

Soil erosion due to clearance of vegetation and earth movements

- The magnitude of this impact without mitigation measures was estimated to be medium and the probable success of the mitigation measures is considered to be moderate. The magnitude of the impact with the implementation of mitigation measures is low. Therefore the significance of the residual effect is considered to be Slight.

Destruction of fertile top soil

- The magnitude of this impact without mitigation measures was estimated to be medium, and the probable success of the mitigation measures is considered to be low. The magnitude of the impact with the implementation of mitigation measures is medium. The significance of the residual effect is considered to be Moderate.

Surface water

Impairment of water quality due to the introduction of pollutants

- The magnitude of this impact without mitigation measures was estimated to be medium and the probability of success of the mitigation measures is considered to be high. Therefore the magnitude of the impact with the implementation of mitigation measures is low. Therefore the significance of the residual effect is considered to be Slight.

Groundwater

Impairment of groundwater quality due to the introduction of pollutants

- The magnitude of this impact without mitigation measures was estimated to be medium and the probability of success of the mitigation measures is considered to be high. The magnitude of the impact with the implementation of mitigation measures is low. Therefore the significance of the residual effect is considered to be Slight.

Alteration of groundwater flow patterns during cutting operations

- The magnitude of this impact without mitigation measures was estimated to be negligible and the probability of success of the mitigation measures is considered to be high. The magnitude of the impact with the implementation of mitigation measures is even lower. Therefore the significance of the residual effect is considered to be Neutral.

Operation phase

Soils

Impairment of soil quality (soil contamination) due to the introduction of pollutants

- The magnitude of this impact without mitigation measures was estimated to be medium,

and the probability of success of the mitigation measures is considered to be high. The magnitude of the impact with the implementation of mitigation measures is low. Therefore the significance of the residual effect is considered to be Slight.

Soil erosion in earth banks devoid of vegetation

- The magnitude of this impact without mitigation measures was estimated to be low, and the probability of success of the mitigation measures is considered to be high. The magnitude of the impact with the implementation of mitigation measures is even lower. Therefore the significance of the residual effect is considered to be Slight.

Surface water

Impairment of water quality due to the introduction of pollutants

- The magnitude of this impact without mitigation measures was estimated to be low, and the probability of success of the mitigation measures is considered to be high. The magnitude of the impact with the implementation of mitigation measures is even lower. Therefore the significance of the residual effect is considered to be Slight.

Alteration of flow patterns and sediment deposition during flooding Periods

- The magnitude of this impact without mitigation measures was estimated to be low and the probability of success of the mitigation measures is considered to be high. The magnitude of the impact with the implementation of mitigation measures is even lower. Therefore the significance of the residual effect is considered to be Slight.

Groundwater

Operation phase- Impairment of groundwater quality due to the introduction of pollutants

- The magnitude of this impact without mitigation measures was estimated to be medium, and the probability of success of the mitigation measures is considered to be high. The magnitude of the impact with the implementation of mitigation measures is low. Therefore the significance of the residual effect is considered to be Slight.

8.2.2. Air Quality

8.2.2.1. Mitigations Measures for Air

Construction Phase

The measures which will be undertaken to minimize dust emissions include:

1. Hoardings will be constructed around the construction sites to minimize the spread of dust;
2. Accesses and construction sites will be kept moist to reduce dust formation. Water sprays should be implemented during drilling and excavation activities;
3. In the dry season, hygroscopic additives will be used in water to increase its presence in the ground;
4. Dust-generating activities will be slowed down in days of strong wind;
5. In windy and dry conditions, earth stockpiles will be moistened to prevent the lifting of dust particles;
6. Ground will be moistened during loading and unloading of aggregates in trucks;
7. Truck dumpers carrying spoil or other dusty materials will be covered with tarps;

8. Loaded trucks should be washed down prior to exit from the working site to ensure that loose material is not tracked onto the roads;
9. Work sheds should be large enough to allow stockpiling of the excavated material, access of trucks and truck loading operations;

Measures which will be taken to minimize emissions of combustion gases:

1. Vehicles and construction machinery will be required to be properly maintained and to comply with relevant emission standards;
2. No unnecessary idling of construction vehicles at the construction sites will be allowed;
3. Construction truck traffic will be optimized so as to get a minimum number of trucks carrying the maximum volume of materials. This will be addressed in the Construction Traffic Management Plan;
4. The truck routes will be planned to avoid peak traffic hours or routes with heavy traffic.

Measures which will be taken to avoid asbestos emissions during demolition of buildings will include:

1. Development of an asbestos operational control procedure during demolition works according to national legislation on hazardous waste, Directive 91/689/EEC on hazardous waste, Council Directive 87/217/EEC on the prevention and reduction of environmental pollution by asbestos and EU Directive 2009/148/EC on the protection of workers from the risks related to exposure to asbestos at work;
2. The storage and transport of demolition materials will be removed, packed, labeled and processed in according the national and EU legislation on management of hazardous waste and asbestos (Directives 87/217/EEC and 91/689/EEC);
3. Undertaking a risk assessment before beginning an activity involving exposure to asbestos dust or to materials containing asbestos.

Operational Phase

According to the evaluation of the dust and waste air pollution in the operation phase at section__, toward 2020, the degree of the dust pollution exhausted from engines does not affect people living outside the corridor. Only Nox exceeds the permissible level 0,20mg/m^3 in the area which is far from the road about 60m in 2020.

Nox is reduced by the following measures:

1. Discourage the use of old vehicles exhausting the high hazardous gas, and instead encourage the use of newer vehicles with low gas emission under the current standard in Europe and other developed countries;
2. Planning residential areas suitably; not build house in the corridor of road safety or far from road about over 50m.
3. Not locating any sensitive facilities such as health facilities and school within the scope of 100m from the road.

Due to the long habit of people living near the road for easy transport and for conducting business along the road, application of these measures is quite difficult. However, authorities must start taking measures to control these habits in order to have a healthy living environment as is the case the developed countries nowadays.

8.2.2.2. Assessment of Residual Effects

Construction Phase

Impairment of air quality due to emission of construction-borne air pollutants

- The magnitude of this impact without mitigation measures was estimated to be medium and the probability of success of the mitigation measures is considered to be moderate. The magnitude of the impact with the implementation of mitigation measures is low. Therefore the significance of the residual effect is considered to be Slight.

Operational Phase

Impairment of air quality due to emission of air pollutants from combustion gases of diesel

- The magnitude of this impact without mitigation measures was estimated to be low, and the probability of success of the mitigation measures is considered to be high. The magnitude of the impact with the implementation of mitigation measures is low. Therefore the significance of the residual effect is considered to be Slight.

8.2.3. Noise and Vibrations

8.2.3.1. Mitigations Measures for Noise

Construction Phase

The main mitigation measures to reduce noise as well as vibration levels during construction will be as follows:

1. Wherever possible all construction equipment will comply with the requirements of EU Directive 2000/14/EC on noise emission in the environment by equipment for use outdoors (there is a lack of national legislation on outdoor equipment emission noise levels). All the equipment shall bear the CE marking and the indication of the guaranteed sound power level and shall be accompanied by an EC declaration of conformity;
2. The equipment will be fitted with appropriate noise muffling devices that will reduce sound levels;
3. Construction works will not be permitted during the night; the operations on site shall be restricted to the Period 07.00-19.00 h;
4. All vehicles and machinery used at the construction sites will be subject to regular maintenance. The vehicles and machines that are excessively noisy due to poor engine adjustment or damage noise control devices shall not be operated until corrective measures have been taken;
5. The construction traffic plan will establish speed limits for construction vehicles and machinery at the construction site and the haulage roads used, and organize traffic so as to avoid as much as possible populated areas;
6. Affected local residents will to the best of the project's efforts be kept informed on due time of the planned works and the vibration and noise levels and Periods during which they will occur;
7. The location of noisy equipment will be chosen as far as possible from sensitive receptors (houses, workplaces, schools and hospitals). When near sensitive receptors, construction works will be scheduled and provided with the necessary resources so that the time of exposure is as short as possible;
8. Good management practice will be used to distribute heavy noise equipment along the route so as to avoid the cumulative effects of noise;
9. In the case where noisy works would need to be performed at night or during a longer Period

than one day at a given site, a noise shield will be erected around the working area;

10. Monitoring of vibrations during the performance of critical work processes (e.g. foundation of piles and catenary masts) will be undertaken in buildings which are within a distance of 20-30 meters from the area where the these works take place. Should buildings result damaged as a result of vibrations generated by the construction works, the damaged buildings will be repaired or compensation paid;
11. Earth moving equipment operating on the construction site will be as far away from vibration-sensitive receptors as possible;
12. Activities such as demolition, earthmoving and ground-impacting operations will be scheduled so as not to occur in the same time Period. Unlike noise, the total vibration level produced could be significantly less when each vibration source operates separately;
13. Decrease dynamic loads from construction sources such as:
    - Blasting. Explosive type and weight, delay-timing variations, size and number of holes, distance between holes and rows, method and direction of blast initiation;
    - Dynamic compaction. A smaller falling weight will produce smaller vibrations;
    - Pile driving. Pre-drilling, pre-jetting, replacement of displacement piles with non-displacement ones, switch impact hammer to vibratory one, replacement of driven piles with augered cast in-place piles or drilled shafts;
    - Select demolition methods not involving impact, where possible;
    - Avoid vibratory rollers and packers near sensitive receptors.

Operational Phase

To reduce the noise during operation, the project proponent through various agencies such as RTSA will apply the following measures:

1. Discourage the use of old vehicles which is noisy and instead encourage the use of new vehicles with the low noise under the current Standard of European and other advanced countries;
2. Discourage or completely ban the use of air horn when passing through heavily settled areas;
3. Planning residential areas suitably; not build house in the corridor of road safety or far from road about over 50m.
4. Not locating any sensitive facilities such as health facilities and school within the scope of 100m from the road.

Due to habitually prefer to live near road for easy transport and business of many people and the current economic situation in the country, the application of the above measures is quite difficult. However, the authorities must take part in to early have the healthy living environment as in the developed countries nowadays

8.2.3.2. Assessment of Residual Effects

Construction Phase

Noise

Impairment of acoustic quality due to noise emissions from construction vehicles and machinery

- The magnitude of this impact without mitigation measures was estimated to be high, and the Probability of success of the mitigation measures is considered to be moderate. The

magnitude of the impact with the implementation of mitigation measures is medium. Therefore the significance of the residual effect is considered to be Moderate.

Operational Phase

Noise

Impairment of acoustic quality due to train traffic noise emission (diesel traction)

- The magnitude of this impact without mitigation measures was estimated to be medium and the probability of success of the mitigation measures is considered to be high. The magnitude of the impact with the implementation of mitigation measures is low. Therefore the significance of the residual effect is considered to be Slight.

8.2.4. Landscape

8.2.4.1. Mitigations Measures for Landscape

Construction Phase

During construction operations, the landscape impact can be mitigated by utilising techniques to screen the operations from observers the construction site, the camp and ancillary areas

Operational Phase

The effects of the constructed road on the landscape can be corrected in part through measures, such as landscape planting and the integration of the design of the road structures in the surrounding landscape, as follows:

- Shaping of the terrain around altered impacted areas so as to recreate the surrounding land morphology;
- Planting vegetation with autochthonous species present in area such as:
  - ✓ Slopes of the cuttings and embankments. Vegetation measures are generally recommended for 2H:1V slopes;
  - ✓ Water courses and banks underneath constructed bridges, as well as in the abutment areas;
  - ✓ Aesthetic integration of the structural parts of viaducts and bridges (e.g. deck, pillars) using construction materials with colours and textures that blend well with those of the surrounding landscape (e.g. dark concrete for pillars in a black pine forest);
- Designing the landfill waste disposal patterns so that the final contours are integrated with those of the unaffected part of the waste receiving valley;
- Vegetating the sealed landfills with autochthonous species adapted to the resulting valley conditions;
- Any borrow pits opened for the construction of the road project, will be reinstated at the end of the construction works and replanted.

8.2.4.2. Assessment of Residual Effects

Construction Phase

Alteration of landscape scenery by the presence of construction works, construction camps and other auxiliary facilities

- The magnitude of this impact without mitigation measures was estimated to be low and

the probability of success of the mitigation measures is considered to be moderate. The magnitude of the impact with the implementation of mitigation measures is even lower. Therefore the significance of the residual effect is considered to be Slight.

Operational Phase

- The magnitude of this impact without mitigation measures was estimated to be medium, and the probable success of the mitigation measures is considered to be moderate. The magnitude of the impact with the implementation of mitigation measures is medium. Therefore the significance of the residual effect is considered to be Moderate.

8.2.5. Habitats, Fauna and Flora and Protected& Designated Areas

The mitigation measures for flora, fauna, habitats, and protected/designated area are presented together since most of the measures, although aimed at the protection of a particular receptor (e.g. flora), are beneficial to all four resources. For example the measures that protect flora and fauna, will also protect habitats and protected and designated areas, and vice versa. In fact, for some of the receptors like protected and designated areas specific mitigation measures have not been identified because it has been considered that those identified for flora, fauna and habitats should be sufficient for effectively protecting this resource.

Moreover, mitigation measures identified for other resources like landscape or soil and water, also contribute to protect these receptors. This will be indicated in the assessment after the application of the mitigation measures of the individual impacts identified for each resource, as shown below.

8.2.5.1. Mitigations Measures for Flora

Construction Phase

The main impacts on vegetation during construction arise from clearance operations of the road corridor, stations, haulage roads, camps and other auxiliary facilities. Measures to minimize the impacts will be as follows:

- ✓ The surface for carrying out the clearance of vegetation will be limited to the strip of land needed for the occupation of the permanent way and the right of way of the future road corridor and the adjacent working width, if needed;
- ✓ Likewise, for the construction of access roads, parking places and utility service areas, clearance of vegetation will be limited to the surface occupied by these infrastructures;
- ✓ The workers camps constructed during the previous Periodic maintenance Period of the road (2013-2014) shall be reutilized. Should new camps and auxiliary facilities needed, these will be constructed in areas of vegetation with negligible sensitivity vegetation (only on abandoned fields) or low sensitivity (only on Black locust stands and plantations and Black Pine plantations);
- ✓ In areas of high and very high sensitive vegetation, the working sites will be marked by means of ribbons or other type of landmark so that workers and construction vehicles and machinery do not trespass on non-working areas;
- ✓ In forested areas, and especially those where the value of vegetation is high or very high, each tree lying in the border of the construction site will be protected by covering its trunk with wood planks held in place with wires or similar which do not impinge on the truck;
- ✓ Should permits be required for the cutting of trees, applicable regulations will be complied with and all the necessary permits will be obtained prior to the clearance of vegetation;

- ✓ Any area affected by the construction works that is not going to be permanently occupied by the road structures should be restored to a state as close to the original conditions as possible through reinstatement activities, using native plant species from the surrounding areas;
- ✓ Training will be delivered to constructions workers before construction works start and during construction to increase their awareness and responsibilities with regards to the surrounding natural values, including those of vegetation.

Operational Phase

The main impacts on vegetation during operation will arise from maintenance activities of the road. In general, the program will take into consideration the following guidelines based on good environmental practices and the International Finance Corporation (IFC) Environmental, Health, and Safety Guidelines (Roads) recommended measures to prevent and control impacts from right-of-way vegetation maintenance:

1. The road area should be kept completely clear of vegetation.
2. From the edge of the track area to the boundary of the right-of-way, vegetation should be structured with smaller plants near the line and larger trees further away from the line to provide habitats for a wide variety of plants and animals. This means that:
    - Mowing can be used to control growth of ground covers, minimize propagation of plants in the track area, and prevent the establishment of trees and shrubs in the right-of-way;
    - Herbicides in combination with mowing can control fast growing weedy species that have a potential to mature to heights over those permitted within the right-of-way;
    - Trimming and pruning can be utilized at the boundaries of rights-of-way to maintain corridor breath and prevent the encroachment of tree branches;
    - Hand removal or removal of vegetation, while labour intensive, can be used in the vicinity of structures, streams, fences and other obstructions making the use of machinery difficult or dangerous.);
3. Native species should be planted and invasive plant species removed. This has the advantage that:
    - Dense, thorny native shrubs can be used to help deter trespassers;
    - Native plants can also help to stabilize clay soils;
    - As leaves of some tree species with invasive root systems can cause traction problems for rail wheels, to minimize disruption and potential for accidents, such trees should be removed, even if native to the area;
    - Waste from removal of invasive species should be disposed of (e.g. by incineration of at a landfill) to avoid accidental spreading of the weeds to the sites.);

8.2.5.2. Mitigations Measures for Fauna

Construction Phase

During the construction phase a reduction in animal populations could be expected due to killing of animals by vehicles and machinery (crushing or collisions) or from illegal hunting by construction workers; destruction of nests, burrows, and other animal sheltering/breeding structures, or the displacing individuals due to the presence of humans and running vehicles and machinery. Among the species affected there may be sensitive species that might be present in the surroundings of the construction works.

In order to minimize this impact during construction, the following measures shall be implemented:

1. Construction activities shall be scheduled so as to avoid the breeding season and other sensitive seasons or times of day, especially in areas where high sensitive species are concerned associated to sensitive habitats:
    - High sensitivity species for this project include those identified in section for Impacts on Fauna);
    - A highly sensitive area that needs to be specifically taken into account in the scheduling of construction activities, regardless of the habitats it hosts, is the Section between Danger hill village (Km___) and Lwanya (Km____). This section of the project road corridor is a protected forest (Bwinjimfumu) although it is highly encroached.
2. Prior to the commencement of any construction work activity on a site, a fauna survey of the area and its surroundings shall be carried out by a qualified biodiversity expert:

- In case active breeding sites of sensitive species of fishes, amphibians, reptiles, bird, or mammals, including bats, are found, they will be transported by specialized technicians to another appropriate location away from the road construction area, unless the biodiversity expert decides on other precautionary measures to take.

3. All equipment and personnel movements will occur within the established construction works site and hauling roads;
4. Traffic of construction vehicles and machinery will be reduced as much as it is possible to perform construction works adequately;
5. The speed of vehicles in the area of construction works and hauling roads will be limited to a specific maximum speed (30 km/h) and drivers reminded through signage and installation of speed bumps, where necessary;
6. Any animal crushing or collision of animals will be recorded in a logbook;
7. Hunting of wildlife in the area of the construction works by workers will be prohibited;
8. Before the start of works, construction workers will be trained on the natural values of the area and the need to be proactive in implementing the measures for the protection of wildlife.

The mitigation measures designed to protect soil and surface water during the construction phase will also contribute to minimize killings or injuries to wild animal associated to riparian habitats. These are addressed in subsections 8.1.1.1 and 8.1.1.2.

8.2.5.3. Mitigations Measures for Habitats

Construction Phase

The construction of the road involves the destruction of the habitats along the road corridor through the elimination of the vegetation cover and earth movements to prepare the road corridor for the laying down of the track and stations. It also involves the temporary occupation of natural biocorridors formed by the streams and stream banks that are intersected by the alignment and those watersheds to be used as landfills, which creates a temporary severance of these riparian biocorridors.

As the loss of habitats implies the loss of vegetation, the mitigation measures for this impact are those that have been described in subchapter 7.1.5.1. These measures, where relevant, are also applicable for the mitigation of the temporary severance of riparian corridors together with those described for fauna in chapter 7.1.5.2, soil and water in subsection 7.1.1.1, and landscape in subsection 7.1.4.1 (in all cases, when relevant for the mitigation of this impact).

8.2.5.4. Mitigations Measures for Protected and Designated Sites

The mitigation measures identified for flora, fauna and habitats, as well as those identified for soils, water and groundwater, and landscape shall be enough to preserve the integrity of the protected and designated areas in the road corridor area.

8.2.5.5. Assessment of Residual Effects

The mitigations described above are intended to avoid or minimize the impacts on flora, fauna, habitats and protected and designated spaces as follows:

Construction phase

Fauna

1. **Decrease in animal populations**
   - The magnitude of this impact without mitigation measures was estimated to be low and the probability of success of the mitigation measures is considered to be high. The magnitude of the impact with the implementation of mitigation measures is even lower. Therefore the significance of the residual effect is considered to be Slight.

Habitats

1. **Loss of Habitats**
   - The magnitude of this impact without mitigation measures was estimated to be low and the probability of success of the mitigation measures is considered to be high. The magnitude of the impact with the implementation of mitigation measures is even lower. Therefore the significance of the residual effect is considered to be Slight.

2. **Temporary severance of riparian biocorridors**
   - The magnitude of this impact without mitigation measures was estimated to be medium and the probable success of the mitigation measures is considered to be high. The magnitude of the impact with the implementation of mitigation measures is low. Therefore the significance of the residual effect is considered to be Slight.

Operation phase

Flora

1. **Impact on plant diversity by herbicides used in maintenance operations**
   - The magnitude of this impact without mitigation measures was estimated to be medium and the probability of success of the mitigation measures is considered to be high. The magnitude of the impact with the implementation of mitigation measures is low. Therefore the significance of the residual effect is considered to be Slight.

Fauna

1. **Decrease in animal populations**
   - The magnitude of this impact without mitigation measures was estimated to be high, and the probable success of the mitigation measures is considered to be moderate. The magnitude of the impact with the implementation of mitigation measures is medium. Therefore the significance of the residual effect is considered to be Moderate.

Habitats

1. **Habitats fragmentation**
   - The magnitude of this impact without mitigation measures was estimated to be medium, and the probability of success of the mitigation measures is considered to be high. The magnitude of the impact with the implementation of mitigation measures is low. Therefore the significance of the residual effect is considered to be Moderate.

Protected and Designated Areas

1. **Loss of conservation values**
   - The magnitude of this impact without mitigation measures was estimated to be high, and the probable success of the mitigation measures is considered to be high. The magnitude of the impact with the implementation of mitigation measures becomes low. Therefore the significance of the residual effect is considered to be Slight.

