

**ENVIRONMENTAL IMPACT ASSESSMENT REPORT FOR
THE KAFUE TOWN - MUZUMA – VICTORIA FALLS 220kV
TO 330kV LINE UPGRADE PROJECT**

Prepared by

ENVIRONMENT AND SOCIAL AFFAIRS UNIT

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ACRONYMS AND SYMBOLS

°C	Degrees Celsius
CEC	Copperbelt Energy Corporation
CSO	Central Statistics Office
ECO	Environmental Coordinator
ECZ	Environmental Council of Zambia
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
FMP	Forestry Management Plan
GMA	Game Management Area
KFD	Kafue District
KF	Kafue Flats
KM	Kilometers
KNBE	Kariba North Bank Extension
KW	Kilowatts
kV	Kilovolts
MW	Mega Watts
NWASCO	National Water and Sanitation Council
PFA	Protected Forest Area
PRP	Power Rehabilitation Project
REA	Rural Electrification Authority
SP	Southern Province
UNICEF	United Nations Children's Fund
ZIZABONA	Zimbabwe Zambia Botswana Namibia



ACKNOWLEDGEMENT

This Environmental Impact Assessment (EIA) study for the proposed Kafue Town - Muzuma - Victoria Falls 220kV – 330 kV transmission line upgrade project covers six districts namely, Kafue, Mazabuka, Monze, Choma, Kalomo and Livingstone. The EIA study would not have been successful without the support of people in the project area.

We, therefore, wish to acknowledge the cooperation and support received from various Heads of Government Departments (District Administration, Agriculture, Tourism and Environment, Education, Forestry, Health and District Councils) and private institutions in the project area. Special thanks particularly go to the traditional leaders (Chiefs) in the project area for their support.

Last but not least our thanks go to the individuals, investors and farmers whose properties are in close proximity of the line for their cooperation, support and understanding by granting us various permits to allow for the upgrade works on the line.

**AUTHORS DETAILS AND TASKS**

This EIA study was undertaken by a team of staff from the Environment and Social Affairs Unit of ZESCO Limited with support from professionals in other departments such as Civil Engineering, Transmission Development and Surveying. The team comprised the following;

Name & Qualification	Professional / Title	Position on the Team	Signature and date
Elenestina M. Mwelwa (Mrs.): BA, MSc.	Senior Manager - ESU	Team Leader	
Mellon H. Chinjila: Bsc, MSc.	Chief Environmental Scientist	Project Coordinator	
Flaviour S. Chanda : (Mrs.) BA, MA	Environmental Information Specialist	Forestry, Wildlife and Environmental	
Kandi Shikabi: BA	Social Scientist	Socio-economist	
Bonje M. Michelo (Mrs.) BSc, MSc	Senior Environmental Scientist	Hydrologist	
Lwanda K. Kahongo (Mrs.) BSc. Forestry	Senior Ecologist	Ecology/Biological	
Arnold Habeenzu B.Eng	Transmission Engineer/Planning & Power System Design	Site Engineer	
Mwalimu Silwembe: B. Eng (Civil), M.Eng	Civil Engineer	Civil Engineer	
Kelvin Mutunga: Dip. (Land Surveying)	Surveyor	Surveyor	
Chetwaile Nyendwa Dip. (Land & Mine Surveying)	Way-leave Officer	Way-leave land acquisition	
Anthony Mando Dip (Fisheries Science)	Environmental Technologist	Aquaculture and Water quality	
Cholwe H. Chanda (Mrs.) Dip (Fisheries Sciences)	Environmental Technologist	Physical Environment	



EXECUTIVE SUMMARY

The Kafue Town – Muzuma - Victoria Falls 220 kV line upgrade project involves upgrading the current existing line to a 330kV power line from the Kafue Town substation to the proposed Zimbabwe-Zambia Botswana-Namibia (ZIZABONA) substation in Chief Mukuni's area in Livingstone, a distance of approximately 341Km. The transmission line to be upgraded will use the already existing towers and the already existing way leave, which was acquired in the early 1970's for the project. This transmission line has a way-leave of 50m, with 25m on each side of the line. The project is not anticipated to have any major impacts on both the social and physical environment since the power infrastructure of towers and substations, is already in place.

The Kafue Town – Muzuma - Victoria Falls 220kV transmission line connects the Victoria Falls Power station to the national Grid at Kafue town substation through Muzuma substation in Choma. The total installed generation capacity at Victoria Falls Power Station is 108MW. Recently a 220kV transmission line between Victoria Falls and Katima Mulilo (Namibia) via Sesheke was commissioned. It is through this link that electricity is being exported to Namibia.

It should also be noted that ZESCO is currently developing the Itezhi-tezhi Power Station as well as expanding Kariba North Bank Power station. These two projects will result in an addition of a total of 480MW in the national generation capacity. This amount of power will be transmitted to the north of the country without any constraints. However, if there is a requirement to transmit some of this power to the south, the constraint will be the existing Kafue Town – Muzuma – Livingstone link. Although the line was constructed on 330kV towers, it has limited power transfer capacity mainly because of the Length, conductor size and the transmission voltage level of the line. Therefore in order to increase the power transfer capacity of this line it is proposed to upgrade it from 220kV to 330kV voltage level. This will enable increased capacity on the new transmission line to facilitate the transfer of power to the potential markets in Namibia, Zimbabwe and Botswana, whose supply routes will be through the proposed ZIZABONA interconnector and the newly commissioned Victoria Falls – Katima Mulilo 220kV transmission line.

