



**3<sup>rd</sup> Draft ENVIRONMENTAL IMPACT STATEMENT  
FOR THE PROPOSED REHABILITATION AND UPGRADE OF A 33/11KV  
SUBSTATION AND CONSTRUCTION OF A 66/11KV SUBSTATION, 66KV,  
33KV, 11KV AND 0.4KV LINES UNDER THE SUSTAINABLE ELECTRICITY  
SUPPLY SOUTHERN DIVISION PROJECT, SOUTHERN PROVINCE**

**LIVINGSTONE AND KAZUNGULA PROJECT COMPONENTS**



Prepared by:

ZESCO LIMITED

AND

SWECO INTERNATIONAL AB

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## **AUTHORS OF THE ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT**

This Environment Impact Statement (EIS) was prepared by the ZESCO Environmental Sustainability Department Social Unit and Sweco International consultants.

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## **EXECUTIVE SUMMARY**

ZESCO Limited is a vertically integrated electricity parastatal registered under the Companies Act. ZESCO was established in 1970 and is wholly owned by the Government of the Republic of Zambia (GRZ). However, ZESCO operates as an autonomous entity that is monitored by the Government, through the Board of Directors, to ensure that performance benchmarks are met. The Company is mandated to Generate, Transmit and Distribute electricity throughout Zambia.

Development cannot be sustained without energy, and electricity is one of its key forms. Limited access to modern, clean and affordable energy services is an important contributor to the poverty levels in Zambia particularly in rural areas. Access to modern forms of energy is cardinal to fighting poverty, promote economic growth and employment opportunities, support the provision of social services, and in general promote sustainable human development. It is for this reason; therefore, that enhancing energy service delivery for poverty alleviation and sustainable development is one of GRZ's highest priorities in infrastructure development.

The development of a sustainable, long-term solution to meeting the ever-increasing demand for electricity services is a defining issue of our time in Zambia and indeed worldwide. Energy is directly linked with key national and global challenges being faced such as poverty alleviation, climate change, environmental degradation and food security. It is against this background that energy today is at the core of every economic, environmental, and developmental issue. Zambia, like any country in the world, needs sufficient clean and reliable energy services to meet its long-term needs for growth and development. It needs to expand access to reliable and modern energy services and increase productivity to enhance competitiveness and economic growth.

Livingstone and Kazungula districts have in the recent past experienced increasing economic growth and power demand. However, the current electrical infrastructure cannot meet the increased demand. Therefore, the proposed reinforcement and rehabilitation of the electrical infrastructure is necessary.

### **Description of the Project**

The Project will involve the following:

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3<sup>rd</sup> draft Environmental Impact Statement for the proposed rehabilitation and upgrade of a 33/11kv substation and construction of a 66/11kv substation, 66kv, 33kv, 11kv and 0.4kv lines under the Sustainable Electricity Supply Southern Division project, Southern Province. Livingstone and Kazungula project components.

## **Livingstone West 66/11 kV Substation**

- Construction of new Livingstone West 66/11 kV substation near Mwandia Township in the western area of Livingstone to be fed at 66 kV from Lusaka Road – Kazungula 66 kV line and Linda substation
- Construction of 1 x 9.3km of single circuit 66kv from existing Linda substation to the proposed Livingstone West substation.
- Construction of 1 x 13 km of double circuit 66 kV line from Livingstone West substation to link into the Lusaka Road – Kazungula 66 kV line
- Construction of 7.3 km of 11 kV lines to join into existing network

## **Sun Hotels 33/11 kV substation**

### Upgrade and Rehabilitation of Sun Hotels 33/11 kV Substation

- Installation of new 33 kV switchgear and 11 kV board
- Construction of 0.4 km of 33 kV line to join into Victoria Falls – Linda line 1
- Connection of 1, 553 customers under the Access component

## **Project Objectives**

The main objectives of the project are to increase capacity, improve reliability and improved service delivery to ZESCO clients in Livingstone and Kazungula districts.

Other objectives:

- To describe existing baseline of the ecological characteristic, socio-economic aspects and the physical environment
- To identify major environmental and social impacts and to propose mitigation measures for negative impacts as well as enhancement measures for positive impact.
- To bring out key environmental management costs expected throughout the project life cycle.



## Project Location

The proposed project is located in Livingstone and Kazungula districts, with some activities in Kazungula District, Southern Province of Zambia. Table 1 below shows the coordinates for the existing Linda substation and proposed Livingstone west substation. Table two (2) on the other hand, shows the proposed transmission lines from Linda 66kV through the 66kV Livingstone West to Imushu.

Table 1: Coordinates for existing Linda and proposed Livingstone west substations

POINT ID	LATITUDE	LONGITUDE	REMARKS
L1	17°51'49.73"S	25°51'43.24"E	Linda substation
L2	17°51'49.89"S	25°51'47.90"E	Linda substation
L3	17°51'51.78"S	25°51'43.26"E	Linda substation
L4	17°51'52.07"S	25°51'47.71"E	Linda substation
A	17°51'9.27"S	25°48'34.38"E	Livingstone West substation
B	17°51'8.85"S	25°48'44.64"E	Livingstone West substation
C	17°51'11.25"S	25°48'44.52"E	Livingstone West substation
D	17°51'11.55"S	25°48'34.53"E	Livingstone West substation

Table 2: Coordinates for proposed Transmission lines

POINT ID	LATITUDE	LONGITUDE	REMARKS
Starting Point	17°51'52.41"S	25°51'45.26"E	66kV Linda – Livingstone West S/S
End point	17°51'11.65"S	25°48'33.14"E	66kV Linda – Livingstone West S/S
Starting Point	17°51'11.64"S	25°48'33.00"E	66kV Livingstone West-Imushu
End point	17°46'31.46"S	25°46'57.61"E	66kV Livingstone West - Imushu

## Investment Cost

To implement the project, a sum of Nine Million Seven Hundred Twenty Thousand United States Dollars (**USD 9,720,000.00**) has been allocated and is expected to be completed over a period of **24 months**.

## Project Alternatives Consideration

- **Product**

The main products from these sub-projects shall be as follows;

1. New 66/11 kV, 2 x 20MVA substation
2. Assorted 11 kV overhead lines (OHLs)
3. 0.5 km of 33 kV OHL



4. Rehabilitation/Conversion of an existing rural/outdoor type sun 33/11 kV, 2 x 10MVA substation into a fully-fledged indoor substation

The above components will then be linked into the existing Livingstone and Kazungula networks to enhance the flow of power in the districts. Additionally, a number of selected customers will be connected to the ZESCO power grid under the access/subsidy component on these sub-projects.

- **Project Need**

Network stability studies have shown very high voltage drops on the present 66kV,33kV, 11kV and 0.4kV line with presently planned expansion of customer base in Livingstone and Kazungula. In addition, this increases the redundancy and hence reliability of supply along the lines.

- **Site**

The proposed New 66/11 kV substation will be located on the western side of the town so as to form a ring with the other two main substations on the eastern side, i.e. Linda 33 (66)/ 11 kV and New Lusaka road 66/11 kV substation, engulfing the Town's load centre in order to provide for the firm capacity and enhancement of system availability, accessibility and, security and quality of supply.

The overhead lines follow the shortest possible routes and are positioned in such a way that they pose minimal interference with the built-up areas or need for demolition of structures or property and or relocation of people.

- **Design**

The design shall be according to the ZESCO and ERB design principles and should be sufficiently safe and be able to handle the load growth for some years into the future.

These sub-projects involve distribution and sub-transmission networks with nominal voltages ranging from 66 kV down to 0.4 kV and their associated apparatus/Equipment.

- **Technology**

Two technologies were considered, overhead lines and underground cables. In this case an over-head line (OHL) is preferable to underground and cables. The Overhead line is easy to maintain in case of fault compared to the under- cable. Further, the OHL is less costly than the underground



alternative. The preferred technology will be using overhead conductors on wooden poles. Under- ground cables are not a viable option for these lines, Except possibly for short segments in congested areas.

- **Raw materials**

The main construction materials on the project shall include but will not be limited to the following:

- All 11 and 33 kV OHL accessories
- All 66 and 132 kV OHL accessories
- Assorted cables
- Circuit breakers and Isolators
- Transformers
- Steel Monopoles
- 14, 12 and 10m Wooden poles
- Fencing wire for substation
- Steel nuts and bolts
- Concrete reinforcement
- Cement Blocks
- Clay bricks
- Aggregates

### **Option 1 (Preferred Alternative) Reinforcement of the Grid**

Since Livingstone town is already supplied by the existing network it will be easier and cost effective to extend and reinforce the grid hence this is an attractive option. The sub-project is intended to help ZESCO increase its power delivery capacity, stability of the network, reliability of supply and improve its service delivery towards agricultural, commercial, industrial, as well as household customers. There is also an access (last mile) component where 1, 533 customers in selected areas will get connected to the network at a subsidized rate.

This option has less adverse environmental and social impacts as the proposed requires less land use, less relocation of people's properties/structures and will use the footprint of the existing wayleave and substation site.

### **Option 2 – Solar Power**



The second option was to set-up solar power plant with associated transmission lines and substation, distant from the existing grid. However, the initial cost for solar systems is very high. In addition, this project would require large parcel of land, entailing clearing large tracts of vegetation. It would also result in significant displacement, loss of livelihoods and impact greatly on protected areas of cultural and heritage significance. Further, the lack of technical know-how in maintenance has rendered some of the few solar systems in most parts of the country inoperable.

### **Do-Nothing Option**

If this Alternative is selected, it will mean the proposed project not being implemented.

Therefore, electricity supply and the potential positive benefits of the project would be lost. Selection of this option would also result in the stagnation or cessation of many Government strategies and interventions that have been planned, especially those that are aimed at poverty reduction in the proposed Project and surrounding areas. Furthermore, the existing erratic power supply will continue.

### **Environmental and Social Impact Assessment**

It is a requirement in the Environmental Management Act (EMA) No.12 of 2011, read together with Section 3 (1) of Statutory Instrument No. 28 of 1997 of the above Act that "A developer shall not implement a project for which a project brief or environmental impact statement is required under these Regulations, unless the Project Brief or an Environmental Impact Statement has been concluded in accordance with these regulations and the Zambia Environmental Management Agency (ZEMA) has issued a Decision Letter". The project under consideration requires an Environmental Impact Statement (EIS). The project brief highlights the important environmental and social issues pertaining to the project and the mitigation and enhancement measures to be taken.

The present Environmental Impact Statement (EIS) provides the results of the Environmental and Social Impact Assessment detailed studies and consultations that have been carried out, including biomass and biodiversity studies, socio-economic baseline survey, and inventory of people and assets potentially affected by the project activities. The EIS is accompanied by two



additional, separate, documents, the Resettlement and Compensation Action Plan (RCAP), and the Stakeholder Engagement Plan (SEP).

The environmental and social assessment includes the following:

- Environmental and Social Impact Assessment
- Environmental and Social Management Plan
- Resettlement and Compensation Action Plan
- Stakeholder Engagement Plan

**Employment situation:** Only a quarter of the respondents had a formal employment, and the majority of those stating a specific employment were teachers. Table 26, shows the formal employments rates.

## Energy

### Energy appliances

The ownership of energy appliances ranged from more almost 80% (Improved mbaula<sup>1</sup> + charcoal stove), to zero for kerosene appliances. Air conditioning system and gas stove was barely used. The low percentage for wood stove, in spite of the relatively large number of users of wood for cooking is likely due to the use of a three-stone fire, which is not actually a stove.

The high prevalence of refrigerators and electric stoves is testimony to the relatively high standard of living among the sampled population.

### Development priorities

Respondents were asked to rank a number of possible priority development areas. There was also the possibility to add and rank their own ideas. The highest priority was to be given the value "1", the second highest "2" and so on. The most highly prioritized was employment, with water in second place.

## Legislation and Policy Framework

Major relevant Legislations and Policy Framework include:

A number of local and international environmental management and protection Acts and relevant to the implementation of the proposed project

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<sup>1</sup> The Improved mbaula is a charcoal stove, usually with



will be reviewed before project implementation. Some of these legislations include:

- The Water Supply and Sanitation Act No. 28 of 1997
- Local Government Act No.2 of 2019
- Worker Compensation Act No.10 of 1999
- Employment Code Act NO. 3 of 2019
- Gender Equity and Equality Act No.22 of 2015
- Forestry Act No.4 of 2015
- Land Act No.29 of 1995;20 of 1996
- Land Acquisition Act (Cap 189) of 1995
- National Heritage Conservation Commission Act No.13 of 1994
- Local Government Act No.2 of 2019
- Energy Regulation Act, No. 11 of 2019
- Electricity Act, No.11 of 2019
- Urban and Regional Planning Act, No. 3 of 2015
- Occupational Health and Safety Act No. 36 of 2010
- Zambia Wildlife Act No.14 of 2015
- National Council for Construction Act No.10, 2020

In addition to the national legislation, the project will be implemented in adherence to international environmental and social guidelines, including:

- World Bank Environmental and Social Framework (2018)
- IFC performance Standards (2012)
- KfW Sustainability Guidelines (2016)

Zambia is a signatory and a ratified party to a number of international conventions. The following are some of the conventions that relate to the proposed project:

- United Nations Framework Convention on Climate Change Ratified 1997 UN-FCCC
- Convention on International Trade in Endangered Species of Wild Fauna and Flora Ratified: 1975
- UN Convention on Biological Diversity (1992)
- Convention Concerning the Protection of Workers Against Occupational Hazards in the Working Environment Due to Air Pollution (1977;1980)



- Conversion on Control of Trans boundary Movements of Hazardous Wastes and their Disposal (1992).

## Major Potential Impact

The project will affect the general physical, biological and socio-economic environments in the immediate project area through the works associated with its implementation such as digging, excavations, movement of materials and other construction activities. The significant impacts of the project are entirely of a social nature, negative and positive. The identified significant environmental and social impacts anticipated are:

### Negative Impacts

- Soil contamination - Digging of foundations, soil contamination by oil and building materials;
- Air pollution - Emissions like dust and exhaust materials generated during the construction and operation phase;
- Water pollution - Spillages and leakages during construction and operation, and surface runoff; could potentially contaminate water.
- Noise pollution- Due to construction works and vehicle traffic movement
- Increased traffic- during construction
- Occupational/Community Health and Safety - Spread of communicable diseases and safety hazards.
- Dust pollution -The project area may experience increased dust levels during the dry from influx of vehicles bringing materials to site especially in the dry season;
- Disturbance to fauna and flora Loss - There will be also clearance of the vegetation in areas where new lines will be constructed;
- Population influx - A project of this magnitude has potential to influence influx of job seekers into the area;
- Stress on social amenities - Skilled workforce will come from outside the project area, hence, there would be stress created on the social amenities; and
- Public health and Safety risks
- Involuntary resettlement
- Loss of houses and other assets (access to farmland, trees, walls, wells etc.)



- Damage to land/Soil erosion – Digging of foundations, may as a result of land cover removal lead to the development of gullies and erode.
- Solid waste generation

### **Positive Impacts:**

- Improved quality and reliability of electricity supply in the project area
- Increased number of people connected to electricity, especially in peri-urban and rural communities
- Enhanced investment - The project may attract investments in various sectors of the economy in the area due to availability of reliable electric power.
- Improved local economy - The local economic activities maybe enhanced due to increased levels of income for the construction workers which will in turn encourage commerce;
- Employment creation- The project will create employment for the local community including casual labour opportunities during project implementation, and skilled labour force;
- Capacity building for the local community
- Increased public revenue
- Increased electricity capacity- The project once completed will provide much needed electricity to household consumers, small business, health and education facilities, all of which contribute to improved living conditions in the area;
- Creation of market for goods and services to local providers by the workforce.
- Improved living conditions -The project, once completed, will provide much needed electricity to household consumers, small business, health and education facilities, all of which contribute to improved living conditions in the area

Equally important to note, the project has two major opportunities to enhance, namely optimisation of the land use and job opportunities for the local economy.

### **Mitigation and Enhancement Measures**

In order to mitigate against the anticipated adverse impacts and to enhance the opportunities available, mitigation and enhancement measures have

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been proposed and shall be operationalized through the implementation of the Environment and Social Management Plan (ESMP), RCAP and associated safeguard plans.

- To ensure **public safety**, the site will have restricted access and have strict waste management procedures to prevent water contamination and mosquito breeding areas.
- **Soil Contamination:** Conducting soil testing before construction to identify potential contaminants will be done. Secondly, the site engineers for the contractor will implement proper storage and handling of construction materials and chemicals. Also, containment systems will be installed and impermeable barriers to prevent spills from reaching the soil. And a Spill Response Plan will be developed and monitored. Provision of training to workers on its implementation will be mandatory.
- **Air Pollution:** dust control measures will be implemented including; water spraying, dust screens, and dust suppressants, to minimize particulate matter emissions. Use of cleaner construction equipment and machinery to reduce exhaust emissions will be promoted. Scheduling of construction activities during periods of lower wind speeds to minimize dust dispersion will be emphasized.
- **Water Pollution:** Storage of chemicals and hazardous materials will be done in designated areas with secondary containment to prevent mixed up with soil run off. A spill response plan will be in place to address accidental spillages promptly.
- **occupational health and safety**, workers on site will be inducted in occupational health and safety, and the site will have a competent health and safety officer to ensure compliance to health and safety procedures and advise where need be. The HSE Officer will also provide health and implement disease prevention measure. Prioritize worker safety and community health through strict adherence to safety standards and healthcare facilities.
- **Increased Traffic:** A traffic management plan will be developed to minimize congestion and maintain safe traffic flow. And also, coordination with local authorities to plan road improvements and manage traffic during construction, including vaccination and sanitation facilities.
- **Spread of communicable diseases:** health awareness campaigns for both the construction workers and the people living along the route corridor will be provided at regular intervals throughout the construction period to raise awareness and mitigate the spread of

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diseases such as Covid-19, HIV/AIDS and STIs. These will be incorporated in the Health and Safety Management Plan. (HSMP)

- **Dust pollution** - will be mitigated by spraying water by water bowsers on a routine basis, coordinated by a site stationed safety officer as a dust suppression mechanism.
- **Noise and vibration management** - the contractor(s) will adopt the international standard of 85 decibels (dB) for exposure of its employees to noise over an 8-hour shift. Employees will wear appropriate ear protection in workplaces where noise levels exceed 85 dB; the project will schedule noisy construction activities during less sensitive hours
- **Disturbance to the flora and fauna** – the contractor(s) will be obliged to ensure that existing vegetation is as much as possible preserved and no vegetation removed unnecessarily. Any areas which are disturbed and will not be used during operation will be re-vegetated. Manual removal of trees and shrubs is recommended as opposed to using chemicals, fire, or bulldozers. Additionally, as a key mitigation measure, stumping of trees as opposed to uprooting is recommended to avoid complete removal of vegetation. Further, vegetation clearance shall be limited to the wayleave, maintaining a width of 10m, i.e. 5m on either side of the wooden-pole.
- **Soil erosion** may occur as a result of land cover removal leading to the development of gullies. Therefore, complete removal of vegetation cover will be avoided as much as possible. Where not possible, erosion control measures, re-vegetation, to prevent soil erosion will be implemented.
- **Population Influx:** The project will develop temporary housing and facilities for workers to reduce pressure on local communities
- **Employment** will be on merit basis and not based on gender, ethnicity or race etc., furthermore, the locals will be prioritized for job opportunities.
- **Public Revenue** -To ensure that the project contributes to the increase in public revenue, all relevant taxes will be paid and also contributions will be made to NAPSA for formally employed persons.
- **Involuntary resettlement-** Displacement of people and properties will be mitigated according to the assessments reported in the RCAP which is accompanied by this EIS. This will be done by implementing a comprehensive resettlement compensation action plan which will include compensation, relocation, and livelihood restoration. Further, through the social expert, engagement with affected communities



throughout the resettlement process and provide adequate support has been done thus far and is documented and annexed to this EIS.

- **Solid Waste Generation:** A waste management plan will be developed to segregate, recycle, and dispose of waste properly and through the HSE Officer on site, the culture of waste reduction and recycling among workers and the community will be promoted routinely.

## **Enhancement of Positive Impacts**

### **a) Employment**

To ensure that employment is given to the local people, workers will be employed on the basis of merit and not gender or race. All unskilled labor will be sought from the surrounding communities.

### **b) Public Revenue**

To ensure that the project contributes to the increase in public revenue, all relevant taxes will be paid and also contributions will be made to NAPSA for formally employed persons.

- The local economic activities may, however, be enhanced due to increased levels of income for the construction workers which will in turn encourage commerce;
- The project will create employment for the local community and skilled labour force;
- The project once completed will provide much needed electricity to household consumers, small business, health and education facilities, all of which contribute to improved living conditions in the area; and
- Furthermore, the project may attract investments in various sectors of the economy in the area due to availability of reliable electric power.
- Public revenue  
Creation of market for goods and services to local providers

- **Improved Quality and Reliability of Electricity Supply:**

Regular maintenance and upgrades of infrastructure to ensure consistent service quality and the implementation of advanced technology for monitoring and rapid response to power outages will be applied.

- **Increased Access to Electricity:** a comprehensive electrification plan targeting underserved rural and peri-urban areas will be



developed and promotion of awareness campaigns to encourage residents to connect to the grid.

- **Enhanced Investment:** Collaborating with investment agencies to promote the area's potential and Facilitation of business-friendly policies and incentives to attract investments.
- **Public Revenue:** Ensure transparent financial reporting to build trust and attract further investment.
- **Improved Local Economy:** the project will support local entrepreneurship through business development programs and encourage project contractors and workers to patronize local businesses.
- **Employment Creation: The project will** implement local hiring policies to prioritize job opportunities for the community and will also offer training and skills development programs for local residents to meet job requirements.
- **Capacity Building for the Local Community:** The project developer will collaborate with educational institutions to provide relevant courses.
- **Increased Public Revenue:** The project developer set up deliberate mechanisms to collect and allocate revenues from the project to fund public services and ensure tax compliance and fair revenue-sharing agreements.
- **Increased Electricity Capacity: The project developer** continuously monitors electricity demand and plan for capacity expansion and encourage energy-efficient practices and technologies to optimize electricity usage.
- **Creation of Markets for goods and services to Local Providers:** The project developer will promote local procurement policies for project-related goods and services and facilitate partnerships between local providers and the project workforce.
- **Improved Living Conditions:** The project developer by project design through its subsidizing policy for this project, has develop programs to subsidize electricity costs for low-income households and has prioritized community engagement, feedback and has maintained open channels of communication with local communities to address concerns and gather feedback.



## **Project lifespan**

The project is scheduled to be implemented within **24 months**; and it is likely to commence by January 2024, subject to issuance of a Decision Letter of approval by ZEMA and compliance to other regulatory requirements.

## **Recommendation**

It is therefore recommended that this Project is supported to ensure availability of sufficient, reliable and quality power supply which will in turn greatly contribute to achieving ZESCO's Mission "Making it easy for people to live a better life".

In light of the available options, the identified negative and positive impacts, recommended mitigation measures and the budgetary commitment to address them, the Corporation looks forward to the implementation of the Project.

**Eng. VICTOR B. MAPANI**  
**MANAGING DIRECTOR – ZESCO LIMITED**



## **NON- SUMMARY IN LOCAL LANGUAGE TECHNICAL**

### **EXECUTIVE SUMMARY**

The Government of the Republic of Zambia through ZESCO Limited intends to rehabilitate and upgrade of a 33/11kv substation and construction of a 66/11kv substation, 66kv, 33kv, 11kv and 0.4kv lines for the proposed Livingstone and Kazungula component. The proposed project main projects are to in increase capacity, improve reliability and improved service delivery to ZESCO clients in Livingstone and Kazungula districts.

### **Project Description**

The Sustainable Electricity Supply Southern Division project is meant to rehabilitate and upgrade the distribution infrastructure in Livingstone and Kazungula districts. It will involve the construction of new substations and lines (voltage levels of 11kV to 66kV) as well as reinforcement of existing substations and lines. The implementation of this project will result in increased capacity, improved reliability and quality of power, and improved service delivery.

### **Location**

Livingstone is located in Southern Province, at around latitude 17° 50' South and lon-gitude 25° 50' east. It is located 480 km south of Lusaka and about 190 km south of Choma, the provincial capital of Southern Province. Livingstone used to be the provincial capital of Southern Province until 2012, when this role shifted to Choma. Livingstone District is an enclave in Kazungula district, and has a total surface are of 740 km<sup>2</sup>. The district has an estimated population of 185,000 with a growth rate of 3.3% per annum 2010-2019. Tourism is the most important sector in Livingstone. Further, some targeted customers for power include Maloni, Mulala A&B, Nakatindi and Mwandu areas.

Kazungula District is situated in the south - western part of the Southern Province and is located on the northern bank of the Zambezi River at around 17° 46' south and 25° 16' east. It has a total surface area of 18 300 km<sup>2</sup>. It is located about 60 km west of Livingstone and approximately 135 km east of Sesheke. Sesheke is located near Katima Mulilo in Namibia. Kazungula District encloses Livingstone District as an en-clave. Kazungula



District has an estimated population of 156 000 and a growth rate of 4.6 % per year in 2019 and the targeted customers include Makalanguzu.

### **Investment Cost**

To implement the project, a sum of Nine Million Seven Hundred Twenty Thousand, United States Dollars (USD 9,720,000.00) has been allocated.

### **Major Potential Impacts**

#### **Positives**

The project shall bring significant positive benefits to the project area as indicated below:

- Improved quality and reliability of electricity supply in the project area increased number of people connected to electricity, especially in peri-urban and rural communities.
- Enhanced investment - The project may attract investments in various sectors of the economy in the area due to availability of reliable electric power.
- Improved local economy - The local economic activities maybe enhanced due to increased levels of income for the construction workers which will in turn encourage commerce ;
- Employment creation- The project will create employment for the local community including casual labour opportunities during project implementation, and skilled labor force ;
- Increased electricity capacity- The project once completed will provide much needed electricity to household consumers, small business, health and education facilities, all of which contribute to improved living conditions.

#### **Negative Impacts**

Some of the anticipated negative significant impacts identified include, but not limited to the following:

- Soil contamination - Digging of foundations, soil contamination by oil and building materials ;
- Air pollution - Emissions like dust and exhaust materials generated during the construction and operation phase ;



- Water pollution - Spillages and leakages during construction and operation, and surface runoff ; could potentially contaminate water.
- Noise pollution- Due to construction works and vehicle traffic movement increased traffic- during construction
- Occupational/Community Health and Safety - Spread of communicable diseases and safety hazards.
- Dust pollution -The project area may experience increased dust levels during the dry from influx of vehicles bringing materials to site especially in the dry season ;
  - Vegetation Loss - There will be also clearance of the vegetation in areas were new lines will be constructed ;
- Population influx - A project of this magnitude has potential to influence Influx of job seekers into the area ;
- Stress on social amenities - Skilled workforce will come from outside the Project area, hence, there would be stress created on the social amenities Public health and Safety- The skilled migrant labor force could also lead to the introduction of communicable diseases such as sexually transmitted diseases (STIs) & HIV/AIDS ;
- Soil contamination - soil contamination by fuel and building materials ;
- Involuntary resettlement - Loss of houses and other assets (access to farmland, trees, walls, wells etc.)
- Damage to land/Soil erosion – Digging of foundations, may as a result of land cover removal lead to the development of gullies and erode Solid waste

Mitigation and enhancement measures for the anticipated negative and positive impacts include, but are not limited to the following:

### **Enhancement Measures**

- To enhance access to electricity services in the Province, power shall be stepped down at the various substations to introduce the project benefits at district level and surrounding areas
- To enhance employment opportunities that the project shall introduce in the receiving environment, ZESCO shall ensure that the Project Contractor works with the local leadership to restrict employment of none skilled labour to local communities.



- To enhance gender equity in employment opportunities provided by the proposed project, all jobs that can be undertaken by women shall be reserved, and the women folk shall be encouraged to enrol
- To ensure that the project contributes to the increase in public revenue, all relevant taxes will be paid and also contributions will be made to NAPSA for formally employed persons.

## Mitigation Measures

In order to mitigate against the anticipated adverse impacts and to enhance the opportunities available, mitigation and enhancement measures have been proposed and shall be operationalized through the implementation of the Environment and Social Management Plan (ESMP), RCAP and associated safeguard plans.

- Cardinal is the carrying out of environmental awareness campaigns for the construction team as this would sensitize them on environmental conservation measures necessary to minimize environmental degradation. Specific guidelines shall be incorporated in the ESMP.
- Health awareness campaigns for both the construction workers and the people living along the route corridor will be provided at regular intervals throughout the construction period to raise awareness and mitigate the spread of diseases such as Covid-19, HIV/AIDS and STIs. These will be incorporated in the Health and Safety Management Plan. (HSMP).
- Dust pollution will be mitigated by spraying water by water bowsers on a routine basis, coordinated by a site stationed safety officer as a dust suppression mechanism.
- Noise and vibration management - the contractor(s) will adopt the international standard of 85 decibels (dB) for exposure of its employees to noise over an 8-hour shift. Employees will wear appropriate ear protection in workplaces where noise levels exceed 85 dB;
- For the flora and fauna – the contractor(s) will be obliged to ensure that existing vegetation is as much as possible preserved and no vegetation removed unnecessarily. Any areas which are disturbed and will not be used during operation will be re-vegetated. Manual removal of trees and shrubs is recommended as opposed to using chemicals, fire, or bulldozers.



**VICTOR B. MAPANI**  
**MANAGING DIRECTOR**

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3<sup>rd</sup> draft Environmental Impact Statement for the proposed rehabilitation and upgrade of a 33/11kv substation and construction of a 66/11kv substation, 66kv, 33kv, 11kv and 0.4kv lines under the Sustainable Electricity Supply Southern Division project, Southern Province. Livingstone and kazungula project components.

## **NON-TECHNICAL SUMMARY MU CITONGA**

### **Muzeezo mu bufwaafwi**

Mfulumende ya cisi ca Zambia kubeleka a kabunga ka ZESCO ilaa muzeezo waku bambulula akuyungizya bupange bwa ma gesi a 33/11 KV substation a kuyaka iimbi ngánda ya magesi iisika ku mweelwe wa 66/11 kV, iinojisi ntambo zyi nyamuna 66kV, 11kV alimwi a 0.4kV, zyalo eezyi ntambo zynootola mulilo ku Libingi alimwi a ku Kazungula, kweendelanya a makanze ayalidwe. Kweedelanya a makanze, ooyu muzeezo ulangilwa kuti ulagwasya kwaamba kuti uyungizye bupange bwa magesi alimwi a bubelesi bwa kabunga ka ZESCO ku bantu baku Libingi alimwi a ku Kazungula.

### **Bupanduluzi bwa Mulimo**

Ooyu mulimo wa Sustainable Electricity Supply ku cookwe ca ku musanza ubambidwe kuti ukabambulule akuyungizya maanda akubambila magesi mu zylíkiti zya Libingi alimwi a Kazungula. Mukati ka mulimo ooyu, kuyakuba kuyaka maanda a magesi alimwi a ntambo zya magesi zyipya zyalo zynakunyamuna magesi aasika ku mweelwe kuzwa ku 11kV kusika ku 66kV. Kunze aboobo, kuya kuba kuyungizya alimwi aku sumpula maanda a magesi a ntambo zya magesi zyalo ziliko kale kwacecino ciindi. Mulimo ooyu wakucitika uyakupa kuti kukabe ku vwula kwa magesi alimwi aya magesi aya kunoo shomeka ciindi coonse.

### **Bujanwa kuli Busena oobu?**

Cilikiti ca Libingi cilajanika ku cookwe ca ku musanza, mubusena butegwa Latitude 17° 15'South alimwi a Longitude 25° 15'East. Cilikiti ca Libingi cilanjanwa ma kilometer aali 480 kuzwa ku cilikiti ca Lusaka kuya ku cookwe ca kumusanza, a ma kilometer aali 190 kuzwa ku cilikiti ca Choma calo kacili nche cilikiti cipati mu cookwe caku musanza. Cilikiti ca Libingi cakali nche cilikiti cipati mu cookwe ca ku musanza kusikila mu mwaka wa 2012 nocaka cinchigwa kutolwa ku cilikiti ca Choma. Cilikiti ca Libingi calo cilagumikizya a busena bwa Kazungula amana cilijisi busena busika ku 740km<sup>2</sup>. Bantu bayanwa mu cilikiti ca Libingi balasika ku mweelwe wa 185,000 amana mweelwe ooyu kaukomena kusika ku 3.3% a mwaka kuzwa mu mwaka wa 2010 kusika mu mwaka wa 2019. Mulimo mupati maningi mu cilikiti ca



Libingi ngwa kutondezya zyilengaleza a bubotu bwa cisi antela tourism. Mukuyungizya, bantu balangilwa kujana mpindu mu mulimo ooyu balajanwa mumasena aayo aitwa kuti Maloni, Mulala A & B, Nakatindi alimwi a Mwandi.

Cilikiti ca Kazungula calo cijanwa kujwe lya ku musunza antela south-west, kubembeleka nkomwe ya mulonga wa Zambezi nkoili ku nyika, mubusena butegwa Latitude 17<sup>0</sup> 46' South, alimwi a 25<sup>0</sup> 16' East. Cilikiti ca Kazungula citola busena busika ku 18,300 km<sup>2</sup> amana cili 60km kumbo lya cilikiti ca Libingi, alimwi a 135km kujwe lya cilikiti ca Sesheke, calo cilikiti cili muni a cilikiti ca Katima Mulilo mu cisi ca Namibia. Cilikiti ca Kazungula cili mbuli kuti cizingulukide cilikiti ca Libingi. Bantu bajanwa mu cilikiti ca Kazungula balasika ku mweelwe wa 156, 000 walo mweelwe uukomena a 4.6% mwaka a mwaka kusika mu mwaka wa 2019. Bantu balangilwa ku kujana mpindu mu mulimo ooyu balajanika a mubusena bwitwa kuti Makalanguzu.

**Mali aayandika** (Investment Cost)

Kutegwa mulimo ooyu ukazwidilile, kwaka bikkwa ambali mali asika ku Nine Million Seven Hundred and Twenty Thousand Dollars (\$9,720,000)

## **Bubotu na Bubi bulangilwa**

### **Bubotu**

Mulimo oyu uyakuleta bubotu ku bantu bwamusyobo oyu:

- Magesi aya kusika ku bantu kakunyina mapenzi antela buyumu yumu, amana bayaku vwula bantu bati kakonzye ku sikilwa magesi mumunzi yabo, kapati abo bazulilwa mumasena ategwa peri urban.
- Makwebo manji - akaambo kakuti kuyakuba magesi mumunzi, bantu banji bayakuyanda kuleta makwebo aandene andene.
- Lusumpuko - oyu mulimo uya kuleta lusumpuko ku bantu, banji bayakujana milimo yandene akaambo ka bukutausi buti kaletwe a mulimo oyu.
- Mulimo oyu waakumana uya kuleta magesi mu maanda, mumakwebo, mu ziyibadela alimwi a mu zykolo.

### **Bubyaabi**

Zyimwi zyintu zi byaabi zilangilwa a kaambo ka mulimo oyu nzyeezyi:

- Kunyongana kwa bulongo akaambo kaku sya zylindi, cimwi ciindi akaambo ka kutika tika kwa ma futa antela ma oilo azyimwi zyibelesyo zyaku yakila.