8.2.6. Cultural Heritage

8.2.6.1. Mitigation Measures

Construction Phase

During the construction phase, accidental destruction of non-identified buried archaeological sites may occur as the clearance of vegetation, buildings, and fences proceed followed by earth movement operations, which might expose previously unknown buried archaeological (also paleontological) sites. In order to prevent unwanted destruction of archaeological sites, the following measures will be taken before and during construction:

1. During the construction works, and more specifically during each earth work to be performed in undisturbed terrain, an archaeological monitoring survey will be conducted on a permanent basis to check that no archaeological remains are unburied without control. This monitoring shall be conducted by a team of expert archaeologists;
2. The construction works should not begin until all relevant permits are provided by the responsible institution, the National Heritage Conservation Commission (NHCC). The archaeologists appointed to the monitoring survey, shall hold a valid archaeological research license;
3. In accordance with Zambia Law on Protection of Cultural Heritage, in the event of the unexpected discovery of archaeological objects the Contractor shall immediately inform NHCC and follow their instructions. The construction works will be temporary stopped while the commission decide if any research are needed or any protection measures should be applied. The Contractor shall follow the instructions provided by the authorities responsible for the protection of cultural heritage;
4. In any case, a comprehensive Cultural heritage Management Plan shall be developed for the project before construction works start, that will address, among other issues, the provisions of the Law on Protection of Cultural Heritage and international treaties;

5. Training shall be provided to construction workers before the start of earth works to foster their awareness on the importance of protecting Zambian cultural heritage, including existing cultural monuments and archaeological sites and to be discovered sites.

Operational Phase

The easier access to the area brought by the improved road may facilitate the access of individuals dedicated to the poaching of archaeological sites causing the plundering of archaeological sites.

In the event of the discovery of archaeological sites, as indicated above, the authorities of the NHCC shall decide how to proceed. The actions to undertake to protect the site will depend on the importance of the finding. It is expected the authorities responsible for the protection of cultural heritage will provide with the most appropriate measures to prevent plundering of any archaeological site discovered along the road alignment.

8.2.6.2. Assessment of Residual Effects

The mitigations described above are intended to avoid or minimize the following impacts:

During construction

1. **Destruction of non-identified buried archaeological sites**
   - Cultural heritage and archaeological sites, either known to exist or to be discovered are resources of a high sensitivity. The magnitude of this impact without mitigation measures is estimated to be high. The probable success of the mitigation measures is considered to be high; i.e. the unwanted destruction of archaeological (and/or paleontological) sites is effectively avoided. The magnitude of the impact with the implementation of mitigation measures becomes low. Therefore the significance of the residual effect is considered to be Slight.

During operation

1. **Plundering of archaeological sites**
   - The magnitude of this impact without mitigation measures was estimated to be medium, and the probable success of the mitigation measures is considered to be moderate; the success would depend on the specific circumstances of the sites. Upon the application of mitigation measures prescribed by the Administration on cultural heritage protection, the magnitude of the impact should be low. Therefore the significance of the residual effect is considered to be Slight.

8.3. SOCIO-ECONOMIC MITIGATION MEASURES AND ASSESSMENT OF RESIDUAL EFFECTS

8.3.1. Land and Property

8.3.1.1. Mitigation Measures

Construction Phase

For the enforcement of the road reserves of 50m and 18 on both sides of the road for rural sections and urban sections respectively, permanent land take on both sides of the existing centre line is needed. During construction works, most land to be utilized will be of a temporary nature and is a result of requirements for construction of compounds and working sites along or close to the road in addition to space for storage of plants, materials and site offices etc. Contractors may temporarily also require land for Borrow Pits & Landfills. Temporary land take will cause removal of livestock from grazing areas during Periods of blasting or heavy equipment operations restrict hunting near work crews, restricted harvesting of forest food and will have temporary effects on use of recreational areas because of construction noise, dust, and visual intrusions, in forest areas, construction activities could result in long-term loss of timber production due to need of removing trees. Construction works will restrict these kinds of activities which will result in potential adverse impacts on the livelihoods of affected persons. Effects on residents from loss of gardens and community land and effect on agricultural production caused by temporary land loss will occur during the construction phase.

In order to minimize the negative impacts, the following measures will be taken before and during construction:

1. The designer will take into consideration the RAP Study. Study is prepared in accordance with Law for Expropriation which recognises only affected people who have formal/informal legal rights;
2. Detailed survey needs to be undertaken in order to understand the detailed situation with regard to land take taking into consideration those without legal rights over properties and belongings;
3. Census will be conducted in line with PR 5 requirements in order to facility the process and successful outcomes of resettlement and/or livelihood restoration;
4. Resettlement Action Plans are to be prepared, separately for each section;
5. RDA (Project Proponent) shall ensure that the affected families are duly compensated for all their belongings and expenses connected with being resettled in accordance with the Resettlement Compensation Framework (Chapter). Additional assistance to be provided to the people who will be resettled for restoring their standards of living and further improve them where possible;
6. With regards to the loss of gardens and agricultural production due to temporary land loss owners will be compensated (any material damage proved to have been caused to local houses, buildings and other infrastructure (including access roads) by the works will be compensated for and subject to repair on a timely basis) according to the Resettlement Compensation Framework. When available and preferred by owners other land (state owned) will be utilized for continuation of agricultural production;
7. Land also needs to be reinstated/restored through intentional activities to help restore it its pre-construction conditions. Measures should correspond to the level of scale disturbances. It will include erosion control measures, re-contouring the land, replacing the topsoil, re-

vegetation, restoration of habitats, regaining its previous use. Review and assessment of the additional impacts and identification of the appropriate mitigation measures will be done by RDA and will be implemented by the Contractor;

8. Temporary land take from sensitive land uses will be avoided as far as possible. Any land take which goes beyond that assessed in the ESIA or results in additional impacts which could be of a significant nature will be reviewed and appropriate mitigation measures identified and implemented.

Operational Phase

During the operational phase some of the changes that occur during construction phase should return the livelihoods of temporarily affected people to their previous condition. Except those Contractor/s who will decide to leave their construction facilities, like Concrete Batching Plants for the needs of some future projects in the region, most of the land will be abandoned and returned to previous condition. Some haulage routes that go through community land maybe will be used as access roads by local citizens or by Forest Department. With the enforcement of the road reserves, residents from communities at or close to the road reserves will be forbidden within the area of the road reserve. Access to this area will be treated as moving on private property and will be illegal. Residents will not be able to undertake their activities related with stockbreeding, hunting, harvesting of forest food and recreational activities within this area.

In order to minimize the negative impacts, the following measures will be taken before commencement and/or during operation:

1. Public Information notices-RDA through different kind of media should assure that residents from communities along the road corridor are duly informed for the preservation of the road reserve and the y and changes like forbidden movement and undertaking different activities within the road reserve area;
2. Public awareness initiatives-RDA should undertake different initiatives together with RTSA for increasing the public awareness (through school visits, safety centres, diversionary activities and communications programmes).

8.3.1.2. Assessment of Residual Effects

The mitigation described above are intended to avoid or minimize the following impacts:

Construction Phase

- Temporary land loss
- Livelihoods
- Effects on residents from loss of gardens and community land and effects on agricultural production/activity (
- Loss of housing (including physical displacement)
- Permanent land loss.

1. **Temporary land loss & Livelihoods (FROM TEMPORARY LAND LOSS)**
   - Land, especially agricultural land as a receptor is considered to have very high sensitivity/value. Magnitude of this impact without mitigation measures was estimated to be low negative. The probable success of the mitigation measures is considered to be high; the proposed mitigation measures have been successful in different circumstances with the same type of aim. The magnitude of the impacts with the implementation of

mitigation measures becomes negligible. The significance of the residual effect is considered therefore to be neutral/slight negative.

2. **Effects on residents from loss of gardens and community land and effects on agricultural production/activity (FROM TEMPORARY LAND LOSS)**
   - Magnitude of this impact without mitigation measures was estimated to be medium negative. The probable success of the mitigation measures is considered to be high; the proposed mitigation measures have been successful in different circumstances with the same type of aim. The magnitude of the impacts with the implementation of mitigation measures becomes low negative. The significance of the residual effect is then neutral/slight negative.

3. **Loss of housing (including physical displacement) & Permanent land loss**
   - Housing as a sub receptor has very high sensitivity. Magnitude of the impact "loss of housing" without mitigation measures was estimated to be high negative. Land has very high and high sensitivity, depending on the type of land. The magnitude of the impact of permanent land loss without mitigation measure was estimated to be high negative. The probable success of the mitigation measures is considered to be high; the proposed mitigation has been successful in the same circumstances with the same type of aim. The magnitude of the impact with the implementation of mitigation measures becomes medium negative. The significance of the residual effect is then moderate negative.

Operation Phase

1. **Effects on livelihood (START AT THE CONSTRUCTION PHASE)**
   - Effects on residents from loss of gardens and community land and effects on agricultural production/activity (START AT THE CONSTRUCTION PHASE)

2. **Effects on livelihood (START AT THE CONSTRUCTION PHASE)**
   - Magnitude of the impact without mitigation measures was estimated to be low negative. The probable success of the mitigation measures is considered to be high; the proposed mitigation has been successful in the same circumstances with the same type of aim. The magnitude of the impacts with the implementation of mitigation measures remains low negative. The significance of the residual effect remains neutral/slight negative.

3. **Effects on residents from loss of gardens and community land and effects on agricultural production/activity (START AT THE CONSTRUCTION PHASE)**
   - Magnitude of the impact without mitigation measures was estimated to be low negative. The probable success of the mitigation measures is considered to be moderate; the proposed mitigation has been successful in different circumstances with the same type of aim. The magnitude of the impacts with the implementation of mitigation measures remains low. The significance of the residual effect becomes neutral/slight negative.

8.3.2. Community Health, Safety and Security

8.3.2.1. Mitigation Measures

Construction Phase

During the construction phase, impacts will occur as a result of exposure to diseases arising from temporary or permanent changes in population, exposure to hazardous materials during construction and transport of raw and finished materials, safety concerns related to risk of accidents related to movement of heavy vehicles during construction. Security can be threatened if safeguard personnel engaged at construction site or contractor's facilities are involved in past mistreatments and if they are not trained adequately in the use of force.

In order to minimize negative impacts, the following measures will be taken before and during construction:

1. Construction work shall commence on site only when the **Health & Safety (H&S Plan** has been adequately developed by the Contractor and accepted by RDA's Representative;
2. **Emergency Preparedness and Response Plan** will be developed prior to construction works starting;
3. **Traffic Management Plan** will be developed for safe access to construction sites with minimum negative impact on the existing roads and in parallel to ensure community safety and easy access to their properties (homes, land, gardens);
4. For traffic control and safety, the information about the project activities will be announced through the local radio/TV for carefully driving (low speed) near the working areas. RDA and the Contractor/s will openly and transparently inform residents of the affected places and villages for planned activities that follow quarterly;
5. The traffic flow through the site and within the urban areas will be coordinated with the responsible traffic engineers in the districts;
6. An **Emergency Plan** will be developed, including covering for the management of cases of incidents during the transportation of raw materials/hazardous substances;
7. **Separate study** on pedestrian/vehicle crossings (over/under crossings) will be developed based on the site visits and consultations with local community, and any additional measures implemented within the design;
8. The structural elements are to be design in accordance with national and international standards on safety and functionality;
9. **Community health and safety educational programme** will be developed to inform and build capacity of the local community and drivers on potential adverse impacts during the construction Period. Residents will be informed that they will be not able to undertake their activities related with harvesting of forest food and recreational activities within the road reserves area;
10. Workers will receive training and guidance in how to avoid conflicts with the local community members and sign a labour code of conduct, in order to avoid creating conflicts with the local environment;
11. Avoidance of unauthorized entry into contractor's facilities will be considered in their design and siting. The design, layout and site location of facilities should facilitate natural surveillance by police and the safeguards engaged by Contractor/s;
12. Adequate selection of qualified security guards with appropriate training;
13. Contractor will have to commit to investors that any material damage made by workers on

local houses, buildings and other infrastructure will be subject to fair compensation;

14. All necessary permits will be obtained prior to the start of construction phase from responsible institutions responsible for urban planning, communal works, forestry management, water protection, electricity and telecommunication, and cultural heritage protection;
15. The designer and Contractor/s will take into consideration all proposed preventive, mitigation and compensation measures included within the ESIA.

Operational Phase

During operation, community safety will be mainly endangered from the increased risks for accidents from movements of vehicles on the improved road.

In order to minimize negative impacts, the following measures will be taken before and during the operational phase:

1. Adequate warning devices will be installed to warn pedestrians of vehicles;
2. Community health and safety educational programme will be developed and implemented;
3. RDA will undertake a series of public relation activities in order to inform local citizens, and will also run and support community activities, including school visits, safety centers, diversionary activities and communications programmes about road safety;
4. Information on safety performance (relating to both accident investigations and overall statistics) will be made publicly available. Safety performance and other safety related data will be developed.

8.3.2.2. Assessment of Residual Effects

The mitigations described above are intended to avoid or minimize the following impacts:

Construction Phase

- Impacts from the influx of temporary workers;
- Impacts from increased community exposure to disease;
- Impacts from increased traffic and heavy vehicles on local roads during construction
- Safety issues associated to the entrance of non-authorized people on the construction site

Communities have been determined previously in the assessment to have a very high sensitivity to impacts on their community health, safety and security. Magnitude of the impact from the influx of temporary workers without mitigation measures was estimated to be low negative. The probable success of the mitigation measures is considered to be high; the proposed mitigation measures have been successful in the same circumstances with the same type of aim. The magnitude of the impacts with the implementation of mitigation measures remains low negative. The significance of the residual effect is then neutral/slight negative.

Magnitude of the impact "increased community exposure to disease" without mitigation measures was estimated to be high negative. The probable success of the mitigation measures is considered to be moderate; the proposed mitigation measures have been successful in different circumstances with the same type of aim. The magnitude of the impacts with the implementation of mitigation measures becomes low negative. The significance of the residual effect is then moderate negative.

Magnitude of the impact from increased traffic and heavy vehicles on local roads during construction without mitigation measures was estimated to be high negative. The probable success of the

mitigation measures is considered to be high; the proposed mitigation measures have been successful in same circumstances with the same type of aim. The magnitude of the impacts with the implementation of mitigation measures becomes low negative. The significance of the residual effect is then slight negative.

Magnitude of the impact related with safety issues associated to the entrance of non-authorized people on the construction site without mitigation measures was estimated to be high negative. The probable success of the mitigation measures is considered to be high; the proposed mitigation measures have been successful in different circumstances with the same type of aim. The magnitude of the impacts with the implementation of mitigation measures becomes low negative. The significance of the residual effect is then neutral.

Operational Phase

1. **Impacts from better access to the larger towns and health services located in larger towns/cities**
   - The operational road could be considered as a potentially significant possibility for providing better accessibility to the larger towns and health services located in larger towns/cities. Thus the magnitude of this impact without enhancement measures is estimated to be high positive. The probable success of the enhancement measures to maximize anticipated benefits is considered to be moderate; the proposed measures have been successful in different circumstance with the same type of aim. The magnitude of the impacts with the implementation of enhancement measures remains high positive. The significance of the residual effect is therefore considered to be large positive.

2. **Safety issues associated with being close to the road**
   - Closeness to the road could be considered as a potentially significant risk to community health and safety resulting in loss of community lives thus the magnitude of this impact without mitigation measures is estimated to be high negative. The probable success of the mitigation measures is considered to be moderate; the proposed mitigation measures have been successful in different circumstances with the same type of aim. The magnitude of the impacts with the implementation of mitigation measures becomes low negative. The significance of the residual effect is therefore considered to be slight negative.

8.3.3. Community Tensions

8.3.3.1. Mitigation Measures

Construction Phase

During the construction phase the presence of a number of temporary workers from outside of the region in the local communities could increase community tensions. Different cultural and social background of the workers compared with the local people could be a reason for potential issues to occur (e.g. verbal conflicts, written and oral threats and even physical violence). This in combination with the disruption to normal life of the local people due to the construction activities creates a ground for increased community tension. The potential disruption to normal life includes: loss of livelihood and land, changes in agricultural production, increased transportation time, heavy vehicles on local roads, restricted movement within construction area, presence of workers camps within the community etc.

In order to minimize negative impacts, the following measures will be taken before and during construction:

1. Workers will receive training and guidance in how to avoid conflicts with the local community members and sign a labour code of conduct, in order not to create conflicts with the local environment;
2. Worker camps will be located outside the communities;
3. **Local Workforce Recruitment Plan** will be developed in order to assure employment of as much as possible local workforce;
4. Limited regime of movement of workers in the area around the construction sites. Mode of movement must be well organized and defined by agreement between RDA and Contractor/s;
5. Strengthening of public/administration awareness (Local Self Government, medias, NGO`s) has high importance for decreasing community tensions. Local authorities must be capable for handling increased grievances from the residents towards disturbance of their normal way of leaving. Public to be acknowledging for disruptions that the construction works may cause to the typical way of leaving in the area.

Operational Phase

During the operational phase there will be some reaction of the community related to the increased risks for accidents on the road. Communities close to the road will mainly be disturbed by noise and vibration caused by movements of vehicles. Mitigation measures proposed for Community Health, Safety and Security and mitigation measures elaborated under quality of life cover impacts related to the community reaction to the operation of the road.

8.3.3.2. Assessment of Residual Effects

The mitigations described above are intended to avoid or minimize the following impacts:

Construction Phase

Communities are generally considered to have very high to high sensitivity to effects which result in an increase in tension caused by influx of workforce into local communities, disruption caused by construction works during construction phase and due to the disturbance arising from the operation of the road.

1. **Effects from influx of workforce into local communities**
   - The entry of a temporary labour force into an area could cause different negative impacts within the local communities including conflicts between local community members and newly arrived people mainly due to differences in socio-cultural background. The magnitude of this impact without mitigation measures was estimated to be low negative. The probable success of the mitigation measures is considered to be moderate; the proposed mitigation measures have been successful in different circumstances with the same type of aim. The magnitude of the impacts with the implementation of mitigation measures remains low negative. The significance of the residual effect is therefore considered to be slight negative/neutral.

2. **Community reactions due to the disturbance arising from the construction works**
   - Magnitude of the impact from community reactions due to disturbance arising from the construction works, without mitigation measures was estimated as high negative. The probable success of the mitigation measures is considered to be high; the proposed

mitigation measures have been successful in the same circumstances with the same type of aim. The magnitude of the impacts with the implementation of mitigation measures is considered to be reduced to medium negative. The significance of the residual effect is then determined to be moderate negative.

Operational Phase

1. **Community reactions due to the disturbance arising from the operation of road**
   - The magnitude of this impact without mitigation measures was estimated to be low negative. The probable success of the mitigation measures is considered to be moderate; the proposed mitigation measures have been successful in different circumstances with the same type of aim. The magnitude of the impacts with the implementation of mitigation measures becomes low negative. The significance of the residual effect is therefore considered to be moderate negative.

8.3.4. Access & Severance

8.3.4.1. Mitigation Measures

Construction Phase

The construction of the road could affect access and result in severance effects on communities at or close to the road. In order to minimize negative impacts, the following measures will be taken before and during construction:

1. **Traffic Management Plan** will be developed and implemented;
2. Risk assessment which clearly identifies all risks from the construction work to the travelers, drivers, workers will be developed and provisions implemented;
3. Identification of all public roads and paths that will be affected and proposal for the travel routes during the construction Period (i.e. which sections will be closed and till when, where the traffic will be diverted);
4. Minimization of the traffic disturbance;
5. The signing of the construction area, new directions, ring roads, access roads;
6. Public notification of any traffic-related concerns, such as road/streets closings.

Operational Phase

The operational phase of the road could impact access and result in severance effects on the general public, community services and business sector in communities close to the road.

8.3.4.2. Assessment of Residual Effects

The mitigation described above are intended to avoid or minimize the following impacts:

Construction Phase

1. **Impacts on access and severance effects**
   - Access and severance effects will occur during the construction Period due to limited movement at construction sites, and changed access road increasing travel time. It is estimated that the general public has very high sensitivity to effects on access and severance, with Community services and Business sector having high sensitivity. The magnitude of this impact without mitigation measures was estimated as low negative.

The probable success of the mitigation measures is considered to be high; the proposed mitigation measures have been successful in the same circumstances with the same type of aim. The magnitude of the impacts with the implementation of mitigation measures remains low. The significance of the residual effect is then neutral/slight negative.

Operational Phase

1. **Impacts on access and severance effects of general public, community services and business sector in communities close to the road.**
   - During operation access will be limited within the road project area and access to this area will be prohibited for unauthorized persons. Magnitude of this impact without mitigation measures was estimated as high negative/positive. The probable success of the mitigation measures is considered to be high; the proposed mitigation measures have been successful in the same circumstances with the same type of aim. The magnitude of the impacts with the implementation of mitigation measures becomes medium. The significance of the residual effect is then moderate positive/negative.

8.3.5. Economy

8.3.5.1. Enhancement Measures

Construction Phase

During construction phase it is expected that related construction works will have significant positive impacts on Local Economy, Muchinga Province's economy, national economy and Africa regional economy.

In order to maximize the positive impacts, the following measures should be undertaken before and during construction:

- Inform people in a timely manner about the possible impacts on economic activity in surrounding areas and expected timings of impacts, which will enable them to plan and prepare. The perception of competition is one driver of local economic development activity and its influence, while observable, may be exaggerated. Increased demand on the market will lead to creation of competition especially on local market. Legislation in force ensures open market and free competition among all subjects which will enhance positive impacts from construction activities especially on local economy.

Operational Phase

During operational phase, new markets will be opened; new transport alternatives will be available which will significantly impact development of Local Economy, Muchinga Province's economy, national economy and Africa regional economy.

Local and State governments must undertake activities for attracting direct foreign investments (activation of industrial free development areas, green field investments or reactivation of closed capacities related with mining, agriculture or tourism). In this direction country has enacted legislation that not only ensures a generally equal footing for foreign investors with their domestic counterparts, but also provides numerous incentives to attract such investment. Zambia consistently provided national treatment to foreign investors. The country has concluded a number of bilateral

investment protection treaties and adopted other multilateral conventions that impose stricter standards of protection for foreign investors. In its bid to attract foreign investment, the government has enacted a number of incentives and continued an extensive promotional campaign through international media outlets. Country offers incentives to foreign investors. Foreign investors are eligible for profit tax exemptions for: profits generated during the first three years of operation, in proportion to the amount of foreign investment; all profits reinvested in the company; profits invested in environmental protection; and profits invested in "underdeveloped" regions of the country. Companies with at least 20 percent foreign capital are exempt from customs duties for the first three years after registration. Moreover, a flat tax for corporate and personal income stands at 10 percent, a fact that the government has highlighted in public campaigns to attract foreign direct investment. Foreign investors are not required to purchase from local sources or to export all of their production. There are also no requirements for the government to be a partner in an enterprise. Commercial agreements determine which entity retains control over the investment revenue. Furthermore, there are no requirements for reducing foreign equity over time or for transferring technology.