The Environmental Impact Statement

The Environmental Impact Statement for the project was developed as a legal requirement and in accordance with the requirements of the Environmental Protection and Pollution Control Act of 1990 and in particular Statutory Instrument No. 28, the Environmental Impact Assessment Regulations of 1997. 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 Environmental Council of Zambia has issued a decision letter". These EIA regulations have the main objective of ensuring the protection of the environment by highlighting impacts and formulation of mitigation measures to ameliorate the identified adverse environmental impacts. The



report is outlined as closely as possible to the general EIA outline given in the EIA regulations with eleven main sections.

In the category of Electrical Infrastructure, the types of projects which need EIAs are new electricity generation stations, electrical power transmission lines more than 1 km long and surface roads for electrical and transmission lines for more than 1km long. Although the project under consideration is classified as an upgrade, the amount of work involved on the stringing of new conductor and the substation works it was screened to be a project that falls within the types of projects which require an Environmental Impact Assessment.

In addition to the local EIA regulations the World Bank Operational Policy OP 4.01 requires environmental assessment (EA) for projects proposed for Bank financing to help ensure they are environmentally sound and sustainable, and thus to improve decision making.

The identified significant environmental impacts of the project

The fact that the project is an upgrade project from the current existing 220kV to a 330kV line which will utilize the existing infrastructure except for the conductors and insulators that will be changed, this reduces the adverse impacts which are usually associated with high voltage power transmission development projects. No settlements will be affected since the existing way-leave will be maintained and there are no houses in the way-leave. However, the project will affect the general physical and biological environment in the immediate project area through the works associated with the clearing and maintenance of the existing access roads. The project area may experience increased dust levels during the dry season.

A project of this magnitude could trigger an influx of job seekers in the area thereby creating stress on the social amenities in the area. An influx of migrant labor force could also be associated with the introduction of diseases not prevalent in the area. The local economic activities may, however, be enhanced due to increased levels of income for the construction workers.

During the scoping exercise consultations with various stakeholders in project area were undertaken for purposes of explaining the project to them. Different communities in the project area provided inputs which informed the preparation of this Environmental Impact Statement.

This project has an inherently significant positive impact in the economic aspects as additional electricity transmission capacity for Zambia would lead to economic expansion and growth in the industrial sector. In addition, both at construction and operation stages, there will be creation of jobs in different operational areas of the proposed transmission line.

Mitigation measures

Adequate notification will be given to the people whose properties are traversed by the existing line to ensure minimal disturbance to them during works. A watering program to



reduce dust from the various works that will be going on shall be implemented during construction. If necessary, gravel roads will be kept wet near populated areas to reduce dust levels.

An adversarial relationship between project workers and the surrounding population can easily be avoided by advising the contractor to hire local workers preferentially and to assist them with tools required for their work.

Educational campaigns for both local community and construction workers will be given at regular intervals throughout the construction period to mitigate the spread of communicable diseases such as HIV/AIDS and STIs.

The remedy for the potential effect on increased poaching due to construction activities lies in properly educating the work force through sensitization campaigns, requiring registration of firearms, to ensure that there is no hunting of the wild animals in the project area. Through these proposed sensitization campaigns project staff who wish to hunt game would be advised of the procedures for obtaining hunting permits and places where hunting is permitted.

Recommendations

Taking into account the available options and all the identified negative and positive environmental impacts of the proposed project and recommended mitigation measures for the identified negative impacts and enhancement measures for positive impacts: and also among other reasons, to meet the growing local and regional power demand, to forestall power shortages that could constrain economic growth, to forestall environmental degradation in the event of power shortage in the country and to create employment opportunities arising from improved power supply that will meet the economic growth of the country, the upgrading of the Kafue Town- Muzuma- Victoria Falls transmission line should be considered favorably for implementation.

ERNEST R. MUPWAYA
ZESCO MANAGING DIRECTOR



1. INTRODUCTION

1.1 Brief Country Profile

Zambia is located in the Southern African Region. It has a land surface of about 752,610km² with various open water bodies such as; Lake Tanganyika (2100km²), Lake Bangweulu (2700km²) and Lake Kariba (5580 km² at maximum retention). Zambia is a landlocked country located between latitudes 8^o and 18^o South of the equator and between longitude 22^o and 34^o east. It is surrounded by eight neighbours, namely: Angola, Botswana, Democratic Republic of Congo, Malawi, Mozambique, Namibia, Tanzania and Zimbabwe. Zambia lies on a plateau with an average altitude between 1000 and 1300 metres though with some high spot (the Muchinga escarpment) standing at 2000 metres above sea level. The vegetation can be broadly described as woodland, forest and grassland. Administratively, the country is divided into nine provinces with 72 districts and has a population of about 10.3 million people.