- Kunyongana kwa luuwo akaambo ka kusya ciindi nokunoyakwa.
- Meenda aalo alalangilwa kunyongana akaambo ka kutikilwa zyintu zyaandene andene kubikkila a zyibelesyo zya ku yakila a ma futa antela ma oilo.
- Kulalangilwa kuba coongo mu luwo akaambo ka milimo ino citika, antomwe a myotokola ino inda mu busena.
- Akaambo ka bukutausi bunoochitika, bantu bala langilwa kuba a malwazi aandene andene mbuli ku kola, alimwi kula langilwa kuti bamwi inga balicisa ciindi noba beleka.
- Lusuko - busena bula langilwa kuba a lusuko lunji akaambo kakuti kuyakuba bukutausi bunji, alimwi kuya kuba myootokala minji ino leta zyibelesyo, kapati ciindi ca cilimo nokunyina mvwula.
- Bantu baya ku vwula akaambo ka basyi kuyandaula milimo.
- Akaambo ka bantu banji bati kaboole mu busena obu, kuya kuba buyumu yumu ku makani akujana lugwasyo ku makani abukale mbuli mu zyibbadela, zyikolo a nkobaya mukuliiba bantu
- Bantu batikaboole kubeleka bala langilwa kuletelzya malwazi andene andene, kapati aya aboola kwiinda mumakani akoonana.
- Nyika antela bulongo bula langilwa kunyongana akaambo ka kutikilwa mingwimba alimwi a zyibelesyo zyakuyakila.
- Bantu bacisi balangilwa kusweekelwa nyika yabo akaambo kakunyangwa masena abo kutegwa kuyakwe nganda ya magesi.
- Nyika ilalangilwa kunyongana akaambo kakusya sya limwi kukacaale zyi golo golo mu masena.

Aboobo, kwaamba kuti zyintu zyita nyonganini limwi, kulangilwa kuti inga kwakucitwa zyintu eezyi:

### **Nzila zyakukulwaizya**

- Kwaamba kuti bantu bakonzye kuba a magesi mu cookwe, mulilo wa magesi uya ku cesyegwa kusika munsaizi ya magesi andene andene asika mu maanda kutegwa bantu bazyibe bubotu bwa kuba a magesi mumaanda abo.
- Kwaamba kuti bantu babe a coolwe ca kujana milimo, ba kabunga ka ZESCO baya kubona kwaamba kuti babeleke antoomwe abamasololi ba mu minzi kutegwa milimo misyoonto syoonto kaipegwa kuli babo bantu bazulilwa mumunzi moona omo kuleka kupa bamuzwa kule.



- Kwaamba kuti boonse basankwa a bamakaintu babweze lubazu mumilimo eeyi, milimo ikonzya kucitwa a bamakaintu iyakubikkwa ambali kutegwa ikabe yabo ba makaintu balikke.
- Kwaamba kuti mulimo ooyu ukabe a mpindu ku cisi, makani aku bbadela mitelo kucisi aya ku kulaizigwa kuli boonse abo bati ka pegwe milimo alimwi boonse bani kubbadelwa mutelo wa NAPSA.

### **Bukwabilizi**

Kutegwa kuka kwabililwe kuzwa ku ziyabyaabi ziyakuboola akaambo ka mulimo ooyu, alimwi aku kulwaizya bubobotu, bukulwaizyi alimwi a bukwalizyi bwabikkwa kwamba kuti bukakubeleke kwiinda mu Environment and Social Management Plan (ESMP), Resettlement and Compensation Action Plan (RCAP) aimwi mizeezo yabukwabilizi.

- Cipati nkubona kwaamba kuti boonse bantu bani kubeleka a mulimo ooyu bayisyigwa nzila njobakonzya kubelesya kubona kwaamba kuti bakwabilila nyika mboizulwa.
- Kubona kwaamba kuti bantu bonse bakkala mumsi abusena oobu bayisyigwa makani a nseba, kapati kugumikizya makani a Covid 19, HIV/AIDS alimwi a malwazi ambi aboola kwiinda mu koonana.
- Makani a kasuko ayakulanganyizyigwa kwiinda muku sansaila meenda mumazila ciindi coonse kutegwa kakubula kasuko. Kuyakubikkwa muntu unikubona kuti eeci cilacitika ciindi coonse.
- Makani a coongo alimwi aku zunzuma kwanyika - basyi milimo bayakubelesya myeelwa izumizyidwe nyika yoonse ya 85 decibels (dB) ku babelesi babo kwa ciindi cisika ku 8 hours abuzuba. Kutu naa babelekela muli coongo ciinda ku 85 decibels, nkokuti babelesi balelede basame zyibelesyo zyaku kwabilila matwi abo kuzwa ku coongo.
- Ku malubaluba a zyinyama - basyi milimo beleelede kubona kwaamba kuti zyi syango zyicaale kakunyina kunyonganisyigwa. Kutu kwajanika kuti zyisyango zygwisigwa amana busena tibwabelesyegwa, nkokuti bayandika kubona kwaamba kuti abusena obo kwasyangwa zyisyango alimwi. Kwakulaizyigwa kwaamba kuti kubelesyegwe maanza kugwisya zyisyango kuleka kuumpa naanka ku belesya misamu na kudadula kubelesya minchini.

### **Victor B. Mapani**

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3<sup>rd</sup> draft Environmental Impact Statement for the proposed rehabilitation and upgrade of a 33/11kv substation and construction of a 66/11kv substation, 66kv, 33kv, 11kv and 0.4kv lines under the Sustainable Electricity Supply Southern Division project, Southern Province. Livingstone and Kazungula project components.

## **Beendelezi Bapati**

### **ACKNOWLEDGEMENTS**

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Further, we would like to sincerely acknowledge and thank all participants for their questions, suggestions and concerns, without which the process would have been more challenging.

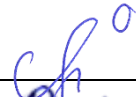





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## ABBREVIATIONS AND ACRONYMS

Acronym	Meaning
7NDP	Zambia Seventh National Development Plan
ACSR	Aluminium-Conductor Steel-Reinforced
AIDS	Acquired Immunodeficiency Syndrome
CEMO	Contractor's Environmental Management Officer
dbh	Diameter at breast height (cm), measurement for trees
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement (Report of the ESIA study)
EMA	Environmental Management Act
EPRAP	Emergency Preparedness and Response Action Plan
ESIA	Environmental Impact Assessment (the study)
ESMP	Environmental and Social Management Plan
FD	Forestry Department
gbh	Girth at breast height (cm), measurement for trees
GRZ	Government of the Republic of Zambia
HIV	Human Immuno-deficiency Virus
IFC	International Finance Corporation
km	Kilometres
kV	Kilo volts
kWh	Kilo Watt Hour
LACP	Land Acquisition and Compensation Plan, a.k.a. RCAP
LRP	Livelihood Restoration Plan
m	Meters
MDGs	Millennium Development Goals
MTZ	Mulungushi Textiles (substation)
MW	Mega Watts
NHCC	National Heritage Conservation Commission
NPWS	National Parks and Wildlife Services
OHL	Overhead line
OHS	Occupational Health and Safety
OPGW	Optical Ground Wire
PAP	Project Affected Persons, People Affected by the Project
RAP	Resettlement Action Plan
RCAP	Resettlement and Compensation Action Plan, same as LACP
SDG	Sustainable Development Goals



<b>Acronym</b>	<b>Meaning</b>
SEP	Stakeholder Engagement Plan
SESSD	Sustainable Electricity Supply Southern Division
STD	Sexually Transmitted Disease
STI	Sexually Transmitted Infection
ToR	Terms of Reference
ZEMA	Zambia Environmental Management Agency



## **1.0 INTRODUCTION**

The Government of the Republic of Zambia has embarked on an ambitious undertaking to prioritize sustainable development. To achieve the same, electricity is an important driver as it provides a quick, clean and reliable energy source. Consequently, ZESCO Limited is in pursuit of a strategic and proactive programme to increase its generation capacity not only to meet the present demand, but also to cater for the anticipated and planned future needs of the nation.

The Corporation is also mindful of the potential and booming economic activities in the different parts of the country. Subsequently, it is ZESCO'S earnest corporate desire to strengthen and extend the National Grid in order to ensure that a greater and wider clientele is availed in line with national objectives such as achieving the Sustainable Development Goals (SDGs) and realization of the goals aimed at alleviating/reducing poverty among Zambians – Vision 2030. This is in line with the corporate philosophy which requires the availability of reliable, affordable and sustainable energy. Therefore, adequate and reliable supply of electricity is an important prerequisite for attracting domestic and direct foreign investment. To this effect, the Government of Zambia recognizes the key role energy plays in all three pillars of sustainable development – economic, social and environmental.

In view of the above, and given the importance of energy infrastructure in underpinning development, the Government of Zambia, through ZESCO Limited, intends to reinforce power supply in Livingstone and Kazungula districts through the Sustainable Electricity Supply Southern Division project, arising from the fact that the capacity of the network is not sufficient to meet the increased demand.

### **1.1 Background of the project**

The SESSD project – Livingstone sub-project aims at modernization of the electricity sector by strengthening the existing sub-transmission and distribution network in Livingstone by increasing network capacity and reliability. The sub-project is intended to help ZESCO increase its power delivery capacity and improve its service delivery towards agricultural, commercial, industrial, as well as household customers. There is also an access (last mile) component where 1, 244 customers in selected areas will get connected to the network at a subsidized rate.



## 1.2 Summary description of the project including project rationale

The Sustainable Electricity Supply Southern Division project is meant to rehabilitate and upgrade the distribution infrastructure in Livingstone and Kazungula districts. It will involve the construction of new substations and lines (voltage levels of 11kV to 66kV) as well as reinforcement of existing substations and lines. The implementation of this project will result in increased capacity, improved reliability and quality of power, and improved service delivery.

## 1.3 Project Objectives

The overall development objective (impact) is to contribute to sustainable economic and social growth in Livingstone and Kazungula districts. The objective (outcome) of the project is the sustainable improvement of energy supply for the population and MSEs in Livingstone. Respective indicators will be total annual energy consumption in the project region (in GWh) and the fault rate of the system in the project region.

Furthermore, the implementation of this Project will result in socio-economic development, poverty alleviation and improved social status.

## 1.4 Brief Description of the Project Location

Point ID	Eastings(mE)	Northings(mS)	Latitude	Longitude
LD LW 1	379480.427	8024687.385	17°51'52.77"S	25°51'45.36"E
LD LW 2	379471.35	8023509.158	17°52'28.94"S	25°51'43.64"E
LD-LW/AP1	379149.476	8023389.645	17°52'35.55"S	25°51'32.86"E
LD-LW/AP2	378865.272	8023404.879	17°52'34.84"S	25°51'23.05"E
LD-LW/AP3	378765.868	8023383.846	17°52'35.76"S	25°51'19.78"E
LDLW 8	378245.366	8023134.832	17°52'43.14"S	25°51'2.30"E
LDLW9	377924.273	8022916.456	17°52'50.79"S	25°50'50.87"E
LDLW 10	377854.688	8022983.965	17°52'40.96"S	25°50'44.65"E
LDLW 11	377728.117	8023214.79	17°52'53.91"S	25°50'28.69"E
LDLW 12	377276.278	8022799.253	17°52'51.65"S	25°50'21.13"E
LDLW 13	377039.899	8022872.966	17°52'29.89"S	25°50'16.45"E
LD LW 14	376712.44	8024230.211	17°52'7.53"S	25°50'10.07"E
LD LW 15	375686.73	8024877.61	17°51'46.28"S	25°49'35.35"E
LD LW 16	375529.473	8025321.469	17°51'32.12"S	25°49'29.57"E
LDLW17New	373857.653	8025600.101	17°51'22.31"S	25°48'32.83"E
LDLW18New	373857.153	8025907.32	17°51'12.68"S	25°48'33.50"E
Point ID	Eastings(mE)	Northings(mS)	Latitude	Longitude
LWKZ1N	373842.129	8025937.706	17°51'11.22"S	25°48'33.04"E



LWKZ2new	373842.702	8025602.518	17°51'22.21"S	25°48'32.22"E
LW KZ 3	373223.063	8025727.206	17°51'20.12"S	25°48'10.15"E
LW KZ 4	372299.496	8026241.413	17°51'1.06"S	25°47'38.68"E
LW KZ 5	371310.545	8026706.19	17°50'45.86"S	25°47'6.38"E
LW KZ 6	371333.574	8027032.911	17°50'36.63"S	25°47'7.36"E
LW KZ7	370106.845	8027786.368	17°50'12.35"S	25°46'24.99"E
LW KZ8	368719.28	8028257.916	17°49'55.18"S	25°45'39.15"E
LW KZ9	370044.579	8032114.383	17°47'50.08"S	25°46'25.39"E
LW KZ10	370176.35	8032218.28	17°47'46.96"S	25°46'30.13"E
LW KZ11	371000.864	8034530.778	17°46'31.42"S	25°46'57.74"E

The proposed project is mainly located in Livingstone district, with some activities in Kazungula District, Southern Province of Zambia. Refer to Chapter 3 for detailed location.

Table 1: Linda and proposed Livingstone West Substation coordinators

POINT ID	LATITUDE	LONGITUDE	REMARKS
L1	17°51'49.73"S	25°51'43.24"E	Linda substation
L2	17°51'49.89"S	25°51'47.90"E	Linda substation
L3	17°51'51.78"S	25°51'43.26"E	Linda substation
L4	17°51'52.07"S	25°51'47.71"E	Linda substation
A	17°51'9.27"S	25°48'34.38"E	Livingstone West substation
B	17°51'8.85"S	25°48'44.64"E	Livingstone West substation
C	17°51'11.25"S	25°48'44.52"E	Livingstone West substation
D	17°51'11.55"S	25°48'34.53"E	Livingstone West substation

Table 2: 66kV Linda - Livingstone West line Coordinators

## 1.5 Shareholding and Board of Directors

ZESCO limited is a parastatal company wholly owned by the Government of the Republic of Zambia (GRZ) and is registered under the company act. The Board of Directors comprise the following:

- |      |                        |                    |
|------|------------------------|--------------------|
| i.   | Mr. Vicson N'cube      | Board Chairperson; |
| ii.  | Mrs. Chikonjiwe Mumba; | Board Member       |
| iii. | Ms. Edna Mudenda;      | Board Member       |
| iv.  | Mr. Emmanuel Gardner;  | Board Member       |
| v.   | Dr. Jolly Kamwanga;    | Board Member       |
| vi.  | Mr. Charles Kaisala;   | Board Member       |
| vii. | Mr. Victor B. Mapani;  | Board Member       |



## **Developer's Physical Address and Contact Details**

### Physical Address

ZESCO Limited  
Stand No. 6949 Great East Road  
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Tel: +260 211 361111  
**LUSAKA**

### Contact Person

Eng. Victor B. Mapani  
Managing Director  
ZESCO Limited  
Fax: +260 211 222753  
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Tel: +260 211 362710

## **1.6 Track Record/Previous Experience of Enterprise Elsewhere**

ZESCO Limited is an electricity utility company created in 1970 which is owned entirely by the Government of the Republic of Zambia, and falls under the jurisdiction of the Ministry of Energy. The company's main objective is to generate, transmit, distribute and supply electricity to all its clientele. ZESCO uses hydro power for over 99% of power generation in the country, with a diesel station in Shang'ombo district, Western province. ZESCO Limited has undertaken and continues to undertake a number of projects some of which are listed below:

- **The Power Rehabilitation Project (PRP)** - The Zambia Power Rehabilitation Project's (PRP) overall objective was to support the Government's objectives of enhancing the ability of the country's electricity supply industry to provide electricity at least cost and in an efficient and sustainable manner to stimulate more and inclusive growth in the economy. The works involved rehabilitation of generation, transmission and distribution infrastructure that included power line repairs and replacements, and reinforcement of substations. Upon completion of the rehabilitation works at the power stations there was an additional 210MW added to the total generation capacity.



- **Kafue Gorge Lower Hydro Power Project (750 MW)** - The Kafue Gorge Lower (KGL) Hydro Power Project with a capacity of 750 MW is currently being implemented. The project will include constructing a 330kV transmission line from the KGL power station into the National Grid.
- **Optic Fibre Communication Project** - The state-of-the-art Optic Fibre cable is aimed at replacing the existing ground wire on the high voltage power lines. The optic fibre cable has been installed on strategic line networks. The optic fibre offers better clarity, has a higher bandwidth and thus offers a better channel of communication for the various services that ZESCO uses. The project has resulted in improved overall corporate effectiveness and efficiency in ZESCO.
- **Itezhi Tezhi Hydro Power Project (120 MW)** - ZESCO signed a Memorandum of Understanding (MoU) with Tata Africa to develop the Itezhi Tezhi 120MW hydro power project. The two companies formed a joint venture company known as Itezhi Tezhi Power Company (ITPC). The 120MW Power Station has just been completed and was recently commissioned for operations. The provision for the development of the power station was made during the construction of the existing Itezhi Tezhi Dam. The power generated is fed into the National grid through a high voltage line, the Itezhi Tezhi – Mumbwa – Lusaka West 220/330kV transmission line.
- **Kariba North Bank Extension Project (360 MW)** - The project was aimed at increasing the capacity of Kariba North Bank power station by adding two generating units of 180MW each to the existing four units. A dam with sufficient capacity exists and provision for the addition of two machines to the existing four was made. For this project, a transmission line was constructed to take the power to the Kafue West Substation.
- **Itezhi Tezhi 330kV Transmission Line** - The project was aimed at constructing a 273 km long line from the Itezhi Tezhi Power Station to the existing Lusaka West Substation, through the Mumbwa 220kV/330kV Substation. The objective was to transmit the 120MW generated by the new power station into the national grid.
- **Kariba North Bank Extension 330kV Transmission Line** - The project involved construction of a 130km long 330kV line from the Kariba North Bank Extension power station to the existing Kafue West Substation. The objective of the project was to transmit the 360MW generated by the Kariba North Bank Extension power station.



- **Muzuma Upgrade 220kV/330kV Transmission Line** - The project involves upgrading the existing Kafue Town – Muzuma - Livingstone 220kV transmission line to 330kV line. The objective of the project is to increase the line's voltage capacity in order to transmit more power. This project is currently under implementation.
- **Leopards Hill – Luangwa 132kV Transmission Line** - The project involves constructing a 187km long 132kV line from the existing Leopards Hill Substation to the proposed 132/33kV Chitope substation in Luangwa District, through a 132/33kV substation in Rufunsa District. The Project include a 33kV reticulation line in Rufunsa and another 33kV line from the Chitope substation to Luangwa Town (62km) and to the Great East Road turn off (25km). The objective of the project is to connect Rufunsa and Luangwa Districts to the National Grid. This project is currently under implementation. The Project will also lead to the decommissioning of the less environmentally friendly Luangwa diesel powered power plant.
- **Pensulo - Kasama 330kV Transmission Line** - The project involved constructing a 400km long line from the existing Pensulo substation in Serenje to the new Kasama Substation, through the proposed 330/66kV Substation in Mpika. The project aimed at extending the 330kV network in order to provide reliable power supply to Luapula, Muchinga and Northern Provinces.
- **Pensulo – Chipata 330kV Transmission Line** - The project involved constructing a 285km long line from the existing Pensulo substation in Serenje to the Chipata West 330/132/66/33kV substation, through the 330/132/66kV substation in Msoro. The Project aimed at extending the 330kV network to Chipata in order to provide reliable supply to the Eastern Province.
- **Luano – Kansanshi – Lumwana 330kV Line** - ZESCO Limited constructed the Luano – Kansanshi Mine – Lumwana Mine 330kV transmission line in order to support economic activities in the mineral rich North-**Southern** Province.
- **Victoria Falls – Katima Mulilo 220kV Line** - ZESCO also constructed the Victoria Falls – Katima Mulilo 220kV transmission line. The objective of the project was to facilitate power transmission interconnection between Zambia and Namibia.

To ensure environmental compliance in all its projects and operations, ZESCO established the Environment and Social Affairs Unit (ESU) in 1996. Over the last 20 years, the Unit has undertaken numerous EIA studies for generation, transmission and distribution projects, some of which are mentioned above



## **1.7 Total project Cost/Investment**

To implement the project, a sum of Nine Million Seven Hundred Twenty Thousand United States Dollars (**USD 9,720,000.00**) has been allocated and is expected to be completed over a period of **24 months**.

## **1.8 Proposed Project Implementation Date**

The commencement of rehabilitation and construction works is scheduled for first quarter 2024 for 2 years' dependent upon approval from ZEMA and other requisite permits.

## **1.9 Purpose of the Environmental Impact Statement**

The purpose of the Environmental Impact Statement (EIS) is to describe the current environmental and social conditions in the project area in relation to the project, identify potential impacts of project activities, and propose actions to avoid, minimise or mitigate these impacts to the greatest possible extent.

The EIS is based on an Environmental Impact Assessment (EIA), which has been carried out through field studies in the project area, interviews with stakeholders and affected persons, and study of secondary sources of data.

## **1.10 Public Consultations**

Stakeholder meetings were held during the scoping survey in 2018, as well as during detailed ESIA studies in 2020. These are listed in the separate Stakeholder Engagement Plan (SEP).

Currently Livingstone district is supplied from Victoria Falls Power station by a 220kV power line which runs from Kafue Gorge Substation. This line feeds both Livingstone and Kazungula districts.

## **1.11 Justification**

Power distribution in the two districts needs to be increased to cater for the socio-economic development in line with the government's objective of increasing access to electricity, and the vision 2030 aimed at improving the living standards of the general citizenry through wealth creation. In addition, being part of the Southern Africa Power Pool (SAPP), Zambia is party to the strategic and ambitious regional integration



aspirations. Consequently, the proposed SESSD project is aimed at providing clean, affordable and reliable energy supply. Important to note is that the Project has a subsidy component which allows for more households to connect to the grid at a subsidized rate, allowing more people to live a better life, as envisioned by ZESCO.



## **2.0 LEGAL AND POLICY FRAMEWORK**

### **2.1 Policy, Legal and institutional framework relevant to the project**

#### **(a) Environmental Policy Framework**

In view of the various environmental challenges the country faces, Zambia launched its National Policy on Environment (NPE) in 2007. The environmental policy document identifies deforestation, land degradation, wildlife depletion, soil erosion, loss of land productivity, inadequate sanitation and air and water pollution as the main environmental challenges the country is facing.

The NPE calls upon all institutions, Non-Governmental Organisations (NGOs), and community-based or people's organizations whose activities affect the environment in any way to carry out their activities judiciously in order to maintain the productivity and integrity of the environment.

Further, the NPE recognizes the need for EIA studies in all development projects in order to eliminate or mitigate adverse environmental impacts and enhance the benefits of the projects. The National Policy on Environment states that "EIAs will be required as deemed necessary to ensure that public and private sector development options are environmentally sound and sustainable and that any environmental consequences are recognized early and taken into account during project design and implementation."

#### **(b) Environmental Legislation**

The legislative responsibility of environmental impact assessment is vested in the Zambia Environmental Management Agency (ZEMA) which administers the Environmental Management Act (EMA) No. 12 of 2011, Statutory Instrument No. 28 of 1997 – The Environmental Impact Assessment (EIA) Regulations. The ZEMA is mandated to:

- a) identify types of projects, plans and policies for which environmental impact assessments are necessary and to undertake or request relevant institutions to undertake such assessments for consideration by the Agency;
- b) monitor trends in the use of natural resources and their impact on the environment;
- c) request information on the quantity, quality and management methods of natural resources and environmental conditions from any individual or organization anywhere in Zambia; and
- d) Consider and advise the Government, on all major development projects at an initial stage and on the effects of any sociological or economic development on the environment.



In addition to the above, the Ministry of Water, Sanitation and Environmental Protection, in consultation with ZEMA, is empowered to make regulations by statutory instrument for any matter that can be prescribed under the Act in the protection of the environment.

In Zambia, it is a legal requirement under the Environmental Management Act No. 12 of 2011, that developers must conduct environmental impact assessments for certain categories of projects. Specifically, Section 3 (1) of Statutory Instrument No. 28 of 1997 of the above Act states that "A developer shall not implement a project for which a Project Brief or Environmental Impact Statement is required under these Regulations, unless the Project Brief or an Environmental Impact Statement has been concluded in accordance with these Regulations and the Zambia Environmental Management Agency has issued a decision letter."

The category of electrical infrastructure that require Project Brief include:<sup>2</sup>

(p) Hydro power schemes and electrification

In the category of electrical infrastructure, the types of projects that need Environmental Impact Assessment include:<sup>3</sup>

#### 8. Electrical Infrastructure

(a) Electricity generation station

(b) Electrical transmission lines - 220 kV and more than 1 Km long

(c) Surface roads for electrical and transmission lines for more than 1 Km long

The present project falls under the category "Electrification", and hence requires a Project Brief to be created.

The legislation that is relevant to the proposed project is presented in

**Table 3:** Describes how the project will comply with this legislative

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<sup>2</sup> Statutory Instrument No. 28 (1997) First Schedule (Regulations 3(2)) PROJECTS WHICH REQUIRE PROJECT BRIEFS

<sup>3</sup> Statutory Instrument No. 28 (1997) Second Schedule (Regulations 7(2)) PROJECTS WHICH REQUIRE ENVIRONMENTAL IMPACT ASSESSMENT





Legal Instrument	Main Provisions	Responsible Institutions	Relevance to the proposed project	Compliance with Legislation
<b>Environment and Natural Resources Management</b>				
<b>Environmental Management Act (EMA) No.12, 2011</b>	<p>This Act provides for integrated environmental management and the protection and conservation of the environment and the sustainable management and use of natural resources. It also provides for the prevention and control of pollution and environmental degradation so as to provide for the health and welfare of persons, animals, plants and the environment.</p> <p>Section 29 (1) of the Act provides that A person shall not undertake any project that may have an effect on the environment without the written approval of the Agency, and except in accordance with any conditions imposed in that approval. The Act also covers the management of water, air, waste (hazardous and municipal), pesticides and toxic substances, noise, ionizing radiation and natural resources, etc.</p>	<p>Zambia Environmental Management Agency,  Ministry of Green Economy and Environment</p>	<p>Implementation of the project is dependent on the EIS approval Decision Letter.</p> <p>ZESCO shall adhere to the principles of sustainable development during all phases of project implementation. This shall be done by making sure that all identified negative impacts are minimized and positive impacts are enhanced in accordance with the EIS and the mitigation measures thereof to enhance environmental protection.</p> <p>Environmental monitoring on various aspects of the project in relation to air and water pollution; waste management; hazardous waste and ozone depleting substances.</p>	<p>Carrying out this EIA study is in compliance with the EMA No. 12 of 2011 in particular, Statutory Instrument No. 28 of 1997, The EIA Regulations,  The Environmental Management (Licensing) Regulations, Statutory Instrument No. 112 of 2013 provide for the licensing of facilities that have the potential to pollute the environment arising from its activities.</p>
Water Supply and Sanitation				

<p><b>The Water Supply and Sanitation Act No. 28 of 1997</b></p>	<p>Framework for providing and regulating water and sanitation services to all areas. Creates the Council (i.e. NWASCO) which administers the Act.</p> <p>Section 24 (3) of the Act provides that a utility or service provider and a local authority in its service area shall establish procedures for adequate consultation to be carried out for developmental planning or for implementing physical works.</p>	<p>Ministry of Local Government; NWASCO</p>	<p>Regulates water supply and sanitation aspects.</p> <p>ZESCO as a utility is in consultation with Water utility companies and the Local Authorities on the best approach of implementing the project without disturbing the water and sanitation installations. ZESCO shall abide by any agreement/instructions from other utilities and Local Authorities.</p>	<p>All sanitation and water aspects arising from the project will abide by the Water Supply and Sanitation Act No.28 of 1997, thus preventing pollution of water bodies and land pollution from sanitary wastes.</p>
<p>Wildlife Resources Management</p>				
<p><b>The Zambia Wildlife Act, No. 14 of 2015</b></p>	<p>To control and manage national parks, GMAs and bird sanctuaries for the purposes of conserving and enhancing wildlife ecosystems.</p> <p>Section 5 (f) of the Act provides for undertaking of measures to ensure the proper balance between the sustainable use of wildlife and the management of ecosystems in National Parks, Community Partnership Parks, bird and wildlife sanctuaries and Game Management Areas.</p>	<p>Ministry of Tourism</p> <p>Department of National Parks and Wildlife</p>	<p>Protection and conservation of wildlife resources. Project activities will be carried out such that there would be no natural habitat degradation in the project area.</p>	<p>During the implementation and operation phases of the project, wildlife, forest resources and ecosystems will be protected and conserved in accordance with the Zambia Wildlife Act, No. 12 of 1998.</p>
<p>Cultural Aspects</p>				
<p><b>National Heritage Conservation</b></p>	<p>To conserve and protect both natural and cultural heritage, e.g. waterfalls, artefacts, graves, in perpetuity and other resources</p>	<p>National Heritage and</p>	<p>Monitoring and management of all identified physical and cultural</p>	<p>The National Heritage Conservation Act No. 23 of 1989 shall be adhered to</p>

<b>Act No. 23 of 1989</b>	<p>within the boundaries of the site for the benefit of the present and future generation.</p> <p>Section 40 (1) of the Act provides that no person shall excavate, collect or export, as the case may be, any ancient heritage, any relic or part thereof, or alter, destroy, damage or remove from its original site any ancient heritage, national monument or relic.</p>	Conservation Commission	<p>heritage sites and artefacts in the area.</p> <p>So far in the proposed servitude, there are no such sites or artefacts. However, should there be any chance finds, ZESCO shall comply by seeking clearance from the National Heritage Conservation Commission.</p>	throughout the life-cycle of the project to ensure conservation of national heritage material.
Electricity Industry				
<b>Energy Regulation Act No.11 2019</b>	<p>ERB) was created under the <b>Energy Regulation Act</b> of 2019 of the Laws of Zambia following the issuance of Statutory Instrument number 6 of 1997, the Energy Regulation Act (Commencement Order) of 27<sup>th</sup> January 1997.</p> <p>Section 2(a) of the Act provides for the production, generation, transmission and distribution or supply of energy.</p>	Ministry of Energy Energy Regulations Board	<p>License for distribution of power required before commencement of the project.</p> <p>The development of the distribution line project will be monitored by ERB to ensure conformity to the provisions of the Act.</p>	All associated project activities shall be done in accordance with the Energy Regulation Act No.11, 2019
<b>Electricity Act No.11 of 2019</b>	Provides for the regulation of the generation, transmission, distribution and supply of electricity; and provides guidance on the matters connected with or incidental to the foregoing and to ensure that ZESCO power projects and operations are carried	ZESCO Limited, Rural Electrification Authority	It is the governing Act for the operations concerning the acquisition of land, safety and smooth transmission of power.	The project operations shall comply with the provisions of the Electricity Act No.433 of 1995

	<p>out in line with the provisions of the Electricity Act.</p> <p>Section 20 of the Act provides that in the exercise of powers in relation to the execution of works given under this Act, an operator of an undertaking shall cause as little detriment and inconvenience and do as little damage as possible, and shall make full compensation to all local and other authorities and other persons who have sustained damage, for all damage sustained by them by reason or consequence of the exercise of such powers and, in default of agreement between the parties, the amount and application of such compensation shall be determined by Arbitration in accordance with the provisions of the Arbitration Act and for that purpose the parties shall be deemed to be parties to a submission in which the reference is to two arbitrators.</p>			
Lands Management				
<b>The Lands Act, 1995 (CAP 292, CAP 289, CAP 288)</b>	The Department of Lands administers the Lands Act, 1995 (CAP 292, CAP 289, CAP 288) and the Lands Acquisition Act, 1995. The Act also provides for the allocation and alienation of land under statutory leaseholds. The Department is responsible	Ministry of Lands and Natural Resources	The Act Governs the acquisition of the land to be used for the development of the Transmission line infrastructure.	All land acquisition procedures, where applicable, shall comply with the Lands Act, 1995 (CAP 292, CAP 289, CAP 288) to

	<p>for the administration of lands and deeds registration and land surveys and mapping.</p> <p>Section 10 (b) Provided that where the property acquired is land the President may, with the consent of the person entitled to compensation, make to such person, in lieu of or in addition to any compensation payable under this section, a grant of other land not exceeding in value the value of the land acquired, for an estate not exceeding the estate acquired and upon the same terms and conditions, as far as may be practicable, as those under which the land acquired was held.</p>			<p>ensure all PAPs are duly compensated.</p> <p>The developer has consulted widely and ensured full alignment with the relevant local council authorities including chiefs in all development activity to date. The developer will ensure full compliance with Zambian regulations (and the Lands Act) in all matters pertaining to land acquisition.</p>
<p><b>The Urban and Regional Planning Act, No.3 of 2015</b></p>	<p>An Act to provide 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 for the Republic; provide for a planning framework, guidelines, systems and processes for urban and regional planning for the Republic.</p> <p>Section 3 (1) (c) provides that planning procedures shall incorporate environmental standards and requirements specified in any law relating to the environment and natural resources.</p>	<p>Ministry of Local Government and Rural Development Local Authorities</p>	<p>Approvals of construction and area plans for siting of substations and line wayleave.</p> <p>Route selection, Planning and implementation of this project has taken into consideration the provisions for sound environmental management through the preparation of the EIA report as part of the detailed design and planning.</p>	<p>The development of the project shall comply with the Urban and Regional Planning Act, 2015 to ensure synchronization with existing and planned developments.</p> <p>The developer will ensure that the plan and layout of this project be in accordance with this Act. All the drawings (site plans) will be approved by the local authorities.</p>

<p><b>Local Government Act, No. 2 of 2019</b></p>	<p>The Act provides for the establishment of Councils in districts which function as Local Authorities. Some of their functions relate to control of the development, use of land and buildings, erection of buildings, conservation of natural resources, prevention of soil erosion, protection of life, property and natural resources from age by fire, control of grass weeds and wild vegetation, and maintenance of environmental health services. Other functions include control of the storage, sale and use of petroleum, extermination of insects, rodents and snakes, dealing with all kinds of refuse and effluent, controlling the provision of drains and sewers, and conservation and the prevention of the pollution of supplies of water.</p>	<p>Ministry of Local Government  Local Authorities</p>	<p>The Act is relevant to the project as some pollution control and environmental protection functions are handled by the local Council.</p>	<p>The development of the project shall comply with the Local Government Act, cap 281, No.22 of 1991 in relation to pollution control and environmental protection.</p> <p>The proponent will ensure that all relevant documents which include licenses and permits are acquired before construction phase.</p>
<p><b>Gender Based Violence Act No.1 of 2011</b></p>	<p>Provides for protection of victims of Gender Based Violence (GBV), constitutes the anti-gender-based violence committee, establish the anti-gender-based violence fund, and provides for matters connected with or incidental to the foregoing</p>	<p>Office of the Vice President</p>	<p>The project is likely to result in influx of people leading to gender-based violence cases.</p>	<p>ZESCO will ensure that the Act is adhered to for the protection of anyone who may fall victim of GBV.</p>
<p><b>The Gender Equity and Equality Act No.22 of 2015</b></p>	<p>It provides for measures to ensure gender equity, equality and integration of both sexes in society. Further provides for elimination of all forms of discrimination against women.</p>	<p>Office of the Vice President</p>	<p>The Act will provide guidance on employment of women during project implementation.</p>	<p>ZESCO will ensure that the Act is adhered to so that women are not discriminated against during employment</p>

<b>Anti-Gender-Based Violence Act No.1, of 2011.</b>	<p>An Act to provide for the protection of victims of gender-based violence; constitute the Anti-Gender-Based Violence Committee; establish the Anti-Gender-Based Violence Fund; and provide for matters connected with, or incidental to, the foregoing.</p> <p>Section 30 (1) provides that the Ministry responsible for social welfare shall provide mechanisms and programs for the rehabilitation of victims.</p>	<p>Ministry of Home Affairs</p> <p>Ministry of Gender</p>	<p>Increased access to electricity will help vulnerable group such as women be connected to the national grid and improve productivity. This will result in an increase in the levels of income, livelihood, less dependence on their spouses and a reduced number of incidences of GBV.</p>	<p>The development of the project shall take cognisance of the provisions of the Anti-Gender-Based Violence Act, 2010 to ensure that it addresses all vices that promote GBV.</p>
<b>Disaster Management Act No. 13 of 2010</b>	<p>An Act to establish and provide for the maintenance and operation of a system for the anticipation, preparedness, prevention, coordination, mitigation and management of disaster situations and the organization of relief and recovery from disasters; establish the National Disaster Management and Mitigation Unit and provide for its powers and functions.</p> <p>Section 7 (1) of the Act provides that the Unit shall give guidance to Government ministries and departments, the private sector, non-governmental organizations, communities and individuals to assess and prevent or reduce the risk of disasters, including (a) ways and means of:</p>	DMMU	<p>Lusaka has continued to experience increased incidences of floods that may pose a danger to ZESCO installations and the general public. The Disaster Management and Mitigation Unit (DMMU) has been established and mandated to anticipate, prepare and manage disasters should they occur. ZESCO will work closely with DMMU should such an occurrence be experienced.</p>	<p>The development of the project shall adhere to the provisions of the Disaster Management Act, 2010 to ensure emergency preparedness and response.</p>