8.3.5.2. Assessment of Residual Effects

Sensitivity of Local Economy, Muchinga Province's economy, national economy and Africa regional economy has high sensitivity to the impacts from construction and operation of the road. The enhancement measures described above are intended to maximize the following impacts:

Construction Phase

1. **Stimulation of economic growth at local levels**
   - It is expected that the impact will result in an improved local economy. The magnitude of this impact without enhancement measures was estimated to be high positive. The probable success of the enhancement measures is considered to be moderate; the proposed enhancement measures have been successful in different circumstances with the same type of aim. The magnitude of the impacts with the implementation of enhancement measures remains low positive. The significance of the residual effect is therefore considered to be large positive.

Operational Phase

1. **Effects on Local Economy, Muchinga Province's economy, national economy and Africa regional economy**
   - It is expected that the impact on the Local Economy, Muchinga Province's economy, national economy and Africa regional economy will be of large scale and result in improvement. The magnitude of this impact without enhancement measures was estimated to be high positive. The probable success of the enhancement measures is considered to be moderate; the proposed enhancement measures have been successful in different circumstances with the same type of aim. The magnitude of the impacts with the implementation of enhancement measures remains high positive. The significance of the residual effect is therefore considered to be large positive.

8.3.6. Employment

8.3.6.1. Enhancement Measures

Construction Phase

The employment benefits during the construction phase are positive since they relate to the project activities and not only due to created employment opportunities but as well due to increased employee spending.

In order to maximize the positive impacts, the following measures should be undertaken before and during construction:

- Local recruitment plan to be prepared and implemented, when possible and when required skilled workforce is locally available, employment of local workforce to be preferred;
- Engagement of woman workforce to be preferred where appropriate.

8.3.6.2. Assessment of Residual Effects

Employment (direct and indirect), Local Economy, Muchinga Province's economy, national economy and Africa regional economy have high sensitivity on impacts that will be caused by construction and operation of road. The enhancement measures described above are intended to maximize the following impacts:

Construction Phase

1. **Creation of local employment (direct and indirect)**
   - It is expected that the impact will cause creation of local employment. The magnitude of this impact without mitigation measures was estimated to be high positive. The probable success of the enhancement measures is considered to be moderate; the proposed enhancement measures have been successful in different circumstances with the same type of aim. The magnitude of the impacts with the implementation of enhancement measures remains high positive. The significance of the residual effect is therefore considered to be large positive.

8.3.7. Education & Training

8.3.7.1. Enhancement Measures

Construction Phase

It is expected that during the construction phase some level of capacity building will be provided (organized and un-organized) through transfer of new technologies and new skills. This will happen mainly as on-the-job training but also as exposure to modern management and logistics procedures and by working with people having international expertise. Joint venture could contribute in transfer of skills which should result in strengthening of local capacities.

In order to maximize the positive impacts, the following measures should be undertaken before and during construction:

1. Supervisors and managers will be responsible to utilize available resources to train, qualify,

and develop their employees.

2. On-the-job training (OJT) is one of the best training methods because it is planned, organized, and conducted at the employee's worksite. OJT to be generally primary method used for broadening employee skills and increasing productivity. It is particularly appropriate for developing proficiency skills unique to an employee's job- especially jobs that are relatively easy to learn and require locally-owned equipment and facilities.

Operational Phase

It is expected that the road operation will stimulate a large and competitive economy in Muchinga which could provide jobs for every working-age resident and a highly qualified local workforce. Operation of the road as well will create possibilities for direct and indirect employment. With better accessibility to universities in the country it can be expected that the percentage both for males and females with secondary education who will continue their education will increase.

In order to maximize the positive impacts, the following measures should be undertaken before and during construction:

1. Increasing participation in skills and training amongst priority groups including those receiving social benefit and lone parents, and vulnerable groups;
2. Increasing the percentage of secondary educated students who will continue with faculty education;
3. Encouraging female to choose untypical profiles-to change the existing tendency for females to focus on traditional "women's work" which often pays less or is less likely to result with high earning potential, and will change attitudinal issues related to a lack of confidence in one's ability to open a business and general hopelessness about personal economic prospects.

8.3.7.2. Assessment of Residual Effects

Sensitivity of education and training on impacts that will be created during construction and operational phase is very high. The enhancement measures described above are intended to maximize the following impacts:

Construction Phase

1. **Capacity building through training**
   - It is expected that the impact from construction activities will participate into capacity building through training. The magnitude of this impact without enhancement measures was estimated to be low positive. The probable success of the enhancement measures is considered to be moderate; the proposed enhancement measures have been successful in different circumstances with the same type of aim. The magnitude of the impacts with the implementation of enhancement measures will be medium positive. The significance of the residual effect is therefore considered to be moderate positive.

Operational Phase

1. **Education & training benefits from employment opportunities; and**
2. **Education & training benefits from improved access to education and employment opportunities.**
   - It is expected that the impact caused from operation of road will contribute significantly in improvement of employment opportunities and in education & training from improved

access to education and employment opportunities. The magnitude of these impacts without enhancement measures was estimated to be high positive. The probable success of the enhancement measures mitigation measures is considered to be moderate; the proposed enhancement measures have been successful in different circumstances with the same type of aim. The magnitude of the impacts with the implementation of mitigation measures remains high positive. The significance of the residual effect is therefore considered to be large positive.

8.3.8. Utilities

8.3.8.1. Mitigation Measures

Construction Phase

During the construction phase utilities, which are located under and above ground, such as water supply, sewerage, cable network and telephone at the construction site could be affected. In addition, it can be expected that the influx of people, such as construction workers, employment seekers and service providers will increase pressure on the utilities in the area.

In order to minimize negative impacts, the following measures will be taken before and during construction:

1. Prior to construction works during designing phase, designer will obtain available underground cadastre from relevant service providers;
2. Prior to excavation works, Contractor/s must inform service providers in writing of planned construction activities which could affect some utilities and to require presence of their representatives on site;
3. Consultation with local citizens regarding possible illegal connections;
4. Manage consumption of water and electricity in order to decrease pressure on the utilities in the area.

8.3.8.2. Assessment of Residual Effects

The mitigations described above are intended to avoid or minimize the following impacts:

Construction Phase

1. **Effects of utility cuts on local businesses and communities**
   - Underground installation will have high sensitivity to impacts should they occur. Due to the nature of works, which are mainly above ground, magnitude of this impact without mitigation measures was estimated as low negative. The probable success of the mitigation measures is considered to be high; the proposed mitigation measures have been successful in the same circumstances with the same type of aim. The magnitude of the impacts with the implementation of mitigation measures becomes negligible. The significance of the residual effect is then considered to be neutral.

Operational Phase

1. **Effects of diversions of utilities on local businesses and communities**
   - Magnitude of this impact without mitigation measures was estimated as negligible. Thus

there is no need for mitigation measures to be undertaken.

8.3.9. Vulnerable Groups

8.3.9.1. Mitigation Measures

Construction and Operational Phases

The construction phase will affect communities at or close to the road and throughout the road corridor and especially in Lot 2 and 3, there are vulnerable groups which are likely to suffer more in economic and social terms from project activities than the general population.

In order to minimize negative impacts, the following measures will be taken before and during construction:

1. A safe access solution for this settlement will be designed and constructed in order to provide safe and regular access of the inhabitants to their houses;
2. **Safety of people who live near road should be insured with adequate, marking and signage, for** both the construction and operational phase;
3. Illiteracy of some of the affected people should be taken into consideration with regard to the method of Project communications with this community;
4. To mitigate negative impacts from vibration and given some of the unstable residential/house structures in close proximity to the route, strengthening of the houses during the construction phase may need to be undertaken;
5. The anti-noise walls/barriers will be construction which are required to protect inhabitants. This will significantly reduce the adverse impact of the noise and will also improve the safety of residents;
6. Compensation will be done in accordance with the Resettlement Action Plan.

8.3.9.2. Assessment of Residual Effects

The mitigation measures described above are intended to avoid or minimize the following impacts:

Construction Phase

- Vulnerable groups identified along project corridor are considered to have a very high sensitivity to change. Impacts will cause minor loss of and alteration to the settlement. Thus it is estimated that the impact without mitigation measures will have high negative. The probable success of the mitigation measures is considered to be moderate; the proposed mitigation measures have been successful in different circumstances with the same type of aim. The magnitude of the impacts with the implementation of mitigation measures becomes medium. The significance of the residual effect is then moderate negative.

Loss of land and properties

- It is estimated that this impact without mitigation measures will have a high negative magnitude. The probable success of the mitigation measures is considered to be high; the proposed mitigation measures have been successful in the same circumstances with the same type of aim. The magnitude of the impacts with the implementation of mitigation measures becomes medium. The significance of the residual effect is then moderate

negative.

Operational phase

- It is estimated that this impact without mitigation measures will have a high negative magnitude. The probable success of the mitigation measures is considered to be moderate; the proposed mitigation measures have been successful in different circumstances with the same type of aim. The magnitude of the impacts with the implementation of mitigation measures becomes medium. The significance of the residual effect is then ***moderate negative***.

8.3.10. Workforce Related Impacts and Issues

8.3.10.1. Mitigation Measures

Construction Phase

Mitigation and management measures to reduce and avoid impacts on workers comprise employer safeguards against discrimination, workers construction compounds, accommodation consultation and grievance mechanisms, security of workers accommodation, accommodation standards, occupational health and safety, worker's right, rules and obligations and employment standards.

In order to minimize negative impacts on the workforce, the following measures will be taken before and during construction:

1. **Working conditions and terms of employment**
   - RDA will adopt and/or maintain appropriate Human Resources Policies. These policies will be clear, understandable and accessible to workers. These policies will ensure that the following will be implemented:
   - According to the Employment Act-workers commences employment voluntarily, in the manner and under conditions determined by law and a collective agreement. Employment may terminate solely in procedures and under conditions determined by law. The worker is obliged to fulfil obligations derived from employment. The worker assumes personal responsibility for violations of working obligations and caused damages in compliance with the provisions of law and the collective agreement.
   - According to the provisions of the Employment Act-and the collective agreement, the managing body or legal representative of the employer, acquires employment rights and obligations with the employer, during the appointment and performance of representative duties.
   - The Project will comply with all relevant national laws provisions related to the employment and will not employ children below the national minimum age of employment. RDA have procedures in place to verify the age of all young workers (those between the minimum age of employment and the age of 18). Young people below the age of 18 years will not be employed in hazardous work and all work of persons under the age of 18 shall be subject to an appropriate risk assessment as it is regulated in the Labour relations act.
   - Project's contractors and subcontractors will be committed to ensuring that all of the

workers that have entered into employment do that freely and voluntarily, without coercion or penalty and that do not use any form of forced, bonded or involuntary prison labour.

- RDA will not employ forced labour, which consists of any work or service not voluntarily performed that is exacted from an individual under threat of force or penalty. This covers any kind of involuntary or compulsory labour, such as indentured labour, bonded labour or similar labour-contracting arrangements.

2. Employer safeguards against discrimination

RDA will

1. Develop policies to promote non-discrimination and equal treatment and opportunities and to prevent harassment (including sexual harassment) and bullying in the workplace, and make sure that they are clearly communicated and accessible to management, supervisors and workers;
2. Ensure that managers and supervisors are trained in the application of the policies;
3. Ensure that job advertisements, job descriptions and applications do not refer to applicants/workers race, gender etc (except rare cases where legal exceptions apply);
4. Ensure that decisions on hiring, working conditions, pay, benefits, training, promotion, termination, redundancy are not made on the basis of discriminatory grounds or on the basis of criteria which disproportionately impact on one group more than another or is question of employment of child;
5. Ensure that women and men are paid the same wages for work of the same value, i.e. remuneration is based on the employee's skills, experience, responsibilities and other objective, non gender- related factors;
6. Monitor the workplace for any form of harassment and, where it is found, act quickly to address it;
7. Ensure that workers are not asked about or required to undergo health or pregnancy testing, except where there is a genuine health and safety need;
8. Take steps to enable workers with disabilities to retain their jobs and make accommodations required by national law for physically disabled persons.

3. Worker's construction compounds

1. Workers camps to be constructed outside the communities.
2. Any camp will not be constructed in protected/sensitive areas and any auxiliary facilities as far as possible would not be located in areas containing sensitive habitats/vegetation. Any such facilities to be located within sensitive area would need to be fully justified. In the vicinity of sensitive habitats construction sites will be clearly delineated so as to avoid damage in non- working areas and appropriate protection measures implemented. Restoration and reinstatement of temporary affected areas to a state as close to the original conditions as possible and using native plant species from the surrounding areas.
3. RDA will undertake an audit of design and implementation of the worker's compound against the checklist in the IFC guidance document:
    - Prior to construction of the accommodation (i.e. an audit of the design);
    - Prior to its opening;
    - On an annual basis (each year after opening).

4. Audits will be undertaken by an independent third party. Any defects or issues (where relevant) identified in the audits to be addressed and will be reassessed for compliance within one month of the audit.
5. **Social Facilities and Services Plan for workers** will be prepared which regulates the following:
    - *Housing standards must include special attention to minimum space allocated per person, supply of safe water in the workers' dwelling in such quantities, adequate sewage and garbage disposal systems and appropriate protection against heat, cold, damp, noise, fire, and disease - carrying animals, and, in particular, insects;*
    - *For facilities located in hot weather zones, adequate ventilation and/or air conditioning systems must be provided. Both natural and artificial lighting must be provided and maintained in living facilities;*
    - *A separate bed for each worker must be provided. The practice of "hot bedding" should be avoided. The minimum space between beds should be 1 meter. Double deck bunks are not advisable for fire safety;*
    - *Canteen, cooking and laundry facilities must be built in adequate and easy to clean materials. Canteen, cooking and laundry facilities are kept in a clean and sanitary condition. If workers wish to cook their own meals, kitchen space will be provided separate from sleeping areas;*
    - *There must be **management plans and policies** especially in the areas of overall operation of the facility, health and safety (with emergency responses), local community and security;*
    - *A **security plan** including clear measures to protect workers against theft and attack is implemented. Security staff must be checked tonsure that they have not been implicated in any previous crimes or abuses;*
    - ***Processes and grievance mechanisms** for workers' to articulate their grievances must be provided and clearly explained to workers. Such mechanisms must be in accordance with IFC guidelines;*
    - *Community representatives must be provided with an easy means to voice their opinions and to lodge complaints to the management. There must be a transparent and efficient process for dealing with community grievances.*

4. Accommodation consultation and grievance mechanisms

- Workers' accommodation arrangements will not restrict workers' rights and freedoms Workers' must enjoy their fundamental human rights and freedom of association in particular;
- All workers will be made aware of any rules governing the accommodation and the consequences of breaking such rules. Processes that allow for consultation between site management and the resident workers will assist in the smooth running of an accommodation site. These may include a dormitory or camp committee as well as formal processes that allow workers to lodge any grievances about their accommodation;
- Mechanisms for **workers' consultation** will be designed and implemented. As is best practice a review committee which includes representatives elected by workers will be established. Processes and mechanisms for workers to articulate their grievances will be provided to workers. Such mechanisms to be in accordance with IFC guidelines;

- Workers subjected to disciplinary proceedings arising from behaviour in the accommodation will have access to a fair and transparent hearing with the possibility to contest decisions and refer the dispute to independent arbitration or relevant public authorities;
- In case of conflicts between workers themselves or between workers and staff break out, workers will have the possibility of easily accessing a fair conflict resolution mechanism;
- In cases where more serious offences occur, including serious physical or mental abuse, there will be mechanisms to ensure full cooperation with the police authority (where adequate).

5. **Worker accidents**
   - Emergency Preparedness Plan for accidents response for the construction stage will be developed by Contractor/s and approved by RDA;
   - Occupational Health and Safety Plan will be developed by Contractor/s and accepted by RDA;
   - Implementing strict and enforceable safety practices. The general contractor and all subcontractors on the site will be required to provide a reasonably safe work environment and to warn employees of hazards there. They must hire responsible personnel to coordinate job safety, and to supervise compliance with legal rules and regulations;
   - Construction Safety Plan will be developed by Contractor/s and approved by RDA.

8.3.10.2. Assessment of Residual Effects

Sensitivity of this receptor is high. The mitigation described within this subchapter and those within Community health and safety and Community tensions are intended to avoid or minimize the following impacts:

Construction Phase

1. **Accidents on work**
   - It was estimated that magnitude of this impact without mitigation measures will be high negative. The probable success of the mitigation measures is considered to be high; the proposed mitigation measures have been successful in the same circumstances with the same type of aim. The magnitude of the impacts with the implementation of mitigation measures becomes low negative. The significance of the residual effect is then ***slight negative.***

8.3.11. Quality Of Life

8.3.11.1. Mitigation Measures

Construction Phase

The quality of the inhabitants' lives will potentially be seriously affected both during construction of the road due to dust, noise, vibrations, safety issues and alteration of the landscape.

In order to minimize negative impacts, the following measures will be taken before and during construction:

1. Construction site, transportation routes and materials handling sites will be water-sprayed on dry and windy days, especially relevant to sites and routes near residential, commercial and business areas. A **dust management plan will be implemented;**
2. If crushing of construction material or waste is required, crushers would be located away from sensitive receptors;
3. Vehicles and construction machinery will be required to be properly maintained and to comply with relevant emission standards and to reduce the leakages of motor oils and dispersion of pollution in waters and soil (The maintenance will be provided by the professional service company);
4. Restriction of the vehicle speed within the construction location, access roads and settlements;
5. Construction materials will be stored in appropriate places covered to minimize dust;
6. Vehicle loads likely to emit dust will be covered;
7. Usage of protective masks for the workers if the dust seems to be appearing;
8. Information to the public about the construction works would be announced through the local radio station for carefully low speed driving near the construction location (especially important within the urban settlements);
9. Methods and equipment will be used to minimize noise during execution of foundation works, especially when working in densely populated areas. Methods to minimize the noise level such as using less machines at the same time for the work will be implemented if appropriate;
10. The construction work should not be permitted during the night-time; the operations on the site shall be restricted to the hours 7.00 -19.00 h;
11. The vehicles that are excessively noisy due to poor engine adjustment, damage to noise amelioration equipment shall not be operated until corrective measures have been taken;
12. There will be a strict permissible speed for heavy mechanization vehicles and predetermined routes for passing near the settlements;
13. The local residents will be kept informed of the planned works;
14. The location of noisy equipment will be chosen as far as possible away from sensitive receptors (houses, workplaces, schools and hospitals);
15. The workers will be provided with ear protection devices (ear muffs and/or ear plugs);
16. Good management practices for the distribution of the heavy noise equipment along the route will be implemented, to avoid the cumulative noise issues;
17. The construction work will as much as possible be organised in a manner where noise is limited as much as possible, e.g. work should be performed during day time in the populated areas and should be announced ahead in good time;
18. In cases where the very noisy work has to go on at night or during a longer Period than one day in a place, a noise shield will be erected around the working area;
19. Methods and equipment which are minimizing noise during execution of foundation works

should be utilized, especially when working in densely populated areas;
20. Monitoring of vibrations during performance of critical working processes will be undertaken. Buildings which are within a distance of 20-30 meters from the area where the foundation of piles and catenary masts take place will be monitored during the works;
21. Damaged buildings will be repaired or compensation paid if damage occurs as a result of the effects of vibration;
22. Before construction work is initiated, the houses nearby the area where the foundation of piles and catenary masts will take place will be photo registered for later documentation of any damages, which the work may have caused. During the construction work, monitoring of vibrations during performance of critical working processes will be undertaken. Buildings which are within a distance of 20-30 meters from the area where the foundation of piles and catenary masts take place should be monitored during the work;
23. Traffic management plan to be developed and implemented.

Operational Phase

8.3.11.2. Assessment of Residual Effects

The mitigation measures described above are intended to avoid or minimize the following impacts:

Construction Phase

Impairment of quality of life due to the overall presence of annoying construction works and activities: dust emissions, high noise level, vibrations, safety risks and altered landscape.

Sensitivity of Quality of life as receptor to change was assessed as high.

1. **Dust**
   - It was estimated that the magnitude of this impact without mitigation measures will be of a low negative nature. The probable success of the mitigation measures is considered to be moderate; the proposed mitigation measures have been successful in different circumstances with the same type of aim. Due to a linear "construction" site of this size the magnitude of the impacts with the implementation of mitigation measures remains same, low negative. The significance *of the residual effect is then* ***slight negative.***

2. **Noise**
   - It was estimated that magnitude of this impact without mitigation measures will be medium negative. The probable success of the mitigation measures is considered to be moderate; the proposed mitigation measures have been successful in different circumstances with the same type of aim. The magnitude of the impacts with the implementation of mitigation measures becomes low negative. The significance of the residual effect is then ***moderate negative***.

3. **Vibrations**
   - It was estimated that magnitude of this impact without mitigation measures will be medium negative. The probable success of the mitigation measures is considered to be moderate; the proposed mitigation measures have been successful in different

circumstances with the same type of aim. The magnitude of the impacts with the implementation of mitigation measures becomes low negative. The significance of the residual effect is then ***moderate negative.***

4. **Safety**
   - It was estimated that magnitude of this impact without mitigation measures will be medium negative. The probable success of the mitigation measures is considered to be high; the proposed mitigation measures have been successful in same circumstances with the same type of aim. The magnitude of the impacts with the implementation of mitigation measures becomes low negative. The significance of the residual effect is then ***moderate negative.***

5. **Alteration of landscape**
   - The magnitude of these impacts without mitigation measures was estimated to be low negative. No mitigation additional measures will be undertaken.

CHAPTER NINE
ENVIRONMENTAL AND SOCIAL MANAGEMENT AND MONITORING PLAN

9.1. INTRODUCTION

The Environmental and Social Management and Monitoring Plan (ESMMP) for the rehabilitation of the T2 road from Mpika to Chinsali is presented in this Chapter. It has been prepared so that all relevant stages of the Project are implemented in compliance with applicable national laws and regulations, EIB's Environmental and Social Standards and in accordance with the ESIA and the result of the consultations with the stakeholders.

The ESMMP describes the environmental and social mitigation and monitoring measures, the criteria for their successful implementation and the organizational measures to be implemented during the pre-construction, construction and operation of the Project.

The ESMMP adopts a long-term and phased process in the sense that it will need to be regularly reviewed and updated as the Project evolves to reflect any changes in the Project implementation and organization as well as in regulatory requirements. Following amendments, the updated ESMMP will need to be communicated to all relevant parties and stakeholders.

9.2. RESPONSIBILITES

9.2.1. Pre-Construction Phase

The ESMMP comprises of actions identified in the ESIA, which need to be undertaken during the pre-construction phase. Furthermore, the approval process for the Project is ongoing with the environmental permitting process, which involves the issuance, by the Zambia Environmental Management Agency (ZEMA).