The country has a mild climate with three distinct seasons: warm rainy summer (November – April) with temperature ranging from 27^oC to 34^oC, cool dry (May-July) with temperature varying from 4^oC to 25^oC and a hot dry season (August – October) with temperatures between 26^oC and 38^oC. The country receives rainfall ranging from 600 mm in the south (agro ecological region I) to 1500 mm in the north of the country.

1.2 Project Background

Zambia, like most of the countries in the southern African region, has been experiencing power shortages in recent years. Hence, the proposed upgrading of the Kafue Town – Muzuma - Victoria Falls 220kV transmission line to 330kV will increase the power transfer capacity of the line. Additionally, the recent studies carried out jointly by ZESCO and NamPower in November, 2005, recommended that the upgrade project would also significantly reduce losses and increase stability benefits to the two utilities. With the expected increased generation capacity at Kariba North Bank to 720MW after the completion of Power Rehabilitation Project (PRP) and to 1,080MW after the completion of the Kariba North Bank Extension (KNBE), it is envisaged that a new 330kV line will be constructed from Kariba North Bank into Kafue West Substation.

The 120MW generation at Itzhi-tezhi Hydropower station is also expected to be evacuated into the national grid at Lusaka West Substation which is currently supplied from Kafue West substation at 330kV voltage level. Due to the increased volume of electrical power coming on the national grid, the proposed Zimbabwe-Zambia-Botswana-Namibia (ZIZABONA) project and the increased power demand in the southern part of the Southern Africa Power Pool (SAPP) region, the need to upgrade this 220kV link between Kafue town and Victoria Falls has become inevitable in order to have sufficient power transfer capacity.

The other motivating factor for this upgrade is the fact that the 220kV line was built on 330kV structures; therefore, there will be no need to replace the existing towers. Only the conductors and the insulation levels will be upgraded.



According to the study proposals, the existing 220kV line will be upgraded to 330kV. It is also important to note that Kafue Town substation is located very close to a fertilizer processing factory; hence the level of pollution is extremely high. It is therefore anticipated that the type of insulation will be upgraded to that which can withstand high levels of pollution.

The national electricity grid is made up of transmission and distribution power lines with various voltage levels. The transmission system (see figure 1) originates from the major generation centers in Kafue Gorge, Kariba North and Victoria Falls and a system of 330kV to 66 kV bulk transmission lines interconnects the major substations located in various parts of the country. The total 330kV and 220kV line coverage is about 2625 km while the 132kV, 88kV and the 66 kV lines cover about 4200 km. Additional lines at 330kV (190km), 220kV (231km) and 66kV (200km) have been constructed and some recently completed to supply power to the new mines in the north west of the country and to interconnect with Namibia and some isolated towns within the country. Distribution lines connect various places in the country at lower voltages to facilitate connections to the customers of various categories such as industrial, commercial, agricultural and domestic.

The Government of the Republic of Zambia has developed a comprehensive Rural Electrification Master Plan which will help to extend the national grid to rural areas which currently have no access electricity.