	<ul style="list-style-type: none"> <li>i) determining levels of risks;</li> <li>ii) assessing the vulnerability of communities, households, environment and economic assets to disasters;</li> <li>iii) increasing the capacity of communities and households to minimize the risk and impact of disasters; and</li> <li>iv) Monitoring the likelihood of, and the state of alertness to, disasters.</li> </ul>			
<b>Human Rights Commission Act No. 39 of 1996</b>	<p>An Act to provide for the functions and powers of the Human Rights Commission; to provide for its composition and to provide for matters connected with or incidental to the foregoing.</p> <p>Section 9 of the Act provides that the function of the Commission shall be:</p> <ul style="list-style-type: none"> <li>a) Investigate Human Rights Abuse</li> <li>b) Investigate any maladministration of justice</li> <li>c) Proposed effective measures to prevent human Rights abuse</li> <li>d) Do such things as incidental or conducive to the attainment of the functions of the commission</li> </ul>	Human Rights Commission	The Act is relevant because the project will involve involuntary resettlement, An activity which requires to be executed in a way that respects the Rights of the PAPs.	The development and implementation of the project shall adhere to the provisions of the Human Rights Commission Act, 1996 to uphold the basic requirements therein.
<b>Occupational Health and Safety Act No. 36 2010</b>	Section 11 and 13 (1) of the Act provided for the establishment of the Occupational Health and Safety Institute and provide for its functions; provide for the establishment of health and safety	Ministry of Labour and Social Security	During the implementation of project activities, personnel involved in construction of infrastructure and their operation will be required to adhere to best practices with	The project will ensure adherence to the Occupational Health and Safety Act, 2010 to provide

	<p>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.</p>		<p>regards to Occupational Health and Safety. Procedures and manuals and regular onsite training will be undertaken to ensure personnel working on site are conversant with the information contained. The project will ensure that high risk areas are clearly marked with restricted access and the provision of the relevant Personal Protective Equipment (PPE) will be mandatory.</p>	<p>for a healthy and safe work environment.</p> <p>Site preparation, construction and operation of the distribution lines shall be done in compliance with this Act ensuring that risk assessments are done at the beginning of any job specifications and workers provided with appropriate PPE. There will always be a competent supervisor on site ensuring that work is done according to the health and safety procedures</p>
<p><b>Public Procurement Act NO. 12 of 2008; Act No. 8 of 2020,</b></p>	<p>An Act to continue the existence of the Zambia National Tender Board and re-name it as the Zambia Public Procurement Authority (ZPPA); revise the law relating to procurement So as to ensure transparency and accountability in public procurement;</p> <p>Section 21 of the Act provides that the user department in relation to procurement are to:</p> <p>(a) Provide information on forecasting procurement requirements to the</p>	<p>ZPPA</p>	<p>The project will involve the procurement of works, goods and services and this will require that the process follow the ZPPA guidelines to ensure fairness, transparency, integrity, accountability and promote public and stakeholder confidence. The process will be further complimented by EIB and World Bank procurement policies on</p>	<p>The project will ensure adherence to the provisions of the Public Procurement Act, 2008 for transparency and accountability in the procurement process.</p>

	procurement unit for the purpose of procurement planning. (b) Initiate procurement requirements Provide technical inputs to the procurement process.		meeting environmental requirements	
<b>National Council for Construction (NCC) Act ,No.10 of 2020</b>	The Act provides for the establishment of the NCC and to define its functions; the promotion and development of the construction industry in Zambia; the registration of contractors; the affiliation to the council of professional bodies or organisations whose members are engaged in activities related to the construction industry; the establishment of the Contribution industry ;the regulation of the industry; the establishment of the Construction School; the training of persons engaged in construction or in activities related to construction; for matters connected with or	Ministry of Local government	The proposed project shall carry out several constructing activities such as construction the substation and electrical infrastructure	ZESCO will ensure the construction of the Substation and electrical infrastructure will be undertaken in accordance with the National Council for Construction Act that will aim to promote the institution
<b>Employment (Amendment ) Act No. 15 of 2015</b>	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 appointment of officers of the Labour Department and for the conferring of powers on such officers and upon medical officers; to make provision for the protection of wages of	Ministry of labour	For the proposed development, this will cover such matters as contracts of work. The proposed project will employ a large number of people.	The developer will ensure that the employees' conditions of service are humane and that all people that get employed will be employed on the basis of merit and skills and not race, gender or tribe

	employees; to provide for the control of employment agencies; and to provide for matters incidental to and consequential upon the foregoing.			
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## 2.2 ZESCO's Corporate Policy and Standard Guidelines

ZESCO Limited is an International Standard Organisation (ISO)-Certified entity which implements and maintains an Integrated Management System (IMS). The ZESCO IMS fulfils the requirements of the following ISO standards:

ISO 9001:2015, Quality Management System;

ISO 14001:2015, Environmental Management System; and

ISO 45001: 2018, Occupational Health and Safety Management System

In addition, the following corporate standards and guidelines are applicable to this project:

- Resettlement and Compensation Policy
- ERB Wayleave guidelines
- Waste management guidelines
- Land acquisition guidelines

## 2.3 International guidelines and conventions

Additional international guidelines that govern the development of this EPB are the International Finance Corporation's Sustainability Framework, in particular, the Performance Standards (PS) on environmental and social sustainability (IFC, 2012), the KfW Sustainability Guidelines (KfW, 2019), and the IFC guidelines on transmission and distribution (IFC, 2007). The IFC Performance Standards applicable to this project are summarized in table 4 below.

**Table 4:** IFC Performance standards on Environmental and Social Sustainability

Performance Standard		Objective
PS 1	Assessment and Management of Environmental and Social Risks and Impacts	The requirements of this Performance Standard apply to all business activities, unless otherwise noted. Its objectives are to promote good environmental and social performance of clients, and to ensure that grievances of affected communities and external communications from stakeholders are addressed appropriately.
PS 2	Labour and Working Conditions	This standard's objectives are to promote the fair treatment, non-discrimination, and equal opportunity of workers, establish, maintain, and improve the worker-management relationship. Promote compliance with national employment and labour laws; protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties, and workers in the client's supply chain. Promote safe and healthy working conditions and the health of workers and avoid the use of forced labour

Performance Standard		Objective
PS 3	Resource Efficiency and Pollution Prevention	This standard aims to avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities, promote more sustainable use of resources, including energy and water and reduce project-related GHG emissions
PS 4	Community Health, Safety, and Security	The standard's objectives are to anticipate and avoid adverse impacts on the health and safety of the affected community during the project life from both routine and non-routine circumstances, ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to the affected communities
PS 5	Land Acquisition and Involuntary Resettlement	This standard aims at avoiding, and when avoidance is not possible, minimize displacement by exploring alternative project designs, avoid forced eviction, anticipate and avoid, or where avoidance is not possible, minimize adverse social and economic impacts from land acquisition or restrictions on land use by <ul style="list-style-type: none"> <li>i. providing compensation for loss of assets at replacement cost and</li> <li>ii. ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected, improve, or restore, the livelihoods and standards of living of displaced persons and improve living conditions among physically displaced persons through the provision of adequate housing with security of tenure at resettlement sites.</li> </ul>
PS 8	Cultural Heritage	This Standard recognizes the importance of cultural heritage for current and future generations. Consistent with the Convention Concerning the Protection of the World Cultural and Natural Heritage, this Performance Standard aims to ensure that clients protect cultural heritage in the course of their project activities. In addition, the requirements of this Performance Standard on a project's use of cultural heritage are based in part on standards set by the Convention on Biological Diversity.

Further, Zambia has signed and is party to more than thirty regional and international protocols and conventions. The most relevant environmental conventions are the Southern African Development Community (SADC) protocols on environment, natural resources management and water and soil conservation.

Some of the other international conventions that Zambia is party to include those dealing with the Protection of the World Cultural and Natural Heritage (of 1972) and ratified by Zambia in 1982; statutes of the International Union for the Conservation of Nature and Natural Resources (IUCN); Convention on International trade in Endangered Species of the wild fauna and flora (CITES), 1993, ratified in 1993; the

RAMSAR Convention; and Bonn Convention. Zambia has also ratified the Basel Convention (1994), which regulates trans-boundary movements of hazardous wastes.

Other International conventions listed and tabulated on table 4 that the country is party to include:

- Convention on Wetlands of International Importance, especially as waterfowl habitat;
- African Convention on the Conservation of Nature and Natural Resources;
- Montreal Protocol on Substances that Deplete the Ozone Layer;
- Convention on Biological Diversity;
- United Nations Framework Convention on Climate Change; and
- United Nations Convention to Combat Desertification

**Table 4:** International convention, protocols and guideline

Protocol/ Convention	Relevance to the proposed project	Compliance
<p><b>Convention on Biological Diversity (CBD):</b> Article 6 section (a) and (b) of the CBD encourages the sustainable development that considers biodiversity through strategies put in place in Articles 8 – 10 of the same convention. Some of the strategies in place to achieve this are to decrease the rate of loss of natural habitats, establish conservation areas, restore degraded areas and protect environments susceptible to human impacts</p>	<p>The project has the potential to affect biodiversity in the project area.</p>	<p>Mitigating and motoring for loss of biodiversity (flora and fauna) shall be conducted through restriction of project activities.</p>
<p><b>United Nations Framework Convention on Climate Change (UNFCCC):</b> in 1992, countries became party to the convention that recognizes the need to limit human activities contributing to climate change and to curb the negative results of climate change. Its ultimate objective, as stated in Article 2 of the Convention and any related legal instruments that the Conference of the Parties may adopt, is "to achieve, in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner".</p>	<p>The project has the potential to increase greenhouse gas emissions through fuel combustion from the motor vehicles and other equipment during construction.</p>	<p>Mitigation of all anthropogenic emissions, such as vehicle and machinery exhaust shall be minimised through a robust operation and maintenance regime.</p>

Protocol/ Convention	Relevance to the proposed project	Compliance
<p><b>Stockholm Convention:</b> Articles 5, 6 and 7 of the Convention, puts in place “measures to reduce or eliminate releases from unintentional production”, “measures to reduce or eliminate releases from stockpiles and wastes” and “implementation plans” respectively, to protect human health and the environment from chemicals that persist in the environment for a long period of time, known as Persistent Organic Pollutants.</p>	<p>Waste generation during construction and operation has the potential to produce Persistent Organic Pollutants.</p>	<p>Sustainable management through implementation of measures that ensure proper storage, handling and disposal of hazardous waste shall be implemented as stipulated in the Environmental Management Plan.</p>
<p><b>World Heritage Convention (of 1972)</b> ratified by Zambia in 1982; Article 5 (d) states that “to ensure that effective and active measures are taken for the protection, conservation and presentation of the cultural and natural heritage situated on its territory, each State Party to this Convention shall endeavour, in so far as possible, and as appropriate for each country to take the appropriate legal, scientific, technical, administrative and financial measures necessary for the identification, protection, conservation, presentation and rehabilitation of this Heritage”.</p>	<p>Historical artefacts are likely to be found at any project site hence measures need to be taken to ensure that these are well preserved upon discovery.</p>	<p>Chance-Find procedures shall be implemented to ensure that historical artefacts are well preserved upon discovery.</p>
<p><b>African Convention on the Conservation of Nature and Natural Resources;</b> Article II of the convention states that steps “shall be undertaken to adopt the measures necessary to ensure conservation, utilization and development of soil, water, flora and faunal resources in accordance with scientific principles and with due regard to the best interests of the people”.</p>	<p>Construction and operation activities have the potential to contaminate surface and ground water resources, soil, flora and fauna resources.</p>	<p>Mitigation measures shall be put in place to minimise pollution/contamination of the environment and its natural resources.</p>

<p><b>Montreal Protocol</b> The agreement regulates and identifies chemical substances that are implicated or have potential to contribute to the depletion of the Ozone.</p>	<p>Exhaust fumes from leaded fuel motor vehicles have potential to deplete the ozone layer</p>	<p>Mitigation of all anthropogenic emissions, such as vehicle and machinery exhaust shall be minimised through a robust</p>
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### **3.0 DESCRIPTION OF THE PROJECT**

The proposed project is mainly located in Livingstone and Kazungula districts, with some activities in Kazungula District, Southern Province of Zambia (Figure 1), with Kazungula marked in red and Livingstone in yellow.

#### **3.1. Livingstone District**

Livingstone town is located in Southern Province, at around latitude 17° 50' South and longitude 25° 50' east. It is located 480km south of Lusaka and about 190km south of Choma, capital of Southern Province. Livingstone used to be the capital of Southern Province until 2012, when this role shifted to Choma. The distribution lines will traverse in Linda Maloni, Lubuyu, Mulala A & B and Nakatindi area.

Livingstone District is an enclave in Kazungula district, and has a total surface area of 740 km<sup>2</sup>. The district has an estimated population of 185 000 with an estimated

#### **3.2 Kazungula District**

Kazungula district is situated in the south part of Southern Province on the north, east and west of Kazungula town which is located on the northern bank of Zambezi River at around 17° 46' south and 25° 16' east. It has a total surface area of 18 300 km<sup>2</sup>. It is located about 60 km west of Livingstone and approximately 135 km east of Sesheke. Kazungula District has an estimated population of 156 000 in 2019, with a growth rate of 4.6 % per year. The distribution lines will traverse in Makalanguzu area.

#### **3.3 Project Alternatives**

When selecting the route alternative several aspects and issues were considered. These include the cost, site, technology, design, raw material and process. The criteria in route selection considered the following factors: Minimal displacement or resettlement of people; minimal loss of natural habitat; and optimal technical, environmental and socio-economic cost implications.

##### **3.3.1 Project alternatives consideration**

- **Product/service**

The main products from these sub-projects shall be as follows;

1. New 66/11 kV, 2 x 20MVA substation
2. Assorted 11 kV overhead lines (OHLs)
3. 0.5 km of 33 kV OHL

4. Rehabilitation/Conversion of an existing rural/outdoor type sun 33/11 kV, 2 x 10MVA substation into a fully-fledged indoor substation

The above components will then be linked into the existing Livingstone and Kazungula networks to enhance the flow of power in the districts. Additionally, a number of selected customers will be connected to the ZESCO power grid under the access/subsidy component on these sub-projects.

- **Project Need**

Network stability studies have shown very high voltage drops on the present 66kV,33kV, 11kV and 0.4kV line with presently planned expansion of customer base in in Livingstone and Kazungula. In addition, this increases the redundancy and hence reliability of supply align the lines.

- **Site**

The proposed New 66/11 kV substation will be located on the western side of the town so as to form a ring with the other two main substations on the eastern side, i.e. Linda 33 (66)/ 11 kV and New Lusaka road 66/11 kV substation, engulfing the Town's load centre in order to provide for the firm capacity and enhancement of system availability, accessibility and, security and quality of supply.

The overhead lines follow the shortest possible routes and are positioned in such a way that they pose minimal interference with the built-up areas or need for demolition of structures or property and or relocation of people.

- **Design**

The design shall be according to the ZESCO and ERB design principles and should be sufficiently safe and be able to handle the load growth for some years into the future.

These sub-projects involve distribution and sub-transmission networks with nominal voltages ranging from 66 kV down to 0.4 kV and their associated.

- **Technology**

The technology will mainly be that of overhead conductors on both wooden (11-33kV systems) and steel monopoles (66-132kV systems). Under- ground cables are not a viable option for these lines, except possibly for short segments in congested areas and as cable loops from the transformer to the breaker and OHLs.

- **Raw materials**

The main construction materials on the project shall include but will not be limited to the following:

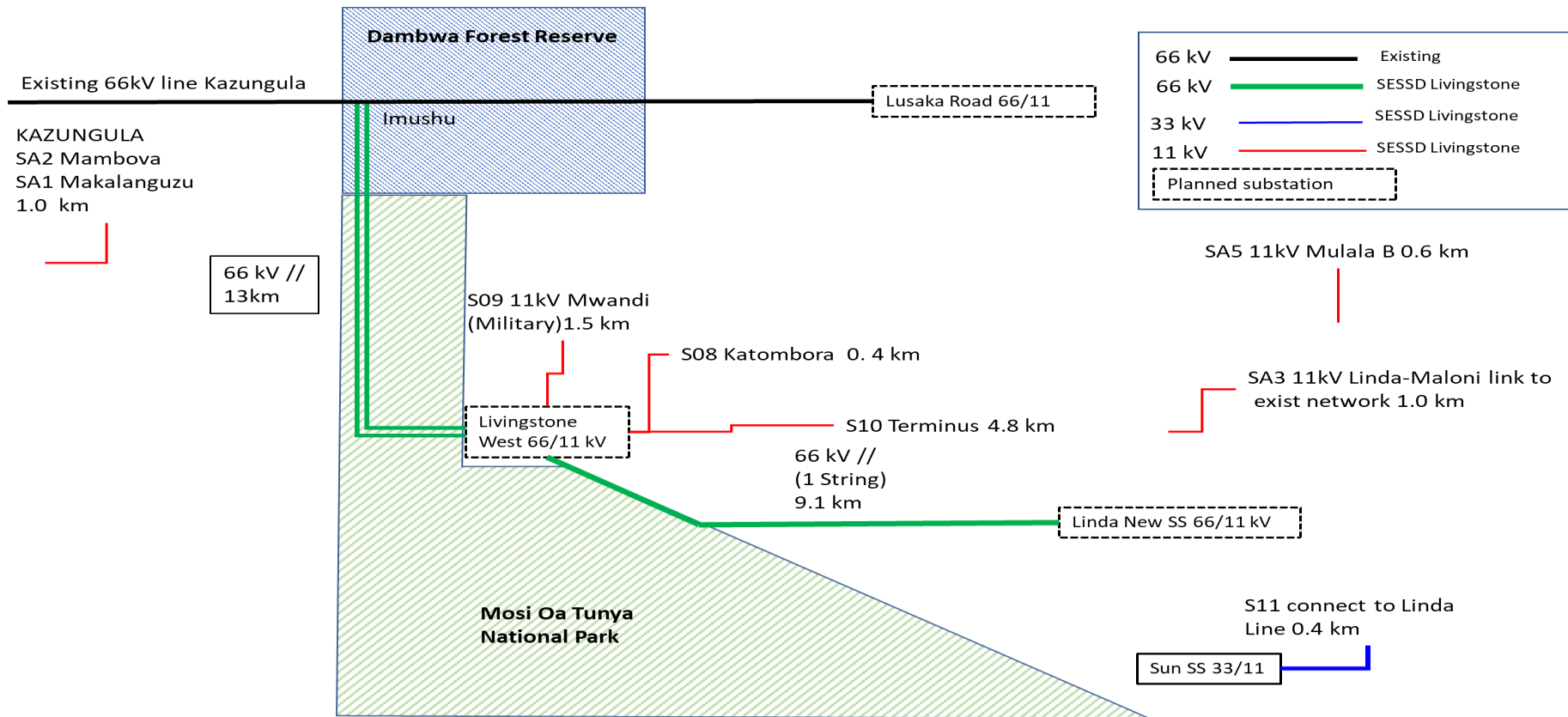
- All 11 and 33 kV OHL accessories
- All 66 and 132 kV OHL accessories
- Assorted cables
- Circuit breakers and Isolators
- Transformers
- Steel Monopoles
- 14, 12 and 10m Wooden poles
- Fencing wire for substation
- Steel nuts and bolts
- Concrete reinforcement
- Cement Blocks
- Clay bricks
- Aggregates

### **3.4 Description of Project Components**

The project has two major components based on the funding sources. The Main Project is funded by the Kreditanstalt für Wiederaufbau and includes 66kV transmission and substations, and 11-33 kV distribution lines. The Access project is funded by the European Union and is aimed to subsidise consumer connections. It contains 11kV distribution lines and transformers, and consumer connections. Each of these funding components contain multiple sub-projects, as detailed below. An overview of the components is given in Figure 2.



Figure 2: Overview of Livingstone SESSD project components



### 3.4.1 Main Project Transmission and Substations

#### Livingstone West Substation 66/11kV

The scope for Livingstone West substation consists of the following;

- 66kV outdoor switchgear and gantries
- 11kV indoor switchgear
- 66/11kV Power Transformers
- Control, protection, supervision and auxiliary systems for above
- Control Building
- Civil works

Livingstone West is a new 66/11kV substation located approximately 5 km west of Livingstone Town Centre close to the highway M10. The substation will be designed as 66/11kV substation with an outdoor 66kV switchgear, two 66/11kV transformers and a control building containing the 11kV indoor switchgear.

The substation plot is relatively flat located at approximately 1000 masl. The plot mainly contains scattered vegetation. A new access road of approximately 20 meters to Highway M10 shall be constructed.

#### 66kV Linda Substation

Since the new 66/11kV Linda substation will be constructed in another project. Only one new 66kV line bay to Livingstone West is included in the Scope of Works for this project. The new feeder will connect to the 66kV double busbar included in the adjacent project. The new substation will be located just east of the existing 33/11kV switchyard. The area is close to Livingstone town centre.

The scope for Linda substation mainly consists of the following;

- 66kV outdoor switchgear and gantries
- Control, protection, supervision and auxiliary systems for above
- Civil works

#### Transmission line Linda S/S – Livingstone West S/S 66kV

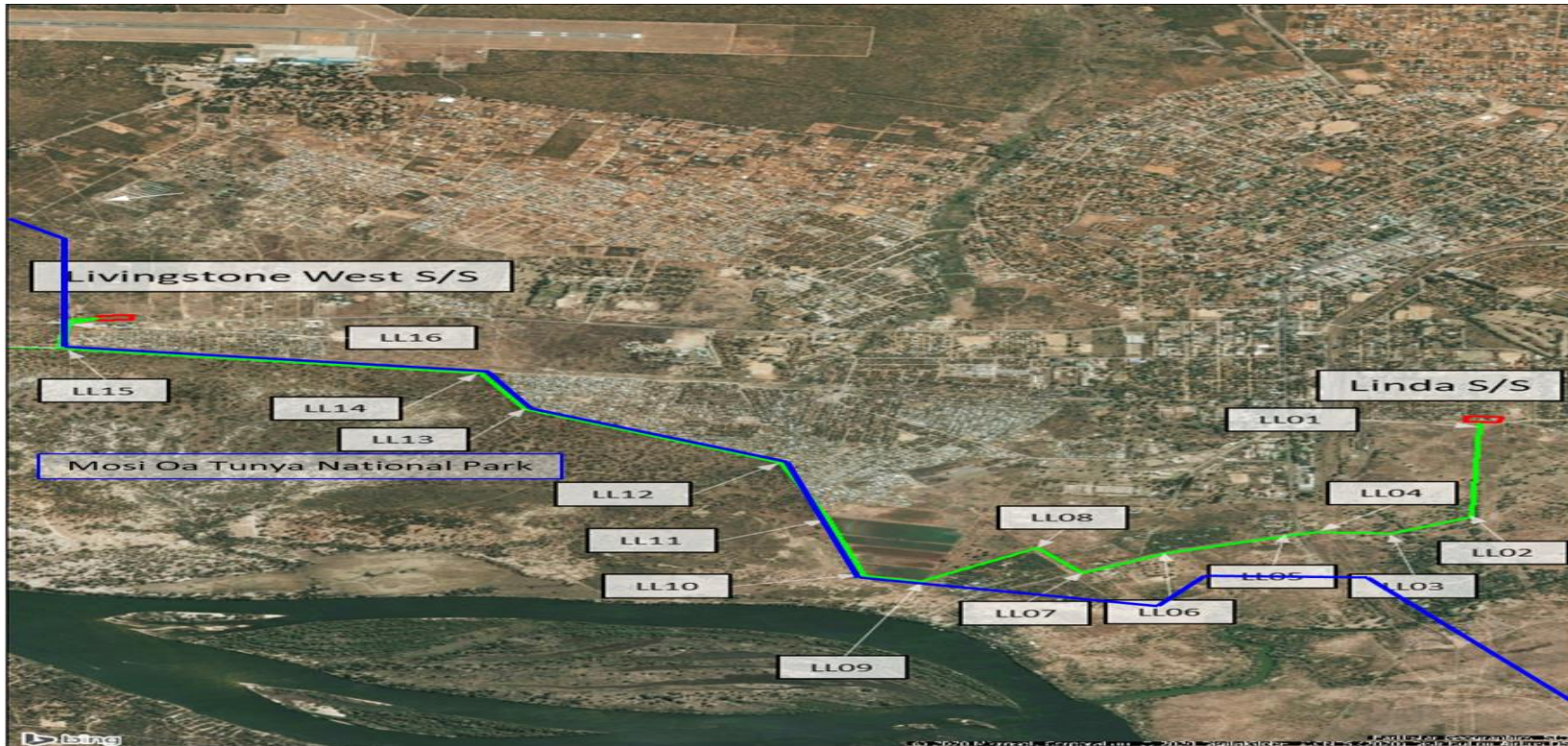
The transmission line will be designed as an overhead line between the new Linda substation and the new Livingstone West substation. It shall be designed as a double circuit 66kV line. The length of this line segment will be 9.1km.

The line will cross the railway line and the T1 road to the Mosi oa Tunya falls, then follow along the local road up to the waterworks (LL10 in **Error! Reference source not found.**). West of the waterworks it will go just inside the Mosi oa Tunya National Park up to the southwest corner of Nakatindi compound (LL15), where it will cross

over to the M10 road to Kazungula and the location of the new substation Livingstone West.

The line shall have steel monopole towers in vertical formation, stringed with only one circuit on one side of the tower and the other side left as a spare for a future line. For the route of the line, refer to Figure 3. The terrain is flat to slightly undulating.

Figure 3: 66kV OHL Linda SS – Livingstone West SS



The wayleave required for a 66kV transmission line in Zambia is 30m, with 15m on either side of the centre line and the required distances between parallel powerlines for a 66kV lines are 15m.

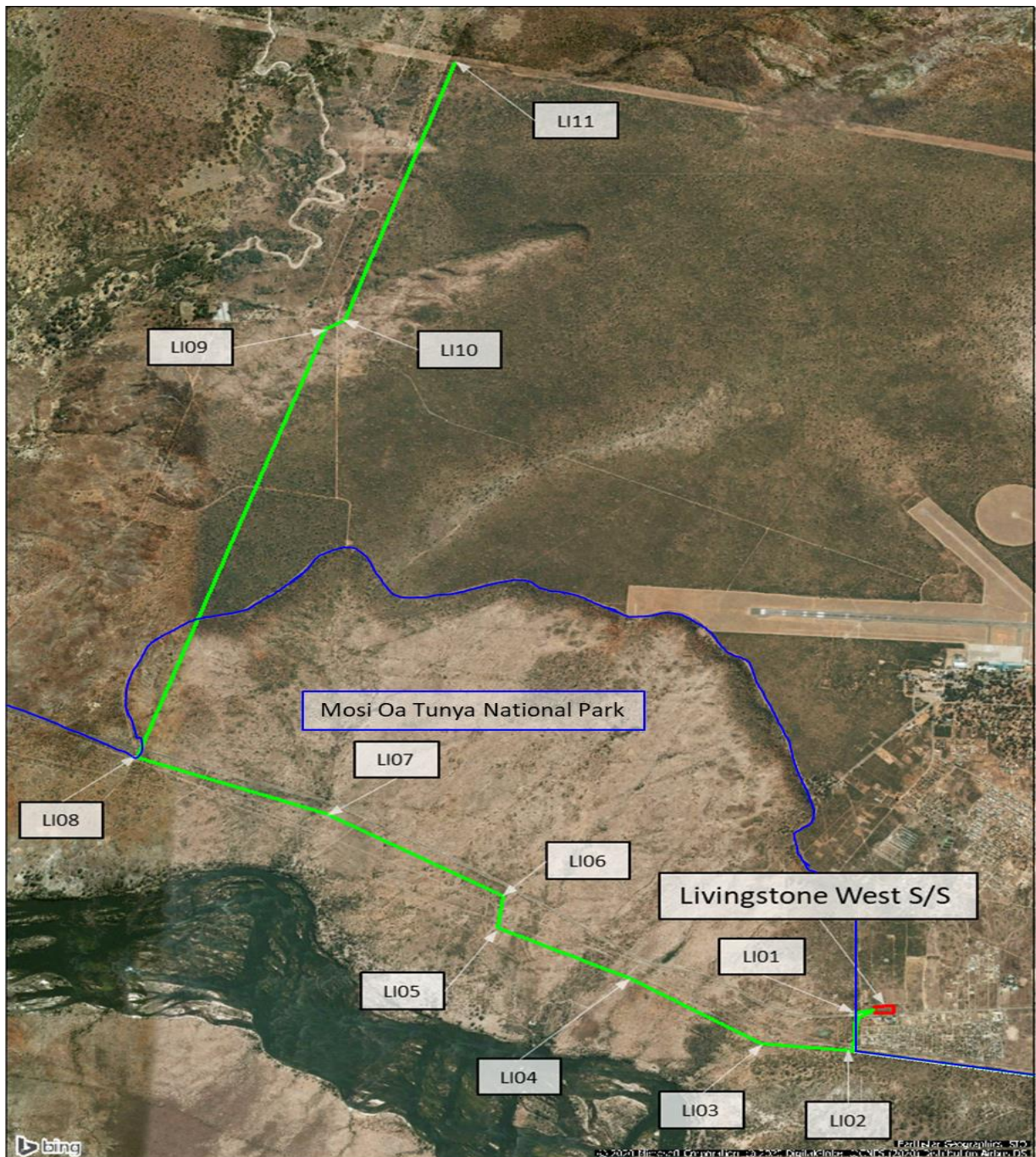
The new 66kV OHTL is proposed to be designed with steel monopole towers in vertical formation, stringed with one circuit on one side of the tower and the other side left as a spare for a future line.

### **Transmission line Livingstone West S/S – Imushu 66kV**

The new overhead transmission line between the new Livingstone West substation and the connection point with the existing 66kV line at Imushu (13km). It shall be designed as a double circuit 66kV line with steel monopole towers in vertical formation with one circuit on each side of the tower.

The line will exit Livingstone West SS along the same corridor as the connection to Linda SS, but will turn west after crossing the railway line. It will then follow south of the railway line for about 6 km at LL08, where it will turn north towards Imushu. For the route of the line, refer to Figure 4. To follow the border of the National Park north from Livingstone West is not an option here, due to the flight security funnel of the Harry Mwanga Nkumbula International Airport.

Figure 4: 66kV OHL Livingstone West S/S - Imushu



### **3.4.2 Main Project Distribution 11 and 33 kV**

#### **S08 SS Livingstone West - Katombora Line x 2 11kV**

Two new 0.4km 11kV feeders will be constructed as a double circuit, 500m south of the existing Katombora Line which will be cut and split into two lines connected to the new lines. This line will follow the same line route as the two 66kV lines entering and exiting Livingstone West.

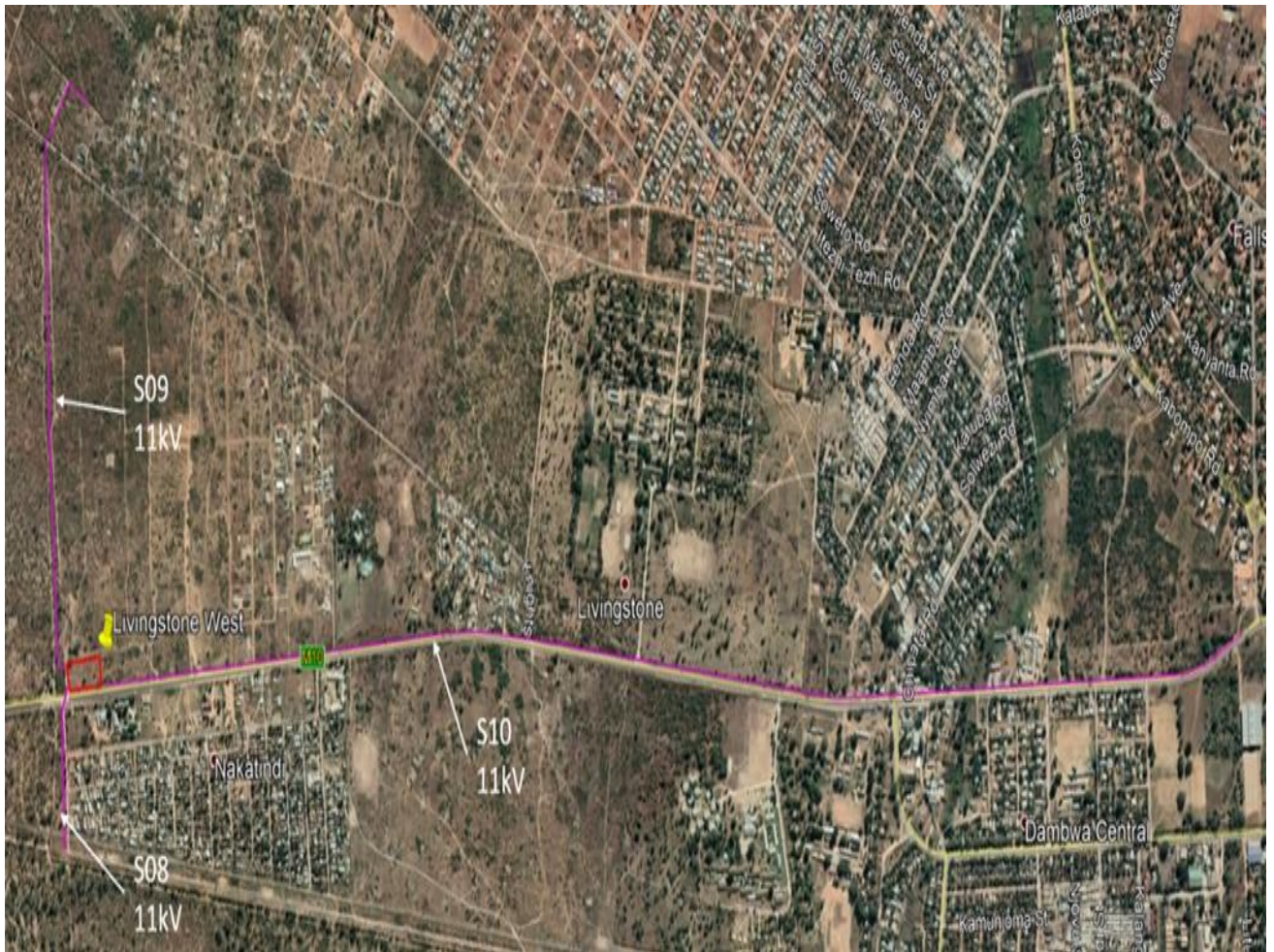
#### **S09 SS Livingstone West – Mwandu 11kV**

From the new Livingstone West S/S a new 1.5 km 11kV feeder will be constructed north to Mwandu and connected to an existing line. This line will follow just outside the border of the Mosi Oa Tunya NP.

#### **S10 SS Livingstone West - Intercity/Capitol Tires Terminus Mwandu**

From the new Livingstone West S/S a new 4.8 km 11kV feeder will be constructed to Terminus Line and connected to an existing line. This line will follow the Kazungula road (M10) east towards the centre of town.

Figure 5: Connections S08, S09, S10 from Livingstone West



### S11 SS Sun Hotel- into Vic Falls- Linda Line

One 33kV feeder of about 1km length will be constructed and terminated at SS Sun Hotel and connected to the existing line. The line will be terminated in a joint box outside the SS Sun and Victoria Falls Substations. Additional infrastructure to be provided at existing Victoria falls Power Station.

Figure 6: S11 33kV connection Sun Hotel SS – Victoria Falls line



**Table 5: Extent of MV lines in Livingstone**

Ref	OH Line Livingstone	11kV km	33kV km
S08	SS Livingstone West - Katombora Line x 2	1	
S09	SS Livingstone West – Mwandu	1.5	
S10	SS Livingstone West - Intercity/Capitol Tires Terminus	4.8	
S11	SS Sun Hotel- into Vic falls line with ADSS		0.4
<b>Total</b>		<b>7.3</b>	<b>0.4</b>

### 3.4.3 Access Project 11kV lines, Transformers and Customer Connections

Several small 11kV extensions will be part of the Access project for Livingstone. These will include consumer connections and transformers. The Makalanguzu extension is located in Kazungula, Mambova is about 10km west of Kazungula. The other lines and connections are in Livingstone and its environs.