The Decision contains an assessment of whether the ESIA Study fulfils the applicable requirements, and the permit conditions for the project implementation as well as measures for prevention and reduction of the harmful effects. The ESMMP will need to be updated for any additional environmental and social requirements identified in the Decision when received. The responsible body to ensure that these actions are undertaken is RDA.

Environmental and social mitigation and monitoring measures contained within the ESMMP and other relevant project documentation and approvals will be part of tender documentation for selection of the construction contractor. Implementation of ESMMP will be a contractual commitment of the chosen contractor.

The selected Contractors will be required to provide the required plans and procedures to RDA for approval prior to construction commencing.

9.2.2. Construction Phase

The actual construction work will be undertaken by a road construction Contractor to be appointed by RDA. Normally, there will be only one main Contractor, but there is the possibility that more than one main Contractor could be appointed. The ESMMP will need to be reviewed at contract award to ensure it fully reflects the project circumstances. During

construction, the actual implementation of most of the ESMMP requirements will be the responsibility of the construction Contractor(s), with RDA having a supervising role.

The requirements for environmental protection and social management contained within the ESMMP, SEP and relevant project documentation and approvals will be an obligatory part of the conditions of contract for the construction Contractor. The Contractor will be obliged to adopt and follow relevant national legislation, Acts, Regulation, Degree, and relevant EU legislation / Good practice /International organization's standards during construction and minimize potential impacts on environmental and social receptors.

RDA is ultimately responsible for the implementation of measures outlined within the ESMMP, with the objective of ensuring effective implementation of the ESMMP, SEP and other project requirements. RDA will appoint resources to undertake environmental and social reviews and audits of the Contractor during the construction phase. Where responsibility for actions is assigned to the Contractor, the Contractor will be responsible for ensuring its sub-contractors understand the requirements contained within the ESMMP and have contract conditions in place to ensure applicable elements of the ESMMP are achieved.

An Environmental and Social Management System and Health & Safety Plans will be established for the construction of the Project.

9.3. STRUCTURE OF THE ESMMP

It is a requirement of EIB policy that the project is undertaken in line with national law and EIB standards. The requirements described in this ESMMP, therefore, reference the Republic of Zambia legislation and are supplemented, where necessary, with measures needed to meet EIB standards; International law and conventions, and relevant international good practices.

The ESMMP has been structured as follows:

- Environmental and Social Management Plan with the following requirements:
  - ✓ General Requirements for Environmental and Social Management;
  - ✓ Socio-economic Requirements;
  - ✓ Environmental Requirements;
  - ✓ Stakeholder Engagement Requirements;
  - ✓ Land Acquisition, Involuntary Resettlement & Economic Displacement Requirements;
- Environmental and Social Monitoring Plan.

9.4. ENVIRONMENTAL & SOCIAL MANAGEMENT PLAN

RECEPTOR / PROPOSED MITIGATION MEASURES	TARGET	RESPONSIBLE INSTITUTION/S	TIMING
A. GENERAL REQUIREMENTS:			
A1. Environmental and Social Management			
RDA and the Contractor will regularly review and update as required the ESMMP and SEP to ensure it is responsive to changes in project circumstances.	Continual through all Phases	RDA, Contractor	All Phases
A2. Applicable Standards			
The project will be managed, constructed and operated in a manner that is compliant with applicable national, and International law and conventions, and EIB requirements	Continual through all Phases	RDA, Contractor	All Phases
A3. Applicable Project Documentation			
RDA and Contractor will implement and comply with all measures specified within the relevant Project Documentation, including inter alia: • ESMMP; • Stakeholder Engagement Plan (SEP); • Resettlement Action Plan (RAP); and • Project contractually binding documents, including the Employer Requirements. Environmental and Social Impact Assessment/Statements and related Decisions from the Competent Authority (i.e. ZEMA)	Performance monitoring demonstrates compliance with environmental and social requirements.	RDA, Contractor	All Phases
A4. RDA Environmental & Social Resources & Organisation			
RDA will establish within their organisation the environmental & social management capacity and capability to undertake inter alia: • Reviews of the environmental and social performance of their contractors and suppliers during railway construction and operation; • Co-ordinate the implementation of actions/measures under the ESMMP which are the responsibility of RDA; • Regular reviews of compliance with the ESMMP obligations; and • Review and update to ESMMP to ensure it reflects project circumstance and still complies with Lender Requirements.	RDA to establish sufficient environmental and social management capacity and capability for each phase.	RDA	All Phases

RECEPTOR / PROPOSED MITIGATION MEASURES	TARGET	RESPONSIBLE INSTITUTION/S	TIMING
B. ENVIRONMENTAL & SOCIAL MANAGEMENT SYSTEMS			
B1. Construction Environmental & Social Management System (CESMS)			
As part of the Site Management Plan the Contractor will develop and implement a Construction Environmental & Social Management System (CESMS) to support the implementation of the ESMMP & SEP and support good environmental & social management practices. The CESMS will be developed and implemented in-line with international standards (i.e. ISO 14001, EU EMAS & SA 8000) and include inter alia: • Organization, responsibilities and resources (including commitment that critical ESHS positions will be identified and maintained) ; • Construction Environmental & Social Management Plan, including supplementary plans (e.g. Waste Management Plans, Hazardous Materials Management Plans); • Procedure which assesses ESHS risks; • Monitoring Plan (see Section 8.4); • Emergency Preparedness & Response Plan; • An audit process and programme (including performance audits, audits on labour & working conditions); • Training programme; and • Reporting of Environmental & Social performance. The Contractor shall appoint an appropriately qualified Environmental, Social, and Health & Safety (ESHS) Manager who will be responsible for the development and implementation of the CESMS and co-ordination to ensure the provisions of the ESMMP are complied with. The ESHS Manager shall have appropriate qualifications, training, authority & responsibility and resources. The ESHS Manager shall have assigned responsibilities including, but not limited to: • Implementation and maintenance of the CESMS (including audits, corrective actions, etc.);	CESMS must be in place prior to construction. Draft Manual to be provided for review and approval by PERI within 45 days of contract award.	RDA/ Contractor	Construction Phase

• Implementation of the ESMMP; • Implementation and co-ordination of Construction Environmental & Social Management Plan and associated management & mitigation plans; • Preparation of quarterly reports for compliance with ESMMP (and other applicable standards/documents) and related to CESMS and Construction Environmental & Social Management Plan; • Managing an incident reporting system (including near-misses); and • Preparation and submission of environmental monitoring reports to RDA and reports as required to EIB/Lenders which will include review of compliance with ESMMP obligations. In the event more than one main contractor is appointed then one overarching Project CESMS should be established for all Contractors to adopt.			

RECEPTOR / PROPOSED MITIGATION MEASURES	TARGET	RESPONSIBLE INSTITUTION/S	TIMING
Environmental & Social Management Systems			
B2. Site Management Plan (SMP)			
Preparation and implementation of Site Management Plan for construction, including inter alia: • Location of borrow pits and inert waste landfills to be used; • Location of batching and crushing plants and construction camps; • Haulage routes; • Site Clearance plan; • Construction Travel Plan (including volume and type of construction vehicles etc) & Traffic Management; • Location of workforce accommodation camps; and • Security plan. Within the Site Management Plan the Contractor must demonstrate how they intend to ensure clear delineation of the 'Project Area' (i.e. site) to ensure construction activities (including site clearance, movement of machinery & vehicles etc.) do not go outside specified area approved in main design and clearly identify any additional land acquisition needs will comply with the RAP(if appropriate) .	The SMP must be in place prior to construction. Draft SMP to be provided for review by RDA within 45 days of award.	RDA/Contractor	Construction Phase
B3. Sub-contractor/Supplier Management			
The road Contractor will apply contractual agreements for securing services of sub-contractors and suppliers, which ensure they are obliged to comply with all environmental and social requirements contained with applicable Project documentation and standards. The Contractor will advise their sub-contractors and suppliers of their Environmental, Social, Health & Safety (including Labour & Working Conditions) responsibilities, including relevant requirements within the ESMMP. Applicable ESHS requirements shall be contained within contractual agreements, including the requirement for sub-contractors to pass requirements to any of their sub- contractors and establish provisions for EHS reporting.	Sub-contractor & supplier agreements to contain ESHS requirements.	Contractor, RDA	Construction Phase

RECEPTOR / PROPOSED MITIGATION MEASURES	TARGET	RESPONSIBLE INSTITUTION/S	TIMING
C. SOCIO-ECONOMIC REQUIREMENTS			
C1. Stakeholder Engagement			
• RDA shall maintain and implement a Stakeholder Engagement Plan (SEP) and grievance mechanism relevant for each Phase of the Project to ensure that all stakeholders are identified, that sufficient information about issues and impacts arising from the Project (e.g. construction impacts) and proposed mitigation are disclosed in a timely manner and that all stakeholders are consulted in a meaningful and culturally appropriate way throughout project implementation. Determine whether any vulnerable / disadvantaged groups or communities are likely to be disproportionately or permanently and adversely affected by the Project and identify and implement appropriate communication methods to consult with them about mitigation measures. • Contractors shall adopt the SEP and grievance mechanism principles and requirements within their own Management Systems as appropriate, and provide training to staff on the SEP requirements. • RDA will aim to involve stakeholders and to keep good communication practices during the lifetime of the project through its PR Division. Their objectives will be: a. Providing local communities with a project schedule and information on project activities that may affect them, together with mechanisms for their feedback b. Provide general information to improve knowledge of what the project involves, with all stages and expected Performance c. To make available to the public a grievance procedure, in order to collect , respond and resolve issues and complaints on a timely basis (30 days) • For each of the stakeholder groups defined in the SEP communication tools suggested will be used in order to ensure easy, transparent, direct, open and interactive communication with all stakeholders.	Stakeholder Engagement Plan and operational grievance mechanism in place prior to construction.	RDA	During all phases of the project

RECEPTOR / PROPOSED MITIGATION MEASURES	TARGET	RESPONSIBLE INSTITUTION/S	TIMING
SOCIO-ECONOMIC REQUIREMENTS			
C2. Land acquisition, involuntary resettlement & economic displacement			
• All feasible alternative project designs should be explored to avoid or at least minimise physical and/or economic displacement. • The Project shall comply with and implement the RAP and ensure all affected owners / users of land (including those who are using land informally) are appropriately informed, consulted and compensated for their assets and any losses: a. Primarily through negotiated settlements; b. At full replacement cost; c. Additional assistance to be provided to the people who will be resettled for restoring their standards of living and further improve them; d. People who have not vacated their houses which were expropriated during 2004 should be advised in good time about the Project and the risk of remaining nearby the line so they can move out; e. Prior to displacement; and f. With any additional resettlement assistance needed • Any grievances are resolved on a timely basis, with evidence of formal and informal communication retained. • Resettlement Action Plans to be prepared by a suitably qualified specialist approved in consultation with ZEMA & EIB. • Affected persons shall be given the opportunity to participate in the negotiation of the compensation packages, eligibility requirements, resettlement assistance and the proposed timing.	• Resettlement Action Plans to be prepared. • Affected people are informed about final Project footprint. • All project affected people have restored their livelihoods and standards of living. • Monitor number and type of submitted grievances.	RDA	Design Phase/Construction phase

RECEPTOR / PROPOSED MITIGATION MEASURES	TARGET	RESPONSIBLE INSTITUTION/S	TIMING
SOCIO-ECONOMIC REQUIREMENTS			
C2. Land acquisition, involuntary resettlement & economic displacement			
• **Detailed socio-economic survey** needs to be undertaken in order to recognize the real situation for all project affected people, taking into consideration those without legal rights over properties and belongings.	• Detailed survey and census to be conducted	RDA	Design Phase/Construction phase
• **Resettlement Action Plans** to be prepared, separately for each section based on Expropriation Study, Detailed survey and Census. RDA shall ensure that the affected families are duly compensated for all their belongings and expenses connected with being resettled in accordance with the Resettlement Compensation Framework developed under this ESIA.	• Resettlement Action Plans to be prepared separately for each section	RDA	Design Phase/Construction phase
• With regards to the loss of agricultural production due to temporary land loss, owners to be compensated according to the Resettlement Action Plan (RAP). When available and preferred by owners, other land (state owned) to be utilized for continuation of agricultural production.	• Support to affected families in restoring their life and standards	RDA	Design Phase/Construction phase

RECEPTOR / PROPOSED MITIGATION MEASURES	TARGET	RESPONSIBLE INSTITUTION/S	TIMING
SOCIO-ECONOMIC REQUIREMENTS			
C3. Community Health and Safety			
• Construction work shall commence on site only when the construction phase Health & Safety (H&S) Plan has been adequately developed by the Contractor and approved by RDA's Supervising Engineers.	• H&S Plan will be developed	RDA/Contractor	During the Design Phase and prior to the start of construction works
• **Traffic Management Plan** will be developed for the safe use of vehicles on and off site ; driving standards; safe access to construction sites with minimum negative impact on the existing roads and in parallel for ensuring community safety and easy access to their properties (homes, land and gardens).Workforce transportation should be considered within TMP.	• Development and implementation of the Traffic Management Plan	Contractor/RDA Contractor: will prepare Plan in discussion with RDA (Approval by RDA). The Police will be a consulted part in the development of the plan	During the Design Phase, prior start of construction works and during construction works
• For traffic control and safety, the information about the project activities and driving standards will be announced through the local radio/TV. RDA and the Contractor/s will openly and transparently inform residents in the affected places and villages as a minimum on a quarterly basis regarding the planned activities and safety measures to be employed.			
• The traffic flow through the site and within the urban areas especially in Mpika town will be coordinated with the responsible traffic engineers in the municipalities.			
• **A CONSTRUCTION Community Health and Safety Educational Programme** will be developed to inform and build awareness and understanding of the local community and drivers on the construction hazards and potential adverse impacts during the construction phase and how to minimize the potential for an accident and/or injury to occur. The Programme will be linked to the SEP and utilise various communication methods to address the needs of vulnerable groups such as children and illiterate residents.	• All main design studies for railway construction prepared by designer to be reviewed by RDA. • Evidence of public consultation on crossing locations.	RDA/Designer	Prior start of Construction Phase
• Workers must receive training and guidance on how to avoid conflicts with the local community members and sign a code of conduct, in order not to create	• Avoid conflicts between workers	RDA/Contractor	Prior start of construction

conflicts with the local environment. Any damage or grievance shall be managed by the Grievance Process and any repair/compensation be made in a timely basis.	and local communities. No community related grievances.		works/Construction phase and Operations (security)
• Worker transportation and modes for workforce movements during construction works will be organised in a way that will minimize negative impacts on local residents.			
• To avoid unauthorized entrance at worker camps and contractor's facilities, the design, layout and site location of facilities should facilitate natural surveillance by police and the security guards engaged by Contractor/s. Worker camps not to be adjacent to local settlements.			
• Adequate selection of qualified security guards and appropriate training. The project shall apply the Voluntary Principles on Security and Human Rights.			
• The design and location of road level crossings must take into account the views and concerns raised by local residents and other stakeholders. Evidence of consultation with stakeholders to be retain	• Consultation Plan.	Designer/Contractor (RDA: review and implement (as required)	During the Design Phase
• Warning devices to be installed to warn pedestrians that a train is approaching, special attention to be given to the stations and where vulnerable residents are located e.g. children. Any hazards such as overhead power lines will be fitted with appropriate warning signs.			
• RDA, together with the Road and Transport and Safety Agency (RTSA) will undertake a series of public relation activities (must run and support a series of community activities, including school visits, safety centers, diversionary activities and communications programmes), in order to inform local citizens, passenger and workers about the dangers associated with the construction of the road use of improved road.	• Public access to the information on railway, informing local citizens, passengers and workers on the nature of the project road works, benefits and risks	RDA	Prior start of Construction Phase/During Operational Phase

RECEPTOR / PROPOSED MITIGATION MEASURES	TARGET	RESPONSIBLE INSTITUTION/S	TIMING
SOCIO-ECONOMIC REQUIREMENTS			
C4. Community Issues			
• Workers will receive training and guidance on how to avoid conflicts with the local community members and sign a labour code of conduct, in order not to minimise potential conflict and community tensions.	• No community tensions	RDA/ Contractor/s	Prior and during Construction Phase
• Location of workers camps to be outside existing communities.			
• Local Workforce Recruitment Plan to be developed in order to assure employment of much as possible local workforce.			
• Modes for workforce movements (will be well organised and reviewed by RDA and Contractors.			
C5. Access			
A Traffic Management Plan should will be developed and implemented, and will cover inter alia: • The risks assessment that which clearly identifies all risks from the construction works to the travellers, drivers, workers will need to be developed; • Identification of the new access roads for construction vehicles and safety measures used for pedestrian access and crossings minimizing and avoiding agricultural temporary land loss; • Identification of all public roads and paths that will be affected and proposed for the transport routes during the construction period (which sections will be closed and till when, where the traffic will be diverted); • Minimization of the traffic disturbance; • The signing of the construction area, new directions, ring roads, access roads etc; • Public notification of any traffic-related concerns, such as road/streets closures; and • The risks assessment which clearly identifies all risks from the construction works to the travellers, drivers, and workers needs to be developed.	• Development and implementation of a Traffic Management Plan	RDA/Designer/Contractor/ (The Police will be a consulted part in the development of this plan and RDA will work with the Police to achieve the correct implementation of the plan)	Prior and during Construction Phase

RECEPTOR / PROPOSED MITIGATION MEASURES	TARGET	RESPONSIBLE INSTITUTION/S	TIMING
SOCIO-ECONOMIC REQUIREMENTS			
C5. Utilities			
• Prior to construction works during the Design Phase, the designer will obtain available underground cadastre from relevant service providers.	• Minimal disruption of utilities	RDA/Designer/Contractor/	Design Phase/ Construction Phase/Operational Phase
• Prior excavation works, Contractor/s will inform service providers in writing about planned construction activities which could affect some utilities and to request presence of their representatives on site. Where necessary the isolation of services which may pose a problem are to be arranged.			
• In case of lack of underground maps consultation with local citizens will be carried out to identify underground connections especially in regards with their properties and consequently to inform referenced service providers.			
• Ensure water and electricity requirements for Project do not result in supply issues with utilities to surrounding area.			
C6. Vulnerable Groups			
• To ensure the safety of people living near project road, there will be adequate markings and signage, for both construction and operational phase.		RDA/Designer/Contractor	Design Phase/ Construction Phase/Operational Phase
• The level of literacy of the affected people should be taken into consideration in the communication methods and signage design.			

RECEPTOR / PROPOSED MITIGATION MEASURES	TARGET	RESPONSIBLE INSTITUTION/S	TIMING
SOCIO-ECONOMIC REQUIREMENTS			
C7. Workforce & Worker Accommodation			
• To adopt and/or maintain appropriate **Human Resources Policies and procedures.** These policies will be clear, understandable and accessible to workers and comply with national labour laws and international good practices and EIB standards.	• Human Resources policies to be prepared and implemented	RDA	Design Phase
• To develop policies to promote non-discrimination and equal treatment and to prevent harassment (including sexual harassment) and bullying in the workplace, and make sure that they are clearly communicated and accessible to management, supervisors and workers.			
• To ensure that managers and supervisors are trained in the application of the HR policies.			
• To ensure that job advertisements, job descriptions and applications do not refer to applicants/workers race, gender etc. (except rare cases where legal exceptions apply).			
• To ensure that decisions on hiring, working conditions, pay, benefits, training, promotion, termination, redundancy are not made on the basis of discriminatory grounds or on the basis of criteria which disproportionately impact on one group more than another.			
• To ensure that women and men are paid the same wages for work of the same value, i.e. remuneration is based on the employee's skills, experience, responsibilities and other objective, non-gender related factors			
• To monitor the workplace for any form of harassment and, where it is found, act quickly to address it.			
• To ensure that workers are not asked about or required to undergo health or pregnancy testing, except where there is a genuine health and safety need.			