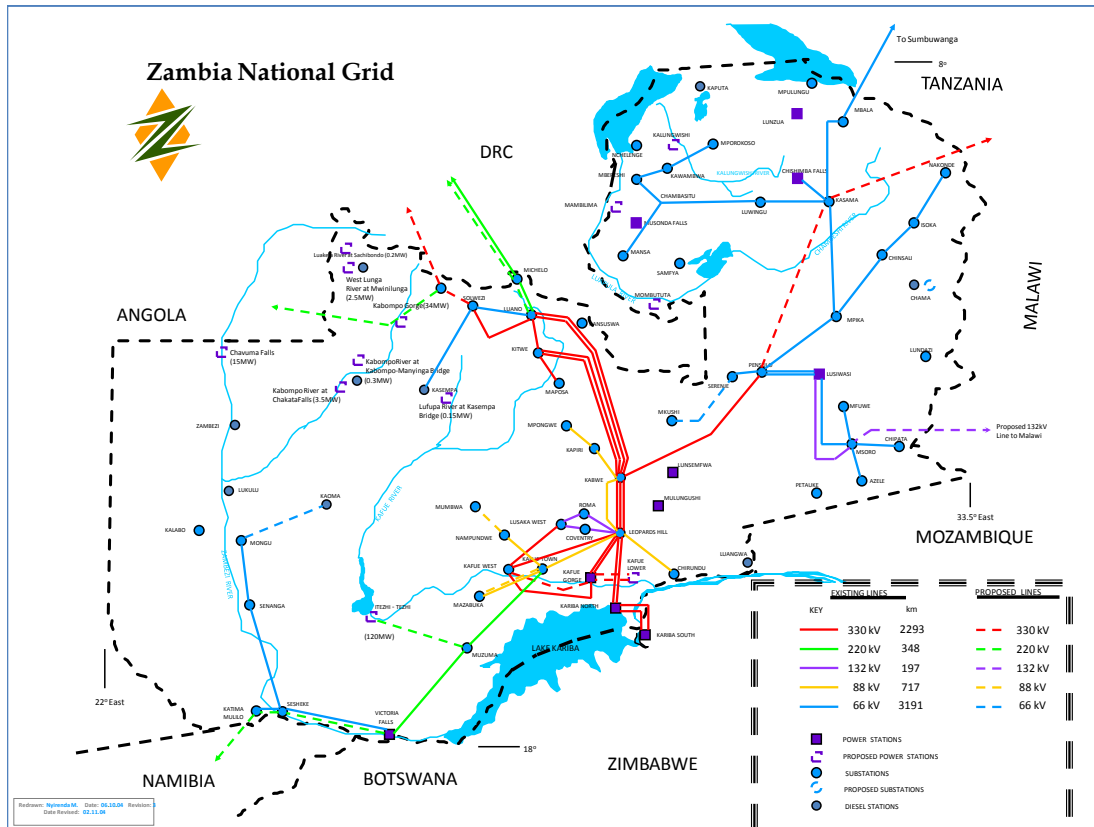


Figure 1 *Zambian Power Grid*



The proposed development of the transmission line upgrade, therefore, required a comprehensive Environmental Impact Assessment (EIA) study in accordance with the provisions of the Environmental Protection and Pollution Control Act of 1990, Statutory Instrument No. 28 of 1997 – The Environmental Impact Assessment Regulations. ZESCO, therefore, has undertaken an EIA study to facilitate approvals before the commencement of project implementation. The EIA study has identified potential impacts and recommended measures to mitigate adverse impacts while enhancing the positive impacts.

As part of the EIA study, a scoping exercise was undertaken which involved meeting with stakeholders in the project area to explain the project to them and to get their input regarding key issues that needed to be addressed in the EIA study. Scoping meetings were held with various stakeholders based on one-on-one approach and small groups in Kafue, Mazabuka, Monze, Choma, Kalomo and Livingstone towns. The stakeholders consulted included Government officials, councilors, traditional leaders (chiefs and village headmen), locals, community leaders, subsistence farmers and commercial farmers. Different categories of people had different concerns and issues, in general local people were concerned about availability of employment during the project, disruption of their social lives by the construction workers and increased traffic due to the construction activities. The farmers' main concerns were the destruction to their crops especially if the project activities were to be done during the cropping periods. The local authorities raised the need for early notification on the project activities to assist in planning efforts. This report addresses the environmental and social issues which were identified during the scoping exercise of formal and informal discussions and physical field observation by the EIA team. The list of people consulted during the process is in appendix 1.

In addition to the scoping meetings, discussions and observations, secondary information about the project area and EIA reports for similar projects was utilized to in the study process. Development Plans, census reports, topographical maps and other literature were also reviewed. Site visits were also made in the project area to collect additional information on the social and physical characteristics of the area.

The scoping meetings, secondary information from literature and the site visits provided valuable input into the development of the TORs for the EIA Study and process. The Terms of Reference presented the second phase in undertaking the EIA study with the main purpose of providing a guide for undertaking and preparation of an EIA for the proposed power line project. The TORs were submitted to the Environmental Council of Zambia for approval before commencement of the EIA study. The TORs for this EIA study are given in Appendix 2.

1.3 Purpose of the EIA

Undertaking the EIA for the proposed development allows the comparison of the capacity and energy benefits from the project with the environmental and socio-economic impacts, in accordance with the requirements of the Environmental Protection and Pollution Control Act – Environmental Impact Assessment Regulations, Statutory Instrument No. 28 Of 1997. It is also aimed at ensuring that the identified negative impacts are mitigated while the positive impacts are enhanced.



1.4 Scope of the EIA

This report addresses the potential environmental effects of the proposed upgrade project of the Kafue Town – Muzuma - Victoria Falls in Zambia. The report has been prepared by ZESCO Environment and Social Affairs Unit to conform to the guidelines of the Environmental Council of Zambia.

The Kafue Town – Muzuma – Victoria Falls Project differs from other transmission projects in that there is an already existing high voltage line which has been in operation for more than 20 years. Thus most of the environmental impacts normally associated with the development of a high voltage transmission line such as blasting, clearing of the way-leave and access roads, truncation of arable land and habitats, displacement of people – are not anticipated.



2.0 LEGAL AND INSTITUTIONAL FRAMEWORK

2.1 *Environmental Council of Zambia*

The legislative responsibility of environmental impact assessment is vested in the Environmental Council of Zambia (ECZ) which administers the Environmental Protection and Pollution Act No. 12 of 1990, Statutory Instrument No. 28 of 1997 – The Environmental Impact Assessment Regulations. The Council 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 Council; b) to monitor trends in the use of natural resources and their impact on the environment; c) to 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) to consider and advise the government, on all major development, 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 Environment and Natural Resources in consultation with the ECZ, is empowered to make regulations by statutory instrument for any matter that can be prescribed under the Act in the protection of the environment.

2.1.1 EIA Study Phases

The study consisted of three phases, as follows:

- Phase 1:** Baseline Data collection and Features Mapping
- Phase 2:** Route Selection Process
- Phase 3:** Environmental Impact Assessment

This study process is summarized in Figure 2, and described in detail as follows:

Phase 1: Baseline Data collection and Features Mapping

The initial step to study consisted of collecting baselines data, reviewing available information and then mapping environmental features. Environmental data was collected from various sources of literature. General route surveys, review of background documents and stakeholder consultations aided in developing a database and maps depicting environmental features and constraints.

In addition previously completed project reports around the study area which are relevant to the proposed study area were reviewed in order to identify potential environmental issues and features.