Table 6: Livingstone Access conductor lengths

Access Project Livingstone		11kV km	ABC 120 km	ABC 70 km	ABC 35 km
SA1	Makalanguzu Extension	1	0.4	1.2	0.4
SA2	Mambova		0.8	2.4	0.8
SA3	Linda (Maloni- reinforcement)	1	0.8	2.4	0.8
SA4	Libuyu R&G		0.4	1.2	0.4
SA5	Mulala B	0.6	0.5	1.5	0.5
<b>Total</b>		<b>2.6</b>	<b>2.9</b>	<b>8.7</b>	<b>2.9</b>

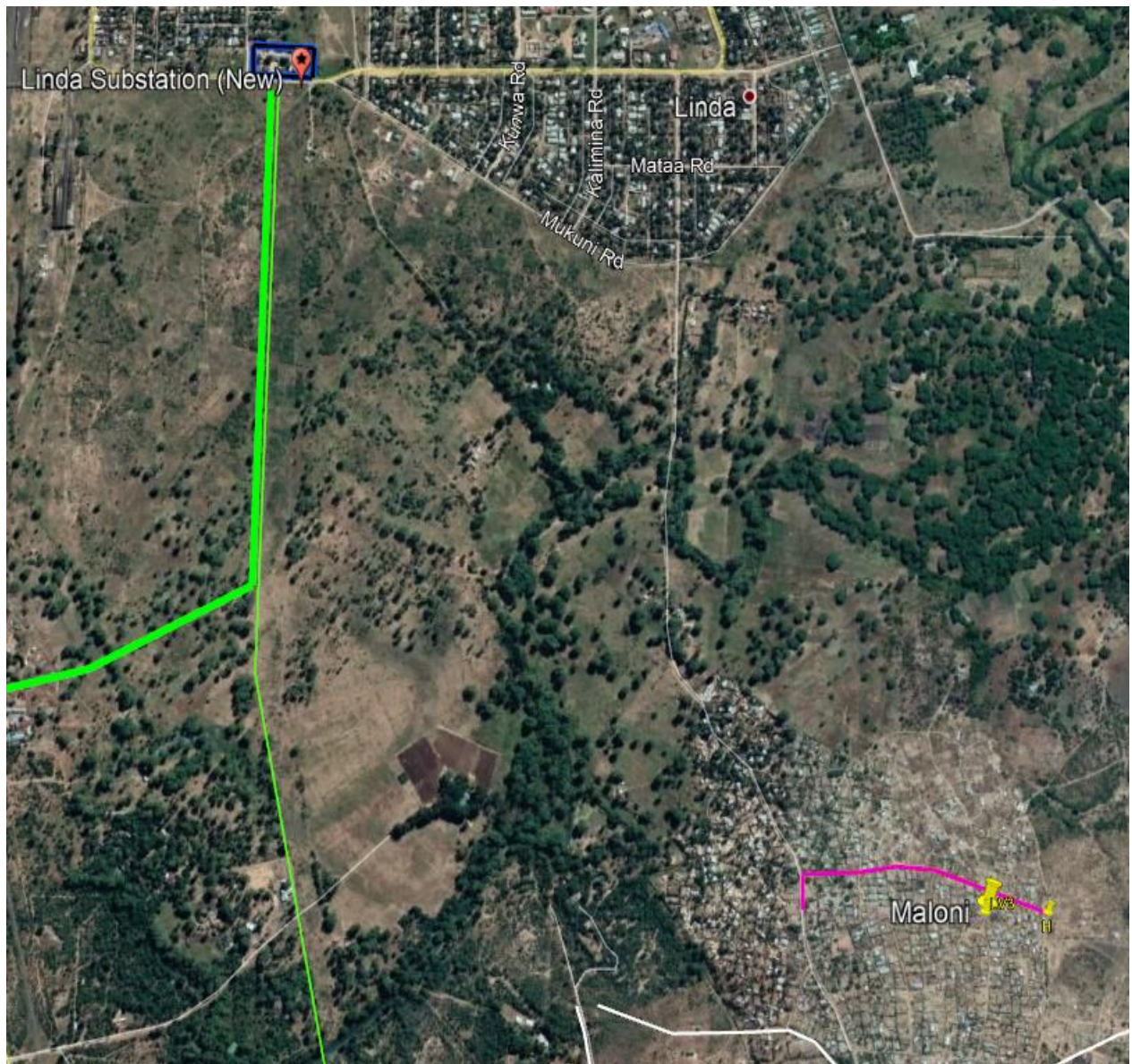
Table 7: Livingstone access: Transformer capacity and customers

		Transformers MV/LV		Customers
		200 kVA	315 kVA	
SA1	Makalanguzu Extension	2		305
SA2	Mambova	2		257
SA3	Linda (Maloni- reinforcement)	2		235
SA4	Libuyu R&G			232
SA5	Mulala B		3	524
<b>Total</b>		<b>6</b>	<b>3</b>	<b>1 553</b>

Figure 7: Location of SA1 in Kazungula



Figure 8: Location of SA3 Maloni 33kV reinforcement



### **3.5 Associated Projects**

- The Governments of Zambia, Zimbabwe and Namibia, together with the Southern Africa Power Pool (SAPP) are planning the construction of a new 400kV transmission line (ZIZABONA) from Zimbabwe to the new Mukuni Substation east of Livingstone and further west to Sesheke and Katima Mulilo in Namibia. This project will reinforce the transmission capacity and facilitate trade and power sharing between the involved countries.
- The Mukuni substation will further be connected to the existing 220kV line from Victoria Falls to Muzuma, and which will be upgraded to 300kV.
- The Batoka Gorge Hydropower Station, currently under construction, will be connected to Mukuni substation.

### **3.6 Project Products and By-products**

The product of the project is electric power that will be transmitted on the proposed transmission and distribution lines, while the resulting by-products could include; waste materials from the construction process such as empty cement bags and other packaging materials, aggregates, steel off cuts, bolts & nuts, wood and waste (domestic) from camp sites.

### **3.7 Resource Requirements**

Construction of the proposed power line will occur over a period of Thirty-six (36) months. Resource requirements include human capital, plant and machinery as well as finance. The labour force shall include environmentalists, social scientist, engineers, surveyors, health inspectors, safety inspectors, quality surveyors and general workmen. Unskilled labour shall be recruited from within the project area. In addition, natural resources such as water, sand, laterite and trees (wood) will be used.

### **3.8 Options Considered**

#### **3.8.1 Line Route Options**

The major component where there are any alternatives or options is the transmission line connecting Linda substation to the new Livingstone West substation and further to connect to the existing 66kV line to Kazungula at Imushu.

The substation locations were determined based on the availability of land, which has already been acquired by ZESCO.

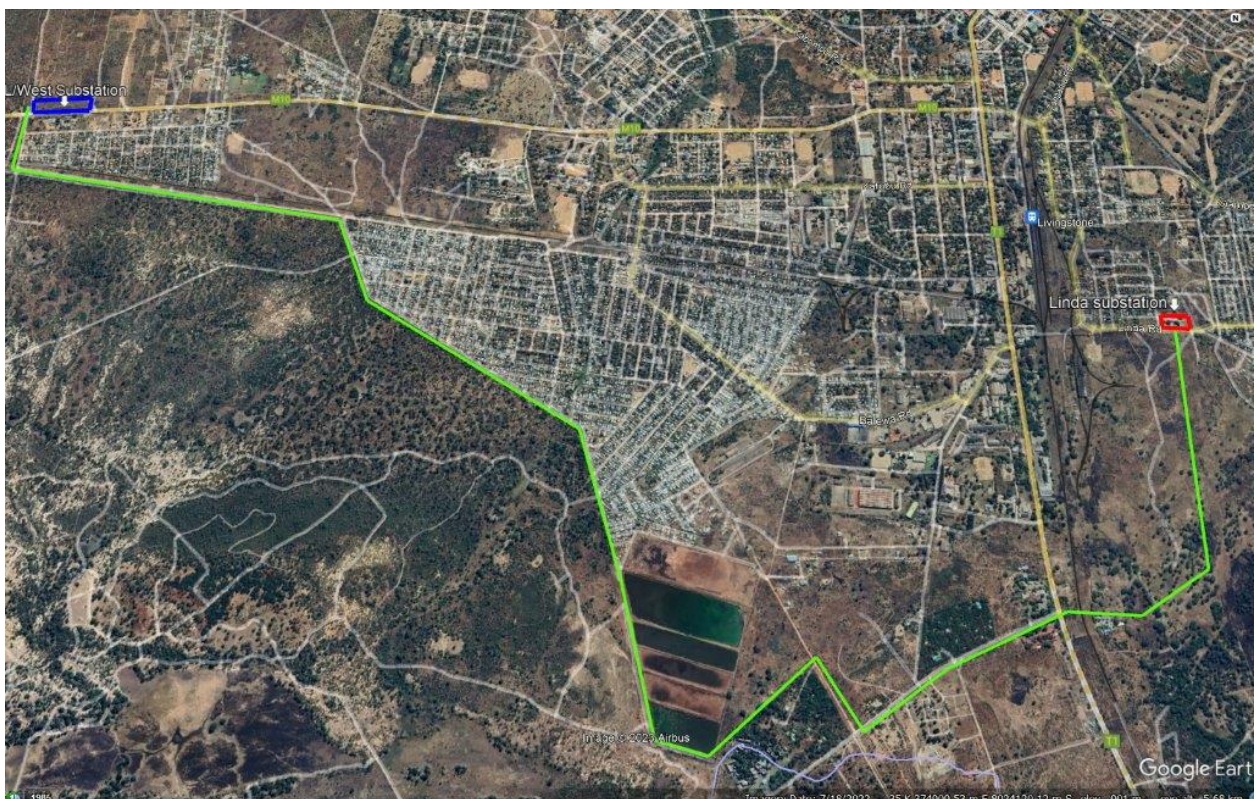
The 11 and 33kV lines do not have any alternatives. These are drawn where there is need for connections and upgrading of the existing network.

- **66kV Transmission Line Linda SS- to Livingstone West SS**

## Option 1

The proposed transmission line will emanate from the existing Linda substation, runs south wards for a 1km before it turns west wards to cross the railway line and Mosi Oa Tunya road. The line then runs parallel to Sichango road and turns Northwards after Maramba cultural village. It then heads westwards following the boundary of the Southern Water and Sewerage Company (SWASCO) Sewer ponds, it then enters the Mosi Oa Tunya National Park and follows its boundary both inside and outside up to the point it crosses the Mulobezi railway line to head directly to the proposed Livingstone West substation. Figure 9 shows the alternative one for the 66kV line.

Figure 9: Alternative (1) one for the 66kV transmission line Linda SS – to Livingstone West

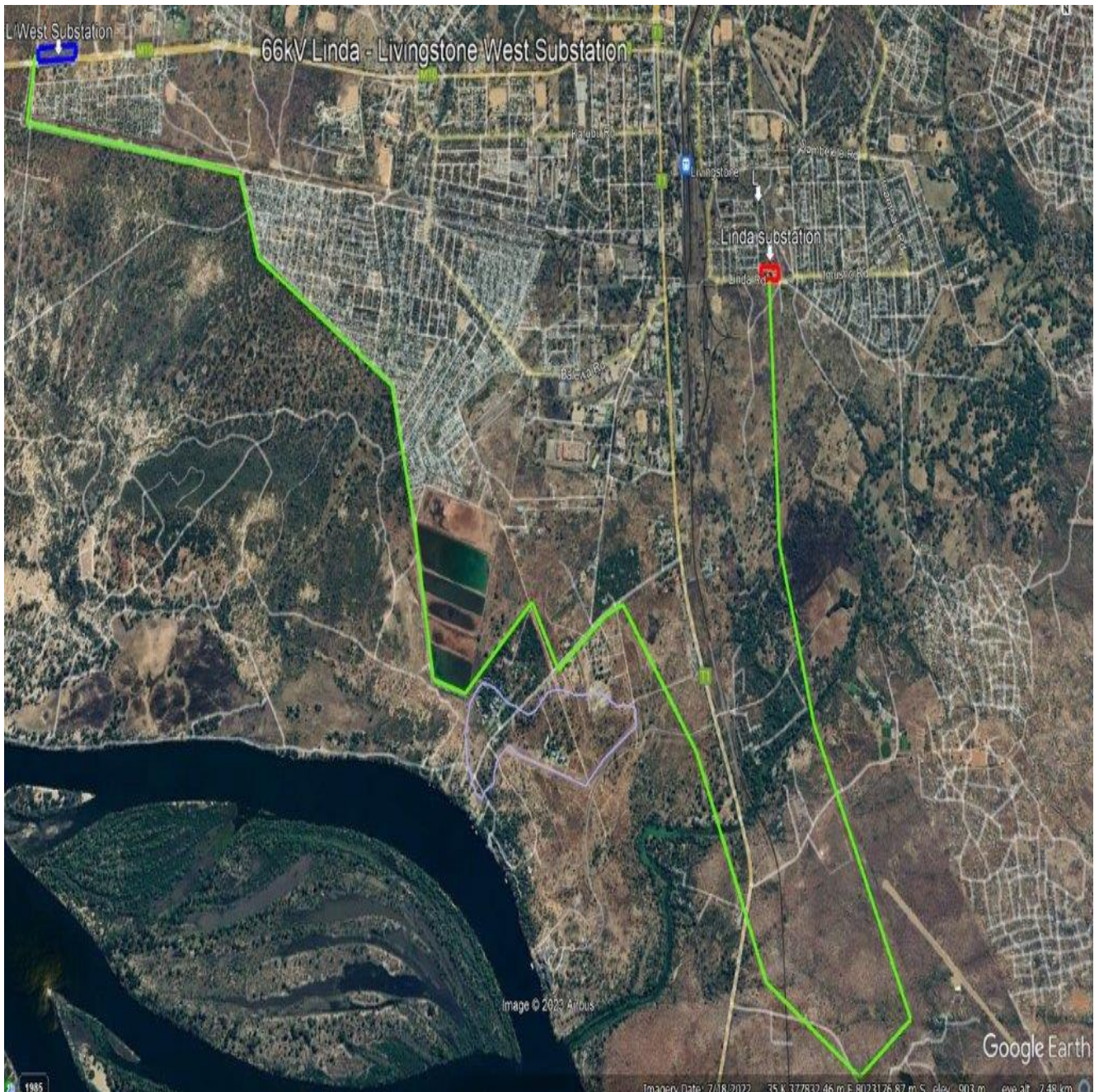


- **Option 2**

The second option is for the proposed transmission line to emanate from the existing Linda substation, and run south wards for 2km before it enters the Mosi Oa Tunya National Park in which it continues to run for 1.3km and turns westwards before turning northwards after 0.4km to cross the railway line and Mosi Oa Tunya road before it exits the park at Maramba river. The line then meets Sichango road where it

turns westwards and makes another turn northwards after Maramba cultural village. It then heads westwards following the boundary of the Southern Water and Sewerage Company (SWASCO) Sewer ponds, it again enters the Mosi Oa Tunya National Park and follows its boundary both inside and outside up to the point it crosses the Mulobezi railway line to head directly to the proposed Livingstone West substation. Refer Figure 10 below

Figure 10: Shows the alternative (1) two for the 66kV transmission line



- **Option 3**

Underground cable for the transmission line was considered as a technical option but is too expensive in terms of setting up and maintenances during operation phase. It will also require a lot of property displacement. The figure 11, below shows alternative 3 for underground cable.

Figure 11: Transmission 66kV Linda SS-Livingstone W SS two options



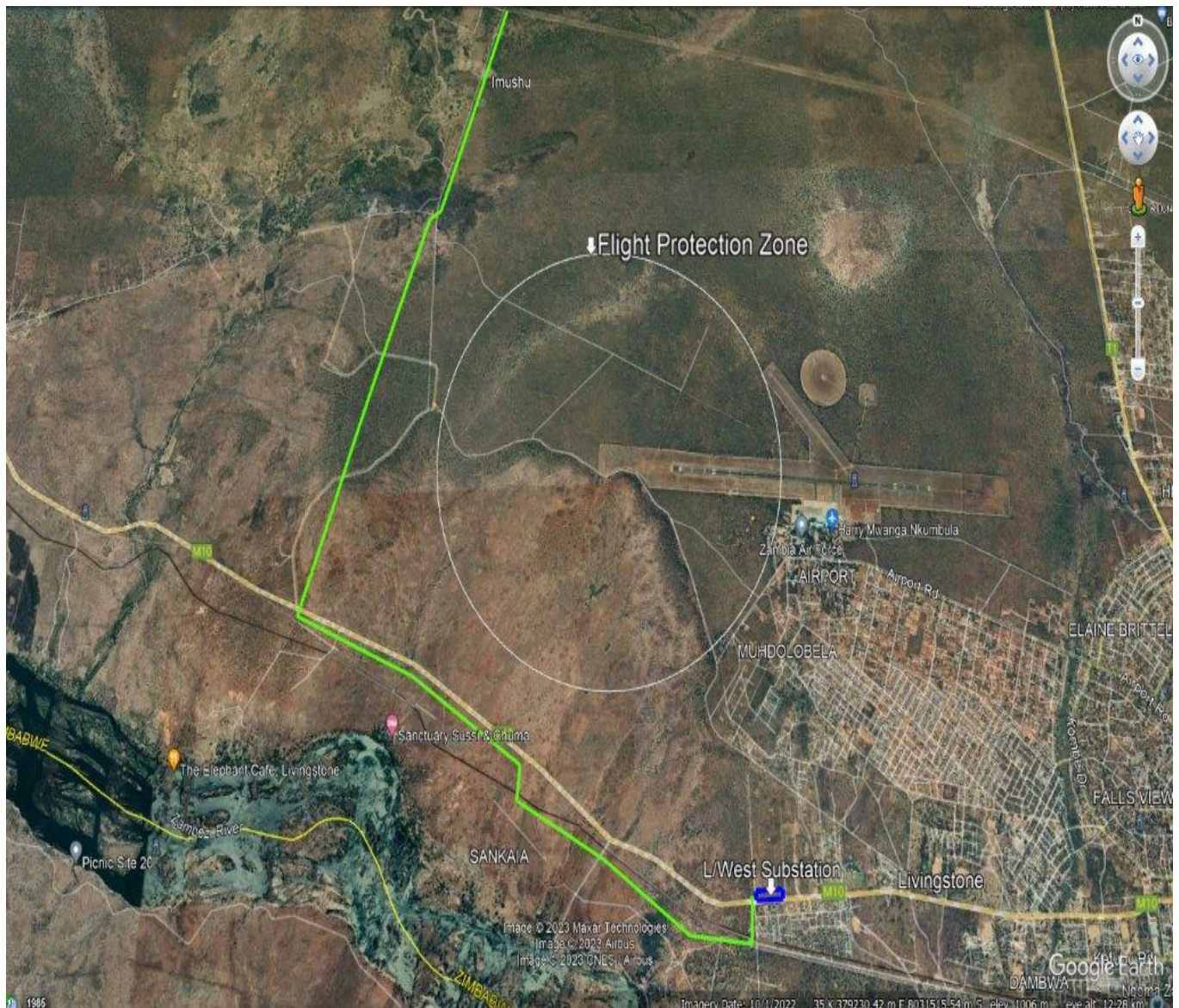
- **Selected option**

Option 1 (green line in figure 9) overhead transmission line was selected because it interferes less with the National Park, it is shorter and less costly. The underground cable solution was not selected due to cost, and difficulty of repair and maintenance.

- **66kV Transmission Line Livingstone West SS – Imushu**
- **Option 1**

The line will be built as an overhead line, exiting Livingstone West SS along the same corridor as the connection to Linda SS, but will turn west after crossing the Mulobezi railway line and enters the Mosi Oa Tunya National Park. It will then run west parallel to the railway line for about 6 km until it exits the park to cross the Kazungula road (M10) northwards towards Imushu. For the route of the line, refer to figure 9 and figure 10 (green line). In the northern part of the line it will affect the Dambwa National Forest Reserve 22. The figure 12, shows alternative 1 of 66kV transmission line Livingstone West SS- Imushu.

Figure 12: Alternative one 66kV Transmission Line Livingstone West SS – Imushu



- **Option 2**

The second option investigated was to draw the line more freely inside the National Park as seen in Figure 13 (green line).

The line is proposed to be built as an overhead line, exiting Livingstone West SS North-Westwards into the Mosi Oa Tunya park for approximately 8 km before heading 2 km North towards the termination point at Imushu approximately 2 km. Within the 8 km in the park, the line crosses the Flight protection zone at Harry Mwanga Nkumbula international airport

For the route of the line, refer to Figure 4 and Figure 10 (green line). In the northern part of the line it will affect the Dambwa National Forest Reserve 22.

Figure 13: Alternative two (2) 66kV Transmission Line Livingstone West SS – Imushu

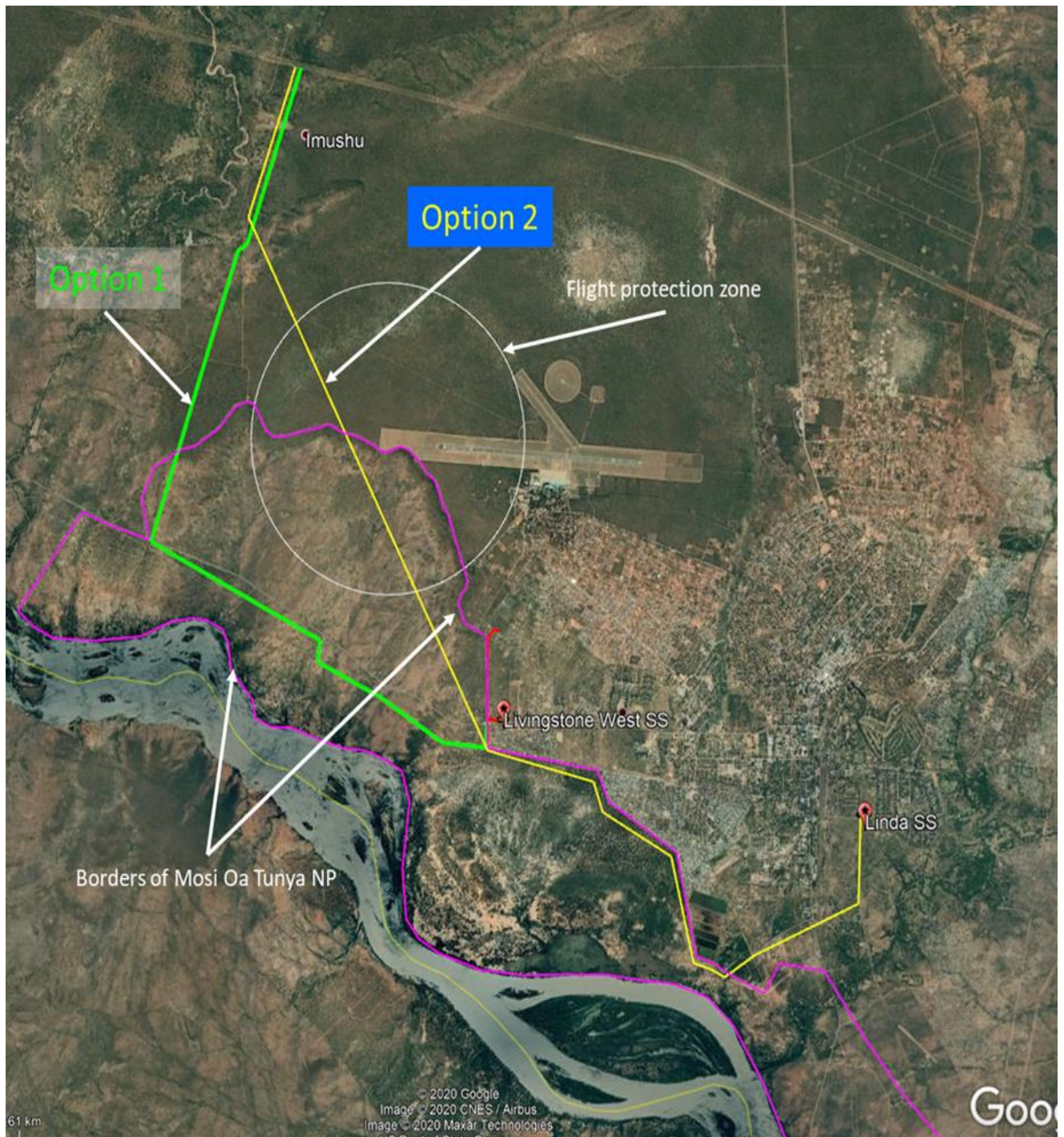


- **Option 3**

Underground cable for the transmission line was briefly considered as a technical option to overhead line.

Figure 14, shows the alternative 1 and 2 on the google map

Figure 13: Transmission 66kV Livingstone W – Imushu SS two options



- **Selected option**

Option 1 (green line in figure 10) overhead transmission line was selected because it does not interfere with the flight protection zone of Harry Mwanga Nkumbula International Airport, and less with the Dambwa forest reserve north of the airport. It does interfere with the National Park, but follows existing infrastructure already located there (road and railway). The underground cable solution was not selected due to cost, and difficulty of repair and maintenance, as well as unsuitable terrain.

- **No Project Option**

The no-project option would mean;

- The old and existing distribution infrastructure in Livingstone would worsen
- The insufficient network capacity would never meet the increasing demand
- Poor quality of supply
- No reliability and security of supply

This was not considered feasible by ZESCO Limited.

## **4.0 PROPOSED PROJECT ACTIVITIES**

### **4.1 Main activities**

The implementation phase of the project will involve various activities which include Site Preparation, Construction and Operation phase respectively.

#### **4.1.1 Preparation Phase**

The activities to be conducted during the site preparation phase of the project include reconnaissance survey, asset survey and inventory, compensation of PAP<sup>4</sup>, clearance of wayleave, and training of personnel.

##### **a) Reconnaissance Survey**

A reconnaissance survey was conducted to minimize anticipated environmental and social impacts. This included the review of maps and preliminary ground-truthing. Additionally, the survey was done to determine the nature of works to be carried out on the lines and substations.

##### **b) Asset Survey, Inventory and Compensation**

A preliminary asset survey, census and inventory were carried out to determine the extent of loss of immovable assets and livelihood opportunities.

##### **c) Wayleave Clearance**

Due to the rural character of most of the project area, the wayleave will be restricted at 22 m for most of the 33 kV lines. For 11 kV distribution lines, both 10- and 15-meter wayleaves will be applied due to environment. It is anticipated that no structure will need to be demolished. Due to the high-density area where the lines traverse the ERB code of practice to reduce the wayleave is utilised.

To facilitate construction works, and to ensure safety, the residents in the area will be required to operate outside the wayleave. Further, construction activities will occur after crop harvesting in sections where the wayleave is encroaching on agricultural activities, therefore not impacting crops. However, any loss of physical assets and/or livelihood opportunities shall be adequately compensated for.

##### **d) Training of Personnel**

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Environmental, Health and Safety, (EHS) training will be given to appropriate contracted personnel prior to the commencement of the works. The level of training will be commensurate with the type of duties of the personnel. The training program will cover plans and procedures specific to the project and may include ZESCO EHS policies, wayleave clearing guidelines, waste management and general EHS education. Application of occupational health and safety practices will be mandatory at the project site.

#### **4.1.2 Construction phase**

The development of the distribution lines involving the construction of associated substation infrastructure. The Project will comprise construction of sub-transmission lines and associated substation works as follows:

#### **4.1.3 Operation phase**

The distribution lines shall be declared operational once all pre-commissioning tests and activities are completed and the lines are energized. Route maintenance of the wayleave (vegetation control) and technical inspections (line patrols), general line performance and normal switching shall constitute the operation phase of the lines.

The distribution lines will be operated and maintained by ZESCO in accordance with standard procedures designed to ensure the integrity of the transmission system.

The activities to be undertaken during operation phase are as follows:

- Routine maintenance of the lines will be carried out during periodic wayleave maintenance by ground patrol.
- The vegetation along the wayleave will be controlled to minimize conducting power to the ground and ground clearances are not to be exceeded. ZESCO currently uses a combination of mechanical bush control and manual cutting for vegetation according to the ZESCO Wayleave Guidelines.

#### **4.1.4 Decommissioning and Closure Phase**

The activities to be undertaken during decommissioning are:

- Removal of all objects:
  - Power lines: Poles, conductors, cross-bars, insulators, etc.

- Substation: Transformers, conductors, insulators, breakers, oils, civil works, etc.
- Recycling of usable objects
- Destruction or deposition of unusable objects and wastes in an environmentally acceptable way
- Restoring land to previous situation and in a proper way for its used by owners or public
- Returning expropriated land to original owners
- Transferring public land to the state; alternatively selling to the public

## **4.2 Line Activities**

The following is the description of typical line construction activities. Specific environmental protection measures and standard construction specifications are included in the ZESCO limited wayleave clearing guidelines. During the detailed wayleave selection process, the centre line and the boundaries of the wayleave were established within the 32m parameter for 132kV transmission line and 11m for the 33kV distribution lines.

### **4.2.1 Bush Clearing**

It is the practice of ZESCO Limited to clear the wayleave by removing standing vegetation. This practice is employed to ensure that sufficient clearance is maintained between the conductor and the ground, and to facilitate maintenance of the line should need arise.

Personnel from ZESCO Limited will be on site during the clearing operation to provide quality control and supply the contractor information that may be required.

### **4.2.2 Erecting of Structures**

Where possible, structure sites are established with minimal grubbing. However, in particularly steep terrain, a flat area may be constructed for the structure site. The structures maybe assembled horizontally on the ground and set in place by a crane. An alternative method would be to assemble the structure vertically one piece at a time at the structure location.

### **4.2.3 Stringing Conductor**

Once the structures are erected, a tractor (or equivalent vehicle) strings the conductor and overhead shield wires through pulleys attached to the insulators. The conductor wires are attached by hand to the insulators. The shield wires provide a path to the ground for lightning strikes.

#### **4.2.4 Installation of Counterpoise**

Counterpoise is installed in areas where ground resistance is high in order to improve grounding, and reduce the number of lightning caused outages on the line.

#### **4.2.5 Re-vegetation**

The wayleave will be allowed to naturally re-vegetate under the vegetation control program. An active re-vegetation program shall be implemented in erodible areas (i.e. road crossings, watercourse crossings) and areas of critical wildlife habitat. People cultivating crops in the wayleaves will be able to continue to do so after the lines have been constructed, with the exception of the location of tower spots on the 132kV transmission line.

#### **4.2.6 Access**

The proposed power line wayleave will traverse and intersect several existing public, private roads and forest roads. Existing roads will be used as much as practically possible to access the wayleave. Existing roads and trails used by Forestry Department will be used where appropriate. In more remote areas, access roads will be constructed during the clearing and construction phases as required. It is anticipated that few new access roads will be constructed for the project.

#### **4.2.7 Operations and Maintenance Activities**

The proposed power lines will be operated and maintained by ZESCO Limited in accordance with standard procedures designed to sustain the integrity of the power line system. Routine inspections will be conducted on the power lines to ensure line security and public safety. During operation, routine maintenance of the proposed line will be undertaken every year during annual wayleave maintenance by ground patrol. The vegetation along the wayleave will be controlled to minimize conducting power to the ground and ground clearances will not to be exceeded. ZESCO Limited currently uses a combination of mechanical bush control and manual cutting for vegetation in line with corporate wayleave guidelines.

#### **4.2.8 Substations**

Substation construction and rehabilitation will include work in a dangerous environment and will include:

- Work near energized electric equipment
- Lifting and moving of heavy loads

- Use of chemicals and oils
- Excavation and backfilling
- Construction of houses and structures
- Movement of heavy vehicles in and nearby the construction site

For all works the Occupational Health and Safety (OHS) requirements of the Contractor's EMP shall need to be adhered to. Public hazards, including that originating in social interaction with the workforce will also be addressed in these.

All material, waste chemical compounds etc. shall be handled in line with the OHS requirements. Protective measures and Personal Protection Equipment shall be available and used for all activities so requiring.

#### **4.2.9 Clean up**

Clean up activities will be on-going as construction progresses, and will involve the removal of all waste materials from the construction site, and installation of erosion control and stabilization techniques, where required.

#### **4.2.10 Decommissioning and Abandonment Activities**

ZESCO Limited facilities are designed and will be operated and maintained to provide safe and efficient service over the long term. Should some facilities need to be decommissioned or abandoned, appropriate technology will be used to ensure that regulatory requirements are adhered to and met. Decommissioning and abandonment of facilities shall be carried out in a safe, efficient and environmentally sound manner and in line with governing national and international laws.

## 5.0 BASELINE ENVIRONMENTAL CONDITIONS

### 5.1 The Physical Environment

#### 5.1.1 Climate

Rainfall in the Livingstone project area is concentrated during the period November to March and average annual precipitation for the 1970-2010 was (mean±1 standard error) 648±24.7 mm. Average monthly annual maximum and minimum temperatures are 30.2±0.13°C and 14.8±0.12°C, respectively. Linear regression analysis was used to assess the significance of climate trends at Livingstone. Although the Livingstone area has been experiencing a decreasing trend in rainfall, the trend is not statistically significant (Figure 15). However, the increasing trend in maximum and minimum temperatures is statistically significant (Figure 16), which indicates a general warming of the climate in the project area.

Winds in the project area are generally Easterlies with speeds that range from 1 – 8.5 km per hour and highest speeds occur during thunderstorms in the rainy season. Relative humidity is lowest in September (30%) and highest in January (80%).

Zambia administrative boundaries and agro-ecological regions (I, IIa, IIb, III). Amount of rainfall received per year: less than 700 mm (I); 800–1000 mm (IIa); 800–1000 mm (IIb); 1000–1500 mm (III). Refer to figure 14 below. Source: FAO (CFA, Zambia Branch home.

The proposed project site falls under agro-ecological region I which has rainfall less than 700 mm.