RECEPTOR / PROPOSED MITIGATION MEASURES	TARGET	RESPONSIBLE INSTITUTION/S	TIMING
SOCIO-ECONOMIC REQUIREMENTS			
C7. Workforce & Worker Accommodation			
• To take steps to enable workers with disabilities to retain their jobs and make accommodations required by national law for physically disabled persons.	• Ensure workers camps are designed and constructed/operated according to EBRD guidance document	RDA	Prior to Construction Phase and annually
• Workers camps to be located outside communities.			
• RDA to undertake audits of the design and implementation of the worker's compounds against the checklist in the IFC; audits will be scheduled as follows: a) prior to construction of the accommodation (i.e. an audit of the design); b) prior to its opening; c) On an annual basis (each year after opening).			
• Audits of worker accommodation to be undertaken by RDA against the IFC worker accommodation guidelines. Any defects or issues (where relevant) identified in the audits to be addressed and then reassessed for compliance within one month of the audit.			
• All workers will receive appropriate ESHS training in required languages. This will form part of the site/project induction process. The ESHS training will cover appropriate ESHS requirements including: the Code of Conduct, community interactions, the grievance mechanisms and biodiversity issues; prevention measures and awareness raising of potential diseases and health issues that may be introduced or effect the workforce and Emergency Planning and Response.	• Site/Project Induction Information/ ESHS Training planned within CESMS & OESMS and grievance mechanism& Response	RDA & Contractor	Construction Phase

RECEPTOR / PROPOSED MITIGATION MEASURES	TARGET	RESPONSIBLE INSTITUTION/S	TIMING
SOCIO-ECONOMIC REQUIREMENTS			
C7. Workforce & Worker Accommodation			
Social Facilities and Services Plan for workers to be prepared which regulates the following: • Housing standards must include special attention to minimum space allocated per person, supply of safe water in the workers' dwelling in sufficient quantities, adequate sewage and garbage disposal systems and appropriate protection against heat, cold, damp, noise, fire, and disease-carrying animals, and, in particular, insects. • Medical Risk Assessment and Medical Response Plan for on-site first aid requirements and medical emergencies in compliance with Lenders requirements. • For facilities located in hot weather zones, adequate ventilation and/or air conditioning systems must be provided. Both natural and artificial lighting must be provided and maintained in living facilities. • A separate bed for each worker must be provided. The practice of "hot bedding" should be avoided. The minimum space between beds should be 1 metre. Double deck bunks are not advisable for fire safety. • Canteen, cooking and laundry facilities must be built in adequate and easy to clean materials. Canteen, cooking and laundry facilities are kept in a clean and sanitary condition. If workers wish to cook their own meals, kitchen space will be provided separate from sleeping areas • There must be **management plans and policies** especially in the areas of overall operation of the facility, health and safety (with emergency responses), local community and security. • **A security plan** including clear measures to protect workers against theft and attack is implemented. Security staff must be checked tonsure that they have not been implicated in any previous crimes or abuses. • Community representatives must be provided with an easy means to voice their opinions and to lodge complaints to the management. There must be a transparent and efficient process for dealing with community grievances. • Mechanisms for **workers' consultation and grievances** to be designed and	• Delivery of Social Facilities and Services Plan, Management plans and policies, Security plan, Processes and grievance mechanisms, Workers' consultation and grievance mechanism, Emergency Preparedness & Response Plan	Contractor/s but approved by RDA	Prior to start of Construction Phase and during Construction Phase

implemented for the duration of the project. Processes and grievance mechanisms for workers' to articulate their grievances must be provided and clearly explained to workers. • **Emergency Preparedness & Response Plan** for the construction stage.			
• **Occupational Health and Safety Plan** to be provided to ensure compliance with National and EIB safety requirements. • All work activities carried out on site are to be properly planned and assessed so that all hazards have been recognised, those who may be at harm have been identified and adequate control measures implemented to reduce the risks to those workers and third parties who may be harmed to as low as reasonably practicable. • All workers are to be provided with suitable information, instruction, training and supervision as is necessary to ensure the health, safety and welfare of all persons working on site. • Any lifting operations carried out on site will be properly planned, assessing the ground conditions and above ground obstruction in the immediate area. The equipment will not exceed the safe working load and be operated by a suitable competent operator. All loads will be secured and the lift control by a competent person at all times in direct communication with the crane operator at all times. • Any working at heights which can't be avoided will be carried out using suitable working platforms with adequate guard rails to prevent falls. Where a risk of falling may still be possible all workers must be provided with, and trained in the use of, suitable safety harnesses / fall arrest equipment to mitigate the consequences if a fall should occur. • All construction traffic on site will be restricted to a maximum speed of 10km/hr at all times on site. Any reversing will be carried out under the guidance of a suitable trained person wearing high visibility clothing. All traffic will have suitable warning devices to allow others of its approach and be suitable segregated from any pedestrians. • Any temporary work structures used during the construction phase will be designed and constructed under the guidance of a suitable competent engineer. • All work activities on site are to comply with national laws and EU Directives and meet best international practise.	• Occupational Health and Safety Plan	Contractor/s but approved by RDA	Prior to the start of Construction Phase and during Construction Phase

RECEPTOR / PROPOSED MITIGATION MEASURES	TARGET	RESPONSIBLE INSTITUTION/S	TIMING
SOCIO-ECONOMIC REQUIREMENTS			
C7. Workforce & Worker Accommodation			
• **Implementing strict and enforceable safety practices**. The general contractor and all subcontractors on a job site are required to provide a safe work environment and to warn employees of hazards there. They must hire responsible personnel to coordinate job safety, and to supervise compliance with legal rules and regulations.	• Implementing strict and enforceable safety practices	Contractor/s but approved by RDA	Prior to the start of Construction Phase and during Construction Phase
C8. Quality of life			
Dust Management			
• Construction site, transportation routes and materials handling sites will utilise dust suppression measures such as water-spraying on dry and windy days to reduce dust emissions. This is especially relevant to any residential areas and commercial and business areas. This will be achieved through the implementation of **Dust Management Plan**.	• Dust Management Plan to minimize annoyance caused by dust	Contractor/s but approved by RDA	Prior to the start of Construction Phase and during Construction Phase
• If crushing of construction material or waste is required, crushers should be located away from sensitive receptors.			
• Vehicles and construction machinery will be required to be properly maintained and to comply with relevant emission standards and to reduce the leakages of motor oils and dispersion of pollution in waters and soil (the maintenance should be provided by the professional service company).			
• Restriction of the vehicle speed to 30km/hr on all access roads and settlements. (There needs to be a figure here although I am not familiar with the types of roads or existing speed limits)			
• Construction materials will be stored in appropriate places and covered to minimize dust.			
• Vehicle loads likely to emit dust will be covered.			
• Usage of protective masks for the workers if dust generation is expected.			

RECEPTOR / PROPOSED MITIGATION MEASURES	TARGET	RESPONSIBLE INSTITUTION/S	TIMING
SOCIO-ECONOMIC REQUIREMENTS			
C8. Quality of life			
Noise and Vibration Management (Design and Construction Phase)			
• Reduce the risk from any noise and vibration impacts by ensuring that the construction activities are at a distance of at least 10 meters from the residences.	• No construction activities closer than 10 meters of any residence	Contractor/s but approved by RDA	Prior to the start of Construction Phase and during Construction Phase
• Information to the public about the construction works will be announced through the local radio/TV station for carefully low speed driving near the construction location (especially important for Mpika urban and other heavily settled areas).	• Providing information to citizens	Contractor/s but approved by RDA	Prior to the start of Construction Phase and during Construction Phase
• Methods and equipment which minimize noise during execution of foundation works will be utilized, especially when working in densely populated areas as Mpika urban, Shiwang'ndu and Mucheleka or Chinsali Turnoff. Methods to minimize the noise level include using less machines at the same time for the work.	• Minimize annoyance caused by noise • No grievances relating to noise issues.	Contractor/s but approved by RDA	Prior to the start of Construction Phase and during Construction Phase
• The construction work should not be permitted during the nights, the operations on site shall be restricted to the hours 07.00-19.00 h.			
• The vehicles that are excessively noisy due to poor engine adjustment or damage of noise abatement equipment shall not be operated until corrective measures have been taken.			
• The maximum permissible speed for the heavy mechanization vehicles and predetermined route for passing near the settlements will be strictly enforced.			
• The local residents will be kept informed of the planned works and advised in advance of noisy works.			
• The location of noisy equipment will be chosen as far as possible away from sensitive receptors (houses, workplaces, schools and hospitals). • The workers will be provided with ear protective devices (ear muffs and/or ear plugs).			

• The good management practice would be used for the on distribution of the heavy noise equipment along the route, to avoid cumulative noise • The construction work will as much as possible be organised in a manner where noise is limited as much as possible, e.g. work should be performed during day time in the populated areas and should be announced ahead in good time • In cases where the very noisy work has to go on at night or during a longer period than one day in a place, a noise shield will be erected around the working area.			
• Monitoring of vibration during performance of critical working processes will be undertaken. Buildings which are within a distance of 20-30 meters from the area where the foundation of piles and catenary masts take place will be monitored during the work. • Damaged buildings will be repaired or compensation paid if damage from vibration occurs. • Before construction work is initiated, the houses nearby the area where the foundation of piles and catenary masts will take place should be photo registered for later documentation of any damages, which the work may have caused.	• Vibration monitoring, measures for preventing damages and fair compensation of damages	Contractor/s and RDA	Prior to construction and during Construction Phase

RECEPTOR / PROPOSED MITIGATION MEASURES	TARGET	RESPONSIBLE INSTITUTION/S	TIMING
D. ENVIRONMENTAL REQUIREMENTS			
D1. General			
• Construction workers will be given training sessions, prior and during construction works, to make them aware of the importance of soil, surface water and groundwater, flora, fauna, landscape, and archaeological remains as valuable resources for humans and nature, and the need for protecting them.	• High level or awareness on environmental issues in the construction workforce	Contractor/RDA	Prior and during construction phase
D2. Soils			
Sedimentation and Erosion Control Plan, will be developed in order to identify specific erosion control techniques for use at particular sites along the railway alignment. The Plan will be based on several principles and approved by RDA prior to construction: • Each site characteristics (topography, soils, drainage patterns, and covers) will be considered when developing the plan. Areas which are prone to erosion will be left undisturbed and undeveloped if possible. Entrance and exits points for runoff will be protected from erosion and equipped with sediment control devices. • Minimize the extent of the disturbed area and the duration of exposure and stabilize disturbed areas as soon as possible. Typically, if an area is not going to be worked on in more than 45 days, it will be protected by erosion control mats. • The use of heavy equipment and techniques that will result in excessive soil disturbances or compaction of soils will be minimized, especially on unstable slopes. • The drainage and runoff controls will be established before starting the site clearance and earthworks. The existing vegetation will be retained as much as possible. • Where water would need to be removed from excavations, it will be transferred at the minimum practical distance to be discharged. • Concentrated flows if possible will be diverted away from sensitive areas. • Sediment control devices such as sediment control ponds will be used to retain sediments from leaving the site. • The most effective erosion control devices will be implemented: a) temporary seedlings; ii)temporary mulching;	• Preparation and implementation of the sedimentation and erosion control plan minimize the loss of soil	Contractor/RDA	Construction Phase

b) permanent sodding; c) temporary or permanent erosion control blankets; d) permanent vegetative buffer strips; e) Sediment control devices to be implemented will include: f) site fencing; ii) straw bales; iii) sediment basins or traps; g) storm inlet traps; h) Rock check dams and vii) interception berms/swales. • Once construction is completed at a site, the decompaction and restoration of the disturbed areas that are not going to be occupied by permanent structures will be carried out by tilling the land before proceeding to the vegetation reinstatement. • Each river or large stream will have a specific Crossing Plan defining the mitigation measures to be applied (see Surface water below).			

RECEPTOR / PROPOSED MITIGATION MEASURES	TARGET	RESPONSIBLE INSTITUTION/S	TIMING
ENVIRONMENTAL REQUIREMENTS			
D3. Hazardous Materials Management and Spill Prevention Plan to address issues such as:			
• All roads and hard standings will be kept clean and tidy to prevent the build-up of oil and dirt that may be washed into a watercourse or drain during heavy rainfall. • The spill kits will be located close to the construction sites in case there is an accidental spill, so that it can be immediately cleaned up. • No refuelling, storage, servicing or maintenance of the equipment will take place within 100 m of drainages, water courses, alluvial plains or other sensitive environmental resources. If these activities had to be done at the construction site, all precautionary measures shall be taken to prevent leaks or spills from reaching the soil or nearby water courses. • These activities (refuelling, storage, servicing or maintenance) will take place in designated repair and maintenance third party sites adequately prepared for these purposes (adequately lined for preventing any soil and groundwater contamination, and equipped with culverts along the perimeters to collect water runoff that will be directed to wastewater treatment facilities). • Ready-mix concrete trucks containing alkaline cement or residues of cement will not be allowed to enter any watercourse. Washout of the concrete trucks shall be performed at the concrete batching plant camp, where appropriate facilities will be provided. If the washout of concrete trucks were necessary at or near the construction site, this shall be done at distance greater than 200 m of any watercourse and never in a very high or high habitat sensitivity area. The washout area will be clearly signposted and drivers shall be aware of the designated locations for washout. • Setting up camps on alluvial terrains has to be avoided because of the high levels of the underground water table and the risk of pollution. • The proper handling and storage of lubricants, solvents will be organized as well proper usage of construction equipment. • The storage of substances that are harmful to soils and waters (e.g. fuels for construction machinery) on the construction site will be minimized. All hazardous	• Preparation and implementation of the Hazardous Materials Management and Spill Prevention Plan to prevent the contamination of soil and waters with hazardous substances	Contractor/RDA	Construction Phase

substances either products to be used or waste, shall be stored in adequate places, far from sensitive areas (e.g. water courses, habitats with a rich biodiversity) and adequately equipped to prevent any soil, surface water or groundwater contamination). • For the storage of the wooden sleepers removed from the railway track in section 1, the temporary storage areas near the construction site will be lined and provided with runoff collectors. Removed sleepers will be taken to a safe storage place or handled to a hazardous waste contractor as soon as possible. • Vehicles and construction machinery will be subject to regular preventive maintenance so as to reduce leakages of lubricants, motor oil and fuel.			

RECEPTOR / PROPOSED MITIGATION MEASURES	TARGET	RESPONSIBLE INSTITUTION/S	TIMING
ENVIRONMENTAL REQUIREMENTS			
D3. Hazardous Materials Management and Spill Prevention Plan to address issues such as:			
The Waste Management Plan will implement procedures for waste minimisation, recycling, treatment and disposal in accordance with national and EU requirement and will cover the following: • The different waste types that could be generated at the construction site (due to the materials used and waste generated in different sections) shall be identified and classified according to the national List of Waste (Official Gazette no.100/05) on hazardous and non-hazardous waste streams. • Complete separation of hazardous from non-hazardous waste streams at the construction site will be done. • The waste material (concrete, iron, rocks, etc.) accidentally deposited will be immediately removed from highly sensitive habitats. • Municipal solid alike waste generated in the construction site and camps (food, beverages, packaging waste such as paper, bottles, glass, etc., glass bottles, batteries) will be collected and treated according to national legislation (separation of recycling waste materials from the waste stream that will be disposed of in the solid waste municipal landfill). Recyclable waste will be given to an authorized recycling company. • A contract with the company for waste collection and transportation shall be signed for the collection and transport of the waste generated at the construction site to the nearest municipality landfill. • Inert waste landfills shall be constructed according to specifications set in the national and EU requirements. • The Closure Plan for the closure of the inert landfills will be established and implemented taking into account the need for cultivation of the landfills area. • The contracts signed with the companies dealing with waste recycling and recovering will ensure that the delivery and acceptance of the waste streams is	• Waste Management Plan to be prepared and implemented to prevent soil and water contamination with hazardous substances contained in wastes, the introduction of extraneous materials in soils and waters, and to prevent the impairment of the landscape quality.	RDA/Contractor – Construction Phase	Construction Phase

performed on a frequent basis so that the construction sites remain clean at any time. • The excavated soil and construction waste will be reused as much as possible. • Possible hazardous waste (motor oils, vehicle fuels) should be collected separately and authorized collector and transporter should be sub-contracted to transport , recovery or finally dispose the hazardous waste; • The Temporary Hazardous Waste Storage Points should be established according the national legislation on handling, labelling, storage and management with hazardous waste; • The hazardous waste management procedure should be established and followed • The hazardous waste will be packaged and labelled showing the R and S phrases (risk and safety statements of the hazardous waste) and it will be temporary stored on safety storage facility equipped with adequate ventilation, fire resistant conditions especially if there are VOC emissions, mercury containing lamps, asbestos materials form demolition works; • The access to these temporary hazardous waste storage points need to be allowed only for trained and equipped staff with prohibited entrance of workers and public; • All waste spills will be promptly cleaned up; • Full records of the type of waste stream generated, quantity composition, origin, disposal destination and method of transport for all different waste streams will be kept be available for inspections; • The reporting on waste management will be done on regular base to the particular municipality and the legal obligation is for further reporting to the ZEMA through the Annual Reports; • The waste material (concrete, iron, rocks etc.) accidentally deposited will be immediately removed from highly sensitive habitats.			
Soil Management Plan shall be prepared by Contractors and approved by RDA. Selective removal and storage of top soil will be conducted which will:	• Selective removal	Contractor/RDA	Construction Phase

a) Topsoil will be stripped from the soil surface so as to serve for reuse in the restoration of disturbed areas not occupied by the railway. b) Topsoil will be reused to restore cuttings, embankments, wildlife crossings, construction and workers camps, landfills, and borrow pits. c) Temporary storage areas will be located along the strip of land along the alignment, near the sites where the soil was removed from, so that it can be reused in those same areas. • The layers of the stripped top soil will be placed aside, on the established storage areas, in the same order as the original soil levels. The topsoil removed will be collected on ridges to be built in flat areas so as to avoid the loss of the organic and biotic properties of the soil, and protected it from weather agents, mainly wind and rain, which cause the erosion of the soil ridge. The top soil storage areas shall be signposted and maintained in proper condition until the reutilization of the topsoil.	and storage of topsoil to be conducted to minimize the loss of fertile soil and ensure its properties are preserved for its reuse in rehabilitated construction sites or elsewhere (e.g. agricultural amendment)		

RECEPTOR / PROPOSED MITIGATION MEASURES	TARGET	RESPONSIBLE INSTITUTION/S	TIMING
ENVIRONMENTAL REQUIREMENTS			
D4. Surface Water			
• Each river or large stream will have a specific Crossing Plan defining the risks and mitigation measures to be applied (taking into account the measures listed below as relevant). Plans will be approved by RDA in advance of works.	• River Crossing Plans	Contractor approved by RDA in advance	Before Construction Phase.
• The construction of drainage pipes and bridges in watercourses will be carried out during the dry season. The design of the drainage pipes will take account of projected maximum flood events and potential changes in future flow regimes due to climate change.	• Construction of civil objects in water courses to be done during dry season to minimize effects on water flow, water quality and aquatic flora and fauna	Contractor/RDA	Construction Phase
• The extension of the construction area next to water courses will be only that strictly necessary to adequately perform the construction works. The perimeter of the area will be marked with signalling ribbons that neither vehicles and machinery nor workers will trespass. No occupation of the stream bed or the banks will be allowed, unless there is no other reasonable alternative to carry out the construction work.	• Any extension of the construction area next to water courses only occurs when signed off by RDA	Contractor for application to develop near water course. RDA to sign off on application.	Construction phase
• The following guidelines will be taken into account in the construction of bridges: ✓ Single span bridges are the preferred structure for crossing streams as they cause the least disturbance to watercourses both hydraulically and environmentally. ✓ Multiple span bridges are acceptable on wide streams. Acceptable arrangements will include: a) Piers located outside the normal low flow stream width. In this regard, a three span bridge may be preferable to a two span bridge. The spans do not need to be of equal length. b) Piers aligned parallel to the direction of flow. c) Riprap provided around the piers to mitigate local scouring. d) If piers/piles have to be constructed inside the normal low flow stream	• Design & Construction to follow stated guidelines	Designer/Contractor/RDA	Design and Construction Phase

width, they would occupy less than 5% of the cross sectional area for not to cause a significant change to the available waterway. e) The bridge abutments would be located so they do not significantly encroach into the waterway and thereby reduce the available waterway area. Abutments will also be located so as to avoid obstruction of movement of terrestrial fauna along the riparian zone. f) Rock beaching will be used on the batters to protect against abutment scour, as this area will generally not revegetate due to inadequate light and lack of rainfall. Beaching should generally extend 3 metres upstream and downstream of the bridge abutments. g) The batter is to be excavated to the depth of the beaching to maintain the waterway area. The slope of the batters would be in the range of 1V:1H to 1V:2H. In general, the beaching should extend at least 600 mm below the toe of the bank to mitigate undermining. Where the stream banks are stable, rock beaching may not be required.			
• The road drainage will be directed to retention basins or grassed filter zones to trap sediments and other contaminants, rather than discharging directly to the water courses. These sediment and contaminant retention structures will be constructed in the areas where habitats of very high or high sensitivity are located along the alignment or in a close location downstream of the effluent discharge point.	• Designing & Construction to follow stated guidelines	Designer/Contractor/RDA	Construction Phase
• Regular control and maintenance of drainage structures and retention basins will be conducted to check they are not clogged with debris or sediments	• No blocked drainage structures	RDA	Operational Phase

RECEPTOR / PROPOSED MITIGATION MEASURES	TARGET	RESPONSIBLE INSTITUTION/S	TIMING
ENVIRONMENTAL REQUIREMENTS			
D5. Groundwater			
• Where the groundwater table is encountered during excavation or cutting works, the intercepted area will be sealed as soon as possible so as to re- establish the normal hydrogeological flow regime.	• No major alterations of groundwater flow	Contractor/RDA	Construction Phase
• Hazardous Materials Management and Spill Prevention Plan to be developed (see mitigation measures for soil) and will address the potential for direct groundwater contamination for activities where the groundwater may become exposed to the atmosphere (e.g. during the construction of pillars near a water course).	• No significant contamination of groundwater	Contractor/RDA	Construction Phase
D6. Air Quality			
• Measures to be implemented to minimize dust emissions and included with a Dust Management Plan: 1) Hoardings will be constructed around the construction sites to minimize the spread of dust. 2) Accesses and construction sites will be kept moist to reduce dust formation. Water sprays will be implemented during drilling and excavation activities. 3) In the dry season, hygroscopic additives will be used in water to increase its presence in the ground. 4) Dust-generating activities will be slowed down in days of strong wind. 5) In windy and dry conditions, earth stockpiles will be moistened to prevent the lifting of dust particles. 6) Ground will be moistened during loading and unloading of aggregates in trucks. 7) Truck dumpers carrying spoil or other dusty materials will be covered with tarps. 8) Loaded trucks will be washed down prior to exit from the working site to ensure that loose material is not tracked onto the roads. 9) Work sheds will be large enough to allow stockpiling of the excavated tunnel material, access of trucks and truck loading operations.	• Dust Management Plan to be prepared and implemented	Contractor/RDA	Construction Phase

• Measures to be implemented to minimize emissions of combustion gases: a) Vehicles and construction machinery will be required to be properly maintained and to comply with relevant emission standards. b) No unnecessary idling of construction vehicles at the construction sites will be allowed. c) Construction truck traffic will be optimized so as to get a minimum number of trucks carrying the maximum volume of materials. This will be addressed in the Construction Traffic Management Plan. d) The truck routes will be planned to avoid peak traffic hours or routes with heavy traffic.			
• Measures to be implemented to avoid asbestos emissions during demolition of buildings: 1) An asbestos operational control procedure during demolition works will be developed according to national legislation on hazardous waste, Directive 91/689/EEC on hazardous waste, Council Directive 87/217/EEC on the prevention and reduction of environmental pollution by asbestos and EU Directive 2009/148/EC on the protection of workers from the risks related to exposure to asbestos at work. 2) The storage and transport of demolition materials will be removed, packed, labelled and processed in according the national and EU legislation on management of hazardous waste and asbestos (Directives 87/217/EEC and 91/689/EEC). 3) A risk assessment will be carried out before beginning an activity involving exposure to asbestos dust or to materials containing asbestos.	• Management of asbestos emission and no exposure to any parties	Contractor/RDA	Construction Phase
• Regular maintenance of the diesel equipment will be performed to keep them in optimal working conditions, including the achievement of minimal air emissions set by the manufacturer.	• Minimise emission of combustion gases	RDA/Contractor	
• Every effort will be made to use the cleanest fuels (e.g. on-road grade diesel) within technically feasible possibilities.			
• In train stations with heating systems based on fossil fuels, these systems will be subject to regular maintenance so that combustion is complete and emission of combustion gases are kept below regulatory thresholds.			