Phase 2: Route Selection Process1



Phase 2 of the study identified and evaluated alternative routes and the selection of a preferred route for the proposed line. The criteria used to identify and evaluate alternative corridors included those suggested in previous way-leaves and professional judgement of the project team.

The team conducted an assessment of alternative corridors and selected a preferred route through an evaluation of identified environmental constraints.

Phase 3: Environmental Impact Assessment (Physical, Biological and Socio-Economic environments)

Phase 3 involved completion of detailed EIA of the proposed line, focusing on the 50m wide preferred corridor. The EIA considered the proposed project in the context of the existing environmental conditions within the preferred corridor. The team identified potential environmental impacts and developed appropriate mitigation measures. The mitigation measures were based on ZESCO's standard construction and environmental protection measures as well as legal requirements.

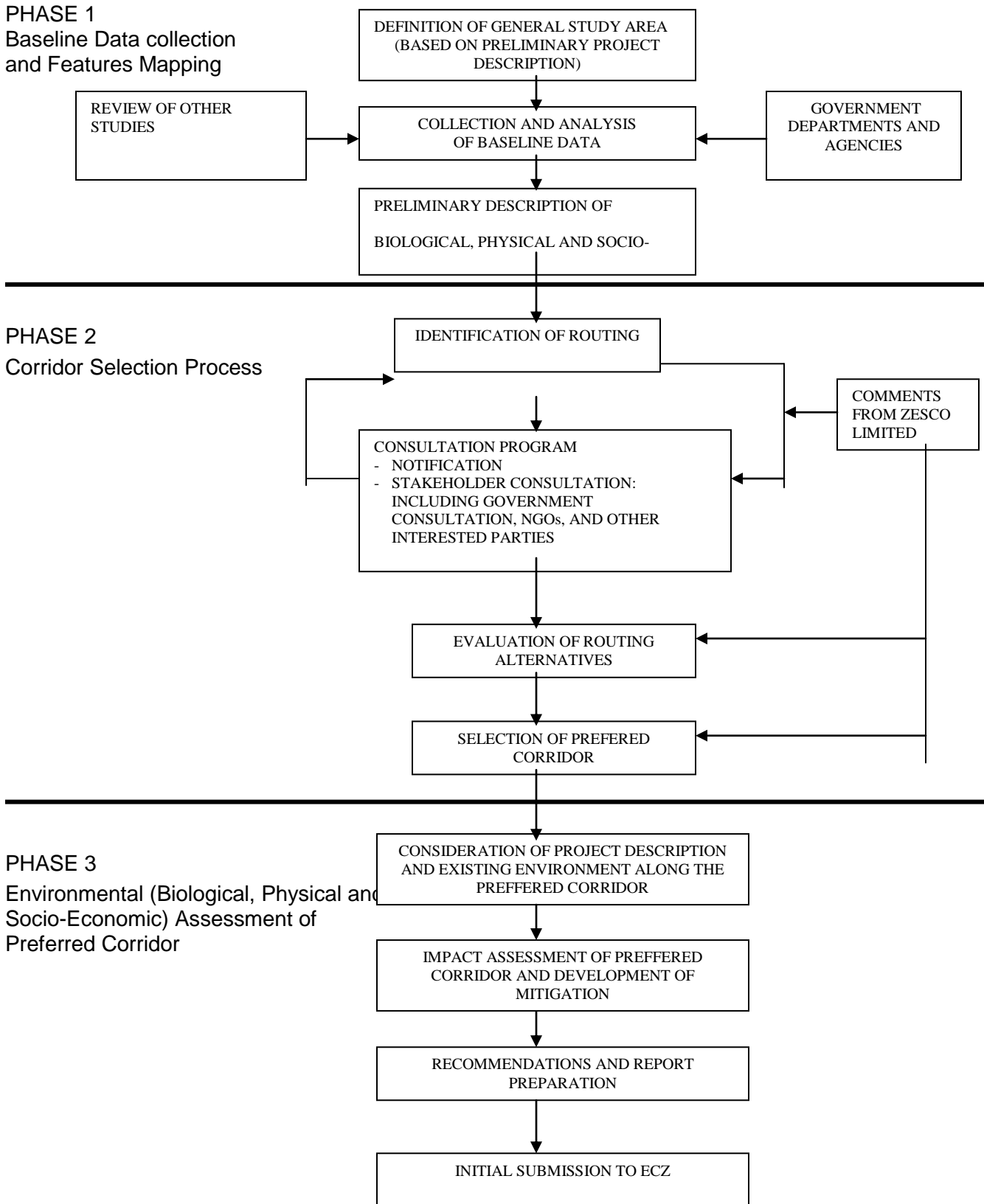


Figure 2: Environmental Impact Assessment study process



Table 1: Legal and Institutional outline

Legal Instrument	Main Provisions	Responsible Institutions	Relevance to the Project
Environment and Natural Resources Management			
Environmental Protection and Pollution Control Act, Cap 204, 1990	To protect the environment and control pollution, so as to provide for the health and welfare of persons, animals, plants and the environment. The Act covers water, air, waste, pesticides and toxic substances, noise, ionizing radiation and natural resources, etc	Environmental Council of Zambia, Ministry of Tourism and Natural Resources	EIA approval letter necessary for project implementation Environmental monitoring to continue throughout the project phases
Natural Resources Conservation Act, Cap 315, 1970	Conservation and improvement of natural resources and control of bush fires.	Ministry of Tourism, Environment and Natural Resources	Monitoring of natural resource conservation and utilization aspects
Local Administration (Trade Effluent) Regulations, No. 161 of 1986	Standards for and regulates discharging of effluent into aquatic environment and define permissible effluent limits for industry	Local Councils	Responsible for management of domestic and industrial waste
Town and Country Planning Act, Cap 283, 1962	Provides for the appointment of planning authorities, the preparation approval and revocation of development plans, and the control of development and subdivision of land	Local Councils	Approvals of construction and area plans
Water Resources Development and Management			
The Zambezi River Authority Act No. 17 of the Laws of Zambia	To provide for control and use of water	Zambezi River Authority	Regulation of abstraction of water from the Zambezi River
Water Supply and Sanitation			
The Water Supply and Sanitation Act No. 28 of 1997	Framework for providing and regulating water and sanitation services to all areas. Creates the Council (i.e. NWASCO) which administers the Act	Ministry of Local Government & Housing; NWASCO	Regulation of water supply and sanitation aspects
Forestry resources management			



Legal Instrument	Main Provisions	Responsible Institutions	Relevance to the Project
The Forest Act No. 7, 1999	Control, manage, conserve and administer National and Local forests; Participation of local communities, traditional institutions, and NGOs; Conservation and sustainable use of forests and trees; and, Implementation of International Instruments. Creates Forestry Commission	Zambia Forestry Commission (yet to be formulated) / currently by the Department of Forestry	Coordination and management of the surrounding forest areas