Figure 14: Agro-Ecological regions in Zambia

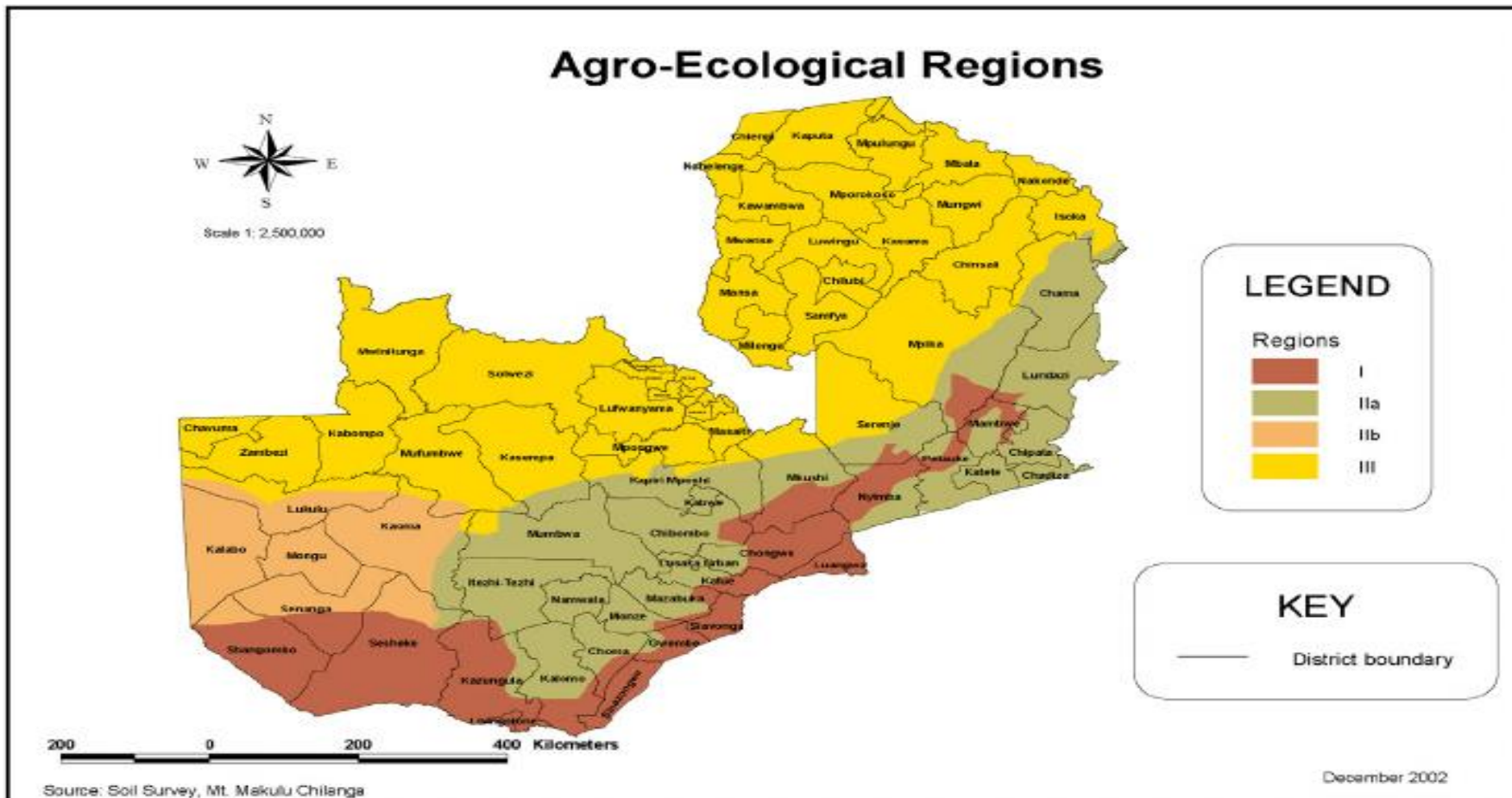
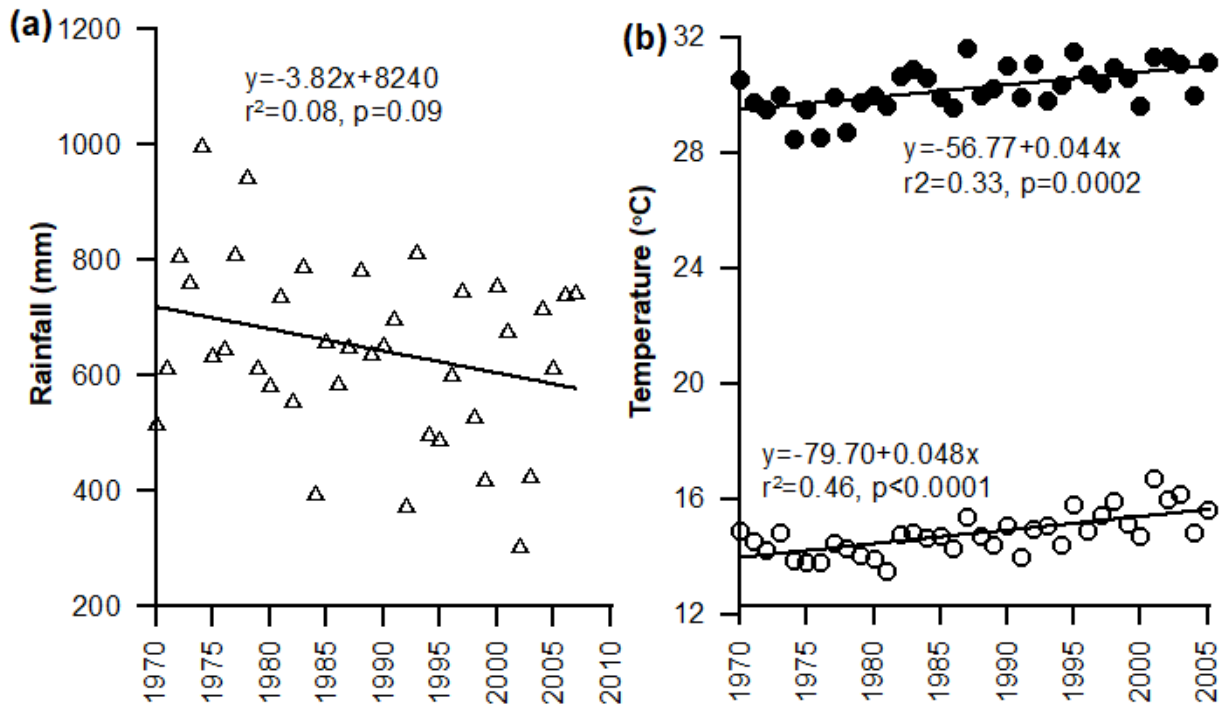


Figure 15: Trends in average climatic conditions at Livingstone: (a) rainfall (empty triangles) (b) minimum temperature (empty circles) and maximum temperature (filled circles). Based on data from 1970 – 2010.

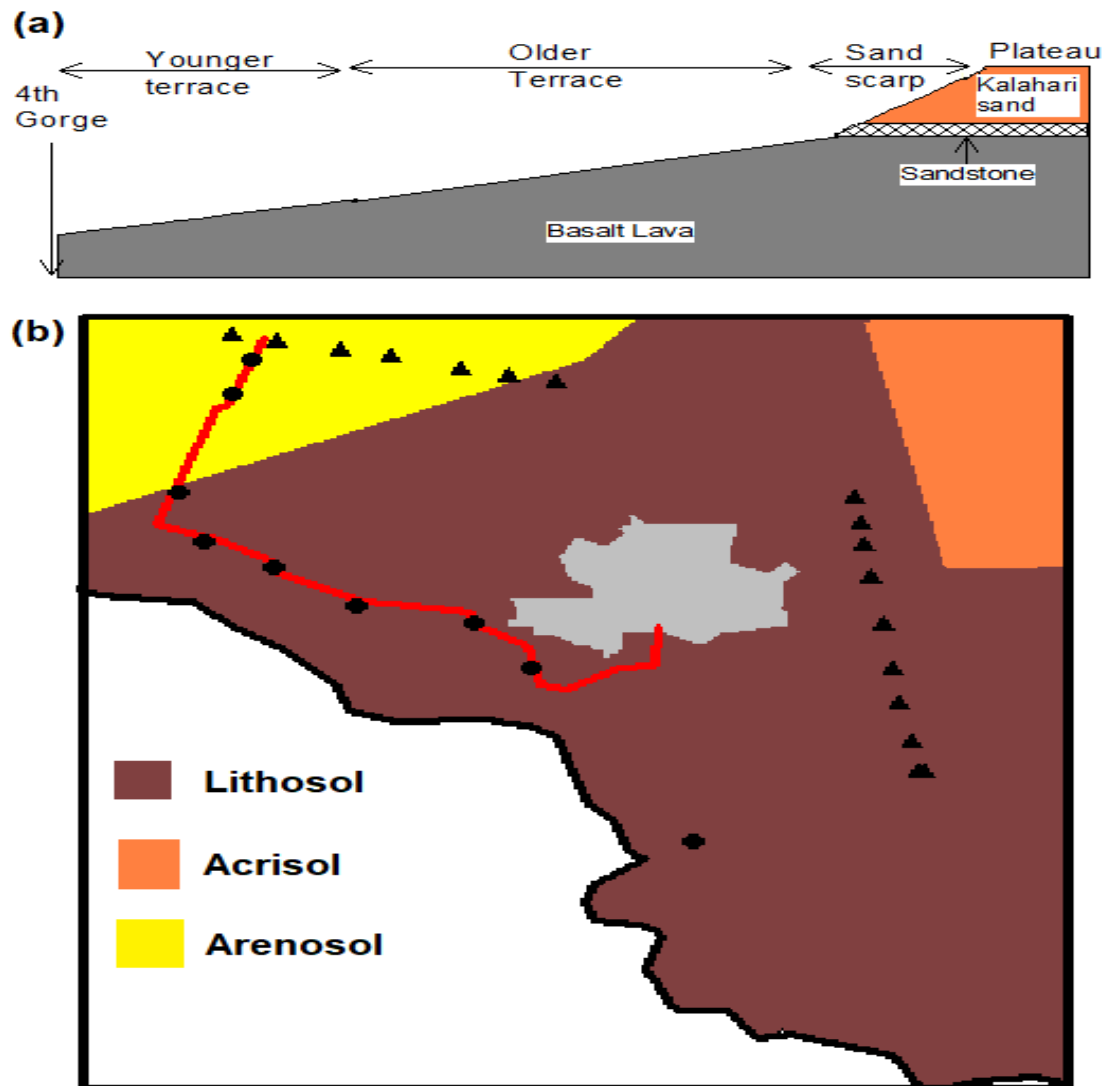


### 5.1.2 Topography, Geology and Soils

The altitude in the project area ranges from 845 to 1020 m above sea level and the main landforms are the Zambezi River valley that is separated from the plateau by a narrow scarp (Figure 16). The valley consists of a river-wide channel upstream of the Victoria Falls and gorges and terraces on the downstream. The River channel and terraces lie directly on the basalt bedrock. On the scarp and plateau the geology consists of Kalahari Sand that is separated from the underlying basalt lava by piped Sandstone that is up to 1.0 m thick (Moore 2013). Upstream to the Victoria Falls the valleys along the major tributaries are covered with alluvium.

The project area has three main soil types: Acrisol, Arenosol and Lithosols (b). In the south of the project area, river gravels and basaltic lithosols occur on the terraces above the Zambezi River (Figure 16). Acrisols occur in a small area to the northeast. Arenosols occur in the northwest of the project area and are deep (up to 4.5 m deep) consisting of red Kalahari sand (Moore 2013).

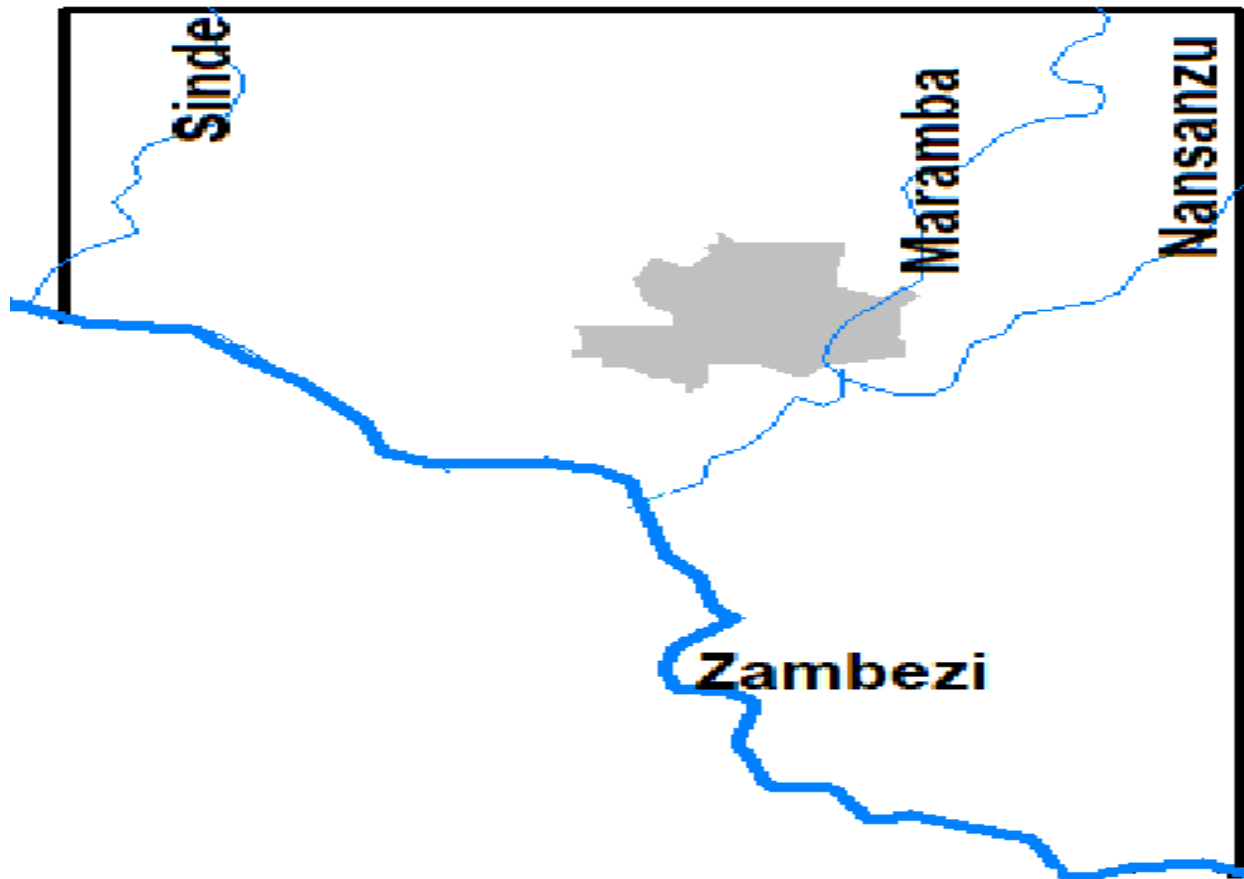
Figure 16: (a) A schematic representation of the geological units across the Zambezi River valley on the north side from the fourth Gorge to the interfluve (based on Clark (1975), and (b) soils in the project area. Also shown in (b) are inventory sample plots.



### 5.1.3 Hydrology

The project area is drained by the Maramba, Nansanzu and Sinda rivers which drain into the Zambezi River (Figure 17).

Figure 16: Drainage pattern in the project area. Urban land use is shown by the shaded area.



#### 5.1.4 Noise

The main source of noise in the project area is generated by aeroplanes using the Harry Mwanga Nkumbula International Airport in Livingstone and lighter aircrafts used in sight-seeing by tourists.

### 5.2 The Biological Environment

#### 5.2.1 Vegetation Cover and Land Use

Of the 390km<sup>2</sup> in the project area, about 15km<sup>2</sup> (3.9%) is under urban land use. The natural vegetation is made up of nearly 9% of scattered patches/stretches of grassland (35km<sup>2</sup>) and a similar percentage of miombo (*Brachystegia -Julbernardia*) woodland in the northeast of the project area. The remainder of the vegetation consists of Kalahari woodland (70 km<sup>2</sup>) in the northwest and mopane (235km<sup>2</sup>) in the rest of the project area. Mopane vegetation is dominated by *Colophospermum mopane* and

occurs either as a woodland or shrubland (Figure 18). Dominant tree species in Kalahari woodland are *Baikiaea plurijuga*, *Baphia mossambicense*, *Diplorhynchus condylocarpon*, *Pterocarpus angolensis* and *Combretum* spp. Kalahari woodland occurs on deep Kalahari sands (arenosols) while mopane grows on basaltic lithosols (mainly mopane scrubland) and alluvium (mopane woodland).

However, much of the natural vegetation in the project area has been degraded or converted to agricultural land use, including cropland and livestock grazing land and peri-urban settlement. Mopane woodland has also been degraded by elephant browsing that has reduced it to mopane scrubland (Figure 18). Thirty-eight percent of the trees on the sample plots were cut while a similar percentage had been debarked.

Figure 17: Vegetation types in the Livingstone project area.



Figure 18: Mopane woodland (a) and scrubland (b) in the project area.



### 5.2.2 Biodiversity

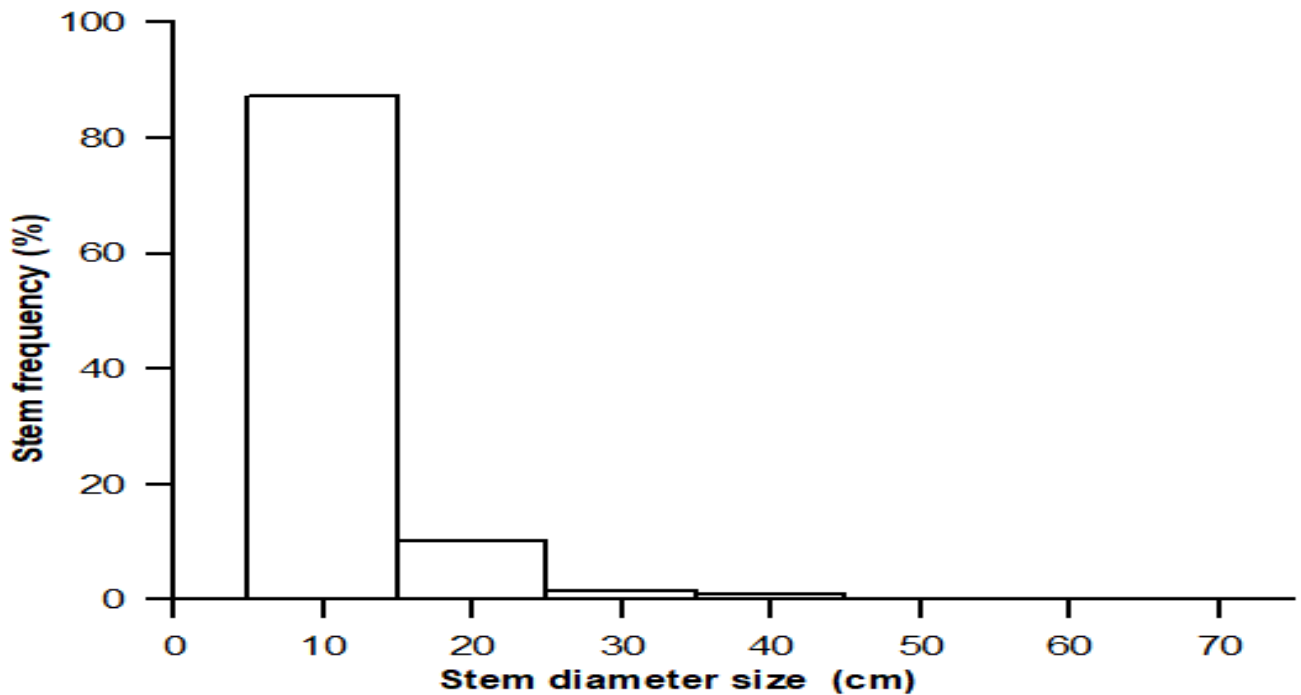
### 5.2.3 Flora Diversity

The 53 plant species that have been recorded in the project area, include a sedge (1.9%), a palm (1.9%), 6 grasses (11.3%) and 45 trees (84.9%) (0).

### 5.2.4 Woodland Structure

Tree stem density (mean  $\pm 1SE$ ) on inventory sample plots was  $775.0 \pm 202.3$  per ha and tree mean diameter at breast height (dbh) in the project area is  $6.6 \pm 0.17$  cm with a range of 3–46 cm. The most frequent dbh size class is 3–10 cm (Figure 19) which is probably a consequence of the widespread disturbance that is occurring in the woodlands in the project area which tends to induce regrowth of young trees that dominated the woodland at sample plots.

Figure 19: Tree stand structure at sample plots in the Livingstone project area.



Aboveground wood biomass of trees (kg, oven-dry) was estimated from dbh data using the following equation (Chidumayo 2013):

$$\ln(y) = 2.5553 * (\ln dbh) - \ln 2.5265$$

The estimates derived by the above model have a mean error of  $4 \pm 3\%$ . Aboveground tree wood biomass was estimated at  $18.9 \pm 4.1$  t per ha with a range of 0 – 74.8 t per ha. This large range in tree biomass is further evidence in support of the idea that the woodlands in the project area have a high spatial variation in standing stock perhaps due to high spatial variability in degradation levels.

### 5.3 Fauna Diversity

#### 5.3.1 Invertebrates

A total of 116 species of invertebrates (animals without a backbone) have been recorded in the project area (0) and these are dominated by insects. A few insects, mainly grasshoppers (Orthoptera) and butterflies (Lepidoptera), were observed during the field survey (Figure 10).

#### 5.3.2 Amphibians

Amphibians in the project area are dominated by frogs and toads and a total of 21 species have been recorded for this area (Table 8). Many of these inhabit the aquatic environment (rivers and streams).

Table 8: Amphibian species recorded in the Livingstone project area

Number	Species	Number	Species
1	<i>Bufo carens</i>	12	<i>Phrynomerus bifasciatus</i>
2	<i>Bufo garmani</i>	13	<i>Ptychadena chrysogaster</i>
3	<i>Bufo maculatus</i>	14	<i>Ptychadena mossambica</i>
4	<i>Bufo regularis</i>	15	<i>Ptychadena porosissima</i>
5	<i>Bufo uertebralis</i>	16	<i>Ptychadena subpunctata</i>
6	<i>Chiromantis xerampelina</i>	17	<i>Ptychadena superciliaris</i>
7	<i>Hemisus marmoratus</i>	18	<i>Tomopterna marmorata</i>
8	<i>Hyperolius aposematicus</i>	19	<i>Tomopterna delalandii</i>
9	<i>Kassina senegalensis</i>	20	<i>Xenopus laevis</i>
10	<i>Phrynobatrachus natalensis</i>	21	<i>Xenopus muelleri</i>
11	<i>Phrynobatrachus ukingensis</i>		

### 5.3.2 Reptiles

Sixty-six reptile (lizards and snakes) species have been recorded in the project area (0).

### 5.3.2 Fish

A total of 16 species of fish have been recorded in the project area (Table 9).

Table 9: Fish species that have been recorded in the Livingstone project area

Number	Species	Number	Species
1	<i>Aethiomastacembelus vanderwaali</i>	9	<i>Hydrocynus vittatus</i>
2	<i>Anguilla bengalensis labiata</i>	10	<i>Labeo altivelis</i>
3	<i>Barbus marequensis</i>	11	<i>Mormyrus longirostris</i>
4	<i>Clariallabes platyprosopos</i>	12	<i>Oreochromis andersonii</i>
5	<i>Distichodus mossambicus</i>	13	<i>Serranochromis angusticeps</i>
6	<i>Distichodus shenga</i>	14	<i>Serranochromis robustus</i>
7	<i>Hepsetus odoe</i>	15	<i>Synodontis zambezensis</i>
8	<i>Heterobranchus longifilis</i>	16	<i>Tilapia rendalli</i>

### 5.3.3 Birds

A total of 49 species of birds have been recorded in the project area (0). Of these, two species were seen (one is shown in **Error! Reference source not found.**) while many others were heard calling during the field survey.

### 5.3.4 Mammals

Sixty-six mammal species (0) have been recorded in the project area and of these, vervet monkey (*Cercopithecus aethiops*), Chama baboon (*Papio ursinus*) and elephant (*Loxodonta africana*), were observed during the field survey (**Error! Reference source not found.**).

### 5.3.5 Biodiversity conservation

The Convention on Biological Diversity (United Nations Environment Programme 1992) defines biological diversity or biodiversity as the variability among living organisms and the ecological complexes of which they are part and this includes diversity within species, between species and ecosystems. Biodiversity is conserved in legally designated forest reserves and national parks (i.e., protected areas). There are two protected areas in the Livingstone project area: Dambwa North Forest Reserve and Mosi-oa-Tunya National Park (**Error! Reference source not found.**).

Forest Reserves (FRs) in Zambia were established under the Forest Act of 1973 that was repealed and replaced by the Forest Act of 2015. Forest Reserves are administered by the Forest Department. There are two main categories of FRs: Local Forests and National Forests. The management objective in Local Forests is to meet the needs for forest produce for present and future generations of local people while the management objective in National Forests is to protect and conserve major catchments and their biodiversity. Dambwa North Forest Reserve (10766 ha in size) is a Local Forest, part of which is within the project area but is not traversed by the proposed power line (**Error! Reference source not found.**).

National Parks in Zambia are natural areas established under the National Parks and Wildlife Act of 1968 that was repealed and replaced by the National Parks and Wildlife Act of 2015 which is administered by the National Parks and Wildlife Service (a Government Institution). The management objectives in National Parks are to protect biodiversity and the integrity of ecosystems for present and future generations and to provide a foundation for spiritual, scientific, educational, recreational and visitor opportunities that are environmentally and culturally compatible with conservation objectives. The extent of the Mosi-oa-Tunya National Park is about 66 km<sup>2</sup> and will be traversed by the proposed power line across its northern sector (**Error! Reference source not found.**).

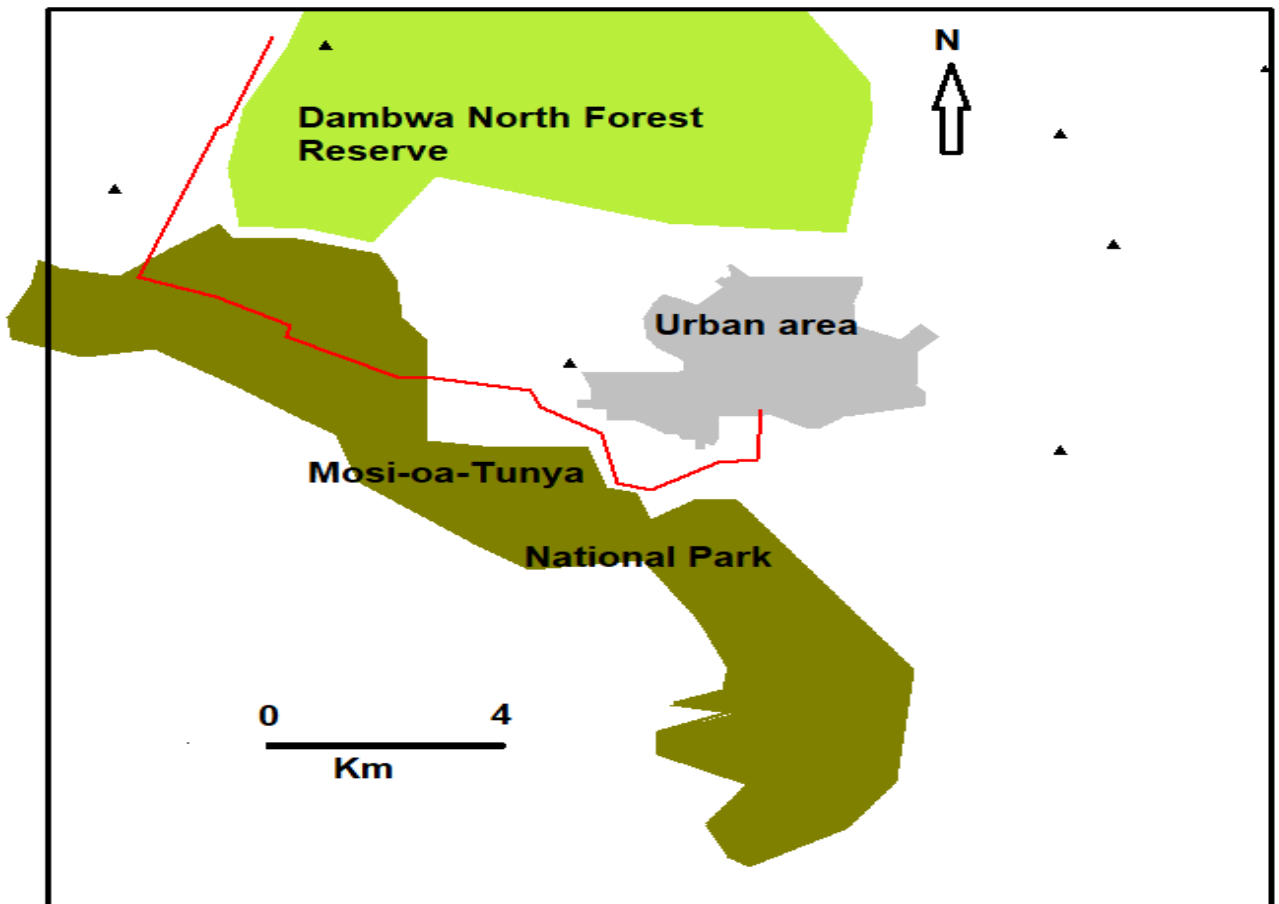
**Figure 10** Some animal species encountered during the field survey in the Livingstone project area. (a) grasshopper (*Ornithacris* sp.), (b) Cape turtle dove (*Streptopelia capicola*), (c) vervet monkey (*Cercopithecus aethiops*) and (d) elephant (*Loxodonta africana*).



Since the ratification of the World Heritage Convention in 1994, Zambia has enlisted a total of 374 National Heritage Sites for the protection of both cultural and natural attributes of national significance which are managed by the National Heritage

Commission. There are seven Heritage Sites in the project area (**Error! Reference source not found.**) but none is traversed by the proposed power line.

**Figure 11 Protected areas and Heritage Sites (filled triangles) in the Livingstone project area. The proposed power transmission line is shown in red.**



## 5.4 Baseline Socio-economic Conditions

### 5.4.1 Approach and Purpose

Baseline socio-economic conditions were investigated on location through sample surveys. These were conducted by ZESCO and SWECO staff and trained locals, using a predefined questionnaire (presented in 0). The survey team visited all locations with planned project activities. The purpose of the survey is to determine the general socio-economic situation in the project areas. In addition to the socio-economic survey, an inventory of assets affected by project activities was undertaken as described in the separate Resettlement and Compensation Action Plan for the Livingstone project

component. The purpose of the inventory is to create the basis for the Resettlement and Compensation Action Plan (RCAP), which is reported separately.

#### 5.4.1 Socio-economic Baseline Survey

A sample survey was undertaken in the project area to determine detailed socio-economic conditions in the study area. A total of 140 interviews were carried out, distributed randomly over the project component areas. Of the respondents the majority (94) were found in Livingstone district, while 46 were in Kazungula district. The results are presented in the following sections.

#### 5.4.2 Sample and Respondent Composition

In the project area, there were more male-headed households than female-headed households. However, slightly more than half of the respondents were women.

**Table 10: Sex of Household Head and Respondents**

	Woman		Man	
	n	% of sample	n	% of sample
Sex of household head	47	34%	92	66%
Sex of respondent	74	53%	66	47%

The education level in the area is rather high, with a large share of households and respondents with high education levels. The share of functionally illiterate households was small.

**Table 11: Highest Literacy Level in Household and Literacy of Respondent**

	Respondent		Any household member	
	n	% of sample	n	% of sample
Illiterate	5	4%	4	3%
Only read and write	2	1%	1	1%
Primary school	43	31%	29	21%
Secondary school	69	49%	66	47%
Higher education	22	16%	41	29%

#### 5.4.3 Household composition

Households were relatively large, at an average of six persons per household, possibly owing largely to relatively many adults in most of the sampled households. Household size was similar for male and female-headed households at 6.1 and 5.8 persons, respectively.

Table 12: Household composition (n)

Grouping	Average	Median
Elderly men (>60)	0.1	0
Adult men (16-60)	1.4	1
School-age boys (5-15)	0.9	1
Small boys (0-5)	0.4	0
Elderly women (>60)	0.2	0
Adult women (16-60)	1.7	1
School-age girls (5-15)	1.0	1
Small girls (0-5)	0.3	0
Household size	6.0	6

#### 5.4.4 Vulnerability

Slightly less than half of the sampled households had members that can be considered vulnerable, and who might require assistance in difficult circumstances. Adding to this the 3% of households who are functionally illiterate results in a rather high level of vulnerability. Most of the vulnerable households had one or two vulnerable persons.

Table 13: Vulnerable household members in the sample

	Disabled men	Disabled women	Widows	Widowers	Orphan girls	Orphan boys	Sample
Average / HH	0.1	0.2	0.1	0.1	0.2	0.2	1.0
Total HH with vulnerable persons	19	26	20	9	29	33	63
% of HH	14%	19%	14%	6%	21%	24%	45%
Percent of households with n disabled members							
0	89%	83%	86%	94%	88%	84%	55%
1	11%	16%	13%	6%	8%	9%	23%
2	0%	1%	1%	0%	2%	4%	12%
3	0%	0%	0%	0%	1%	1%	5%
4	1%	0%	0%	0%	0%	1%	1%
5	0%	0%	0%	0%	0%	0%	2%
6	0%	0%	0%	0%	1%	0%	1%

### 5.4.5 Health related conditions

Most of the respondents stated to have access to medical facilities, and a good share used traditional medicine as well. However, a small fraction still claimed not to have any access. Refer to table 14.

Table 14: Access to medical services

	Access to medical services	Use of traditional medicine
Yes	92%	45%
No	6%	51%
Blanks	1%	4%

The time to reach medical facilities was on average, and for at least half of the respondents about twenty minutes. If by walking, this would equal the 1.5 km average that some respondents reported. However, those estimating the distance were rather few (many blanks).

Table 15: Accessibility of medical facilities

	Time to medical facility (Minutes)	Distance to medical facility (km)
Average	22	1.5
Median	15	1.5
Blanks	8%	92%

Respondents were asked to list up to three of the most common health problems in the household. Only ten percent of respondents did not report any health problems at all.

Table 16: Most common health problems reported by respondents

Health problem	% of sample	n	Health problem	n
Cough	39%	55	Allergy, Asthma, Back pains, Bleeding, Blindness, Body ache, Chest Pains, Diabetes, Difficulty in walking, Dizziness, Eye Problem, Fever, Inflammatory Infections, Leg problem, Low BP, Mental ailments, Short-sightedness, Starvation, TB, Toothache, Ulcers	1 each
Headache	39%	54		
Malaria	19%	27		
Diarrhoea	16%	23		
Flu	14%	20		
Stomach Pain	12%	17		
Sneezing	11%	16		
Hypertension	6%	8		
Sore Eyes	3%	4		

The most commonly reported health problems were cough and headache, followed by malaria. Altogether there seemed to be a high prevalence to respiratory infections. Water-related problems were common, but less than the respiratory.

### 5.4.6 Wealth

Wealth was approached by asking about ownership of assets. This does not give an absolute measure of wealth, but a relative one. Refer to table 17

Table 17: Relative wealth as ownership of fixed assets

Asset	n	% of sample
Cell phone	127	91%
Books, other than the Bible or the Koran	99	71%
Sofa	95	68%
TV/Video	95	68%
Glass windows	79	57%
Radio	78	56%
Bicycle	53	38%
Extra room where nobody sleeps	38	27%
Solar PV	38	27%
Generator set	10	7%
Motorcycle	8	6%

The results show a profile of a relatively well-to-do population. Nearly all have a mobile phone, most have books, a sofa and a TV. Glass windows in the house and radio are also common.

This makes it possible to compare between subgroups of sufficient size, such as district. This is done by creating a "Wealth Index", where the asset ownership of each respondent is summarized, each with the value of 1. This index was calculated for the whole sample and for the subgroups Livingstone and Kazungula districts, as well as for male- and female-headed households. Female-headed households and the respondents of Kazungula were slightly less wealthy.

Table 18: Wealth index for Livingstone and Kazungula

	Wealth index
Livingstone	5.4
Kazungula	4.6
Sample	5.1

Table 19: Wealth index for male- and female-headed households

	Wealth index
Male HHH	5.3

Female HHH	4.7
------------	-----

### 5.4.7 Housing

Most respondents had a residential house, and no secondary houses. Still, three respondents claimed not to have a house, which probably should be interpreted as that they were tenants. Table 20, shows number of houses by respondent.

Table 20: Number of houses by respondent

	No of residential houses	No of houses for animals or storage	No of houses for business. workshop etc.
Average	1.6	0.4	0.2
Median	1	0	0
Max	9	6	4
% with no such house (0)	2%	77%	81%

The housing quality was investigated by asking the material of the **best** house in the household. This was a question with fixed categories, so it is possible that some variation was not captured. Housing quality must be judged as relatively good, as most houses had brick walls, iron sheet roof and a cement floor. No houses with grass walls were found among the best houses. Table 21, the house materials utilised.

Table 21: Housing material

Material	Wall	Roof	Floor
Brick	80%	1%	7%
Cement	6%	9%	68%
Mud	11%	1%	16%
Wood	0%	0%	0%
Grass	0%	1%	0%
Iron sheet	1%	84%	6%
Other	0%	6%	1%

### 5.4.8 Agriculture

Most respondents were not engaged in farming, indicating that the project areas are indeed mainly of an urban character. Of those engaged in subsistence farming, 40% were also doing commercial farming. All of those engaged in commercial farming also did subsistence farming.

**Table 22: Subsistence and commercial farming**

Subsistence farming	Commercial farming
44%	10%

The farmed area was very small. With most farms at less than one hectare, and more than half little more than kitchen gardens of just a few square meters. The maximum farmed area was 10 hectares.