RECEPTOR / PROPOSED MITIGATION MEASURES	TARGET	RESPONSIBLE INSTITUTION/S	TIMING
ENVIRONMENTAL REQUIREMENTS			
D7. Noise and Vibrations			
• All construction equipment will comply with the requirements of EU Directive 2000/14/EC on noise emission in the environment by equipment for use outdoors (there is a lack of national legislation on outdoor equipment emission noise levels). All the equipment shall bear the CE marking and the indication of the guaranteed sound power level and shall be accompanied by an EC declaration of conformity.	• Noise emissions from the Project meet national and EC guideline limits	Contractor/RDA	Construction Phase
• The equipment will be fitted with appropriate noise muffling devices that will reduce sound levels.			
• Construction works shall not be permitted during the night; the operations on site shall be restricted to the period 07.00 -19.00 h.			
• All vehicles and machinery used at the construction sites shall be subject to regular maintenance. The vehicles and machines that are excessively noisy due to poor engine adjustment or damage noise control devices shall not be operated until corrective measures have been taken.			
• The construction traffic plan shall establish speed limits for construction vehicles and machinery at the construction site and the haulage roads used, and organize traffic so as to avoid as much as possible populated areas.			
• Affected local residents will be kept informed on due time of the planned works and the vibration and noise levels and periods during which they will occur.			
• The location of noisy equipment will be chosen as far as possible from sensitive receptors (houses, workplaces, schools and RHC). When near sensitive receptors, construction works will be scheduled and provided with the necessary resources so that the time of exposure is as short as possible.			
• Good management practice will be used to distribute heavy noise equipment along the route so as to avoid the cumulative effects of noise.			
• In the case where noisy works would need to be performed at night or during a longer period than one day at a given site, a noise shield shall be erected around the working area.			

• Monitoring of vibration during the performance of critical work processes (e.g. foundation of piles and catenary masts) should be undertaken in buildings which are within a distance of 20-30 meters from the area where the these works take place. Should buildings result damaged as a result of vibrations generated by the construction works, the damaged buildings will be repaired or compensation paid.	• No lasting damage to buildings		
• Operate earthmoving equipment on the construction site far away from vibration-sensitive receptors as possible.			
• Activities such as demolition, earthmoving and ground-impacting operations shall be scheduled so as not to occur in the same time period. Unlike noise, the total vibration level produced could be significantly less when each vibration source operates separately.			
• Decrease vibration from construction sources, including: a) Blasting. Explosive type and weight, delay-timing variations, size and number of holes, distance between holes and rows, method and direction of blast initiation. b) Dynamic compaction. A smaller falling weight will produce smaller vibrations. c) Pile driving. Predrilling, projecting, replacement of displacement piles with non-displacement ones, switch impact hammer to vibratory one, replacement of driven piles with augered cast in-place piles or drilled shafts. d) Select demolition methods not involving vibration impact, where possible. e) Avoid vibratory rollers and packers near sensitive receptors.			

RECEPTOR / PROPOSED MITIGATION MEASURES	TARGET	RESPONSIBLE INSTITUTION/S	TIMING
ENVIRONMENTAL REQUIREMENTS			
D8. Landscape			
• The landscape impact can be mitigated by hiding from observers the construction site, the camp and ancillary areas. For this, screens will be installed around the perimeter of these sites.	• No significant visual impacts	Contractor/RDA	Construction Phase
• Shaping of the terrain around altered impacted areas so as to recreate the surrounding land morphology. During further design areas where potential visual and/or shading issues for residential areas/properties could occur will be reviewed and measures incorporated into design and/or mitigation measures identified and implemented.			
Vegetation with autochthonous species present in the surrounding area of: 1) Slopes of the cuttings and embankments. Vegetation measures are generally recommended for 2H:1V slopes. 2) Areas around the tunnel mouths. 3) Water courses and banks underneath constructed bridges, as well as in the abutment areas. 4) Affected areas underneath the viaducts as well as above, in abutment zones. 5) Aesthetic integration of the structural parts of viaducts and bridges (e.g. deck, pillars) and tunnel mouths, using construction materials with colours and textures that blend well with those of the surrounding landscape (e.g. dark concrete for pillars in a black pine forest).			
• Design of the landfill waste disposal patterns so that the final contours are integrated with those of the unaffected part of the waste receiving valley.			
• Vegetation of the sealed landfills with autochthonous species adapted to the resulting valley conditions.			

RECEPTOR / PROPOSED MITIGATION MEASURES	TARGET	RESPONSIBLE INSTITUTION/S	TIMING
ENVIRONMENTAL REQUIREMENTS			
D9. Flora			
• As far as possible, site used for workers camps during the previous construction period of the road shall be reutilized. Should new camps and auxiliary facilities be needed, these will be constructed in areas of vegetation with negligible sensitivity vegetation (only on abandoned fields, ruderal and trampled sites) or low sensitivity			
• The cutting of trees will only be done with the required permits in compliance with the applicable regulations and all the necessary permits will be obtained prior to the clearance of vegetation.			
• Non operational areas will be restored to a state as close to the original conditions as possible through reinstatement activities, using native plant species from the surrounding areas.			
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RECEPTOR / PROPOSED MITIGATION MEASURES	TARGET	RESPONSIBLE INSTITUTION/S	TIMING
ENVIRONMENTAL REQUIREMENTS			
D9. Fauna			
• Construction activities shall be scheduled so as to avoid the breeding season and other sensitive seasons or times of day, especially in areas where high sensitive species are concerned associated to sensitive habitats	• No construction activities during the breeding season in sensitive habitats	Contractor/RDA	Construction Phase
• Prior to the commencement of any construction work activity on a site, a fauna survey of the area and its surroundings shall be carried out by a qualified biodiversity expert.	• No significant disturbance of sensitive fauna occurs	Contractor/RDA	Construction Phase
• If active breeding sites of sensitive species of fishes, amphibians, reptiles, bird, or mammals, including bats, are found, they will be transported by specialized technicians to another appropriate location away from the railway construction area, unless the biodiversity expert decides on other precautionary measures to take.			
• Traffic of construction vehicles and machinery will be the minimum required to perform construction works adequately.	• No mortality of sensitive fauna	Contractor/RDA	Construction Phase
• The speed of vehicles in the area of construction works and hauling roads will be limited to a maximum speed and remembered to the drivers through signage and installation of speed bumps, where necessary.			
• Any animal injury or mortality will be recorded in a logbook, and as appropriate further mitigation measures are developed.			
• Hunting of wildlife in the area of the construction works will be prohibited to workers.	• All workers to be trained on measures required to be undertaken to mitigate	Contractor/RDA	Construction Phase
• Before the start of works, construction workers will be trained on the natural values of the area and the need to be proactive in implementing the measures for the protection of wildlife.			

RECEPTOR / PROPOSED MITIGATION MEASURES	TARGET	RESPONSIBLE INSTITUTION/S	TIMING
ENVIRONMENTAL REQUIREMENTS			
D10. Cultural Heritage			
• Chance Find Procedure to be established and implemented prior to construction works commencing. In accordance with Zambian Law on Protection of Cultural Heritage and EIB requirements. In the event of the unexpected discovery of archaeological objects the Contractor shall immediately inform RDA and the NHCC and follow their instructions. The construction works will be temporary stopped while the authorities decide if any research are needed or any protection measures should be applied. The Contractor shall follow the instructions provided by the authorities responsible for the protection of cultural heritage.	• Implement a Chance Finds Procedures	Contractor/RDA	Construction Phase
• Cultural Heritage training shall be provided to construction workers before the start of earth works to foster their awareness on how to identify artefacts and the importance of protecting Zambian cultural heritage.	• All staff, particularly those operating excavation equipment to be trained in the chance finds procedure	Contractor/RDA	Construction Phase
• RDA to undertake the necessary works as directed by the NHCC responsible for the protection of cultural heritage to protect any archaeological finds from damage and plunder.	• No damage of discovered cultural heritage sites	Contractor/RDA	Construction Phase

Chapter Ten

ANALYSIS OF TECHNICAL INSUFFICIENCY & NEED FOR UPDATE OF THE EISA STUDY

10.1. INTRODUCTION

For the preparation of the ESIA, the team had at their disposal it is considered sufficient information, data and documents withstanding the technical insufficiencies and assumptions detailed below. The main sources were official adopted documents by districts, documents at regional or national level, environmental reports issued by the responsible institutions and the Project Proponent – RDA. Several site visits along the road corridor, and interviews with responsible persons (GRZ district departments such environmental officers, inspectors, water management staff, urban planners) from the District Councils of Mpika, Shiwan'gandu and Chinsali were held. Scoping stakeholder meetings were held and at these where additional information was pointed out by the different stakeholders. Following review of this information the team conducted further detailed research on some of the environmental and socio-economic issues. Relevant national legislation, EIB standards and good practice examples from other road projects were considered in the development of the ESIA as well.

Several technical insufficiencies and assumptions in the preparation of the ESIA were identified, which are addressed below.

10.2. ENVIRONMENTAL ISSUES

10.2.1. Topography & Landscape

There are no published landscape unit maps for the study area. A digital terrain model (DTM) to describe the visual envelope could not be prepared due to lack of available 3D map data for the study area. Therefore, a digital intervisibility map (or "point to point" visibility map) for systematically determining visual exposure relationships (e.g. visual envelope), was not prepared.

10.2.2. Geology, Geomorphology and Soils

The primary resource for the geological data was the Basic Geological Map of Zambia for Northern Region. No other geological maps are available. The information was collected from these sources indicated is limited to these sources and the expert knowledge of the geologists that prepared the baseline.

The description of soils along the road corridor was based on the limited available information existing about the study area, the different types of soils known to be present in the area of the road corridor may occupy and on the types of geological substrates intersected by the road corridor.

10.2.3. Hydrology (Surface Water) & Hydrogeology (Groundwater

With regards to groundwater, existing hydro-geological information for the North- Eastern region is very scarce. With regards to geothermal areas, the detailed investigations about this area are lacking.

10.2.4. Climate and Air Quality

There is no any air quality monitoring stations put in place in this part of the country mainly due to lack of industries or any major source of air pollution. Expert judgment was used to describe the baseline conditions.

There is no national legislation adopted yet on air emissions from mobile sources and outdoor equipment specification on air emission limits. There is no information on the testing for compression ignition engines and emissions limits on CO, HC, NOx, NMHC and particulates.

10.2.5. Noise and Vibration

As is the case with Air quality, there is no data available for noise and vibrations long the project road corridor and the consultant only undertook noise level assessment for the project road corridor, which was not very detailed, to just identify and predict noise levels at all sensitive receptors along the alignment (especially across housing zones) and determine specific and optimum noise abatement measures according the WHO standards.

10.2.6. Waste Management

There is no information on total quantities of waste disposal in the existing landfills. All the councils along the project road corridor have adopted annual programs for waste management, but there is limited implementation. Moreover, not all councils report to the Zambia Environmental Management Agency (ZEMA).

10.2.7. Nature Conservation & Biodiversity

The preparation of the biodiversity baseline has been mainly limited by the lack of existing detailed data specific to the road corridor. This has been particularly true for plants and mammals. No vegetation maps or habitat maps exist in the Republic of Zambia at the national or regional levels. Much of the information, thus, has been newly generated by the experts in the various biology fields participating in the ESIA study, through interpretation of cartography, satellite images and aerial photographs, and field surveys.

Moreover, the determination of sensitive plant and animal species that are potentially present along the project road corridor has been limited by the fact that no Red Data Books and Red Lists for Zambia flora, fauna and fungal have been prepared yet at a national or regional level. Thus, the establishment of the presence of sensitive species in the road corridor area had to be done on the basis of the most relevant international conventions and treaties. These international documents contain lists of species threatened to different levels (e.g. from Least Concern to Extinct). The problem arises from the fact that there may be species that are of low concern at an international level, but have some level of threat in Zambia (or vice versa), thus underestimating (or overestimating) the sensitivity value of the species.

10.2.8. Cultural Heritage and Archaeology

No assumptions have been made or limitations encountered.

10.3. SOCIAL ISSUES

The latest available census data was from the Census 2010 which obviously is a limitation of this dataset. However all available recent data, from different sources were used in preparation of this study in order to present more or less the current socio –economic baseline within this region.

10.3.1. Need for Update of the EISA Study

The need for update the ESIA fully depends of the existing technical insufficiency that the ESIA Team was faced during the developing the Study.

Each of the project stages (design, construction and operation) need environmental and social evaluation with main objectives: a) to determine the effectiveness of the proposed minimizing (preventive, mitigative or compensatory) measures and b) to provide feedback to the project developer regarding necessity of modification/add some more effective measures.

The broader benefit of the post-construction evaluation will convert ESIA into a more accurate and useful tool to achieve sound, rational and sustainable infrastructure / road development.

The main tasks to be performed raised from the proposed Monitoring Plan for each environmental and social element and the general activities include: a) listing of parameters to be evaluated (from the Monitoring Plan), b) Nomination of the Evaluators, c) Adoption of the standard evaluation methodology, d) involvement of the public participation in open-transparent way, e) Collection, review and analysis of the monitored data and information, f) Evaluation of the compliance with national, EIB and good practices from the IFC.

The separate Report should be added to the main ESIA Study with the main findings after the evaluation and the updated version of the Environmental and Social Mitigation and Monitoring Plan should be prepared and discussed with the public.

CHAPTER ELEVEN

CONCLUSIONS

11.1. INTRODUCTION

The proposed rehabilitation of the T2 road from Mpika to Chinsali will involve a full reconstruction and widening of the existing carriageway and the enforcement of the mandatory road reserves as enshrined in the Public Roads Act of 100m for the rural sections and 36m for the urban sections of Mpika (Ch0+00-Ch7+780); Shiwang'ndu urban (Ch86+800) and Chinsali turnoff (Ch165+645). The project is scheduled to be implemented as soon as all necessary approvals from various institutions such as ZEMA are obtained and funds are secured from potential financiers such as the EIB.

In order to speed up the construction of the 165Km road stretch, the project has been divided into three lots which will be constructed by three different contractors and to be financed by two different sources as follows:

1. Lot 1: (From Mpika weighbridge to Mazingo with possible financing from the Chinese);
2. Lot 2 - (From Km 4+100 to Km 86+770): Mpika to Shiwan'gandu Junction (D53/T2 Junction) – 82.7 km with possible financing from EIB; and
3. Lot 3 – (Km 86+770 to Km 165+646) Shiwan'gandu Junction (D53/T2 Junction) to Chinsali Junction – 78.8km with possible financing from EIB.

In order to comply with the legal requirements in Zambia and indeed for good international practices, the project had to be subjected to a full ESIA process since the project falls within the second schedule of the ZEMA EIA regulations.

The purpose of the ESIA was to identify and assess the potential positive and adverse impacts that may arise from the Project on the physical and natural environment, on the socio-economic wellbeing and conditions of the population (community and workforce) at the local (municipalities), regional (Muchinga Province), national (Zambia) and transboundary levels. Identified impacts have been assessed taking into account the environmental and social baseline conditions analyzed for the study area, and, where necessary and appropriate, mitigation measures to avoid, prevent, mitigate or compensate significantly adverse impacts and enhance beneficial impacts have been proposed. In this regard, a mitigation and monitoring plan to both monitor and evaluate the implementation of mitigation measures and the Project performance on environmental and social baseline conditions has been included as an integral part of the ESIA. Furthermore, the assessment has determined the significance of residual effects remaining on the environment and community as a result of the Project following implementation of the mitigation measures.

11.2. SUMMARY OF POTENTIALLY SIGNIFICANT RESIDUAL ENVIRONMENTAL EFFECTS

11.2.1 CONSTRUCTION PHASE

With the application of the mitigation measures during the construction phase, the majority of residual effects were found to have a slight negative significance except for 2 potentially significant residual effects in relation to the destruction of top soil and impairment of noise quality, which were found to be of a moderate adverse nature.

11.2.1.1. Destruction of Top Soil

Along the project road corridor, about 82% of the top soil present which will be permanently removed comprise of natural and semi natural soils of high to very high sensitivity and 10% corresponds to medium sensitivity agricultural soils. It was determined in the assessment that even if top soil is removed selectively for reuse in the rehabilitation of disturbed surfaces along the road alignment and for agricultural purposes, the loss of top soil would still be distinguishable and measurable, although however it is not considered this will affect the integrity of the resource in the area.

11.2.1.2. Impairment of Noise Quality

Noisy construction operations (earth movements, bridges construction, demolition, production of gravel and concrete, transport of materials in and out the construction site, etc.) will take place in areas which are currently very quiet, within several small villages along the route. It has been considered that for most of the receptors in any section that live near to the road alignment, there will be potential impacts on noise levels during construction of a high magnitude. Mitigation measures to minimize noise and vibration emissions during construction include compliance of all construction equipment with the requirements of EU Directive 2000/14/EC on noise emission in the environment by equipment for use outdoors, application of restrictions to noise emissions according to noise level areas, limitation of construction activities to a day-time schedule, regular maintenance of vehicles and machine, implementation of a traffic plan, and monitoring of vibrations during the performance of critical work processes. However, it was considered that although these measures are certainly necessary to minimize the impact, the disturbance to neighbours due to noise and vibrations from the construction activities would still have a moderate significance, even though this will be of a temporary short-term nature.

11.3. SUMMARY OF POTENTIALLY SIGNIFICANT RESIDUAL SOCIAL EFFECTS

11.3.1. CONSTRUCTION PHASE

According to the assessment of social receptors the most adversely affected receptors will be land and property and vulnerable groups. With the application of the mitigation measures during the construction phase, the majority of residual social effects were found to not be of a significance adverse nature except for potentially significant residual adverse effects in relation to the Loss of Land & Property and Effects on Vulnerable People. Significantly beneficial residual social effects in relation to the Stimulation of economic growth at local levels during construction and Creation of local employment (direct and indirect) during construction are also anticipated.

11.3.1.1. Loss of Land & Properties

During the construction works, most land to be utilized will be of a temporary nature and is a result of requirements for construction of compounds and working sites along or close to the line in addition to space for storage of plants, materials and site offices etc. Contractors' may temporarily also require land for Borrow Pits & Landfills.

Preliminary assessments conclude that 1,039 PAPS will be affected by the Project mainly due to the enforcement of the road reserves. Significance of the impacts without mitigation

measures both for permanent land loss and loss of housing was found to be large adverse. With implementation of mitigation measures significance of residual effects was found to be of a moderate adverse nature. Mitigation measures include: preparation of Resettlement Action, has included a detailed survey and Census in order to ensure that all affected families, not only those with legal rights already elaborated with Expropriation study will be duly compensated for all their belonging and expenses connected with being resettled.

Situation caused from loss of gardens, community land and agricultural production raised by temporary land loss during construction phase will be returned into previous state during operational phase. However loss of gardens, community land and agricultural production due to permanent land loss during construction phase cannot be returned into previous condition. The owners will be compensated for lost land (with land or financially). For those who have agricultural land without practicing agricultural activities may be expected to choose financial compensation with those with farming activities will require land for land. That will mean that new gardens will be erased, agricultural activities on new land will start maybe with some different crops.

11.3.1.2. Effects on Vulnerable Groups

Among the identified PAPs are some vulnerable people who will lose their houses and land. During the construction phase, 25 vulnerable families due to age and disabilities will lose their homes. Some will lose their land, forestry, pastures, fields, orchards. Some families may lose both their homes and part of their land. People will need to leave their memories, to change their livelihood and to establish new social relations within a new environment. New agricultural activities will result from loss of land. The magnitude of the impacts with the implementation of mitigation measures becomes medium. The significance of the residual effect is then moderate negative.

11.3.1.3. Economy & Employment: Stimulation of economic growth at local levels during construction and Creation of local employment (direct and indirect) during construction

Positive impacts from construction activities are mainly those on economy and employment. Direct and indirect business opportunities will potentially increase significantly for local contractors and especially subcontractors during construction works. Food and some construction materials will be supplied locally and thus increase local trade. The local economy will also experience opportunities for providing skilled services from e.g. like craftsmen and hammer mill operators. Increased revenue and taxes that will be accumulated by construction activities will partly be diverted from the state to the local level. Due to the limited capacity of local economy it is expected that demand for material, services and subcontractors will extend to the entire Muchinga Province. National economy is expected to be affected as well. Most of the larger construction companies are established at national level. For some of the materials to be used during construction, suppliers from other parts of the country will have to be utilized and thus improve opportunities for trade at national level.

Especially important are the positive impacts that will be created by improving the employment situation. The employment benefits during the construction phase are positive since it relates to the project activities, induced by increased employee spending. Considering that a bigger proportion of the total population is economically inactive, the project will increase opportunities for a bigger percentage of the population by improving their access to

employment opportunities. Employment opportunities will be created for both skilled and non skilled labor in the community. The community has the capacity to absorb the employment opportunities arising during construction phase. During construction of the road, employment will be generated mainly for construction workers. Due to technological developments and investment in laborsaving equipment, the workforce needed when work will start on the three Lots is thus estimated to be in the range of 600-700 workers. The workers camps where workers will be accommodated include kitchen and dining room and provided medical service. Although those camps will provide for canteens, it is expected that both the camp management and the workers will spend money locally utilizing the local business community for ensuring supplies for the camps and entertainment and other services for the workers. Thus, positive spin off effects during the construction Period on the local economy are expected.

11.4. SUMMARY

To summarize, it is expected that the proposed project will stimulate a large and competitive economy not only in Muchinga Province but in Zambia as a whole, which could provide jobs for working-age residents and a highly qualified local workforce. At the moment, the area has high levels of unemployment and dependency on peasant farming.

From the point of view of environmental impacts, even though there will be a few residual impacts which will have a moderate adverse significance during the construction phase (destruction of top soil and impairment of noise quality), it is concluded that if the mitigation measures that have been proposed in this ESIA are implemented, the significance of the overall residual impact of Project Road Corridor should be of a slight adverse nature, with no major damages caused to the environmental resources present along the road corridor.

CHAPTER TWELVE

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CHAPTER THIRTEEN

APPENDICES

13.1. APPENDIX 1: ZEMA APPROVAL LETTER FOR TOR

13.2. APPENDIX 2: IMPLEMENTATION PROGRAMME FOR THE PROJECT

The below schedule is an overview of the detailed planning that RDA has put into the preparation and implementation of this through its dedicated RAP Team. A detailed schedule is provided in the Appendices to this report.