Wildlife resources management			
The Zambia Wildlife Act, No. 12 of 1998	To control and manage national parks, GMAs and bird sanctuaries for the purposes of conserving and enhancing wildlife eco-systems.	Zambia Wildlife Authority	To protect both wildlife and forest resources especially in the GMA
Fisheries resources Management			
Fisheries Act, Cap 200, 1974	Provides for development of commercial fishing and the registration of fishermen and their boats and the protection of endangered fish species	Ministry of Agriculture and Co-operatives	Assessing types of fish species suitable for various water bodies
Mining activities			
Mines and Minerals Act, No. 31 of 1995	Regulates the law relating to mines and minerals	Ministry of Mines and Minerals Development	To preserve the area if minerals are found
Agriculture			
Agriculture (Fertilizer and Feed) Act, No. 226 of 1990	Regulates and controls the manufacture, processing and importation and sale of agricultural fertilizers and feed, and establishes minimum standards and purity	Ministry of Agriculture and Co-operatives	Soil conservation around the reservoir and protection of fish species in the reservoir.
Cultural Aspects			
National Heritage Conservation Act No. 23 of 1989	Protection of heritage sites, archaeological sites and artifacts.	National Heritage Conservation Commission	Monitoring and management of all identified cultural and archaeological sites in the area
Electricity industry			



Legal Instrument	Main Provisions	Responsible Institutions	Relevance to the Project
Energy Regulation Act	Regulates prices for electricity, petroleum products and other energy related products	Energy Regulation Board	License for energy generation required before commencement of development.
Electricity Act	Generate, transmit and distribute electricity in Zambia	Ministry of Energy and Water Development Energy Regulation Board	It is the governing Act for the operations of the Power station
Lands management			
The Lands Act	Controls the alienation of land for various uses by developers.	Ministry of Lands	Governs the acquisition of the land to be used for the development of the Power Station infrastructure

2.2 ZESCO's Organisation Structure

ZESCO Limited was formed in 1973 and operates under the Electricity Act number 433 of the Laws of Zambia. ZESCO is mandated under act to generate, transmit, distribute and supply electricity throughout the country in a free and suitable environment. In order to ensure sound environmental and social impact management in its areas of operation, ZESCO Limited established the Environment and Social Affairs Unit (ESU) in 1996. The institution developed an Environmental Policy and also employs an Environmental Management System (EMS working document).

In order to address social impacts such as involuntary relocation of project affected people, ZESCO is guided by its draft Resettlement and Compensation Policy which was developed based on various national and international legislation relating to social issues .Refer to figure 3 and 4 showing the ZESCO's Orgainsation structure and Environment and Social Affairs Unit, respectively.

2.2.1 Environment and Social Affairs Unit

The Environment and Social Affairs Unit (ESU) was established in June 1996 under Engineering Development Directorate. The Unit was established to handle environmental and socio-economic issues pertaining to the operations of ZESCO.