**Table 23: Farm area**

	Farm area (hectares)
Average	0.8
Median	0.01

While the most cultivated crop was maize, vegetables were the main crops grown, the variety of which was rather large. Soya beans, groundnuts and tomatoes were also frequent crops. Table 24 shows the variety of the crops grown.

**Table 24: Type of crops grown**

Crop	% of those farming	% of sample	N
Maize	48%	26%	36
Vegetables	41%	22%	31
Pumpkins	12%	6%	9
Sorghum	11%	6%	8
Groundnuts	7%	4%	5
Okra	7%	4%	5
Rape	7%	4%	5
Tomatoes	7%	4%	5
Onions	4%	2%	3
Beans	3%	1%	2
Cabbages	3%	1%	2
Cow peas	3%	1%	2
Cucumber	3%	1%	2
Sweet Potatoes	3%	1%	2
Millet	1,3%	0,7%	1
Egg Plant	1,3%	0,7%	1
Popcorns	1,3%	0,7%	1

Livestock was kept by only few of the respondents. The most commonly kept were chickens, followed by ducks, cattle and goats. The number of animals kept was small. Table 25 shows the number and type of the livestock being kept.

**Table 25: Type and number of livestock kept**

Livestock	Farmers	% of sample	Avg herd	Largest herd	Median heard
Chickens	19	14%	7	35	4
Ducks	7	5%	9	22	7
Cattle	6	4%	14	35	10
Goats	6	4%	6	11	6
Guinea Pigs	3	2%	3	5	2
Rabbits	3	2%	9	18	7
Donkeys	1	0,7%	4		
Guinea Fowls	1	0,7%	6		
Pigeons	1	0,7%	25		
Quails	1	0,7%	1		
Turkeys	1	0,7%	3		

### 5.4.9 Forestry

Forestry, or forestry related activities such as charcoal burning, was very uncommon among the respondents, with only 4% engaged in such activities.

### 5.4.10 Employment situation

Only a quarter of the respondents had a formal employment, and the majority of those stating a specific employment were teachers. Table 26, shows the formal employments rates.

**Table 26: Formal employment**

Formal employment	% of sample	% of employed	n
Teacher	9%	33%	14
Employed	3%	12%	5
General Worker	2%	7%	3
Storekeeper	2%	7%	3
Government employee	1%	5%	2
Truck Driver	1%	5%	2
Accountant, Carpenter, Chair, Council Worker, Data collector, Industrial Worker, Lawyer, NGO, Post Officer, Receptionist, Security Officer, Service Woman (ZNS), Soldier (One each)	8%	31%	13
None	75%		116

More than two thirds of the respondents (69%) stated to be self-employed with other than farming or forestry activities, most usually in selling some foodstuff or service.

The general category “business” most likely also covers some of the selling activities. Table 27, shows the self –employment for the activities involved in self-employment.

**Table 27: Self-employment activities**

Occupation	n	% of sample
Business	17	12%
General Worker	11	8%
Grocery Shop	10	7%
Piece Works	8	6%
Marketeer	7	5%
Brick Layer	5	4%
Chef	4	3%
Charcoal burning	3	2%
Electrician	3	2%
Saloon	3	2%
Selling Beer	3	2%
Selling Charcoal	3	2%
Selling Clothes	3	2%
Selling Fish	3	2%
Carpenter	2	1%
Contractor	2	1%
Selling Groceries	2	1%
Selling Meat	2	1%

In addition to the above, 19 respondents stated the following income sources (1 each):

Brewing local beer, camera man, flower decoration, hardware, hotel management, lodge owner, mechanic - welding, pastor, plumbing & painting, repairing fridges, restaurant, selling chickens, selling freezits, selling products, selling wood, shop owner, trader, transporter, volunteer community health worker.

Several of these could fit in some of the categories above, such as “Business” or “General worker”.

17% of respondents stated that they receive remittances in some form or the other. This could be either from family or through pensions or other schemes.

#### **5.4.11 Water**

Water access seems to have been well organised in the project area, with a third of the respondents getting their water from a tap, assumed to be in their premises, and a quarter using a public standpipe. Precarious water access, such as from the river or a well was very rare. Only ten of the respondents stated more than one source of water. Table 28, shows the water sources.

**Table 28: Water sources**

Primary source	n	% of sample	Secondary source	n	%of sample
Tap Water	90	65%	River	4	3%
Standpipe	35	25%	Hand Pump	3	2%
Borehole	7	5%	Borehole	2	1%
Hand Pump	3	2%	Tap Water	1	0,7%
River	3	2%			
Well	1	1%			

With most of the people using an internal tap, it may not be so important who is responsible for obtaining it. We have here selected only for those with “collectable” water, disregarding those being served by tap water. As seen in table 29, women have most of this responsibility, followed by children. The responsibility was shared to some extent, as more than one alternative could be selected.

**Table 29: Responsible for collecting water**

	Men	Women	Children
% of HH with collectable water (n=49)	71%	96%	80%

## 5.4.12 Energy

### Energy appliances

The ownership of energy appliances ranged from more almost 80% (Improved mbaula<sup>5</sup> + charcoal stove), to zero for kerosene appliances. Air conditioning system and gas stove was barely used. The low percentage for wood stove, in spite of the relatively large number of users of wood for cooking is likely due to the use of a three-stone fire, which is not actually a stove.

The high prevalence of refrigerators and electric stoves is testimony to the relatively high standard of living among the sampled population. Table 30, shows the energy use appliances.

**Table 30: Energy use appliances**

Appliance	% using
Improved mbaula	71%
Torch	57%
Refrigerator	50%
Electric iron	44%
Electric light	40%

<sup>5</sup> The Improved mbaula is a charcoal stove, usually with

Electric stove	29%
Charcoal iron	28%
Electric fan	23%
Charcoal stove	6%
Wood stove	3%
Gas stove	2%
A/C cooler	1%
Kerosene stove	0%
Kerosene lamp	0%

### Forms and cost of energy used

Almost all used electricity for lighting, with the majority being connected to the ZESCO network, and on in five using solar electricity. Candles and cell phones were used by very few. Diesel use should likely be considered as the source of energy for a generator. One household used solar energy as the primary source, and ZESCO as the alternative, probably owing to the severe load shedding of 20 hours per day at the time of the survey.

**Table 30: Source of energy for illumination**

Lighting source	% of sample
ZESCO	56%
Solar	20%
Batteries	9%
Torch	7%
Candles	6%
Diesel	1%
Phone	1%

All households use some form of energy for cooking. In the project area, by far the most prevalent source was biomass energy, mostly as charcoal but also firewood. Electricity and gas was used in a fifth of the households, solar energy not at all.

**Table 31: Cooking energy sources**

	% of sample
Charcoal	71%
Firewood	26%
Electricity	20%

The cost of cooking energy and energy for lighting comes to all households, which is why it is warranted to add the average expenditures for these two energy uses, in spite of about a fifth failing to estimate their costs. The average household spent about

160 Kwacha per week on these energy uses, with half (median) paying less than 100 Kwacha per week. The median is equal to about USD 20 per month.<sup>6</sup>

**Table 32: Cost of energy for cooking and lighting**

	Average ZMW/week	Median ZMW/week	Missing %	Missing n
<b>Lighting Energy cost</b>	98	55	15%	23
<b>Cooking Energy cost</b>	61	40	16%	40
<b>Total</b>	159	95		

Less than half of households stated they used energy for entertainment, all of it electricity. The most common energy source being the ZESCO grid, seven times as prevalent as solar installations.

**Table 33: Sources of energy for entertainment**

Source	% of sample	% of users
ZESCO	42%	87%
Solar	6%	13%
None	59%	

Only 14% of households claimed to use any room heating, and charcoal was the most dominant source, at 63% of those using room heating. Only 9% of respondents stated to use energy for income earning purposes. As seen above (table 34), almost all respondents (91%) had a cell phone. For cell phone charging, most (80%) used their own source of energy (ZESCO grid or solar), and some used commercial sources or a combination (23%).

**Table 34:: Use and cost of energy for entertainment, room heating and income earning**

	% of sample	Avg cost ZMW/week	Median ZMW/week
Uses energy for entertainment	49%	134	120
Uses energy for room heating	14%	90	75
Uses energy income earning	9%	190	150
Cell phone charging commercial	23%	7.4	6
Cell phone charging at home	80%	2.5	2

Combining the cost of the most common energy uses (Lighting, cooking and cell phone charging at home gives an average energy cost per household per month at almost 300 ZMW per week or 1200 per month.

<sup>6</sup> 1 USD = 20 ZMW in October 2020

## Willingness to Pay for Electricity Connection

While a large share of the respondents was already connected to the ZESCO network, there was still a substantial number (46%) who were not. In order to provide a view of the possible market for connections, these were asked how much they would be willing to pay for connecting and using electricity for household purposes as well as income earning.

Out of those not presently connected, only 34% estimated what would constitute a reasonable connection fee, and only 28% estimated a consumption cost. This suggests that the people not currently connected had little interest in obtaining a connection.

**Table 35: Willingness to pay for household electricity**

	For household use ZMW connection fee	WTP for household use (ZMW/month)
Average	385	107
Median	170	50
Max	2500	1700
Zero (n)	0	0
Blanks (n)	21	23

The discrepancy between the average and the median of willingness to pay household connection is due to the fact that some is willing to pay much more than this, with the maximum being 2500 ZMW for connection fee and 1700 for monthly consumption.

The interest in being connected to the grid for income earning purposes was even cooler, with only 9% giving an affordable connection fee, and only 5% estimating a consumption cost that they could afford. These estimates were also lower than those given for household consumption, indicating that they did not see many opportunities in earning income from having electricity.

**Table 36: Willingness to pay for electricity for income-earning purposes**

	For income earning use ZMW (connection fee)	WTP for income earning use (ZMW/month) (consumption)
Average	188	45
Median	100	50
Max	1720	200
Zero (n)	12	10
Blanks (n)	29	30

## What to do with electricity

People were asked what they could do with electricity, or what others could do. The most popular activities were related to hair service for women and men, followed by various forms of foodstuff production and provision. The most energy-intensive activity proposed was welding, or opening a workshop for welding. Only 22 did not have any idea on what they could do with electricity.

**Table 37: Activities one could do with electricity**

Self-do with power	n	% of sample
<b>Services and production</b>		
Hair Saloon	41	29%
Chicken Rearing	20	14%
Barber Shop	17	12%
Butchery	10	7%
Baking Scones	8	6%
Grocery	6	4%
Freezits	5	4%
Frozen drinks & foods	5	4%
Ice Blocks	5	4%
Drinks	4	3%
Baking	3	2%
Nothing	3	2%
Charging phones	2	1%
<b>Selling items</b>		
Drinks	28	20%
Freezits	15	11%
Fish	10	7%
Ice	10	7%
Water	10	7%
Meat	9	6%
Soft drinks	6	4%
Beer	3	2%
Chickens	3	2%
Sausages	3	2%
Chibwantu	2	1%

The activities that others can perform with electricity were similar to those that respondents could do themselves. More than half of respondents did not give any suggestion in this respect.

### 5.4.13 Development priorities

Respondents were asked to rank a number of possible priority development areas. There was also the possibility to add and rank their own ideas. The highest priority was to be given the value "1", the second highest "2" and so on. Table 38, shows the ranking of needs. The most highly prioritized was employment, with water in second place.

Among those suggested by respondents themselves, security issues appeared conspicuous, in that the largest single category was the demand for a police station. Construction or renovation of a bridge was also mentioned by inhabitants in Maloni area, where apparently a bridge across the Maramba River was out of order.

**Table 38: Development priorities among respondents**

Development need	Average	Median	Blanks
Employment (income earning possibilities)	1,7	1	51
Water	2,0	2	85
Health care	2,1	2	78
Roads	2,2	2	54
Education	2,4	2	84
Transport and communication	2,5	3	97
Other number	3,1	4	94

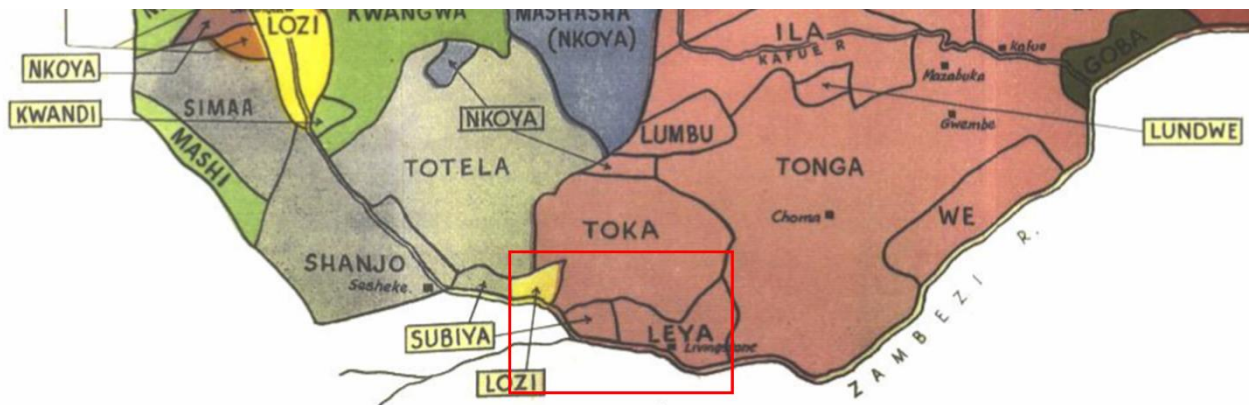
Other development priorities	n
Police post	19
Bridge/ Renovation of bridge	13
Electricity	5
Sewer System	5
Drainage	3
Market/ Supermarket	4
Super Markets	4

#### 5.4.12 Ethnic groups

The majority group in area are the Toka and the Leya, commonly referred to as Toka-Leya. However, the history of Livingstone as the capital of Zambia, the capital of Southern Province and also as a main tourist and trade location has led to the influx of numerous people from other parts of the country, such as the Bemba.

The main original ethnic group (tribe) in the project area is the Leya of Livingstone and Kazungula. Political changes have resulted in a strong presence of Toka and Tonga, as well as Lozi and Subeya around Kazungula (see Figure 20), where the approximate project area is shown as a red square).

**Figure 20: Ethnic and linguistic groups in Southern Province of Zambia<sup>7</sup>**



#### **5.4.13 Cultural, Archaeological and Historical Environment**

Although not on the NHCC list of archaeological and cultural sites, the Livingstone area has contained numerous Neolithic sites, as seen in the marked areas of **Error! Reference source not found.** These extend to the locations where project activities are planned.

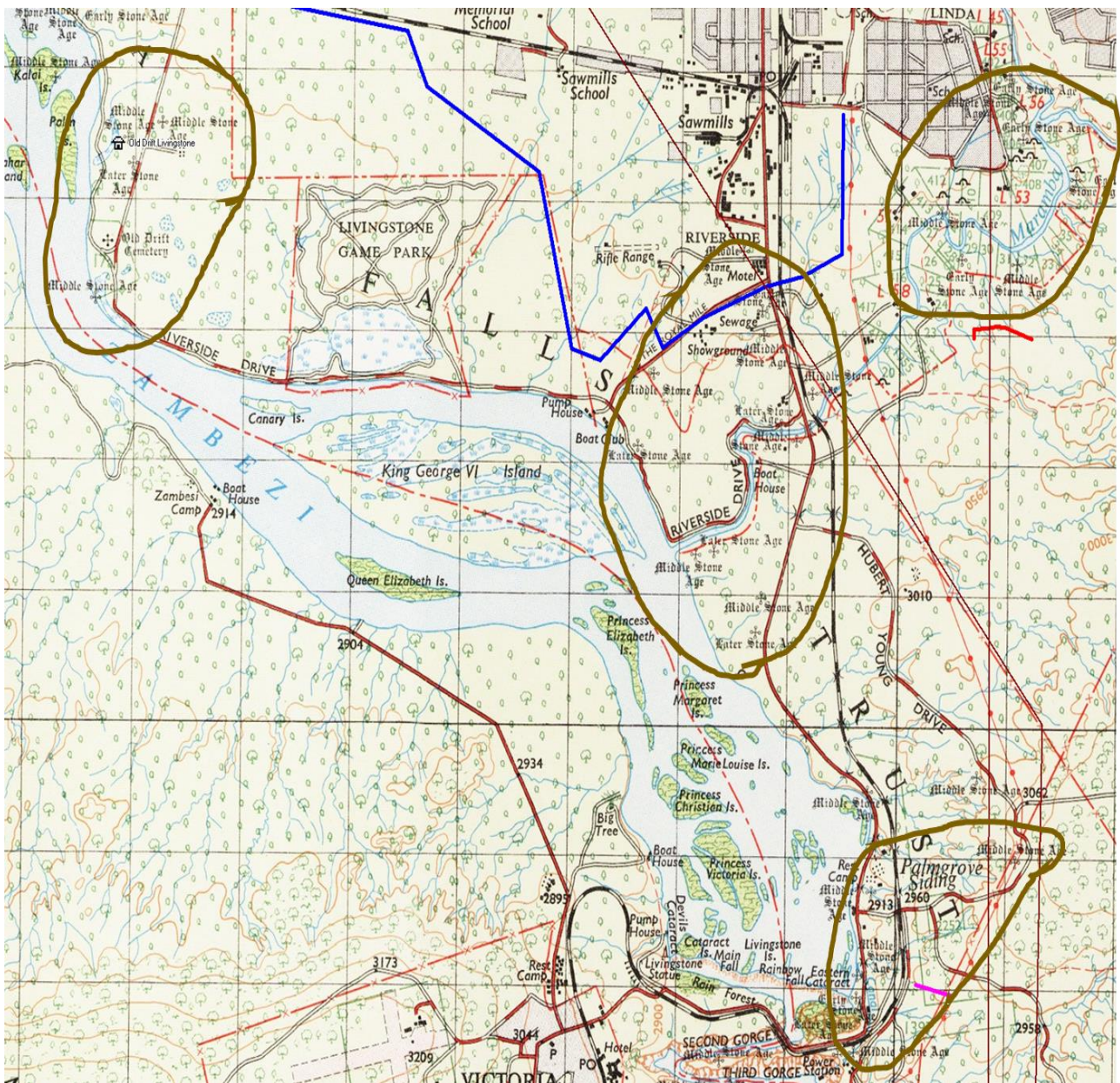
It should be noted, however, that these indications are from a historical map (1961), and since then much of the marked areas has been developed.

There may be impacts to hitherto unknown archaeological or historical sites, as well as locations of cultural importance to local people, such as ceremony sites, graveyards. Whenever such locations are found during project work, care shall be taken to avoid them, or to limit the impact of the project to the lowest possible level.

Local cultural sites and graveyards should be approached in agreement with requests from the local population. Archaeological finds shall be reported to the NHCC. The Chance find Procedure described in 0, page , should be used in case of unexpected finds.

<sup>7</sup> Excerpt from map in Brelsford, 1965

**Figure 21: MAP INDICATING ARCHAEOLOGICAL FINDS IN LIVINGSTONE<sup>8</sup>**



<sup>8</sup> Source: Topographical Map of Livingstone 1725D4 (1961). Not to scale.

## **6.0 STAKEHOLDER ENGAGEMENT**

Stakeholder engagement was performed as public consultation meetings in various locations of the project area, and as interviews with traditional and political leaders and administrative functionaries.

In general, people were positive to the project being carried out, but concerned with timely and adequate compensation for losses, in case the project activities would affect their properties. In those areas where the project will bring electricity for the first time, people were especially positive, but concerned about the cost of connection.

Stakeholder engagement will continue throughout project implementation, and will especially focus on those negatively affected by some of the project installations. Continued stakeholder engagement will be ensured through the Stakeholder Engagement Plan, Resettlement Action Plan submitted as separate documents, and Livelihood Restoration Plan, to be designed during project implementation if required.

## 7.0 POTENTIAL ENVIRONMENTAL IMPACTS

### 7.1 Project Activities

For impact assessment purposes, the Livingstone project activities can be divided into two: (i) those related to substations that are of limited spatial extent but permanent and (ii) those related to power transmission and distribution lines with a longer longitudinal extent.

#### 7.1.1 Activities Associated with Substations

Substations will be constructed on land belonging to or acquired by ZESCO. These are the Linda New Substation, Livingstone West Substation and the Sun Hotels Substation that are located in the urban or peri-urban areas where much of the natural environment has already been transformed. The activities at the Linda New Substation include construction and establishment of a distribution control centre at or near the substation. A 66/11kV substation will be constructed at the Livingstone West substation. The activity at the Sun Hotels substation is limited to the construction of the substation. All these activities will be confined to limited spaces with no significant impacts on the surrounding biophysical environment.

#### 7.1.2 Activities Associated with Power Transmission Lines

Power lines with a capacity of  $\leq 11\text{kV}$  are not subject to detailed EIA and these lines are excluded from further assessment here but are summarized in Table 39.

**Table 39: Summary of 11kV subprojects**

Subproject	Land use	Activity	Extent of way-leave	
			Length (km)	Width (m)
Livingstone Terminus	Peri-urban	Construction of overhead line	4	15
Mwandi	Rural	Construction of overhead line	1	15
Katombora	Rural	Construction of overhead line	0.4	15
Maloni	Peri-urban	Construction of overhead line	1	15
Livingstone existing network	Urban	Construction of overhead line	1	10
Makalanguzu in Kazungula existing network	Rural	Construction of overhead line	1	15

The main project activities likely to cause environmental and ecological impacts relate to the construction of three power lines with a capacity of higher than 11kV voltage:

- Construction of a 9km double circuit 66kV transmission line from Linda New Substation to the new Livingstone West substation;

- Construction of a 13km double circuit transmission line from the Livingstone West Substation to link with the existing 66kV line from the Great North Road – Kazungula. The main project activities likely to cause environmental and ecological impacts are summarized in Table 40.

**Table 40: Description of project activities and potential environmental impacts**

Project phase	Activity	Potential impacts
Construction	Vegetation clearing in the way-leave for the proposed power lines	i. Habitat loss
		ii. Habitat fragmentation
		iii. Fragmentation of protected areas
		iv. Loss of biodiversity
		v. Interference to wildlife movement/migration
		vi. Increased runoff from catchments
		vii. Soil erosion
		viii. Introduction of invasive species
		ix. Emission of greenhouse gases
	Construction of access gravel roads	i. Habitat loss
		ii. Habitat fragmentation
		iii. Fragmentation of protected areas
iv. Loss of biodiversity		
v. Interference to wildlife movement/migration		
vi. Increased runoff from catchments		
Erection of foundation spots and transmission towers	vii. Soil erosion	
	viii. Introduction of invasive species	
	i. Soil erosion	
	ii. Interference to wildlife movement/migration	
Operation	Annual vegetation clearing in the way-leave by cutting vegetation to at least 4-6 cm above ground	iii. Pollution
		iv. Emission of greenhouse gases
		i. Habitat loss
		ii. Habitat fragmentation
		iii. Fragmentation of protected areas
		iv. Loss of biodiversity
		v. Interference to wildlife movement/migration
		vi. Increased runoff from catchments
	Power transmission	vii. Soil erosion
		viii. Introduction of invasive species
		i. Electromagnetic radiation
		ii. Electromagnetic noise

### 7.1.3 Construction of Wayleaves

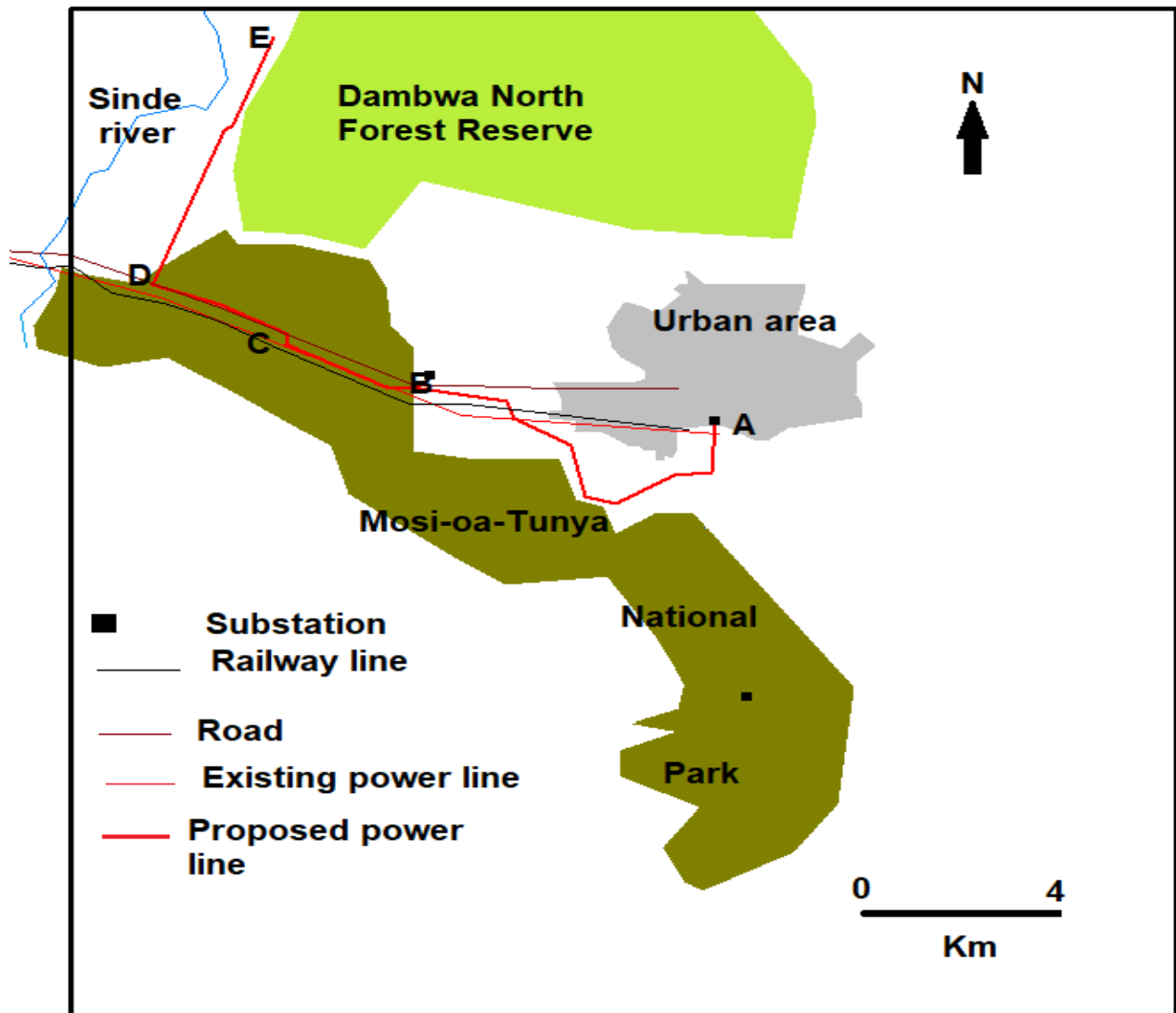
The proposed 66kV transmission power line is 22.1km long, starting from the Linda New Substation to meet the existing 330kV transmission line to Kazungula that traverses the Dambwa Forest Reserve on the northern end of the project area. There

are four segments on this proposed power line (Figure 22, Table 41). The 66kV line requires a wayleave that is 30m wide when traversing a rural landscape.

**Table 41: Description of the proposed 66kV power line in the project area and the four segments used in the wayleave impact assessment. The segments are shown in Error! Reference source not found..**

Segment	Distance (km)	Width (m)	Existing structures	Wayleave km <sup>2</sup>	Wayleave in Park km <sup>2</sup>
A-B	9.1	30	None	0.273	0
B-C	2.5	30	11kV line	0.075	0.075
C-D	3.7	30	Road	0.111	0.111
D-E	6.8	30	None	0.204	0
	22.1	30		0.663	0.186

**Figure 22: The route to be followed by the proposed 66kV transmission power line in the Livingstone project area. For ease of assessment, the line is divided into four segments indicated by letters A to E.**



The extent of the different habitats in Mosi-oa-Tunya National Park is summarized in **Error! Reference source not found..** The Park already has an infrastructure corridor across its northern sector that consists of an existing 11kV power line, the Nakatindi road and a railway to Mulobezi (see figure 22). The proposed 66kV power line will also go through this existing infrastructure corridor which should minimize its impact on the current park integrity. Segment B-C is adjacent to the existing 11kV power line while segment C-D is adjacent to the Nakatindi road ( ).

**Table 42: The extent of habitats in Mosi-oa-Tunya National Park (after Chidumayo et al. 2002).**

Habitat type	Approximate extent in National Park		Wayleave affected area (%)
	Area (km <sup>2</sup> )	Percent	
River	9.5	14.4%	0.0
Riverine forest	5.0	7.7%	0.0
Palm savanna	0.3	0.5%	0.0
Gorges	2.5	3.8%	0.0
Floodplain grassland	2.5	3.8%	0.0
Mopane woodland	18.6	28.2%	0.0
Mopane shrubland	23.4	35.4%	0.80
Kalahari woodland	1.0	1.4%	0.0
Miombo woodland	3.2	4.8%	0.0
All habitats	66.0	100.0%	0.28

The construction of the proposed 66kV transmission power line will result in the clearance of vegetation that will be equivalent to 0.186km<sup>2</sup> or 0.28% of the national park area. The infrastructure corridor that passes through the park only affects mopane shrubland and the vegetation clearing for the wayleave represents 0.80% of this habitat (Table 42). Much of this corridor has already been transformed by the existing development infrastructure and the proposed power line will therefore, have no significant impact on the current integrity of the National Park.

Outside the National Park, the proposed transmission power line has two segments: A-B and D-E (**Error! Reference source not found.**). The A-B stretch will be 9.1km x 30m and will result in the clearing of 0.273km<sup>2</sup> for the wayleave. This stretch traverses a severely transformed peri-urban zone and the construction of the wayleave will have no significant impact on the biophysical environment along this portion of the power line. The D-E stretch will be 6.8km x 30m and will result in the clearing of woody vegetation for the wayleave that is equivalent to 0.204km<sup>2</sup>. This portion of the power line traverses a predominantly degraded rural landscape and is therefore, unlikely to have any significant impact on the current biophysical environment.

The wayleave of 0.4km x 22m along the 33kV line from Sun Hotels substation to link with the line from Victoria Falls to Old Linda substation will result in the clearing of vegetation in an area equivalent to 0.009km<sup>2</sup> of mainly mopane shrubland in an area that is already transformed by tourism infrastructure and therefore will have no significant impact on the current biophysical environment.

#### 7.1.4 Impacts on Habitats and Protected Areas

Habitat loss due to the establishment of the wayleaves is summarized in (Table 42). The clearance of vegetation in the wayleave will result in a loss of less than 0.28% of habitats in the Mosi-oa-Tunya National Park and this impact is considered minor in terms of the extent of the remaining habitats after project implementation. Although the wayleave will fragment the mopane shrubland, the new project will have minimal additional impact on this fragmentation because the fragmentation already exists due to the development infrastructure in the corridor (see Figure 12). The main animals using this part of the National Park are elephants and occasionally white rhino. The infrastructure corridor through the Park is not considered large enough to prevent movement of these species between habitat fragments.

#### 7.1.5 Impacts on biodiversity

None of the habitats along the proposed power line route are important centres of endemism. The establishment of the wayleaves along the power lines does not therefore, pose any threat to critical habitats.

The international conservation status of a species is based on the World Conservation Union (IUCN) criteria. Due to lack of information, the threat status of the majority of plants in Zambia is not known. Of the 364-plant species in Zambia listed by the World Conservation Monitoring Centre (1992), 79.4% have no information, 18.1% are not threatened and 1.4% are rare and the status of 1.1% is indeterminate. The Southern African Botanical Diversity Network (SABONET) classified 144 plant species in Zambia as threatened (Golding 2002; Appendix 5); of these 33% are woody plants and 67% are herbs. Of the 144-plant species only *Baikiaea plurijuga* and *Dalbergia melanoxylon* occur in the project area and only the latter is internationally considered as vulnerable. *Dalbergia melanoxylon* has a wide distribution range in the country while *Baikiaea plurijuga* is the dominant species in mkusi woodland which covers 90 000 ha in south-west Zambia, and the wayleaves will not affect mkusi woodland that is dominated by *Baikiaea plurijuga*.

Of the 22 species of threatened birds and mammals listed in Table 43, only the Elephant, Taita Falcon and Black-cheeked Lovebird occur in the project area. The small elephant population in Mosi-oa-Tunya National Park often move across the Zambezi River into Zimbabwe and back into Zambia. It is therefore, unlikely that the proposed power line will significantly affect this small population of elephants. Indeed, significant populations of elephant are found in South Luangwa and Kafue National Parks in Zambia, and so the construction of the power line will have no significant effect on the national elephant population. The distribution range of the Taita Falcon

is confined to the gorges downstream to the Victoria Falls and the main threats to this falcon are human disturbance to its nesting sites caused by noise from airplanes and helicopters and accidental poisoning from agricultural pesticides. Because the proposed power line is north of the gorges, it will have no significant effect on this bird species. Much of the distribution range for the Black-cheeked Lovebird lies to the north-west of the project area and its main threat is the gradual drying up of water bodies, probably due to climate change (Warburton and Perrin 2005).

**Table 43: Threatened species of mammals and birds in Zambia**

Group/ Subgroup	Species (Common name)	Threat status
Mammals	<i>Crocidura ansellorum</i>	Endangered
	<i>Crocidura pitmani</i>	Vulnerable
	<i>Rhynchocyon cirnei</i> (Checkered Elephant shrew)	Vulnerable
	<i>Plerotes anchietae</i>	Vulnerable
	<i>Pipistrellus anchietae</i>	Vulnerable
	<i>Otomops martiensseni</i>	Vulnerable
	<i>Lycaon pictus</i> (African wild dog)	Endangered
	<i>Acinoyx jubatus</i> (Cheetah)	Vulnerable
	<i>Panthera leo</i> (Lion)	Vulnerable
	<i>Loxodonta africana</i> (Elephant)	Endangered
	<i>Diceros bicornis</i> (Black rhinoceros)	Endangered
	<i>Kobus leche kafuensis</i> (Kafue lechwe)	Vulnerable
	<i>Kobus leche smithemani</i> (Black lechwe)	Vulnerable
	Birds	<i>Egretta vinaceigula</i> (Slaty Egret)
<i>Falco fasciinucha</i> (Taita Falcon)		Vulnerable
<i>Falco naumanni</i> (Lesser Kestrel)		Vulnerable
<i>Bugeranus carunculatus</i> (Wattled Crane)		Vulnerable
<i>Crex crex</i> (Corncrake)		Vulnerable
<i>Sarothrura ayresi</i> (White-winged Flufftail)		Endangered
<i>Agapornis nigrigenis</i> (Black-cheeked Lovebird)		Endangered
<i>Pogoniulus makawai</i> (White-chested Tinkerbird)		Vulnerable
<i>Hirundo atrocaerulea</i> (Blue Swallow)		Vulnerable

### 7.1.6 Interference to Wildlife Movements and Migration

Four species of birds occurring in the project area are Eurasian migrants (Dowsett 1975). These include *Caprimulgus europaeus* (European Nightjar), *Circus macrourus* (Pallid Harrier), *Falco naumanni* (Lesser Kestrel) and *Locustella fluviatilis* (River Warbler). These species occur in small numbers and neither the migration route followed, nor the flying height used to reach the project area are not known. However, so far, there have been no records of bird mortalities as a result of collision with power lines on the already existing power lines in the project area. The probability of the proposed power lines interfering with bird movements and causing deaths is therefore

highly unlikely. However, there is need to monitor bird mortality along the power lines during project operation.

For other wildlife species, the width of the wayleave (30m) is too narrow to have a significant impact on wildlife movements between habitat fragments created by the swath along the new proposed power lines.

### **7.1.7 Increased Runoff and Soil Erosion on Catchments**

Human and animal activities in the project area have already degraded the woodland vegetation. The proposed power lines therefore, will have no significant impact on runoff from catchments and soil erosion. Besides, the proposed power line routes traverse a region of very gentle slopes (<2%) on the basalt terrace and the deep sands on the D-E stretch of the power line have a high infiltration capacity in a region of very low soil erosion risk (Chiti, 1991). However, soil erosion should be monitored, especially where the power line traverses the scarp (see

a).