The compensation issues and rehabilitation measures will be completed before civil work starts. Civil works contracts will not be awarded unless required compensation payment has been completed. RAP implementation schedule is given below:

	RAP implementation Schedule	2016		2017												2018			Responsible Agency
Task No	Task	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	
1	Completion of Draft RAP																		BICON (Z) LTD & RDA
2	Approval of Draft RAP																		RDA & EIB
3	Training of RDA & Other RAP Implementation Teams (ongoing)																		BICON (Z) LTD & EIB
4	PAP/community consultation (ongoing)																		RDA-ESMU/ Consultant
5	Notification of entitlements																		BICON (Z) LTD & RDA
6	Payment of compensation																		Compensation Team
7	Notification to PAPs/community of demolition of structures and land																		Community Liaison Team/RDA-ESMU
8	Demolition of old structures and land acquisition																		RDA/ Contractors
9	Replace any community facilities (i.e. boreholes) destroyed as part of requisition																		RDA/ Contractors
11	Grievance mechanisms and procedures (ongoing)																		Community Liaison Team & RDA-ESMU
12	Performance monitoring (Ongoing)																		RDA-ESMU
	External evaluation (bi-annual for three years)																		Independent Evaluator

13.3. APPENDIX 3: MINUTES OF THE STAKEHOLDER CONSULTATION

MINUTES OF THE SCOPING MEETING FOR THE MPIKA CHINSALI ROAD

Date: 03/03/2016

Venue: Mpika Civic Centre

Time: 10:37 hours

The meeting started with introductions, and the consultant welcomed the participants and explained the project which is a full rehabilitation of T2 from Mpika to Chinsali. Moses explained that the project will be a full pavement reconstruction. He stressed that the construction of the road has been a pending issue for residents along the road. He mentioned that the full rehabilitation will be beneficial both environmentally and socially and that the meeting was being conducted in fulfilment of the Environmental Management Act of 2011. He urged the participants to feel free to air their views and he thanked members of the DDCC for taking time off their schedule to attend the meeting.

Moses explained that the Government initiated the periodic maintenance of the road in 2013, prior to which RDA used to carry out some periodic maintenance which included patching up potholes along the road. The government realized that a lot of money was being spent on periodic maintenance and decided to carry out a full rehabilitation. He stated that the consultants Typsa and ASCO conducted the designs in 2012 taking into consideration that the works will be a full rehabilitation of the road.

In 2012, Typsa in association with ASCO had conducted an Environmental Impact Assessment (EIA) for the proposed rehabilitation of the Mpika to Chinsali road and the Environmental Impact Statement (EIS) was submitted to ZEMA and consequently approved in 2013.

Moses explained that since then the Government of the Republic of Zambia (GRZ) has been discussing the Project with a range of prospective lenders and specifically the European Investment Bank (EIB).

He further explained that the EIB operate strict procedures for environmental and social due diligence which require the detailed stakeholder engagement and consultation with various affected groups including vulnerable groups and the preparation and public disclosure of an Environmental and Social Impact Study (ESIS) Report and an accompanying Environmental and Social Management Plans (ESMP), prior to the decision to approve finance for the project. The requirement for this ESIA process has thus arisen as a result of GRZ seeking finance from EIB to support the development of the Project.

Moses explained that RDA is looking at adopting three different road reserves for different road sections as follows:

- Adoption of a 100m road reserve (i.e. 50 on either side of the road from the existing centerline) for the rural sections of the road;
- Adoption of a 60m road reserve (i.e. 30 on either side of the road from the existing centerline) for the rural sections of the road; and
- Adoption of a 36m road reserve (i.e. 18 on either side of the road from the existing centerline) for the heavily settled and urban sections of the road such as *Mpika urban area, Kalalantenkwe (Shiwang'andu BOMA) and Mucheleka (or Chinsali turnoff area).*

He emphasized that it is obvious that adoption of these road dimensions has serious implications on private properties and assets and would require the preparation of a full Resettlement Action Plan (RAP).

Moses explained that the meeting has been called for in view of the foregoing but also taking into consideration the EIBs environmental and social principles and standards, which were not part of the guidelines followed in 2012.

He explained that Bicon Zambia Ltd has been commissioned by the Road Development Agency (RDA) to update the (i) the Environmental Impact Assessment (EIA) to an Environmental and Social Impact Assessment (ESIA); (ii) the Environmental Management Plan (EMP) to an Environmental and Social Management Plan (ESMP); and preparation of (iii) a census and socio-economic baseline survey and (iv) a Resettlement Action Plan (RAP) for the Rehabilitation of 161.5Km of the Mpika Chinsali Road (T2) in Muchinga Province.

Moses stated that the Environmental Management Act of 2011 was the supreme environmental Act in Zambia. He went on to explain the guidelines being followed in the preparation of the Environmental and Social Impact Statement (ESIA) process, these included the following stages:

- Screening process-first step in the ESIA process
- Scoping exercise with full stakeholder participation & development of TOR-second stage
- Baseline studies and preparation of ESIS-third stage
- Disclosure of ESIA findings-fourth stage
- Approval by ZEMA-fifth & final stage

Moses went on to explain the purpose of the scoping meeting which included the following:

- Requirement in terms of the National Environmental Management Act of 2011
- Provides every person with an opportunity to be involved
- In best interest of all concerned because:
  - ✓ Provide opportunities for IAPs and authorities to voice their concerns
  - ✓ Provide IAPs with the opportunity to make suggestions
  - ✓ Enables RDA to incorporate needs, preferences and values of IAPs into its decision and designs
  - ✓ Vital for ensuring transparency and accountability in decision-making.

Moses further stated that the ESIA team is composed of the following:

- EIA specialist/ team leader
- Socio-economist
- Health and Safety Expert
- Real estate specialist
- Any other specialization that shall be deemed necessary.

Moses stated that the Mpika to Chinsali road was a trunk road and according to the Roads Act required a road reserve of 100m, 50m on each side of the road from the centerline. Moses explained that all structures found within the road reserve will be compensated when government decides to use this space. However, he stated that the contractor might not use up the entire road reserve for road works.

Moses stated that the objective of the project was to carry out necessary consultation and supervision with the view of constructing a road that will last for 20 years with routine maintenance before reconstruction. He gave the current condition of the road from visual observation as follows:

- 6.1m carriage way
- 1.5m wide unsealed shoulders
- Some sections have a carriage way ranging from 5.8m to 6.1m
- Edge breaks and potholes are common

- Double bituminous surface dressing
- Some sections contain 150mm stabilized cement
- Fair to poor and narrow general condition of the road

Moses explained that the current pavement design was going to have the carriage way widened to 7m from the original 6.1m and 2m sealed shoulders. He stated that the entire road will be ripped off and the material will be used to burry existing drainages to create shoulders for the new carriage way, this will be helpful in terms of environmental management.

Moses stated that the contractor will be expected to observe the following:

Temporary traffic diversion
Temporary traffic diversions shall use the shortest possible route to rejoin the main T2road, in case of a single lane detour, the lengths of the detour shall allow traffic travelling in opposite directions to pass at frequent intervals.

The contractor shall be responsible for safely maintaining and directing traffic through or around any part of the works, with the maximum practical convenience, for the full twenty-four (24) hours of each day.

Access to properties
where closure of such accesses is unavoidable, the contractor shall give sufficient notice, at least ten (10) days, to the occupiers of the affected properties so that inconvenience is minimized-maximum 2days of closure.

Clearing & grubbing

- Clearing & grubbing shall consist of ripping of the existing pavement, demolishing, breaking up and removal of all trees, tree stumps, brush, other vegetation, rubbish of any nature, buildings, structures
- Areas to be affected will be portions of the site falling within the limits of the width of the road prism, as well as areas of certain material sources
- The engineer shall designate the areas to be cleared and such areas shall not necessarily be limited to those afore-mentioned
- Unless specifically required on the drawings or instructed by the engineer, clearing, grubbing and demolition/dismantling works will not be permitted in areas outside the limits of the width of the road.

Maintenance during construction

- The contractor will at all times keep the sites including storage areas, free from accumulation of waste materials
- Servicing of plant, equipment and vehicles shall be carried out at a workshop area to contain any spillages
- All waste water and sewage shall be piped to soak pits/septic tanks or other disposal areas constructed in accordance with local regulations
- Contractor shall obtain a permit or other appropriate documentation approving the disposal methods being used

Engagement of staff and labour

- Contractor is encouraged to employ staff and labour with appropriate qualifications and experience from sources within the project road corridor

Wages and conditions of labour

- Contractor shall pay rates of wages, and observe conditions of labour as established by GRZ and especially for the road sector.

Working hours

- No work shall be carried out on site on locally recognized days of rest, or outside the normal working hours, unless:
- The work is unavoidable, or necessary for the protection of life or property or for the safety of the works, in which case the contractor shall immediately advise the engineer.

STI/STD AND HIV/AIDS Programme

- Contractor shall plan and implement government's strategy of STI/STD AND HIV/AIDS alleviation measures
- Contractor shall work in close liaison with the ministry of health (MOH) and experienced NGOS/CBOS
- The contractor shall conduct monthly IEC campaigns which shall include:
- At a minimum the provision of a one hour lesson/lecture to the specified recipients once every week provision of pamphlets/flyers (A4 paper size printed on both sides) describing and sketching the topics of the lessons/lectures, and provision of 10 A1 paper size campaign boards of weatherproof construction with approved inscription and sketches
- The contents of the lessons/lectures, pamphlets/flyers, campaign boards and location for display shall be agreed with the MOH/authorities/engineer/NGOS/CBOS.

Health and Safety

- The contractor shall at all times take all reasonable precautions to maintain the health and safety of the his personnel
- Contractor shall ensure that medical staff, first aid facilities, sick bay and ambulance service are available at all times at the site and suitable arrangements are made for all necessary welfare and hygiene requirements and for the prevention of epidemics
- Contractor shall appoint an accident prevention officer at the site, responsible for maintaining safety and protection against accidents.

Land take and resettlement

As mentioned earlier, desirable road reserve width applicable for a class T road is 100m resettlement impacts are therefore expected from the project if these road dimensions are adopted.

Moses thanked the stakeholders for attending the meeting and stated that in a nut shell the above mentioned were the issues the consultant felt might arise as the project was being implemented. He urged the stakeholders to feel free and share their views; concerns or recommendation which they felt should be considered during project implementation.

OPEN SESSION

COMMENT: Kaweme P. Mumbi- I am happy to see representation from the DEBS office, farmers, councilors and Muchinga Water and Sewerage Company. Our office sent out invitation letters to ZESCO and ZAMTEL, but I cannot see any representatives from these institutions. However, we invited these stakeholders so that they can air their views on the road project.

QUESTION: Banda Sydney- My question is concerning the issue of compensation. How will such issues be handled?

RESPONSE: Moses- On the issues of compensation, the ESIA team will at later stage be conducting valuation exercise for all the assets and fruits located within the project road reserve and these will be valued at

replacement cost. Once this is done and after full consultation with the affected and other interested stakeholder a Resettlement Action Plan including a Valuation Report shall be submitted to RDA. It is the desire and wish of government through RDA to compensate all those who will be found within the road reserve and this will be done at replacement cost. No one will be evicted without having been fully compensated and enough notice will be given. Our job as consultants is to document who is affected by this project and present this information to RDA.

The land policy does not have a provision for compensation where traditional land is involved, only land on title is compensated fully. For land that is not on title, RDA will only compensate the effort put in the development of that land. A detailed plan of how this will be done will be communicated to the people later.

The project is in the preliminary phase, and there will be more meetings. We also realize that matters of compensation are issues we should talk about with the people.

QUESTION: Crispin Chishimba At Danger Hill Village, there is a community water reticulation project shall has enabled people on that community to have access to piped water some of the pipes are very close to the road and other actually cross the project road. When the project will be undertaken, are the community going to stop receiving this service or what shall be done?

RESPONSE: Moses- Mr. Chishimba, we have taken note of your concern and we shall engage every stakeholder to ensure that there is no disruption of water to households. Are there any other areas that you feel might be affected by the project or is this the only area?

RESPONSE: Mr. Mulenga- It is the only area.

COMMENT: Kelvison Musukwa- You talked about compensation, but we should also consider the issue of HIV/AIDS. People live in poverty and when they see people with money, they will be flocking to them. So I feel there is need for sensitisation on matters of HIV/AIDS.

RESPONSE: Moses- During the detailed studies for the ESIA report, the consultant shall engage various organization and community members to understand the issues of HIV/AIDS and other anticipated impacts that may arise as a result of the project. The ESIA report shall provide mitigation measures to address the challenges of the project such as the issue of HIV/AIDS and a budget will be allocated for the implementation of activities such as sensitisation in order to curb such impacts.

QUESTION: Elias Chitambala- Concerning employment, consider employing workers from the local community.

RESPONSE: Moses- Usually contractors are not allowed to bring workforce outside the project areas unless if there is any skill that cannot be obtained within the project area. But contractors face a few challenges. Is it true that when workers get paid, they run away from work? The contract has a time frame in which to complete all construction works and so in order for him to finish his works on time, sometimes he opts to employ people who are far away from families. However, this should not be the case and it is a complete wrong approach although he justifies his actions. During the next phase, we shall engage various stakeholders to make sure we come up with right recommendations on how issues of employment should be handled on this project so that the local people benefit from the project.

QUESTION: Peter Zulu- I am not clear on the issue of the road reserve. Is it implemented already or is it just at RDA? I would want to concentrate on the road reserve.

RESPONSE: Moses- This is law, ignorance is not a defence. It is part of the laws of the country as contained in the Public Roads Act. However, RDA is aware that is has not been sensitising community members on the Public Roads Act and therefore majority of people in this country are not aware of these requirement. The law has not just been enforced. It is law and if RDA decides to compensate, the agency is just put on a human face. The Mpika to Chinsali road is a trunk road and needs a road reserve of 100m, although there is always a compromise in built up areas and the road reserve for district roads which is 36m is used. A project has to be sustainable and compensation has to be avoided at all costs. We will take note of issues arising from this project and make necessary recommendations.

QUESTION: Maxwell Mwelwa- I would like to find out what the current position is on the 20% which is supposed to be allocated to local contractors.

RESPONSE: Moses- On the allocation of 20% to local contractors, this is also law. What is difficult for local contractors who might be based along this project road corridor is to meet the requirement of procurement system because all sorts of documents are needed from the contractor and some of them may not have them. During the detailed studies, we shall plan to meet local contractors to understand some of the challenges they might have and what how the project can help.

QUESTION: Mufakela Kayonde- Rates that contractors give to sub-contractors are so ridiculously low. Is there a standard reasonable rate that should be allocated to sub- contractors? We need to build the capacity of local contractors so that they can grow and develop. Asphalt works were sub-contractors and now they are main contractors.
RESPONSE: Moses- I may not be in a position to answer that, but we have taken note.

COMMENT: Mufakela Kayonde- On the issue of the road reserve, we need to get involved as a community. The road will be property that will belong to everyone and we shall all benefit from it. If people are given a chance they would even build all the way up to the road. The roads are now congested, but we had enough space a few years ago. The local authority has given away all the land including the land falling in the road reserve. As a community, we should work with RDA who is trying to preserve the road reserve.

MINUTES OF THE SCOPING MEETING FOR THE MPIKA CHINSALI ROAD

Date: 04/03/2016

Venue: Shiwang'andu Boma

Time: 15:21 hours

The meeting was chaired by the District Commissioner. He opened the meeting at 15:25 hours with the singing of the national anthem and a prayer from Mr. Mwewa.

In his opening remarks, the District Commissioner invited the people in attendance to be attentive and contribute their views in a free manner. This meeting is an extra ordinary one in that it was not going to be a formal one. People are encouraged to express themselves in any language they are comfortable with. This is because your views will be recorded and form part of the terms of the contract to be signed between the government and the road contractor. The chair emphasized the need for all heads of departments to attend these meetings so that they are aware of what is going on in their locality.

It is at this point that he noticed the absence of the director of works for Shiwanga'ndu council. The chair expressed concern at this as the issues to be discussed in the meeting were more to do with his work. The chair then called the people to introduce themselves.

After the introductions, the chair thanked the people for making themselves available for the meeting. He explained that we are here because of the development agenda of the government which is infrastructure development. This meeting is about the rehabilitation of the road from Mpika to Chinsali. He reminded the people that the road was an old one whose culverts have either been stolen or rotten. The government has committed itself to rehabilitating this road.

This meeting has been called so that government can hear your views on the same project as regard the manner in which the works should be done. This has been done because we do not want people to raise issues after the works have already started. We want you to raise these issues now so that they can be ironed out before the contractor comes on site. Therefore people should feel free to express themselves in any language they feel like. The language is not important here but your views. So feel free.

The chair then asked Moses Chamfya who was the lead consultant, to take the people through the project before people could express their views.

Moses started his remarks by thanking the people for availing themselves for this consultative meeting. He explained that it was important for government to implement a project which people will find useful. This can only happen if we are able to share experiences and concerns as regards road rehabilitation and design.

May I also take this opportunity to thank the District Commissioner for helping us organize these meetings.

Moses explained that the Government initiated the periodic maintenance of the road in 2013, prior to which RDA used to carry out some periodic maintenance which included patching up potholes along the road. The government realized that a lot of money was being spent on periodic maintenance and decided to carry out a full rehabilitation. He stated that the consultants Typsa and ASCO conducted the designs in 2012 taking into consideration that the works will be a full rehabilitation of the road.

In 2012, Typsa in association with ASCO had conducted an Environmental Impact Assessment (EIA) for the proposed rehabilitation of the Mpika to Chinsali road and the Environmental Impact Statement (EIS) was submitted to ZEMA and consequently approved in 2013.

Moses explained that since then the Government of the Republic of Zambia (GRZ) has been discussing the Project with a range of prospective lenders and specifically the European Investment Bank (EIB).

He further explained that the EIB operate strict procedures for environmental and social due diligence which require the detailed stakeholder engagement and consultation with various affected groups including vulnerable groups and the preparation and public disclosure of an Environmental and Social Impact Study (ESIS) Report and an accompanying Environmental and Social Management Plans (ESMP), prior to the decision to approve finance for the project. The requirement for this ESIA process has thus arisen as a result of GRZ seeking finance from EIB to support the development of the Project.

Moses explained that RDA is looking at adopting three different road reserves for different road sections as follows:

- Adoption of a 100m road reserve (i.e. 50 on either side of the road from the existing centerline) for the rural sections of the road;
- Adoption of a 60m road reserve (i.e. 30 on either side of the road from the existing centerline) for the rural sections of the road; and
- Adoption of a 36m road reserve (i.e. 18 on either side of the road from the existing centerline) for the heavily settled and urban sections of the road such as *Mpika urban area, Kalalantenkwe (Shiwang'andu BOMA) and Mucheleka (or Chinsali turnoff area).*

He emphasized that it is obvious that adoption of these road dimensions has serious implications on private properties and assets and would require the preparation of a full Resettlement Action Plan (RAP).

Moses explained that the meeting has been called for in view of the foregoing but also taking into consideration the EIBs environmental and social principles and standards, which were not part of the guidelines followed in 2012.

He explained that Bicon Zambia Ltd has been commissioned by the Road Development Agency (RDA) to update the (i) the Environmental Impact Assessment (EIA) to an Environmental and Social Impact Assessment (ESIA); (ii) the Environmental Management Plan (EMP) to an Environmental and Social Management Plan (ESMP); and preparation of (iii) a census and socio-economic baseline survey and (iv) a Resettlement Action Plan (RAP) for the Rehabilitation of 161.5Km of the Mpika Chinsali Road (T2) in Muchinga Province.

Moses stated that the Environmental Management Act of 2011 was the supreme environmental Act in Zambia. He went on to explain the guidelines being followed in the preparation of the Environmental and Social Impact Statement (ESIA) process, these included the following stages:

- Screening process-first step in the ESIA process
- Scoping exercise with full stakeholder participation & development of TOR-second stage
- Baseline studies and preparation of ESIS-third stage
- Disclosure of ESIA findings-fourth stage
- Approval by ZEMA-fifth & final stage

Moses went on to explain the purpose of the scoping meeting which included the following:

- Requirement in terms of the National Environmental Management Act of 2011

- Provides every person with an opportunity to be involved
- In best interest of all concerned because:
  - ✓ Provide opportunities for IAPs and authorities to voice their concerns
  - ✓ Provide IAPs with the opportunity to make suggestions
  - ✓ Enables RDA to incorporate needs, preferences and values of IAPs into its decision and designs
  - ✓ Vital for ensuring transparency and accountability in decision-making.

Moses further stated that the ESIA team is composed of the following:

- EIA specialist/ team leader
- Socio-economist
- Health and Safety Expert
- Real estate specialist
- Any other specialization that shall be deemed necessary.

Moses stated that the Mpika to Chinsali road was a trunk road and according to the Roads Act required a road reserve of 100m, 50m on each side of the road from the centerline. Moses explained that all structures found within the road reserve will be compensated when government decides to use this space. However, he stated that the contractor might not use up the entire road reserve for road works.

Moses stated that the objective of the project was to carry out necessary consultation and supervision with the view of constructing a road that will last for 20 years with routine maintenance before reconstruction. He gave the current condition of the road from visual observation as follows:

- 6.1m carriage way
- 1.5m wide unsealed shoulders
- Some sections have a carriage way ranging from 5.8m to 6.1m
- Edge breaks and potholes are common
- Double bituminous surface dressing
- Some sections contain 150mm stabilized cement
- Fair to poor and narrow general condition of the road

Moses explained that the current pavement design was going to have the carriage way widened to 7m from the original 6.1m and 2m sealed shoulders. He stated that the entire road will be ripped off and the material will be used to burry existing drainages to create shoulders for the new carriage way, this will be helpful in terms of environmental management.

Moses stated that the contractor will be expected to observe the following:

Temporary traffic diversion

Temporary traffic diversions shall use the shortest possible route to rejoin the main T2road, in case of a single lane detour, the lengths of the detour shall allow traffic travelling in opposite directions to pass at frequent intervals.

The contractor shall be responsible for safely maintaining and directing traffic through or around any part of the works, with the maximum practical convenience, for the full twenty-four (24) hours of each day.

Access to properties

where closure of such accesses is unavoidable, the contractor shall give sufficient notice, at least ten (10) days, to the occupiers of the affected properties so that inconvenience is minimized-maximum 2days of closure.

Clearing & grubbing

- Clearing & grubbing shall consist of ripping of the existing pavement, demolishing, breaking up and removal of all trees, tree stumps, brush, other vegetation, rubbish of any nature, buildings, structures
- Areas to be affected will be portions of the site falling within the limits of the width of the road prism, as well as areas of certain material sources
- The engineer shall designate the areas to be cleared and such areas shall not necessarily be limited to those afore-mentioned
- Unless specifically required on the drawings or instructed by the engineer, clearing, grubbing and demolition/dismantling works will not be permitted in areas outside the limits of the width of the road.

Maintenance during construction

- The contractor will at all times keep the sites including storage areas, free from accumulation of waste materials
- Servicing of plant, equipment and vehicles shall be carried out at a workshop area to contain any spillages
- All waste water and sewage shall be piped to soak pits/septic tanks or other disposal areas constructed in accordance with local regulations
- Contractor shall obtain a permit or other appropriate documentation approving the disposal methods being used

Engagement of staff and labour

- Contractor is encouraged to employ staff and labour with appropriate qualifications and experience from sources within the project road corridor

Wages and conditions of labour

- Contractor shall pay rates of wages, and observe conditions of labour as established by GRZ and especially for the road sector.