Functions of the Environment and Social Affairs Unit

The main function of the Unit is to handle environmental and socio-economic issues pertaining to the operations of ZESCO to ensure that ZESCO operates within the



provisions of the environmental regulations. Specifically, the major functions of the Unit are:

- ensuring that ZESCO operates in accordance with Zambian environmental regulations;
- developing environmental guidelines and environmental operational plans for ZESCO on various aspects;
- advising engineering and other ZESCO staff on environmental and social issues;
- training ZESCO staff in environmental and social issues;
- representing ZESCO on environmental and social issues in national and international fora;
- liaising with Government ministries and other institutions responsible for management of water, land and other natural resources, environment regulation and socio-economic affairs;
- developing baseline environmental and socio-economic database for catchment areas where ZESCO operates;
- conducting environmental impact assessments for ZESCO projects to identify the impacts, recommend mitigation measures and monitoring implementation of recommended mitigation measures;
- supervising consultants hired to do environmental work for ZESCO projects pertaining to power generation, transmission and distribution;
- managing land acquisition, resettlement programmes and compensation related to implementation of ZESCO projects;
- Conducting public meetings in project areas to ensure that the public understands the project being undertaken by ZESCO and to get their input on various aspects of the project.

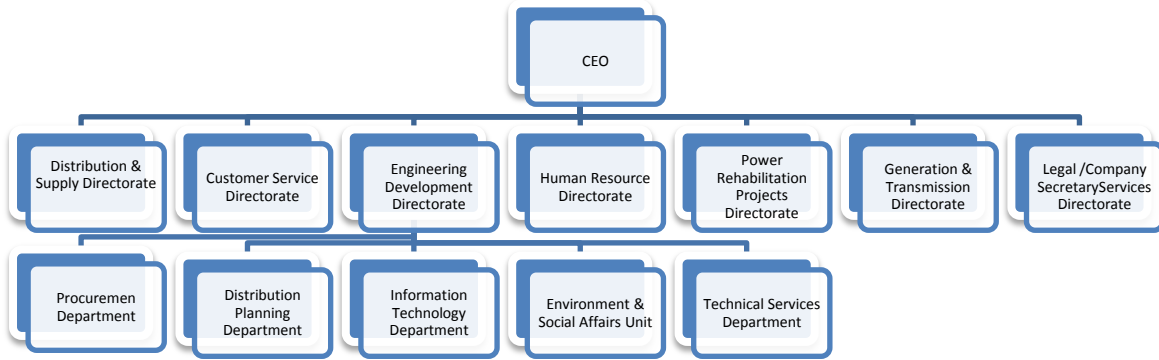


Figure 3: ZESCO Structure

Environment and Social Unit Affairs department

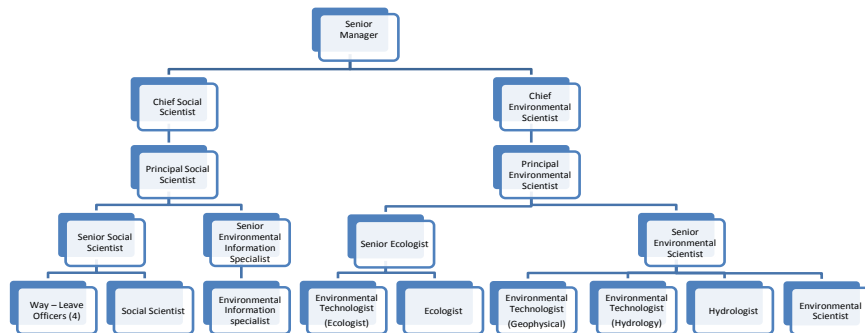


Figure 4: ESU Structure

2.3 International Conventions and Protocols

Zambia has signed and is party to more than thirty International and Regional Conventions and Protocols. The most relevant environmental conventions are: Convention dealing with the Protection of the World Cultural and Natural Heritage (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 and the RAMSAR Convention and Bonn Convention. Zambia has also ratified the Basel Convention (1994) which regulates trans-boundary movements of hazardous wastes

2.4 World Bank Operational/ Safe Guard Policies

In addition to the national environmental legal framework, this EIA takes into consideration World Bank Safeguards Policies that could be potentially triggered by the project. Table 2 below gives some of the Environmental and Social Safeguard Policies that would potentially be triggered by the transmission line project:

Table 2: List of Some of the World Bank Environmental and Social Safeguard Policies relating to power line projects and their Objectives

No.	Safeguard Policy	Objective
4.01.	Environmental Assessment	<ul style="list-style-type: none"> To help ensure the environmental and social soundness and sustainability of investment projects To support integration of environmental and social aspects of projects into the decision making process
4.04	Natural Habitats	<ul style="list-style-type: none"> To promote environmentally sustainable development by supporting the protection, conservation, maintenance, and rehabilitation of natural habitats and their functions.
4.12	Involuntary Resettlement	<ul style="list-style-type: none"> To avoid or minimize involuntary resettlement and, where this is not feasible, to assist displaced persons in improving or at least restoring their livelihoods and standards of living in real terms relative to pre-displacement levels or to levels prevailing prior to the beginning of project implementation, whichever is higher.
4.20	Indigenous Peoples	<ul style="list-style-type: none"> To design and implement projects in a way that fosters full respect for Indigenous Peoples' dignity, human rights, and cultural uniqueness and so that they: (a) receive culturally compatible social and economic benefits; and (b) do not suffer adverse effects during the development process.
4.11	Physical Cultural Resources	<ul style="list-style-type: none"> To assist in preserving physical cultural resources and avoiding their destruction or damage. PCR includes resources of archaeological, paleontological, historical, architectural, religious (including graveyards and burial sites), aesthetic, or other cultural significance.