### **7.1.8 Introduction of Invasive Species**

The major invasive species in Zambia are water plants, such as, water hyacinth (*Eichhornia crassipes*), water fern (*Salvinia molesta*) water lettuce (*Pistia stratiotes*) and *Azolla* spp and weeds of arable and built-up areas such as *Lantana camara*, *Opuntia* spp, *Agave* spp etc. *Lantana camara* is already a serious weed in the Victoria Falls World Heritage site which is within the National Park and water hyacinth has been reported in the Maramba River near its confluence with the Zambezi River. The proposed power lines are north of these infested sites and the field survey team did not encounter any invasive plant species along the proposed power line route. In addition, the power line is not passing through critical wetland habitats where the risk of introducing invasive aquatic plants is high. Similarly, since there will be no permanent settlements in the wayleaves after construction, the risk of introduction of invasive terrestrial plants is very low.

### **7.1.9 Emission of Greenhouse Gases**

The estimated aboveground wood biomass in the project area, based on the field survey data, is 18.9t per ha and with a total of 76.6ha of vegetation to be cleared during wayleave establishment, the total aboveground wood biomass that will be cut is estimated at 1448t. The carbon content of wood in indigenous woodland trees is 47% (Chidumayo 1994). The establishment of the wayleaves along power lines will therefore result in the release of 1814t of carbon dioxide into the atmosphere. However, if the cut wood is given to local people to use as household cooking fuel instead of the usual fuelwood they collect and use, this amount of carbon dioxide released would be greatly minimized, if not avoided altogether.

### **7.1.9 Access Road Construction**

Out of the 22.5km of the proposed 33/66kV power lines, access roads exist for nearly 15.7km. The construction of access roads will therefore, be limited to the remaining 6.8 km along the D-E stretch of the 66kV power line (see Figure 23). This will greatly reduce the environmental impacts that might arise from the proposed new power line due to access road construction.

### **7.1.10 Construction of Platforms for Transmission Towers and Power Lines**

Self - supporting steel lattice towers weigh up to about 20 tons and occupy a base area of about 10m x 10m per tower (Figure 23). Construction involves excavation of

foundation spots, followed by foundation construction and some concrete curing period (usually 21 days) before tower erection. Tower structures may be assembled horizontally on the ground and set in place by a crane or assembled vertically one piece at a time at the tower location.

**Figure 23: Self-supporting power transmission tower standing on four concrete foundation spots.**



### **7.1.11 Impact on biodiversity, runoff and soil erosion**

Since construction of transmission towers involves a small area (10 x 10 m) at each location, this activity is unlikely to significantly affect biodiversity, runoff and soil erosion and ZESCO has standing guidelines for the construction of towers which, if enforced by the contractor, should further minimize or avoid impacts on biodiversity, runoff and soil erosion.

### 7.1.20 Pollution

Solid waste disposal appears to be a problem at some sites in the project area (Figure 24). Tower construction can produce large quantities of waste, which if not well managed, can adversely affect areas where it will be dumped. Additional waste such as concrete, steel bars, bolts, nuts, cables, cable drums, waste oils, paper, plastics, metal and woody vegetation, which have adverse impacts on the environment, will also be generated. The project is also expected to generate domestic waste such as left-over foodstuffs and human waste, especially at the camping sites for workers. However, if waste disposal follows ZESCO and ZEMA guidelines such adverse impacts will be minimized or in some cases avoided.

**Figure 24: Uncontrolled solid waste disposal at a site in the Livingstone project area with a scavenging baboon.**



### 7.1.21 Landscape Transformation

Aerial power transmission lines on towers impact on the landscape. However, although this type of linear infrastructure transforms the landscape, it does not necessarily obscure visibility and in some cases may actually add diversity to landscape aspects.

### **7.1.22 Maintenance of Wayleave and Power Transmission**

Wayleave maintenance involves annual re-clearing of regrowth vegetation after the initial vegetation clearing to establish the wayleave. This is done by cutting the regrowth vegetation to at least knee-height above ground. This is done to ensure safe power transmission. However, power transmission generates electromagnetic waves and radiation noise whose strength depends on the amount of power being transmitted. These electromagnetic waves and noise are strongest under the transmission lines but get weaker away from the lines. However, the design of the wayleave is such that the specified width marks the outer safe distance for the electromagnetic waves.

### **7.1.23 Impact on Biodiversity, Runoff and Soil Erosion**

Since annual re-clearing of regrowth vegetation in the wayleave does not involve uprooting the vegetation but only cutting it back to knee-height above ground, this activity is unlikely to adversely affect biodiversity, runoff and soil erosion in the project area beyond the level described for the initial establishment of the wayleave. On the contrary, annual re-clearing of regrowth vegetation can be used to monitor long-term impacts (both positive and negative) of the project on biodiversity, including the appearance of invasive species, landscape stability in respect of runoff and soil erosion and monitoring bird mortalities along the power lines.

### **7.1.24 Impact on People**

Long term exposure to electromagnetic waves and radiation noise can be harmful to human beings. Whereas cultivation of low crops is allowed, the construction of buildings under transmission lines and in the wayleave is prohibited by ZESCO. This is done to minimize and prevent this negative impact that is associated with high voltage power transmission lines.

### **7.1.25 Characterization of Impacts**

In addition to the above analysis, the notable impacts identified above were assessed using other criteria, such as duration of the impact (i.e., a once-off effect or a short-term effect or a long-term effect); extent to which the impact can be mitigated or not

and whether the impact is reversible or not as required by ZEMA regulations. **Error! Reference source not found.** is a summary of the overall characterization of the notable environmental/ecological impacts of the Livingstone power project using multiple criteria.

**Table 44: Characteristics of notable impacts arising from the ZESCO Livingstone power line project activities**

Impact	Extent of change from baseline condition	Permanence	Reversibility	Mitigation potential		
				Minimization	Restriction/Prohibition	Monitoring
Habitat loss	Insignificant	Permanent	Irreversible	No		Yes
Habitat fragmentation	Insignificant	Permanent	Irreversible	No		Yes
Fragmentation of protected areas	Insignificant	Permanent	Irreversible	No		Yes
Loss of biodiversity	Insignificant	Permanent	Irreversible	No	Yes	Yes
Interference to wildlife movements and migration	Insignificant	Permanent	Irreversible	Yes		Yes
Increased runoff from catchments	Insignificant	Short term	Reversible	Yes		Yes
Soil erosion	Insignificant	Short term	Irreversible	Yes		Yes
Introduction of invasive species	Insignificant	Permanent	Reversible	Yes		Yes
Emission of greenhouse gases	Significant	Once-off	Irreversible	Yes		
Visual transformation	Significant	Permanent	Irreversible	No		
Pollution	Insignificant	Once-off	Irreversible	Yes		
Electromagnetic radiation	Significant	Permanent	Irreversible	No	Yes	
Electromagnetic noise	Insignificant	Permanent	Irreversible	No	Yes	

## **8.0 PROPOSED MITIGATION MEASURES**

In line with good environmental stewardship and sustainability principles, after the findings of the EIA studies, the corporation will contain/mitigate the aforementioned adverse impacts through the formulation and dedicated implementation of comprehensive and responsive Environmental and Social Management Plans (ESMP). Additionally, a Resettlement and Compensation Action Plan will be developed after an exhaustive inventory of project affected people in order to equitably resettle and mitigate any economic loss that will be caused by the project.

To achieve the above stated objectives, the corporation will commit an adequate budgetary allocation and corresponding human and logistical resources. Further, affected and interested parties, and various specialists will be engaged in this important process. Below are the proposed mitigation measures.

### **8.1 Physical Environment**

To minimize the negative impacts, and enhance the positive impacts, the following mitigation measures are proposed:

#### **8.1.1 Geology and Soil**

To minimize impacts on geology, controlled blasting (controlling both fly rocks and ground vibrations during blasting) will be employed. Fly rocks shall be controlled effectively by covering the blasting patch with specially designed blasting mats. Ground vibrations shall be controlled through the use of non-electric shock tubes and emulsion explosives. The contractor will develop a blasting schedule to the approval of the environmental coordinator. This shall be communicated to the public and appropriate warning shall be given.

Upset of soil shall be limited to areas of tower/pole erection and the soil returned during compaction within the foundation after mounting the poles

#### **8.1.2 Topography**

Impacts arising from borrow pits for construction material will be addressed through rehabilitation and where appropriate re-vegetation of borrow pits.

### **8.1.3 Hydrology**

There are no anticipated significant impacts on hydrology and therefore, no mitigation measures are proposed for the project area.

### **8.1.4 Climate and Emission of Greenhouse Gases**

The rapid pace of local and ultimately global climate change resulting from clearing of vegetation and generally developmental projects of this nature are impacts which will be addressed by ensuring that trees and other forms of vegetation which do not interfere with construction works are left standing.

Wood cut during the establishment of the wayleaves should be given to local people to use as household cooking fuel instead of the usual fuelwood they collect and use. In this way the project's carbon dioxide emissions can be significantly reduced or altogether avoided.

Additionally, in 2016, ZESCO Limited has embarked on the yearly Tree Planting Programme particularly in river catchment areas under the theme "ZESCO Goes Green – Planting a minimum of one hectare of trees per year". This is aimed at mitigating the effects of climate change and enhancing low carbon development pathways for sustainable development the attainment of Zambia's Vision 2030".

Wood cut during the establishment of the wayleaves should be given to local people to use as household cooking fuel instead of the usual fuelwood they collect and use. In this way the project's carbon dioxide emissions can be significantly reduced or altogether avoided.

### **8.1.5 Air Quality**

Impacts of increased dust, gas, and particulate emissions shall be mitigated by dust suppression measures through spraying of water in dust prone areas by water bowsers; use of blast mats; and imposing speed limits within the project area, particularly during the construction phase.

Additionally, the use of construction vehicles and equipment that are in good working condition shall be employed.

### **8.1.6 Noise**

The impacts of noise from the operation of equipment shall be mitigated through the use of mufflers, silencers, and screens to minimize noise from construction activities. Furthermore, vehicle movements and operation of loud machinery and equipment shall be restricted to daylight hours. In addition, the noise emanating from the use of explosives shall be moderated by employing controlled blasting. Construction vehicle shall be kept in good working condition to avoid excessive noise.

### **8.1.7 Waste disposal**

The waste generated through project activities should be sorted according to type. Plastics and empty cement bags should be collected from site and burnt. Leftover metal pieces (steel bars, bolts, nuts, conductors and cables) should be removed from site and stored for reuse. Those which cannot be re-used should be sold as scrap metal or be donated to local blacksmiths. Waste oil should be put in drums and sold to companies that recycle used oil. The machinery should be kept in good working condition to avoid oil leakages. Dumping of waste should be done at designated sites approved by the Zambia Environmental Management Agency. All the oil to be used in transformers and other electrical equipment should be PCB - free.

## **8.2 Biological Environment**

### **8.2.1 Impacts Requiring Monitoring**

For impacts that may not be significant but for which there is inadequate knowledge about their long-term development, there is need to monitor these over the long-term. These impacts include loss of biodiversity, interference to wildlife movements and migration, appearance of invasive species and soil erosion along the power line. This can be done during the periodic re-clearing of regrowth vegetation in the wayleave and the observations should be reported to ZESCO and ZEMA.

## **8.3 Socio-economic Environment**

The main socio-economic impacts are of a positive nature, where increased quality and availability of electricity will be improved. This will improve living conditions and possibility to use electricity for income-earning purposes. More consumers will be connected through the access component of the project, especially in rural areas. Enhancement of these aspects include connection of

large number of consumers, and timely operation and maintenance of electricity infrastructure.

The main negative socio-economic impact is for those whose land, assets and sources of livelihood are negatively affected by project activities. Mitigation for these shall be in the form of compensation to full replacement value of the asset lost. The people so affected have been identified in the RCAP inventory of assets, and a process for compensation and resettlement has been outlined. Vulnerable persons and households affected by the project shall be given additional support in order not to reduce hardship. A livelihood restoration plan shall be outlined for those whose livelihoods is threatened by the project activities.

The influx of workers into the project areas can result in negative impacts, such as spread of STDs, drunkenness and disorderly behaviour. These types of impacts shall be reduced by strict application of the Contractor's code of conduct, which all workers shall be required to honour. In addition, the Contractor shall be required to employ local casual labour for non-qualified works to the greatest extent. Mitigation of impacts, for instance of STDs can be through provision of contraceptives.

However, influx of workers can also constitute a positive impact, through increasing demand for products from local shops and restaurants. Locals can also provide accommodation, and can be offered jobs at work camps.

#### **8.4 Resettlement and Compensation Action Plan (RCAP)**

A resettlement and compensation action plan, RCAP has been prepared and is available as a separate document.

The RCAP includes inventory of properties and identification of Project Affected People (PAP). This is the basis for valuation of properties and costs for support of PAP that will be determined during implementation of compensation and resettlement process.

#### **8.5 Grievance Redress Mechanism**

The grievance redress mechanism describes the process for PAP to submit complaints or contest valuation of assets and opportunities lost. It is described in greater detail in section 0, page .

## **8.6 Stakeholder Engagement Plan (SEP)**

The consultations with stakeholders and community shall continue throughout the preparation and construction part of the project. This shall include:

- Plan and timing for public consultation meetings
- Production of culturally appropriate information
- Timely information on project activities
- Grievance mechanism for the public and construction workers to submit complaints and queries.

The SEP is a framework document that is updated throughout the project and reflects new developments during implementation. The statutory consultation meetings required by law shall be integrated and reported in the SEP.

The SEP of the project is presented as a separate document.

## **8.7 Livelihood Restoration Plan (LRP)**

If it is found that physical resettlement needs to take place, and that substantial aspects of people's livelihoods will be affected, a Livelihood Restoration Plan will be designed and commissioned.

## **8.8 Mitigation of Cultural and Archaeological Impacts**

Whenever the contractor or his subcontractors encounters cultural or archaeological sites, this shall be reported according to the chance find procedure which shall be available and operational with the contractor management, and which is described in section 0.

The first line of mitigation is to make changes to the location of the project component which impacts the sites. If this is not possible, other options shall have to be found as below.

Archaeological sites shall be reported to the National Heritage Conservation Commission (NHCC). The NHCC will advise on how to proceed in order to limit any damage to the site.

For cultural sites used or owned by the local community, such as sacred groves, graveyards, etc., the local community in charge or use of them shall be approached for advice on how to proceed. Often, such locations can be deconsecrated following a ritual. Graves may need to be shifted. The cost and material for these measures shall be borne by ZESZO Ltd.

## **8.9 Chance Finds Procedures**

In the event of a chance find, the following procedures shall be followed;

- i) Stop the construction activities in the area of the chance find;
- ii) Delineate the discovered site or area;
- iii) Secure the site to prevent any damage or loss of removable objects. In cases of removable antiquities or sensitive remains, a night guard shall be present until the responsible local authorities and the NHCC take over;
- iv) Notify the supervising Engineer who in turn will notify the responsible local authorities and the NHCC;
- v) The NHCC would be in charge of protecting and preserving the site before deciding on subsequent appropriate procedures. This would require a preliminary evaluation of the findings to be performed by the archaeologists of the NHCC. The significance and importance of the findings should be assessed according to the various criteria relevant to cultural heritage; those include the aesthetic, historic, scientific or research, social and economic values;
- vi) Decisions on how to handle the finding shall be taken by the NHCC. This could include changes in the layout (such as when finding an irremovable remain of cultural or archaeological importance) conservation, preservation, restoration and salvage;
- vii) Implementation for the authority decision concerning the management of the finding shall be communicated in writing by the NHCC; and

- viii) Construction work could resume only after permission is given from the responsible local authorities and the NHCC concerning safeguard of the heritage;
- ix) These procedures must be referred to as standard provisions in construction contracts, when applicable. During project supervision, the Site Engineer shall monitor the above regulations relating to the treatment of any chance find encountered are observed;
- x) Construction work will resume only after authorization is given by the responsible local authorities and the NHCC concerning the safeguard of the heritage.

## 9.0 ENVIRONMENTAL AND SOCIAL MANAGEMENT

### 9.1 Objectives of the Environmental Social Management Plan

The environmental management plan will address the upcoming adverse environmental impacts of the proposed project, enhance the project's overall benefits and introduce the standards of good environmental practice. The primary objectives of the ESMP are to provide:

The objectives of this ESMP are to:

- i) Provide a system that develops a means for incorporating the findings and outcomes of the ESIA into the Project construction and operations processes;
- ii) Establish systems and processes, to ensure compliance with applicable guidelines and legislation;
- iii) Detail construction monitoring, reporting and auditing requirements;
- iv) Identify environmentally sensitive assets and assist the construction crews and operations staff in avoiding and/or minimising potential impacts;
- v) Incorporate the environmental mitigation measures identified by the assessment process into a comprehensive framework which facilitates appropriate interpretation and implementation of mitigation measures throughout the Project;
- vi) Provide a tool to assist in tracking compliance with environmental obligations; and
- vii) Clarify areas of responsibility during Project activities.

Monitoring is necessary to avoid negative effects during construction and operation of the proposed project and achieve sustained environmental compliance. Details of the proposed environmental social monitoring plan (ESMP) which provides mitigation/enhancement measures, and timing for the relevant actions are presented in Table 8.1 for construction and operational phases, respectively.

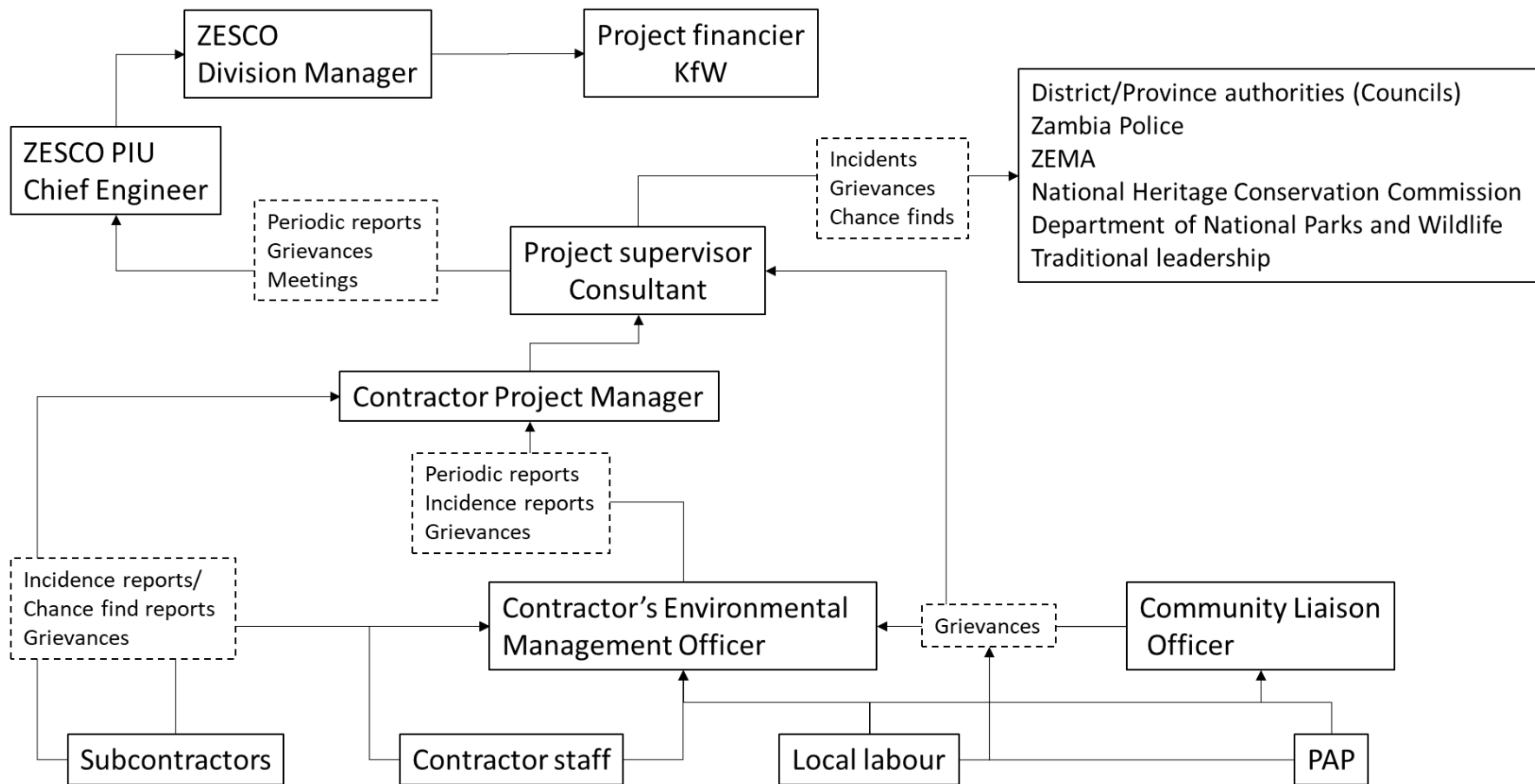
### 9.2 Organizational Structure

The organizational chart (**Error! Reference source not found.**) provides a visual representation of the organizational structure and how it relates to the implementation of the ESMP.

**Figure 25: Organizational Chart for ESMP Implementation**



3<sup>rd</sup> draft Environmental Impact Statement for the proposed rehabilitation and upgrade of a 33/11kv substation and construction of a 66/11kv substation, 66kv, 33kv, 11kv and 0.4kv lines under the Sustainable Electricity Supply Southern Division project, Southern Province. Livingstone and kazungula project components.



All Project personnel have a responsibility for their own environmental performance and compliance with the direction of the ESMP and national environmental legislation. Roles and responsibilities relating to environmental management for the key positions in the Project team are given below.

### **9.2.1 ZESCO Division Manager**

The ZESCO Division Manager will provide direction on ZESCO's position relating to issues of environmental compliance and responsibility with respect to the Project. He/she will act as a conduit of information between the ZESCO Project Manager and other government agencies with an interest in the Project (for example, ZEMA).

### **9.2.2 ZESCO Chief Engineer**

The ZESCO Chief Engineer will endorse and support the implementation of the ESMP and associated policies and documentation. The Chief Engineer will be responsible for ensuring that appropriate resources are made available to implement the ESMP and to support established systems, procedures and environmental objectives. Some specific responsibilities included;

1. Promoting the development of an appropriate culture to support environmental objectives and environmental management measures; and
2. Assisting in resolving disputes which may arise in respect to environmental and social management, according to the Grievance Mechanism (section 0).

### **9.2.3 Project Supervisor (Consultant)**

The Project Supervisor will review works performed by the Contractor on a continuous basis. The Project Supervisor will receive periodical reports including on the environmental and social performance, grievance reports, incident reports, etc., which he will forward to the appropriate levels within ZESCO and if need be to other authorities, including ZEMA.

### **9.2.4 Contractors Environmental Management Officer (CEMO)**

The Contractors Environmental Management Officer (CEMO) shall be responsible for the implementation of the environmental management and simpler mitigation measures during construction. The CEMO will liaise regularly with the construction crews to ensure all environmental commitments are incorporated into the construction activities and work processes. Specific responsibilities include:

- i) Maintaining and reviewing the ESMP (in conjunction with the Project Supervisor and ZESCO Project Manager);
- ii) Ensuring compliance with the ESMP and associated activity specific work plans;
- iii) Supporting construction personnel in achieving their responsibilities as outlined in the ESMP;
- iv) Liaising with government agencies and relevant stakeholders regarding Project matters;
- v) Overseeing the implementation of environmental construction requirements;
- vi) Coordinating appropriate responses to environmental related complaints, ensuring complaints are investigated for effective resolution according to the Grievance Mechanism (see section 0);
- vii) Providing input and advice on activity specific work plans;
- viii) Regularly reviewing and assessing environmental risks throughout the construction phase;
- ix) Identifying and preparing environmental induction and training materials;
- x) Responding to environmental incidents as required;
- xi) Coordinating the involvement of environmental specialists as the need arises throughout the construction phase; and
- xii) Managing compliance reporting as it relates to the Project.
- xiii) Contractor's Project Manager

The contractor's project manager will support and assist the CEMO in implementing the directives of the ESMP and act as a liaison between the Project Supervisor, ZESCO PM the CEMO and the contract workers.

### **9.3 Environmental Awareness and Training**

The objective of the environmental awareness and training is to provide all personnel working on the project with:

- i) An understanding of what their responsibilities are as outlined in the ESMP;
- ii) A means of developing a culture of compliance with the Project environmental requirements; and
- iii) A means to improve the environmental awareness of the workforce through the education of Project field personnel.

### **9.4 Project Environmental Awareness Induction**

An environmental awareness induction (training) will be developed by the CEMO. An environmental training register will be kept, maintained and used to verify that all

personnel working onsite have completed the environmental induction. The content of the induction is to include, but not be limited to:

- i) An overview of the Project environmental policy;
- ii) Relevant details of the ESMP including potential significant impacts;
- iii) Identification of relevant Project stakeholders;
- iv) Conditions of any environmental licenses, permits and approvals;
- v) Roles and responsibilities of all personnel in achieving environmental conformance;
- vi) Identification of any environmentally sensitive areas;
- vii) Definition and management of environmental incidents and operation of pollution / spill control equipment;
- viii) Definition and management of waste and an explanation of the waste minimisation and recycling strategy;
- ix) Processes for refuelling and the management and use of hazardous substances; and
- x) Appropriate responses to environmental incidents.

## **9.5 Environmental Toolbox Talks**

A toolbox talk involves the dissemination of information to project personnel at the field level. Generally, toolbox talks focus on safety aspects with reference to certain project jobs or tasks. They can be used to disseminate environmental management information. Environmental toolbox talks should cover aspects such as:

- i) Explanation of new project requirements;
- ii) Explanation of the key environmental risks associated with an activity or specific procedures which could potentially have environmental impacts;
- iii) Explanation of mitigation strategies with reference to an activity or specific procedures which could have potential environmental impacts;
- iv) Reminder of the importance of specific or generic environmental commitments;
- v) To obtain feedback related to environmental issues; and
- vi) Any other purpose related to the implementation of the ESMP.

Toolbox training will help to ensure that relevant information is communicated to the workforce and will also provide a forum for feedback on issues of interest or concern. Toolbox training will generally be prepared and delivered by the CEMO but may also be delivered by Site Engineers or Site Foreman. Possible Toolbox Talk topics include:

- i) Traffic safety, safe driving and operation of movable equipment in the project area
- ii) Management of works in and near waterways;
- iii) Working in flood zones;
- iv) Noise and vibration minimization;
- v) Wildlife conservation;
- vi) Soil erosion and sediment control; and
- vii) Waste management, minimization and recycling.

A register of toolbox talks and attendance records shall be maintained onsite.

## **9.6 Monitoring, Auditing and Reporting**

### **9.6.1 Monitoring**

The environmental monitoring requirements for the Project are detailed for each environmental issue/impact addressed by the ESMP. All environmental monitoring equipment, such as noise meters, water quality meters etc. should be maintained and calibrated according to manufacturer's specifications. All monitoring equipment details, status, calibration dates and maintenance should be documented and recorded.

### **9.6.2 Auditing**

Internal environmental audits will be undertaken throughout the construction process to ensure that the environmental requirements of the ESMP are implemented appropriately. The auditing process should be designed to identify any non-conformances, and provide an opportunity to apply corrective and / or preventative action where appropriate.

### **9.6.3 Reporting**

The CEMO will prepare a Monthly Environmental Report summarising monitoring, auditing and inspection outcomes as well as details of any environmental non-compliances. Other details to be reported on include:

- i) Actions resulting from any environmental inspections or audits, including those completed by external regulatory bodies or government agencies;
- ii) Action and reporting of all incidents; and
- iii) Other impacting non-conformance events, pertinent to the Project.

Regulatory and funding agencies may also require the preparation of reporting as part of approval conditions. Approvals should be checked for such requirements and it would be the responsibility of the CEMO to develop regulatory reports.

#### **9.6.4 Inspections**

The CEMO should undertake and document regular site inspections for the purpose of verifying compliance with the ESMP, licenses, permits and approvals, and the other environmental requirements. Inspection records shall be kept on file. Where inspections determine that environmental management measures are not effective, corrective and preventative measures will be implemented.

#### **9.6.5 Project Records**

A record keeping system will be developed and implemented, identifying how records will be managed and maintained during the Project. Records systems to be established which are directly relevant to environmental management include:

- i) Induction register;
- ii) Environmental incidents, non-conformances and complaints;
- iii) Inspection reports, checklists, diary entries;
- iv) Environmental monitoring results;
- v) Meeting minutes;
- vi) Formal letters and correspondence;
- vii) Waste measurement and tracking records;
- viii) Calibration records; and
- ix) Activity specific environmental risk assessments.

### **9.7 Preventative & Corrective Action**

#### **9.7.1 Preventative Action**

The CEMO will be responsible for directing and monitoring of the following aspects of the Project to determine trends and recommend actions to be taken to avoid recurrences of environmental incidents:

- i) Project, activity, or area-specific environmental risks;
- ii) Any exceedance of environmental standards;
- iii) Legislative changes; and
- iv) Auditing outcomes

#### **9.7.2 Corrective Action**

Deficiencies identified at worksites, if possible, be rectified immediately by the person identifying the deficiency, and reported to the foreman and the CEMO. A corrective action request should be completed and supplied to the foremen and CEMO within one working day of any of the following:

- i) A major departure from agreed or approved procedure, approval conditions or Project environmental management objectives;
- ii) A major non-compliance with the ESMP performance criteria; and/or
- iii) Any perceived breaches of the legislative requirements.

The corrective action request should include details of the environmental effect, action taken to correct the problem and proposed measures to prevent the occurrence of a similar incident. The identification, reporting and rectification of environmental deficiencies should be encouraged at Project inductions and in toolbox discussions.

### **9.7.3 Maintenance Observations**

Weekly site inspections should be undertaken by the CEMO in conjunction with the contractor's environmental manager to identify those day-to-day tasks such as the maintenance of environmental controls, the adjustment of existing environmental controls or minor modifications to practices that need to occur. A list of observations will be made during these site inspections and actions recommended to rectify issues.

Where recommended actions are suggested, priorities should be set against these actions for site implementation. The list of actions should be distributed to the responsible personnel, typically the Superintendent, Foremen or responsible Engineer for action. A close out system should be included to ensure risks are managed.

## **9.8 Grievance Redress Mechanism**

The goal of this mechanism is to ensure project's affected persons' satisfaction with implementation project, and in effect provide for on the ground monitoring by affected persons of the adequate implementation of the project. This GRM handles projects physical impacts as well as some social aspects of the project.

The main objectives of the grievance procedure are to provide a mechanism to ensure that the environmental and social aspects of the project have been implemented accurately and fairly, alleviating any adverse effects on PAPs, to mediate conflict and to avoid lengthy litigation that can delay the project implementation. It also provides people who have objections or concerns about the project with an accessible and known procedure through which to raise their objections and have them resolved. In

summary, a complaint shall be received by a Contractor's Environmental Management Officer who will process it and try to resolve it in conjunction with ZESCO or engaging the local leadership. If CEMO fails, then the complaints can be escalated by the CEMO to higher levels like ZEMA, ZESCO and other authorities. If it cannot be resolved at this stage, then complaint can be escalated to courts of law who are the final party in complaint resolution.

A complaints management system and stakeholder register will be established and maintained for the Project. The register shall record, track and direct the response to environmental complaints within specified timeframes, in liaison with the CEMO. The register will record the date and time, type of communication (telephone, letter, meeting etc.), personal details including a contact number, and any action taken to resolve the complaint.

### **9.8.1 Grievance Redress Mechanism Set-up and Process**

The Grievance Redress Mechanism will be set up for the duration of project implementation. The organization will include the following actors, as illustrated in figure 27.

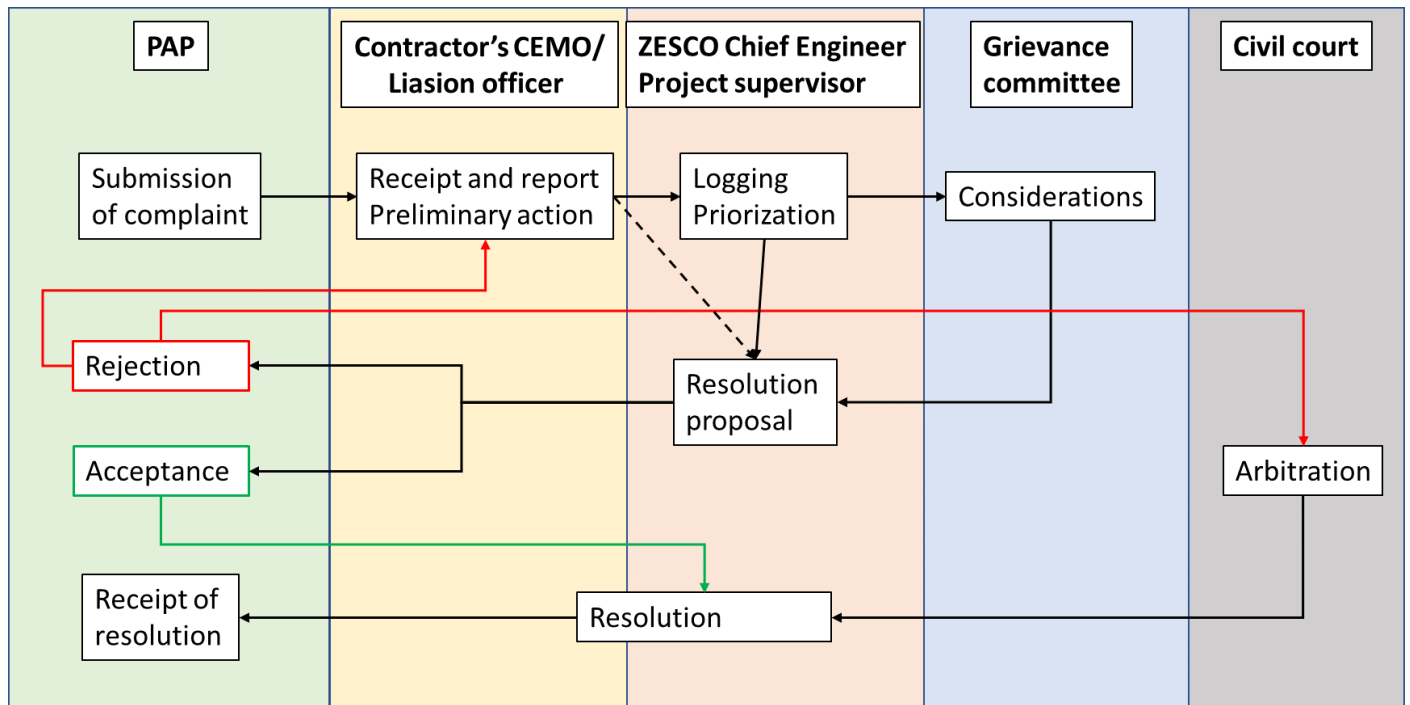
- The person affected by the project (PAP), or any aggrieved party who has a complaint against project implementation, or has sustained damage or injury by project actions, including Contractor's workers;
- The Contractor with its Environment Management Officer (CEMO) and community liaison officer(s);
- The ZESCO Chief Engineer and Project supervisor (Consultant);
- The Grievance Committee consisting of ZESCO, Contractor and representatives of the local community or administration;
- The appropriate level of civil court

The mechanism by which stakeholders can submit their grievances and include oral presentations in meetings, interaction with the contractor's Community Liaison Officer, or written submission to ZESCO or the project supervisors, in free text or using the attached Public Grievance Form (0). Letterboxes will be positioned at locations easily accessible to locals, such as at Contractor's camps, ZESCO offices, and fixed workplaces such as substation locations.

Information about means of contact such as the existence and location of letterboxes, and name, telephone number and email to the responsible persons with the Contractor and with ZESCO shall be provided to local people and workers. This shall be done in meetings, and by distributing leaflets in the project areas.