Working hours

- No work shall be carried out on site on locally recognized days of rest, or outside the normal working hours, unless:
- The work is unavoidable, or necessary for the protection of life or property or for the safety of the works, in which case the contractor shall immediately advise the engineer.

STI/STD AND HIV/AIDS Programme

- Contractor shall plan and implement government's strategy of STI/STD AND HIV/AIDS alleviation measures
- Contractor shall work in close liaison with the ministry of health (MOH) and experienced NGOS/CBOS
- The contractor shall conduct monthly IEC campaigns which shall include:
- At a minimum the provision of a one hour lesson/lecture to the specified recipients once every week provision of pamphlets/flyers (A4 paper size printed on both sides) describing and sketching the topics of the lessons/lectures, and provision of 10 A1 paper size campaign boards of weatherproof construction with approved inscription and sketches
- The contents of the lessons/lectures, pamphlets/flyers, campaign boards and location for display shall be agreed with the MOH/authorities/engineer/NGOS/CBOS.

Health and Safety

- The contractor shall at all times take all reasonable precautions to maintain the health and safety of the his personnel
- Contractor shall ensure that medical staff, first aid facilities, sick bay and ambulance service are available at all times at the site and suitable arrangements are made for all necessary welfare and hygiene requirements and for the prevention of epidemics
- Contractor shall appoint an accident prevention officer at the site, responsible for maintaining safety and protection against accidents.

Land take and resettlement
As mentioned earlier, desirable road reserve width applicable for a class T road is 100m resettlement impacts are therefore expected from the project if these road dimensions are adopted.

Moses thanked the stakeholders for attending the meeting and stated that in a nut shell the above mentioned were the issues the consultant felt might arise as the project was being implemented. He urged the stakeholders to feel free and share their views; concerns or recommendation which they felt should be considered during project implementation.

DISCUSSION

Question
Mr. Musonda Alberta -I'm very happy with the Bottom up approach being employed in this project because it brings about true development. Projects that ignore the views of the people make a lot of mistakes and makes it difficult for the people to own the project. For example, sometime back a project called D- WASHE went into the community and drilled boreholes in an area where victims of cholera where buried. If they had consulted like you have done all this could not have happened. We might not live near the said road but I think we are also better placed to give views on the construction.

Response
Moses
Thank you very much for your comment on the bottom up approach. Indeed it is important to involve the people and this is the very reason as to why we are here today. I must mention here that this is not the end of this process of consultation but will be on going until the project is successfully completed. As I mentioned earlier we still have several more steps to that needs your participation and we would be more than grateful if you will be willing to participate in more of such consultation.

Question
Mr. Samuel Mwenya
I am concerned about the life span of the road. Why are you giving us a road with a short life span? Is it because of lack of resources or what? Secondly, I want the consultant to say something about the materials for road marking because they were not mentioned.

Response
Moses
Mr. Mwenya, it is standard practice that after 20 years a road will need rehabilitation. It is also prudent to construct a road to last within predictable future. This allows for any changes to the road that may arise as a result of unforeseeable changes such as weather. In terms of markings, yes they will be there as part of the general safety features. At some later stage when we shall be doing a disclosure, I hope you be able to attend because then more details of the designs will be made known but you can be assured that the road will be designed to international standards and such road features such as road marking are part of the road designs and implementation.

Question
Mr. Martin Kaoma
Coming from the hospital my concern is that the design of the road especially the corners which are a danger to the travelling public must be looked at.

Response
Moses
I agree with you Mr. Kaoma. The design has included features such as widening of the carriageway and provision sealed shoulders to make the road as wide as possible. The designs have also included improvement to the climbing lines and to ensure that the dangerous spots are dealt with in the contract. Curves will be widened and the community is encouraged to come forward and give their suggestions on such spots.

Question
Pride Bwalya
What will happen to the structure within the road reserve?

Response
Moses
Thank you Mr. Bwalya. Government through RDA will compensate the people affected. Enough notice will be given to those affected in order for them to replace their lost properties. In the next few weeks, our team of experts will be going along the road reserve to document all the assets and properties affected and our real estate expert will value all the properties at replacement value. The whole exercise will be very consultative and will involve everyone who is affected and those with interest in the project including community leaders and community organizations.

We are not expecting that people we be resettled in other villages but money will be given to those affected to move away from the road threshold. This also applies to traditional wells and fruits. Real Estate property evaluators will come to give the true value of the properties. As mentioned earlier, more detailed consultation on the compensation procedures will be conducted.

Question
Mwape Henry
What will happen to the ditches that remain after collection of gravel. I am asking because these when they remain, they do affect wild animal such as crocodile which come to live there.

Response
Moses
Environmental damage in such projects is commonplace. This is despite the fact that there is always money put aside for the rehabilitation of such places. What is lacking is supervision on the part of both the community and other relevant authorities to ensure that all burrow areas are rehabilitated to their original state. On top of that, the contractor is expected to pay for the materials they sourced from your land. As mentioned earlier, the team of experts will be engaging various stakeholders in the next phase in order to come up with measures that can help to resolve these issues so that the current project can be done in a sustainable way.

Question
Mr. Mutati Chola
My appeal is that please when the construction begins; make sure you employ local people and not foreigners.

Response
Moses

Mr. Chola, it is expected that about 300 direct general workers will be employed and that 50 others with qualifications will be employed. The contractor is always required by law to employ people within the project area. There are certain jobs that are reserved for women such as flagging. Gender considerations will also be factored in the contract for the contractor. We shall be coming back to you again to find out more about how this can be done so that the project benefits the local people and women in particular.

Question
Jason Mpundu
I am concerned with contractors who run away without paying dues for the workers. Assure us that you are not going to bring such a contractor.

Response
Moses
We hope and trust that such a thing will not happen in this project and I tend to think that a project of this magnitude would not have a contractor who can run away. However, we have taken that concern and we shall include it the recommendation so that the project get quality contractors who can work to the satisfaction of all parties involved including you as community members.

Question
Mambwe Peggy-The problem is that contractors come into the district without paying courtesy call on the DC with the terms of reference of the contract to enable the DC Supervise them.

On the road reserve encroachment let the contractor put bicons to show that the road reserves end here in the manner that TAZARA Pipeline has done it. I have also noticed that when the markings are put on the road, within a short period of time they fade why not use marble reflectors like the ones on Kafue road? The other thing is that in order to ensure gender equality, why not put a sealing of say 30% as female workers?

Response
Moses
We shall take all your concerns as proposals and investigate them in more details through consultation with various stakeholders so that they can be included in the ESMP and finally in the works contract.

Question
Gibson Kabaso
I want the contractor to know that when they fail to employ or pay people, the people go to the chiefs to complain. This to me is being unfair on the chief who is not part oft the administration of those companies.

Response
Moses
The issue of employment is a very complex one and I will therefore throw it back to the community to suggest ways in which they can be better handled.

Suggestions
Mr. Mukosha
The contractor knows the number of people to employ so its better to let them handle the issues.

Mr. Chimpampe
The best is to ensure that the contractors pay a courtesy call on the DC so that they are aware of what is taking place.

Fred Milambo

The contractors should stop coming with their own foremen. These are the causes of corruption and people going to get recommendations from the chief for employment.

Question

Mr. Mukosha

How are we going to ensure that employment opportunity is spread throughout the road corridor because if the contractor starts from Mpika, then it will be those in Mpika who will get the chance of being employed and if its starts from Shiwang'andu, then its her where people will be employed.

Response

Moses

That has been noted and will be taken as a proposal for further considerations through consultations so that the project gives fair opportunity for people to benefit from road rehabilitation.

There being no other business, the meeting came to a close at 11:35, with a prayer.

MINUTES OF THE SCOPING MEETING FOR THE MPIKA CHINSALI ROAD

Venue: Boma Conference Hall (Chinsali)

Date: 17/03/2016

Time: 10:55 hours

The meeting was chaired by the District Commissioner. He opened the meeting at 11:00 hours with the singing of the national anthem and a prayer from Mr. Mwewa.

In his opening remarks, the District Commissioner invited the people in attendance to be attentive and contribute their views in a free manner. This meeting is an extra ordinary one in that it was not going to be a formal one. People are encouraged to express themselves in any language they are comfortable with. This is because your views will be recorded and form part of the terms of the contract to be signed between the government and the road contractor. The chair emphasized the need for all heads of departments to attend these meetings so that they are aware of what is going on in their locality.

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DISCUSSION
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COMMENT: DC - That was a briefing from our consultant. When we received communication from the consultant, we thought of identifying stakeholders who can raise issues concerning this road. The works cannot start because some issues concerning this road need to be brought to their attention, and if possible incorporated in the designs. If there is resistance, the project will not take off. That is why we are having this consultation meeting so that we can make a way forward for this project. We are going to be taking three questions, raise your hand, when pointed at state your name and ask your question or give your comment.

OPEN SESSION
QUESTION:
Kamalondo Jean-
I just wanted to find out from the consultant what the thickness of this road will be?

QUESTION:
Mwape Mutati
Concerning the completion of the project, how long will it take, what is the life span of the road and will the contractors be able to show us as stakeholders how this road will be constructed?

QUESTION:
Charles Simwanza
Concerning matters of dust suppression, is it possible to sub contract a company dealing with dust suppression? When the Chipata Chadiza road was under construction, the contractor was buying gravel from the local people, is there a provision for buying gravel under this contract?

Responses
Moses
The road is designed to last for 20 years with periodic maintenance. After 20 years a decision will be made whether reconstruction will be needed or not. Concerning the construction period, the road has been divided into 2 lots with Lot I being from Mpika to Shiwang'andu and Lot II from Shiwang'andu to Chinsali turnoff.

All things being equal, construction is expected to take a maximum of 3 years depending on the flow of funds.

COMMENT: Charles Sinwawa- There is money allocated for dust suppression, but sub-contracting a local contractor to do that is not a bad idea.

RESPONSE: Moses- Money allocated for such activities is included in the proposal submitted to RDA. If materials are being extracted from someone's land, by law compensation is to be made to the parties involved with approval from the resident engineer and RDA. If the contractor demolishes any property without approval from the resident engineer and RDA, he will bear the cost of compensation. If the contractor will open up new borrow pits, he will have to prepare separate Environmental Project Briefs and submit them to ZEMA.

QUESTION: Lewis Miyanda- When will the designs for the 10km stretches be complete? Are we assured that when the designs are done works will begin?

COMMENT: Mufalo Kabika- I want to differ with the consultant on the issue of thickness of the road. Zambia is a signatory to SATCC and there is always a range for riding bases. Our interest as North Western Water is at the Chinsali Bridge where we have a big pipeline. The Roads Act gives the distance from the centerline of the road to where infrastructure should be, therefore, there is serious need for consultations with utility companies to decide on a specific cost for relocation of these lines, and this is the right time to ask. You said a stretch of 10km will be completed before the rainy season. It is fair for us to know what will be happening during the rainy season. This is a critical road. Specify to the contractor the kind of works that can be carried out during the rainy season because we have waited for a very long time for this road.

QUESTION: Justine Samanana- I do not know whether this Mpika to Chinsali road is becoming highly technical or highly political. We witnessed a launch and we thought all was put in place for the road. We are now hearing these constraints. Does the president know about this? If 3 groups will cover 30km of the 166km, that means that in two years, 0nly 60km of the road will be completed. We want all road works to be complete in 3 years, from the look of things construction of this road might take more than 3 years. This road is very important to us, and the president said it will have a thickness of 50mm. If that is the thickness you agreed upon, tell us, are you implying that the information at hand is not enough? I am failing to understand why we have 3 contractors and 2 portions of the road will be worked on by the same contractor.

RESPONSE: Moses- The people in charge of the designs would have received the designs for the first 10km of each road in 3 weeks' time. In the meantime, the contractors need to carryout preparatory works, they need to rip the road and make alternative routes in readiness for these works. Buildcon has already started making deviations, but China Geo is facing a few challenges in terms of making these preparations. The contractor will not sit idle, but will be carrying out other works. All the 3 contractors have already started works. Whether the road is too political or technical I might not be able to answer that question. Maybe RDA can be in a better position to answer. What is important to us is that the works have begun. Technical information is not yet ready, but it will be ready in the next few weeks. Works have already started but they are in the preparatory stage. The 2 contractors working on the first and last sections of the road have the same name but they are two different contractors working under one manager.

COMMENT: Mr. Chipawa-Why are you worried? The President launched this project. It is now up to the implementers to implement the project. The contractor is already on site and money for the project is there, we should not worry about the road not being constructed. This is the same consultant for the Chinsali to Kipushi road, so the consultant and the contractor are both on site. The contractor cannot start work until the consultant engages the people, and that is why we are having these consultative meetings. Let us not fear the consultant, but let us give him advice.

QUESTION: Concerning mobility and labour migration, I would like to find out how much is available for HIV/AIDS prevention for lots 1, 2 and 3. I would also like to find out the scope that had been proposed for HIV/AIDS.

QUESTION: Daudy Mukwemba- Road have classes, what class of road are we going to have and what type of road are we going to have?

QUESTION: Eddie Jibusha- Bridges are not going to be reconstructed, some bridges are rough. Are you going to make the bridges smooth or you will leave them without maintenance?

QUESTION: Dunstan Sawomba-Is the Mpika to Chinsali road going to be chip and spray or will it be a smooth road?

RESPONSE: Moses- In terms of how much will be allocated to HIV/AIDS, the amount has not yet been decided, but it will be done in the next few weeks and we will be visiting your office for advice. There has been a cry from the National AIDS Council (NAC) that contractors do not do much when it comes to issues of sensitization on HIV/AIDS because NAC has functional and effective structures which are used along the road. There has been a request for the contractor to sub contract NGOs for sensitization. That is the switch from the usual practice. The NGOs submit their proposals to RDA and that is where they get funding from. This road will be a class A bituminous road. It will not be chip and spray.

RESPONSE: Manda Ndabane (RDA) - Inyati is conducting periodic maintenance on some roads in Chinsali. The bases of the roads are not being tempered with, hence the rough surface that you are seeing which is chip and spray. For the Chinsali- Mpika road, a full rehabilitation is being carried out and the riding surface will be smooth.

RESPONSE: Moses- The Mpika- Chinsali road will be made strong enough to accommodate the kind of traffic on the road, and it will be made strong enough to last for 20 years. The road will be a smooth road. The engineers and RDA will be on site to ensure that all procedures are followed and a road of good quality is constructed. The bridges will be maintained and extended to accommodate a dual carriage way. Everything will be maintained to class A standard.

COMMENT: Arnold Malambo- We have so many roads that have been constructed such as Zimba road, Ndola –Kitwe dual carriage way and Kitwe- Mpika dual carriage way. When these roads are of poor quality, we put the blame on the engineers and the consultants. Kitwe – Ndola dual carriage way is in bad state. It has potholes and rutting in some parts. What considerations have you put in place to ensure that a road of high standard is constructed?

COMMENT: Charles Sinwawa- As you design the road furniture that is the white lines and centerlines, please make provision for metallic pegs and stop attacking our forests.

RESPONSE: Moses- Water affairs is one of the service providers we will engage. Nothing will happen to the water points located at the bridge, if anything happens to them, RDA will bear the cost. Bus bays will be constructed on the road, these will include separate parking areas for heavy trucks and these will have different designs. The issue concerning rutting, we will take that as a recommendation. In addition, some sections of the road will be made of concrete to prevent rutting. Concerning the road furniture, the Northwestern Rail line is not crossing the road anywhere, it is only crossing Mushishima stream into Kansanshi. Thank you.

Concerning the road furniture, we cannot compromise on that, but these things will be emphasized in the designs. The issue of using steel pegs, we have taken note and will advise the contractor accordingly.

QUESTION: Miyanda – My concern is on the cost of rehabilitation of the road and the Bill of Quantities on HIV/AIDS, it that ready? If the designs are based on what is available are we not going to have a bad road. This new contractor Buildcon, have you had an opportunity to see the kind of work they can do?

RESPONSE: Manda Ndabane (RDA) - Buildcon was constructing a road in Monze. We advertise all the work that the government has, and if a contractor meets the criteria, they are given the job. This is the same process that made Biuldcom win the tender.

QUESTION: Miyanda- How do you rate Buildcon because he does not have machinery?

RESPONSE: Manda Ndabane (RDA) – He has machinery, you can even see it by the roadside.

COMMENT: Moses- Buildcon is a Zambian firm. If he fails to perform it will be unfortunate. We need to support local contractors so that money remains in the country. As an individual, I am happy that a local contractor was awarded a contract.

COMMENT: Mr. Chipawa (DAO) - Buildcon has a very good workforce, and we are assured that he is going to do the work and understands the road. We need local contractors to be supplying materials, and we need to be engaging them.

COMMENT: Mufalo Kabika- I would like to comment on road failures. Even a good road can fail, there is therefore need to engage the people. Even a fuel leak can make the road fail, sometimes due to lack of better utilization of the road. Oil reacts with the riding surface and a pothole develops.

QUESTION: Justine Samanana- Is there a deliberate policy for locals to be awarded contracts?

RESPONSE: Manda Ndabane (RDA) - we always urge local contractors to push in their profiles so that they can be considered for projects. Local contractors need to submit their profiles for them to be considered for a project. Concerning the BOQ, there is a design review going on. There is money allocated for HIV/ AIDS awareness, however the amount is not known and it will be subjected to review after this meeting.

QUESTION: Miyanda –If the money is there, what criterion was being used to arrive at the amount set aside for HIV/AIDS issues.

RESPONSE: Manda Ndabane(RDA) - I would not know how the amount was arrived at, but it was not imposed.

RESPONSE: Mufalo Kabika- There are experts in these institutions, they are the ones who come up with such costs. RDA has experts on HIV/AIDS and those are the ones who give guidance in this process.

COMMENT: Miyanda – We must take these issues seriously, I must be proud to tell someone how I came up with a figure for HIV/AIDS. We have online reports and systems, we should be able to question the processes being used in coming up with the amount allocated for HIV/AIDS sensitization.

QUESTION: Moses- Are there any companies that are moving hazardous materials on this road?

RESPONSE: Yes, Kilobo Investments somewhere near Mushitala and Kansanshi.

RESPONSE: Arnold Malambo- Get in touch with us, we will be in a position to give you more information on that.

There was confirmation from RDA that finances for the road project will be made available. The signing of the contract and mobilization of the contractor on site confirmed that the works had commenced.

Sadius Siamujembo

My concern is on the term design and redesign. Design is for a new road and redesign is for an old one. What exactly are you going to do to the road? The other one is that please do not listen to laymen about which bridge to demolish and which one not to demolish. Instead you people should do your own assessment and make a decision. And are you going to compensate structures demolishe along the road?

Response

Moses

Compensation will definitely be there and it is our job to determine the amount to be given after doing some assessments. A real estate expert will visit the whole stretch of the road and ad add a 15% inconvenience allowance for the people affected. Government would rather spend money now than wait after more people have encroached on to the road reserve. Government will not compensate land not on title. The other thing is that after determining the number of people to be compensated, there all those who will build after the cut off date will not be compensated.

Question

Samson Chizebuka

When are the works starting?

Response

Moses

On exactly when the works will start I may not be able to say. This is because the process has just started and after we present our report, government will now find a contractor for the project. So you see its not possible for us to give a date but just to say soon.

Question

Headman Sikalongo

I want the government to employ a very good contractor like grenaker because most of the contractors just smear the road with bitumen and go.

Response

We will take that as a recommendation. But maybe you just need to understand that the works involve making a new road and not maintenance.

Question

Justine Manjimela

You are talking about Batoka to Maamba at the hospital. Now who will take care of the remain9ng stretch?

Response

Dodo Sindaza

We seem to have a case of misinformation which I want the consultant to correct. The road ends at the gate of Maamba colliaries and not the gate of the hospital. So please correct your information.

Moses

We will make sure that this is corrected thank you.

Question

Are you going to take issues of environmental protection into account?

Response

All issues concerning the community will be taken into account including environmental issues. The contractor is required by law to rehabilitate all bore pits they excavate gravel from. Any materials they get from your land they must pay for it because the contractor is paid money for such. The contractor can only manage not to do a good job if they are in league with the resident engineer.

There being no other business, the meeting came to a close at 12:54 hours.

13.4. APPENDIX 3: LIST OF STAKEHOLDERS PRESENT DURING THE STAKEHOLDER CONSULTATION

ATTENDANCE LIST

THE REPUBLIC OF ZAMBIA

Consulting Services for the Update of (i) the Environmental Impact Assessment (EIA) to an Environmental and Social Impact Assessment (ESIA); (ii) the Environmental Management Plan (EMP) to an Environmental and Social Management Plan (ESMP); and preparation of (iii) a census and socio-economic baseline survey and (iv) a Resettlement Action Plan (RAP) for the Rehabilitation of 161.5Km of the Mpika Chinsali Road (T2) in Muchinga Province

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STAKEHOLDER CONSULTATION & PUBLIC MEETINGS

MPIKA

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LWANYA COMMUNITY MEETING

STAKEHOLDER CONSULTATION & PUBLIC MEETINGS

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STAKEHOLDER CONSULTATION & PUBLIC MEETINGS

ATTENDANCE LIST

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05/03/16
LWANYA
COMMUNITY
MEETING

STAKEHOLDER CONSULTATION & PUBLIC MEETINGS

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CHINSALI
TURN OFF

STAKEHOLDER CONSULTATION & PUBLIC MEETINGS

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MATUMBO

STAKEHOLDER CONSULTATION & PUBLIC MEETINGS

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MULENGA KASTONE	MATUMBO	0968141729	[signature]
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13.5. APPENDIX 4: PHOTOGRAPHS TAKEN DURING STAKEHOLDER CONSUTLATION

Stakeholder consultation meeting held with members of the Mpika DDCC at Mpika District Council Chamber

Stakeholder consultation meeting held with members of the DDCC at Shiwang'andu Boma Hall

Stakeholder consultation meeting held with members of the Chinsali DDCC at Chinsali Boma Hall

Stakeholder consultation Meeting Held at Mukungwa Primary School in Mpika District

Stakeholder consultation meeting held at Lwanya Primary School in Shiwnga'ndu District

Stakeholder consultation meeting held at Kalalatankwe Market in Shiwnga'ndu District

Stakeholder consultation meeting meeting held at Mucheleka (Chinsali turn off) in Chinsali

Stakeholder consultation meeting held at Matumbo Market Area in Shiwang'andu District