Project affected people (PAP) eligible for compensation have been listed as part of the RCAP, and ZESCO will keep a file on each PAP recording all steps in the process. The PAP shall be given a copy of the file on request at any time, and free of charge. Those among the PAP that are defined as vulnerable shall be given special consideration regarding and support regarding ways and means of making their grievances known.

**Figure 26: Outline of Grievance Redress Mechanism**



### 9.8.2 Initiation

The grievance process begins with the PAP submitting a complaint through one of the means described above. If the grievance is received by the Contractor's organisation, it will be considered and reported to the ZESCO. For minor complaints with simple resolution, such as repair of a broken fence, the Contractor can propose and effect a solution directly (dashed line in **Error! Reference source not found.**). It will, however, have to be reported to ZESCO's organisation for logging.

### 9.8.3 Logging and record keeping

The log shall be a database with all information about the complaint, including name of complainant, contact data, summary of complaint, reference of where to find full information on complaint, date of receipt, dates of proposed resolution, approval,

rejection and final resolution. All additional data such as letters, second opinions, etc to be kept on file by the ZESCO project organisation.

#### **9.8.4 Convening of Grievance Committee**

More complicated or grievances will be prioritized and treated within the ZESCO organisation. This can result in a resolution proposal directly, or can be referred to the Grievance Committee, which shall be appointed and convened specifically for the purpose. The Grievance Committee will hear the aggrieved party and will come to a proposed resolution for acceptance of him/her.

#### **9.8.5 Acceptance of grievance resolution**

If the proposed resolution is accepted, it will be executed, and the case closed. The acceptance shall be entered into the log, and files kept at least for the duration of the project implementation.

#### **9.8.6 Rejection of grievance resolution**

If the proposed resolution is rejected even after consideration and proposal by the Grievance Committee, then the case will be taken to civil court for arbitration. The court will follow all legal procedures, and eventually issue a verdict.

### **9.9 Review & improvement of ESMP**

The appointed Project Environmental Officer will review the ESMP, its operation and effective implementation at least bi-monthly. Between the scheduled reviews, a register of issues will be maintained to ensure that issues raised by internal or external personnel associated with the Project is recorded

The purpose of the review is to ensure that the ESMP is meeting the requirements of the standards, policies and objectives and if not to amend the ESMP to address any short comings. The review will consider:

- i) Site personnel comments;
- ii) Audit findings;
- iii) Environmental monitoring records;
- iv) Community complaints;
- v) Details of corrective and preventative actions taken;
- vi) Incident reports;
- vii) Changes in organization structures and responsibilities;
- viii) The extent of compliance with objectives and targets; and

ix) The effect of changes made to environmental standards and/or legislation.

Acting on the findings of the review, the Project Environmental Officer will review the various policies and objectives and approve any changes.

## 10.0 ENVIRONMENTAL AND SOCIAL MANAGEMENT AND MONITORING PLAN

The Environmental and Social Management and Monitoring plan is presented in 46-47 for the three project phases, pre-construction, construction and operation. Responsibility for the measures will be as shown in Table 45.

**Table 45: Responsibility for implementation and monitoring through project phases**

<b>Phase</b>	<b>Implementation</b>	<b>Monitoring</b>
Pre-construction	Consultant	ZESCO
Construction	Contractor	Consultant/ZESCO
Operation	ZESCO	ZESCO

Costs for the implementing the measures will be included in the project costs during all phases. During pre-construction in the Consultant's budget and ZESCO's planning budget. During construction it will be included in the Contractor's budget and the Consultant's supervision budget. During operation, costs will be included in the operational budget of ZESCO.

**Table 46: Environmental mitigation and monitoring plan, pre-construction phase**

<b>Aspect</b>	<b>Impact</b>	<b>Mitigation Measure</b>	<b>Frequenc y of Monitorin g</b>	<b>Performance Indicator</b>
Wayleave management	Potential conflicts of encroachment	Acquisition and numbering of wayleaves and acquisition of titles of substations. Scheduled wayleave inspection and maintenance. Stakeholder engagement	Bi-annually	Level of encroachment with an anticipated target of no encroachment.
Wayleave acquisition	Involuntary resettlement, impact on properties, structure, crops	Location away from properties, adequate compensation, follow-up of RCAP grievance mechanism	Bi-annually	Properties affected and compensated for (register). Grievances received and resolved.
Cultural and heritage	Destruction of cultural heritage	Identification and location of structures of away from cultural and heritage sites	Bi-annually	Chance find register. Sites identified and avoided

**Table 47: Environmental mitigation and monitoring plan, construction phase**

Aspect	Impact	Mitigation Measure	Frequency of Monitoring	Performance Indicator
Excavation, borrowing and blasting activities; movement of heavyduty machinery and vehicles	Vibrations leading to loosening of rock, and cracking of some of the existing infrastructure in the area.	Use of controlled blasting by qualified and registered (licensed) blasters; and appropriate warning given before blasting	Before and during blasting activities	Reduction in loosening of unwanted rock and no cracking of infrastructure
Movement of heavyduty machinery and vehicles	Risk of traffic accidents, compaction of soils	Training of vehicle operators, road signs. Operation in non-farming season.	Annually	Curriculum of training, number of trained operators
Dust	Increased dust, gas, and particulate emissions	Dust suppression measures through spraying of water in dust prone areas by use of water bowsers use of blast mats; watering down the area; maintenance of access roads; and speed limits imposed; Use of construction vehicles and equipment that are in good working condition.	Daily during dry season	Subjective perception, complaints
Noise	Noise pollution	Use of mufflers, silencers, and screens to minimize noise from construction activities; Restricting vehicle movements and operation of loud machinery and equipment to daylight hours.	Bi-annually	Subjective perception, complaints
Waste Management	Construction will produce some waste such as steel bars, bolts, nuts, paper, and plastics which have adverse impacts on the environment.	Waste shall be sorted according to types. Plastics and empty cement bags shall be collected from site and burnt. Leftover metal pieces (steel bars, bolts, nuts) shall be removed from site and stored for reuse. Dumping of waste will be done at designated sites approved by Nyimba Municipal Council.	Monthly	Quantity of waste produced and/or disposed of at approved facilities

Aspect	Impact	Mitigation Measure	Frequency of Monitoring	Performance Indicator
Chemical pollution	Spills and leaks are the major waste products	The collected oils shall be packed according to regulations and temporarily stored in recommended drums and eventually disposed off-site according to ZEMA guidelines	Monthly	Remaining chemicals on site
<b>BIOLOGICAL ENVIRONMENT</b>				
Vegetation clearance and construction activities	Loss of habitats and biodiversity of fauna.	Conservation awareness campaigns to be carried out; Use of noise controlled equipment.	During clearance campaigns	Limited disturbance to fauna habitats
Vegetation clearance and construction activities	Destruction to vegetation	Wayleave clearance shall be restricted to 5 m either side of line;	During clearance campaigns	Vegetation destruction limited.
Vegetation clearance and construction activities	Destruction to vegetation	Use of fires shall be monitored and restricted to residential camps	During clearance campaigns	Vegetation destruction limited.
<b>SOCIO-ECONOMIC ENVIRONMENT</b>				
Wayleave management	Potential conflicts of encroachment	Acquisition and numbering of wayleaves and acquisition of titles of substations. Scheduled wayleave inspection and maintenance	Monthly during construction	Level of encroachment
Wayleave management	Requirements for compensation	Adequate compensation; Grievance mechanism for public	Bi-annually	Grievance mechanism register showing conflicts solved/pending

<b>Aspect</b>	<b>Impact</b>	<b>Mitigation Measure</b>	<b>Frequency of Monitoring</b>	<b>Performance Indicator</b>
Increase in population in search of employment	Stress on social amenities	Employment during site preparation and construction stages shall be done from within the local community, wherever possible.	Weekly during the project implementation	Number of Local people employed
Site preparation and construction activities	Provision of employment to locals	Employment during site preparation and construction stages shall be done from within the local community	Weekly during the project implementation	Local people employed especially as unskilled labour
Occupational and public health and safety	Workers and members of the public exposed to hazards at project site.	First Aid training and first aid kits shall be given to workers as part of emergency preparedness and response.	Weekly	Reduced injuries and quick response to any hazards
Occupational health and safety	Provision of personal protective equipment to all project staff and site visitors		Daily	All workers and site visitors with PPE
Labour conditions	Inadequate payment; improper use of forced or child labour; lack of safety equipment; unsafe working conditions	Grievance mechanism for workers (including casual labourers); health and safety committee	Monthly	Grievance register
Health risks	Spreading of communicable diseases	Conducting of health awareness talks to the workers and the community at regular intervals during project implementation.	Bi-annually	Attendance at health talks (register)

<b>Aspect</b>	<b>Impact</b>	<b>Mitigation Measure</b>	<b>Frequency of Monitoring</b>	<b>Performance Indicator</b>
Traffic safety	Road accidents	Appropriate signage and safety symbols shall be placed in respective areas to warn workers, visitors, and locals of any hazards that may exist	Monthly	Appropriate signage and safety symbols placed.
Cultural heritage	Destruction of sites	Identification and reporting of chance finding of heritage sites	Bi-annually	Sites identified and avoided Chance finds register

**Table 48:** Environmental mitigation and monitoring plan, operations phase

Aspect	Impact	Mitigation Measure	Frequency of Monitoring	Performance Indicator
<b>BIOLOGICAL ENVIRONMENT</b>				
Vegetation clearance and construction activities	Loss of habitats and biodiversity of fauna.	Conservation awareness campaigns to be carried out; Use of noisecontrolled equipment.	Periodically throughout project phases	Limited disturbance to fauna habitats
Vegetation clearance and construction activities	Destruction to vegetation	Wayleave clearance shall be restricted to 5 m either side of line;		Vegetation destruction limited.
<b>SOCIO-ECONOMIC ENVIRONMENT</b>				
Public health and safety	Electricity hazards	Information to public on electricity risks	Once per three years	Operational register ZESCO



3<sup>rd</sup> draft Environmental Impact Statement for the proposed rehabilitation and upgrade of a 33/11kv substation and construction of a 66/11kv substation, 66kv, 33kv, 11kv and 0.4kv lines under the Sustainable Electricity Supply Southern Division project, Southern Province. Livingstone and kazungula project components.

## 11.0 Decommissioning Plan

The technical lifetime of this type of project is 20-50 years, and with due maintenance and repair it could last and provide services longer than this. With such a long time-span, it is not possible to budget the costs of decommissioning. However, the responsibility for decommissioning will rest with the owner of the infrastructure, i.e. ZESCO, or its potential successor(s). The activities to be undertaken during decommissioning are:

- Removal of all objects:
  - Power lines: Poles, conductors, cross-bars, insulators, etc.
  - Substation: Transformers, conductors, insulators, breakers, oils, civil works, etc.
- Recycling of usable objects
- Destruction or deposition of unusable objects and wastes in an environmentally acceptable way.
- Restoring land to previous situation and in a proper way for its used by owners or public.
- Returning expropriated land to original owners
- Transferring public land to the state; alternatively selling to the public

## 12.0 SUMMARY

The present Environmental Impact Statement (EIS) provides the results of the Environmental and Social Impact Assessment detailed studies and consultations that have been carried out, including biomass and biodiversity studies, socio-economic baseline survey, and inventory of people and assets potentially affected by the project activities. The EIS is accompanied by two additional, separate, documents, the Resettlement and Compensation Action Plan (RCAP), and the Stakeholder Engagement Plan.

Due to the urban and peri-urban location of most of the project components, the degree of degradation of the natural ecosystems, and the relatively small scale of project components, it is expected that the environmental impact on these systems will be negligible.

The socio-economic conditions among people in the project areas is characterised by relatively high standards, with more than basic education and access to electricity and water services of good quality. The main development priority, however, is increased employment opportunities.

The significant impacts of the project are entirely of a social nature, negative and positive.

Anticipated negative impacts identified include:

- Loss of houses and other assets (access to farmland, trees, walls, wells etc.)
- Involuntary resettlement
- Movement of heavy vehicles during construction; increased traffic
- Dust and noise pollution during construction
- Increase in the spread of STIs among locals due to the influx of people in the project area.

Anticipated benefits from the project:

- Casual labour opportunities during project implementation
- Improved quality and reliability of electricity supply in the project area
- Increased number of people connected to electricity, especially in peri-urban and rural communities

The environmental and social assessment includes the following, which form the basis of this environmental impact statement:

- Environmental and Social Impact Assessment

- Environmental and Social Management Plan
- Resettlement and Compensation Action Plan
- Stakeholder Engagement Plan

Based on assessment of the preliminary project designs, the RCAP found that a total of 108 households may be affected by construction activities, possibly affecting 34 houses. Of these 28 houses may need to be removed, resulting in possible need of physical resettlement. Out of those in possible need for resettlement, 11 households are determined to include vulnerable PAP. An inventory of assets has been performed and is reported in the RCAP.

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## **14. APPENDICE**

### **APPENDIX 1: Stakeholder list of attendance and consents**

## APPENDIX 2: Plant species recorded in the project area and adjacent areas.

Number	Species	Growth form
<b>TREES</b>		
1	<i>Senegalia nigrescens</i>	Tree
2	<i>Vachellia sieberana</i>	Tree
4	<i>Adansonia digitata</i>	Tree
5	<i>Albizia harveyi</i>	Tree
6	<i>Baikiaea plurijuga</i>	Tree
7	<i>Baphia massaiensis</i>	Tree
8	<i>Bauhinia petersiana</i>	Tree
9	<i>Brachystegia boehmii</i>	Tree
10	<i>Brachystegia spiciformis</i>	Tree
11	<i>Burkea africana</i>	Tree
12	<i>Cassia abbreviata</i>	Tree
13	<i>Cassia abbreviata</i>	Tree
14	<i>Colophospermum mopane</i>	Tree
15	<i>Combretum imberbe</i>	Tree
16	<i>Combretum sp</i>	Tree
17	<i>Combretum zeyheri</i>	Tree
18	<i>Commiphora sp</i>	Tree
20	<i>Dalbergia melanoxylon</i>	Tree
21	<i>Dichrostachys cinerea</i>	Tree
22	<i>Diospyros mespiliformis</i>	Tree
23	<i>Diospyros mespiliformis</i>	Tree
25	<i>Erythrophleum africanum</i>	Tree
26	<i>Friesodielsia obovata</i>	Tree
27	<i>Guibourtia coleosperma</i>	Tree
29	<i>Julbernardia globiflora</i>	Tree
30	<i>Kirkia acuminata</i>	Tree
31	<i>Lannea discolor</i>	Tree
33	<i>Mimusops zeyheri</i>	Tree
34	<i>Ochna pulchra</i>	Tree

Number	Species	Growth form
35	<i>Oldfieldia dactylophylus</i>	Tree
38	<i>Peltroforum africanum</i>	Tree
39	<i>Philenoptera violacea</i>	Tree
40	<i>Phoenix reclinata</i>	Tree
42	<i>Piliostigma thonningi</i>	Tree
43	<i>Pterocarpus angolensis</i>	Tree
44	<i>Pterocarpus antunesii</i>	Tree
45	<i>Schinziophyton rautanenii</i>	Tree
46	<i>Sclerocarya caffra</i>	Tree
47	<i>Securidaca longepedunculata</i>	Tree
48	<i>Sterculia africana</i>	Tree
49	<i>Sterculia quinqueloba</i>	Tree
50	<i>Syzygium cordatum</i>	Tree
51	<i>Syzygium quineense</i> <i>barotsense</i>	Tree
52	<i>Trichilia emetica</i>	Tree
53	<i>Xeroderris stuhlmannii</i>	Tree
<b>GRASSES and SEDGE</b>		
3	<i>Acroceras sp</i>	Grass
19	<i>Cyperus papyrus</i>	Sedge
24	<i>Echinochloa sp</i>	Grass
28	<i>Hyphaene ventricosa</i>	Palm
32	<i>Leersia sp</i>	Grass
36	<i>Panicum sp</i>	Grass
37	<i>Paspalum sp</i>	Grass
41	<i>Phragmites sp.</i>	Grass

### APPENDIX 3.: Invertebrate species recorded in the project area

Number	Species	Number	Species
1	<i>Acrea aglaonice</i>	59	<i>Locris maculate</i>
2	<i>Acrea atergatis</i>	60	<i>Lymeae natalensis</i>
3	<i>Acrea atolmis</i>	61	<i>Macromia nyanzana</i>
4	<i>Aedes aegypti</i>	62	<i>Macrotermes bellicosus</i>
5	<i>Aegocera fetvida</i>	63	<i>Macrotermes falciger</i>
6	<i>Aegocera trimeni</i>	64	<i>Macrotermes michaelsoni</i>
7	<i>Amblyomma variegata</i>	65	<i>Macrotermes natalensis</i>
8	<i>Ammophila ludovicus</i>	66	<i>Macrotermes vatrialatus</i>
9	<i>Anopheles arabiensis</i>	67	<i>Mantichora sp</i>
10	<i>Anthia burchelli</i>	68	<i>Mecostibus mafukae</i>
11	<i>Apis mellifera</i>	69	<i>Melanoides victoriae</i>
12	<i>Bactrododema sp</i>	70	<i>Nemeura glauningi</i>
13	<i>Belonogaster griseus</i>	71	<i>Neoperla spio</i>
14	<i>Biomphalaria pfeiferi</i>	72	<i>Nepheronia thalassina</i>
15	<i>Bombylius discoideus</i>	73	<i>Ornithacris magnifeca</i>
16	<i>Boophilus decoloratus</i>	74	<i>Pachylomera femoralis</i>
17	<i>Brachytrypes membranaceus</i>	75	<i>Palpares cataractae</i>
18	<i>Bromophila caffra</i>	76	<i>Paltothyreus tarsatus</i>

<b>Number</b>	<b>Species</b>	<b>Number</b>	<b>Species</b>
19	<i>Bulinus globosus</i>	77	<i>Papilio constantinus</i>
20	<i>Bulinus tropicus</i>	78	<i>Papilio leonidas</i>
21	<i>Charaxes fulgurata</i>	79	<i>Papilio nireus</i>
22	<i>Clonia wahlbergi</i>	80	<i>Papilio porthaon</i>
23	<i>Crameria amabilis</i>	81	<i>Paragomphus cataractae</i>
24	<i>Crenigomphus cornutus</i>	82	<i>Pentila pauli</i>
25	<i>Cueta punctatissima</i>	83	<i>Pephricus livingstoni</i>
26	<i>Cybister immarginata</i>	84	<i>Petalochirus umbrosus</i>
27	<i>Cymatomera denticollis</i>	85	<i>Phaon iridipennis</i>
28	<i>Cyrtacanthacris septemfasciata</i>	86	<i>Phlebotomus papatasii</i>
29	<i>Diasemopsis obstans</i>	87	<i>Platycypha caligata</i>
30	<i>Dicronorrhina derbyana</i>	88	<i>Probergrothius sexpunctatus</i>
31	<i>Dictyophorus griseus</i>	89	<i>Prosopocera lactator</i>
32	<i>Eatonica schoutedeni</i>	90	<i>Pseudocreobotra wahlbergi</i>
33	<i>Eleuthemis buettikoferi</i>	91	<i>Pseudoderopeltis dilutes</i>
34	<i>Enyaliopsis sp.</i>	92	<i>Purpuricenusa laetus</i>
35	<i>Eronia leda</i>	93	<i>Rhipicephalus appendiculatus</i>
36	<i>Eumenes maxillosus</i>	94	<i>Rhyothemis semihyalina</i>
37	<i>Eustegaster poecila</i>	95	<i>Rothia burleri</i>
38	<i>Gonimbrasia zambesina</i>	96	<i>Salamis anacardia</i>
39	<i>Graphopterus amabilis</i>	97	<i>Schausia coryndoni</i>
40	<i>Gryllotalpa Africana</i>	98	<i>Semioptila torta</i>
41	<i>Gyna maculipennis</i>	99	<i>Senaspis haemorrhoea</i>
42	<i>Haematopota vittate</i>	100	<i>Sibyella pretiosa</i>
43	<i>Heliocopriss japedus</i>	101	<i>Silveira marshalli</i>
44	<i>Hemipepsis vindex</i>	102	<i>Simulium damnosum</i>
45	<i>Hodotermes mossambicus</i>	103	<i>Stizus dewitzii</i>
46	<i>Hyalomma marginatum</i>	104	<i>Synagris analis</i>
47	<i>Hyalomma truncutum</i>	105	<i>Systropus snowi</i>
48	<i>Hyperechia bifasciata</i>	106	<i>Tabanus taeniolar</i>

<b>Number</b>	<b>Species</b>	<b>Number</b>	<b>Species</b>
49	<i>Ictinogomphus ferox</i>	107	<i>Tarsocnodes molossus</i>
50	<i>Ioba leopardine</i>	108	<i>Teniorhinus harona</i>
51	<i>Krausaria prasine</i>	109	<i>Tetralobus rotundifrons</i>
52	<i>Labidura riparia</i>	110	<i>Tmesebasis lacerate</i>
53	<i>Lamarckiana punctosa</i>	111	<i>Truxaloides brasiliensis</i>
54	<i>Lanistes ovum</i>	112	<i>Xenopsylla sp.</i>
55	<i>Leucophlebia afra</i>	113	<i>Xylocopa inconstans</i>
56	<i>Ligyra mars</i>	114	<i>Ypthina cataractae</i>
57	<i>Limnogonus sp</i>	115	<i>Zabalius aridus</i>
58	<i>Litorrhynchus basalis</i>	116	<i>Zanna punctatus</i>

#### **APPENDIX 4: Reptile species recorded in the project area**

<b>Number</b>	<b>Species</b>	<b>Number</b>	<b>Species</b>
1	<i>Agama hispida</i>	34	<i>Mabuya quinquetaeniata</i>
2	<i>Amblyodipsas ventrimaculatus</i>	35	<i>Mabuya striata</i>
3	<i>Amblyodipsas polylepis</i>	36	<i>Mabuya varia</i>
4	<i>Aparallactus capensis</i>	37	<i>Mehelya capensis</i>

<b>Number</b>	<b>Species</b>	<b>Number</b>	<b>Species</b>
5	<i>Aparallactus lunulatus</i>	38	<i>Mehelya nyassae</i>
6	<i>Atractaspis bibronii</i>	39	<i>Monopeltis mauricei</i>
7	<i>Bitis arietans</i>	40	<i>Naja haje</i>
8	<i>Boaedon fuliginosus</i>	41	<i>Naja mossambica</i>
9	<i>Causus defilippii</i>	42	<i>Natriciteres olivacea</i>
10	<i>Chamaeleo dilepis</i>	43	<i>Nucras taeniolata</i>
11	<i>Crocodylus niloticus</i>	44	<i>Pachydactylus oshaughnessyi</i>
12	<i>Crotaphopeltis hotamboeia</i>	45	<i>Pachydactylus punctatus</i>
13	<i>Dalophia longicauda</i>	46	<i>Panaspis wahlbergii</i>
14	<i>Dalophia pistillum</i>	47	<i>Peusios sinuatus</i>
15	<i>Dasypeltis scabra</i>	48	<i>Pelomedusa subrufa</i>
16	<i>Dendroaspis polylepis</i>	49	<i>Pelusios bechuanicus</i>
17	<i>Dispholidus typus</i>	50	<i>Philothamnus semivariatus</i>
18	<i>Dromophis lineatus</i>	51	<i>Philothamnus irregularis</i>
19	<i>Elapsoidea semiannulata</i>	52	<i>Psammophis angolensis</i>
20	<i>Geochelone pardalis</i>	53	<i>Psammophis subtaeniatus</i>
21	<i>Gerrhosaurus major</i>	54	<i>Psammophis sibilans</i>
22	<i>Gerrhosaurus nigrolineatus</i>	55	<i>Pseudaspis cana</i>
23	<i>Hemidactylus mabouia</i>	56	<i>Python sebae</i>
24	<i>Hemirhagerrhis nototaenia</i>	57	<i>Rhamphiophis oxyrhynchus</i>
25	<i>Ichnotropis capensis</i>	58	<i>Riopa sundevallii</i>
26	<i>Ichnotropis capensis</i>	59	<i>Telescopus semiannulatus</i>
27	<i>Ichnotropis squamulosa</i>	60	<i>Thelotornis capensis</i>
28	<i>Kinixys belliana</i>	61	<i>Typhlops schlegelii</i>
29	<i>Leptotyphlops scutifrons</i>	62	<i>Typhlosaurus ngamiensis</i>
30	<i>Limnophis bicolor</i>	63	<i>Varanus exanthematicus</i>
31	<i>Lycophidion capense</i>	64	<i>Varanus niloticus</i>
32	<i>Lygodactylus capensis</i>	65	<i>Xenocalamus mechowii</i>
33	<i>Lygodactylus chobiensis</i>	66	<i>Zygaspis quadrifrons</i>

## APPENDIX 5: Bird species recorded in project area

Number	Species	Number	Species
1	<b><i>Agapornis lilianae</i></b>	<b>26</b>	<b><i>Mirafrapa passerina</i></b>
2	<i>Agapornis nigrigenis</i>	27	<i>Necrosyrtes monachus</i>
3	<i>Alopochen aegyptiacus</i>	28	<i>Numida meleagris</i>
4	<i>Balearica regulorum</i>	29	<i>Oena capensis</i>
5	<i>Caprimulgus europaeus</i>	30	<i>Parisoma subcaeruleum</i>
6	<i>Circus macrourus</i>	31	<i>Plectropterus gambensis</i>
7	<i>Cisticola fulvicapillus</i>	32	<i>Poicephalus cryptoxanthus</i>
8	<b><i>Coturnix adansonii</i></b>	<b>33</b>	<b><i>Poicephalus meyeri</i></b>
9	<i>Coturnix delegorguei</i>	34	<i>Polemaetus bellicosus</i>
10	<b><i>Crex crex</i></b>	<b>35</b>	<b><i>Pycnonotus nigricans</i></b>
11	<i>Emberiza impetruani</i>	36	<i>Recurvirostra avosetta</i>
12	<i>Falco cuvieri</i>	37	<i>Sarkidiornis melanotos</i>
13	<b><i>Falco fasciinucha</i></b>	<b>38</b>	<b><i>Scotopelia peli</i></b>
14	<i>Falco naumanni</i>	39	<i>Stractolaema anchietae</i>
15	<b><i>Francolinus coqui</i></b>	<b>40</b>	<b><i>Streptopelia capicola</i></b>
16	<i>Francolinus natalensis</i>	41	<i>Streptopelia semitorquata</i>
17	<i>Francolinus sephaena</i>	42	<i>Streptopelia senegalensis</i>
18	<i>Francolinus shelleyi</i>	43	<i>Tockus pallidirostris</i>
19	<i>Francolinus swainsonii</i>	44	<i>Torgos tracheliotus</i>
20	<i>Gallinago media</i>	45	<i>Treton calva</i>
21	<b><i>Gyps africanus</i></b>	<b>46</b>	<b><i>Tricholaema frontatus</i></b>
22	<b><i>Haliaeetus vocifer</i></b>	<b>47</b>	<b><i>Tricholaema leucomelas</i></b>
23	<i>Hirundo cucullata</i>	48	<i>Trigonoceps occipitalis</i>
24	<i>Locustella fluviatilis</i>	49	<i>Turtur chalcospilos</i>
25	<b><i>Merops variegatus</i></b>		

## APPENDIX 6: List of mammal species recorded in the project area

Number	Species	Number	Species
1	<i>Acinonyx jubatus</i>	34	<i>Lepus saxatilis</i>
2	<i>Acomys spinosissimus</i>	35	<i>Loxodonta africana</i>
3	<i>Aepyceros malampus</i>	36	<i>Lutra maculicollis</i>
4	<i>Aethomys chrysophilus</i>	37	<i>Lycaon pictus</i>
5	<i>Aethomys namaquensis</i>	38	<i>Manis temmincki</i>
6	<i>Aonyx capensis</i>	39	<i>Mellivora capensis</i>
7	<i>Cania adustus</i>	40	<i>Mus minutoides</i>
8	<i>Ceratotherium simum</i>	41	<i>Oreotragus oreotragus</i>
9	<i>Cercopithecus aethiops</i>	42	<i>Orycteropus afer</i>

10	<i>Connochaetus taurinus</i>	43	<i>Otocyon megalotis</i>
11	<i>Crocuta Crocuta</i>	44	<i>Panthera leo</i>
12	<i>Damaliscus lunatus</i>	45	<i>Panthera pardus</i>
13	<i>Equus burchelli</i>	46	<i>Papio ursinus</i>
14	<i>Felis caracal</i>	47	<i>Paracynictus selousi</i>
15	<i>Felis serval</i>	48	<i>Paraxerus cepapi</i>
16	<i>Galago senegalensis</i>	49	<i>Pedetes capensis</i>
17	<i>Genetta genetta</i>	50	<i>Pellomys fallax</i>
18	<i>Genetta tigrine</i>	51	<i>Phacochoerus aethiopicus</i>
19	<i>Giraffa camelopardalis</i>	52	<i>Poecilogale albinucha</i>
20	<i>Helogale parvula</i>	53	<i>Potamocheirus porcus</i>
21	<i>Herpestes ichneumon</i>	54	<i>Praomys natalensis</i>
22	<i>Herpestes sanguineus</i>	55	<i>Proteles cristatus</i>
23	<i>Heterohyrax brucei</i>	56	<i>Raphicerus campestris</i>
24	<i>Hippopotamus amphibius</i>	57	<i>Raphicerus sharpie</i>
25	<i>Hippotragus equinus</i>	58	<i>Saccostomus campestris</i>
26	<i>Hippotragus niger</i>	59	<i>Silvicapra grimmia</i>
27	<i>Hystrix africaeaustralis</i>	60	<i>Syncerus caffer</i>
28	<i>Ichneumia albicauda</i>	61	<i>Tatera leucogaster</i>
29	<i>Ictonyx striatus</i>	62	<i>Taurotragus oryx</i>
30	<i>Kobus ellipsiprymnus</i>	63	<i>Tragelaphus scriptus</i>
31	<i>Kobus leche</i>	64	<i>Tragelaphus strepsiceros</i>
32	<i>Kobus vardon</i>	65	<i>Tragelaphus strepsiceros</i>
33	<i>Lemniscomys griselda</i>	66	<i>Viverra civetta</i>

## APPENDIX 7: Socio-economic sample survey questionnaire

### 1. Location

Subvillage	
Village	
Ward	
District	

**2. Respondent gender**

Man                  Woman

**3. Gender of Household head**

Man                  Woman

**4. Education level of respondent**

Illiterate                  Only read and write                  Primary school                  Secondary school  
Higher education

**5. Highest education level of any of the household members (mark one)**

Illiterate                  Only read and write                  Primary school                  Secondary school  
Higher education

**6. Household composition**

	<b>Number of Males</b>	<b>Number of Females</b>
Elderly (>60)		
Adults (16-60)		
School-age children (5-15)		
Small children (0-5)		

**widowers, orphans in household.**

	<b>Number</b>

**7. Number of household members disabled or persons with a long-term illness?**

	Women	Men
Number		

**8. Number widows,**

Widows	
Widowers	
Orphan girls	
Orphan boys	

**9. What are the most common health problems/issues in the household?**

1	
2	
3	

**10. Does the household have access to medical services?**

Yes  No

**11. What is the distance to nearest health post in km OR minutes?**

Km  Minutes

**12. Does the household use traditional medicine(remedies)/traditional healers?**

Yes  No

**13. Does the household have any of the following (pls fill all)?:**

	Yes	No
Books, other than the Bible or the Khoran		
Motorcycle		
Bicycle		
Extra room where nobody sleeps		
Sofa		
Cell phone		
Glass windows		
Generator set		
Solar PV		
Radio		
TV/Video		

**14. Number of houses belonging to household?**

	Number
For people to live in	
For animals or storage	
For business, workshop etc.	

**15. Quality of BEST house in household?**

**Bricks    Cements    Mud    Wood    Grass    Iron sheet    Other**

**Wall**

**Roof**

**Floor**

**16. Are you engaged in farming to produce food for the family?**

**Yes    No**

**17. If you are farming, did you sell any of the harvest last year?**

**Yes    No**

**18. If you are farming, how much land do you have, in acres OR hectares?**

Acres

Hectares

**19. If you are farming, what crops do you plant**

Crop 1	
Crop 2	
Crop 3	
Crop 4	

**20. What type of livestock or labour animals do you keep, if any?**

	Type	Number
Livestock 1		
Livestock 2		
Livestock 3		
Livestock 4		

**21. Are you engaged in forest activities (logging, planting, charcoal burning, etc.)?**

**Yes No**

**22. Other income earning activities by yourself or other persons in household (NOT farming or forestry)?:**

	Type of occupation
Self employed	

Formal employment	

**23. Did you get money sent to you last year (e.g. from relatives in town or pension from previous employment)?**

Yes  No

**24. What are your sources of water (e.g. well, river, public standpipe etc)?**

Source 1

Source 2

Source 3

**25. Who is responsible for obtaining water (tick)?**

Men	
Women	
Children	

**26. If household has generator set, how much fuel do you use per month? (litres OR cost in ZMW)**

Litres	ZMW	Petrol or Diesel

**27. What type of energy appliances do you have in the household?**

Energy appliance	Tick
Wood stove	
Charcoal stove	
Improved mbaula	
Charcoal iron	
Torch	

<b>Energy appliance</b>	<b>Tick</b>
Electric light	
Electric iron	
Refrigerator	
Gas stove	
Kerosene stove	
Kerosene lamp	
Electric stove	
Electric fan	
A/C cooler	

**28. What type of energy do you use for lighting, and how much?**

Energy sources	Cost /Use per week (ZMW)

**29. What type of energy do you use for cooking, and how much?**

Energy source s	Cost /Use per week (ZMW)

**30. What type of energy do you use for room heating, and how much?**

- None – skip to next

Energy sources	Cost /Use per week (ZMW)

**31. What type of energy do you use for entertainment (radio, TV, video), and how much?**

- None – skip to next

Energy source	Cost /Use per week (ZMW)

**32. What type of energy do you use for income earning, and how much?**

None – skip to next

Energy source	Cost /Use per week (ZMW)

**33. If you have a cellphone, how do you charge it?**

Yes No

Charge from own source (grid, PV or generator)

Charge commercially

**34. If you charge cellphone commercially, how much does it cost you?**

ONE charge (ZMW)	Total cost for charging per week (ZMW)

**35. Are you already connected to the ZESCO electricity network?**

Yes

No

If yes, skip to 38

**36. If you are NOT connected to ZESCO, how much do you think you can afford to pay for electricity CONNECTION once it comes to your area? ZMW per MONTH (Only connection, not for electricity use) (Write zero only if they say they cannot pay. If no answer or don't know, write n.a.)**

	ZMW connection fee
For household use	
In income earning activity	



3<sup>rd</sup> draft Environmental Impact Statement for the proposed rehabilitation and upgrade of a 33/11kv substation and construction of a 66/11kv substation, 66kv, 33kv, 11kv and 0.4kv lines under the Sustainable Electricity Supply Southern Division project, Southern Province. Livingstone and kazungula project components.

**37. If you are NOT connected to ZESCO, how much do you think you can afford to pay for electricity consumption once it comes to your area? ZMW per MONTH (Not connection, only for electricity use) (Write zero only if they say they cannot pay. If no answer or don't know, write n.a.)**

	ZMW/ month
For household use	
In income earning activity	

**38. If you have power, what can you do to earn money?**

<b>1</b>
2
3

**39. If there is power in the village, what can others do to earn money?**

<b>1</b>
2
3

**40. What are the most important development needs in the community? Please try to rank at least the three most important of the following issues**

<b>Need</b>	<b>Rank (number)</b>
Health care	
Employment (income earning possibilities)	
Water	
Education	
Roads	
Transport and communication	
Other: .....	

## **APPENDIX 8: Grievance Form**

Example of a grievance form. The form can be submitted anonymously, and by a person other than the aggrieved party. It can also be submitted orally, in which case the receiving officer shall fill the relevant parts of the form.

Name of complainant (optional)

Name of person to be contacted (optional)

Nature of complaint

### **Solution proposed/requested**

### **Form of contact preferred**

Personal meeting

Letter

Telephone

Email

Name of person to be contacted (optional)

Telephone

Email

Received by (name)

Logged (date)

Resolution proposal issued (date)

Resolved (date)