It should be noted that in Zambia the classification of people as "Indigenous Peoples" does not exist.



3.0 NEED FOR PROPOSED ACTION

3.1 Importance of the Project

The Kafue Town –Muzuma- Victoria Falls 220kV transmission line connects the Victoria Falls Power station to the national Grid at Kafue town substation via Muzuma substation in Choma. The total installed generation capacity at Victoria Falls Power Station is 108MW. Recently a 220kV transmission line between Victoria Falls and Katima Mulilo (Namibia) via Sesheke was commissioned. It is through this link that electricity is anticipated to be exported to Namibia.

The total load for Livingstone town is currently approximately 30MW and it is also envisaged that about 100MW will be exported through Sesheke to Namibia. This means that Victoria Falls Power station alone cannot manage to supply this load, therefore other power stations have to support this load and the only link between Victoria falls power station and the main grid is the Kafue Town – Muzuma - Victoria Falls transmission line.

It should also be noted that ZESCO is currently developing the Itezhi-tezhi power station as well as expanding Kariba North Bank Power Station. These two projects will result in a total of 480MW being made available. This amount of power will be able to be transported to the north of the country without any constraints. However, if there is a requirement to transport this power to the south the constraint will be the existing Kafue Town – Muzuma – Livingstone link. It is important to note that this line is currently constructed on 330kV towers. This line has limited power transfer capacity mainly because of the Length, conductor size and the transmission voltage level of the line. Therefore in order to increase the Power transfer capacity of this line it is proposed to upgrade it from 220kV to 330kV voltage level. This will enable increased capacity on the new transmission line to facilitate the transfer of power to the potential markets in Namibia, Zimbabwe and Botswana, whose supply routes will be through the Proposed ZIZABONA interconnector and the newly commissioned Victoria Falls – Katima Mulilo 220kV transmission line.

3.2 Alternatives to the Proposed Project

The gradually increasing demand for electricity could be met by alternative hydroelectric projects or by additional use of diesel and gas turbine units. The use of coal is also possible. Economic considerations dictate the use of hydroelectric power where water is available. Although the hydroelectric plants usually exert higher initial impacts, through the inundation of land and habitat and the displacement of people, coal and diesel alternatives impact air quality and may require substantial consumption of water for cooling. The construction of new power stations to the south of the country would provide additional capacity to meet demand in the south and export to neighboring countries. However the need to have adequate transmission capacity in an interconnected national grid will still not be met. The project seeks to transit already generated power from the existing power stations to the Southern part of the country. The infrastructure for the existing transmission line has the capacity to transmit 330 kV from the existing 220 kV when upgraded. Other alternatives would not have been as



technically, environmentally and economically viable as the chosen alternative for upgrade.

3.3 The Do-Nothing Option

If the project is not upgraded, ZESCO will not be able to evacuate power to be generated at the ITT Power Station as well as at the Kariba North Bank Power Station Extension. These two projects will result in a total of 480MW being made available. This amount of power will be able to be transported to the north of the country without any constraints. However, if there is a requirement to transport this power to the south the constraint will be the existing Kafue Town – Muzuma – Livingstone link. It is important to note that this line is currently constructed on 330kV towers hence the project will not be too expensive to undertake comparing with constructing a completely new line. If the project is undertaken ZESCO will be able to meet the future load demand and to export power to other countries in the region but if not undertaken this would result in load shedding affecting acceptable quantity and quality of electricity supply to customers (industries as well as residents).

3.4 Potential benefits of the Project

There are a number of benefits that will result from the upgrade and operation of the proposed 330kV line. These include:

1. Employment opportunities for the local communities during construction and operation. Thus it will play a part in improving the quality of life in the project area;
2. Development of the project is part of the long term strategy to develop the hydropower potential of the country and provide transmission capacity to evacuate the power generated to load centers.
3. Development of the project will help meet the growing electricity demand in Zambia and the region.
4. Export of power to other countries in the region through the development of the project will earn the country foreign exchange

3.5 Study Route

The proposed project designated as the Kafue Town – Muzuma- Victoria Falls transmission line project will originate from the Kafue Town Substation in Kafue town through Muzuma substation in Choma to the proposed Zimbabwe – Zambia – Botswana - Namibia (ZIZABONA) Substation in Chief Mukuni's area in Livingstone. The power line will be a 330kV line with a way-leave of 50meters (25m on either side of the power line). Refer to Figures 5 and 6 for the project area.



4.0 TECHNICAL DESCRIPTION OF THE PROJECT

4.1 Project Description

The project area lies in the Lusaka and Southern provinces of Zambia. It stretches from Kafue to Livingstone through Muzuma Substation that is located about 24km east of Choma.

The upgraded 330kV transmission line will use the existing steel lattice self supporting towers between Kafue Town substation and the proposed Livingstone substation. The conductor to be used shall be double bison per phase and will be in a horizontal flat formation. One of the aerial earths on this line has been recently replaced with optic fibre guard wire. The existing conductor on this section shall be recovered and properly re – drummed for reuse.

The whole transmission line will employ silicon rubber insulators. The existing line to be upgraded is about 341km. Refer to Figures 5, 6 and 7 for the location of the project area.

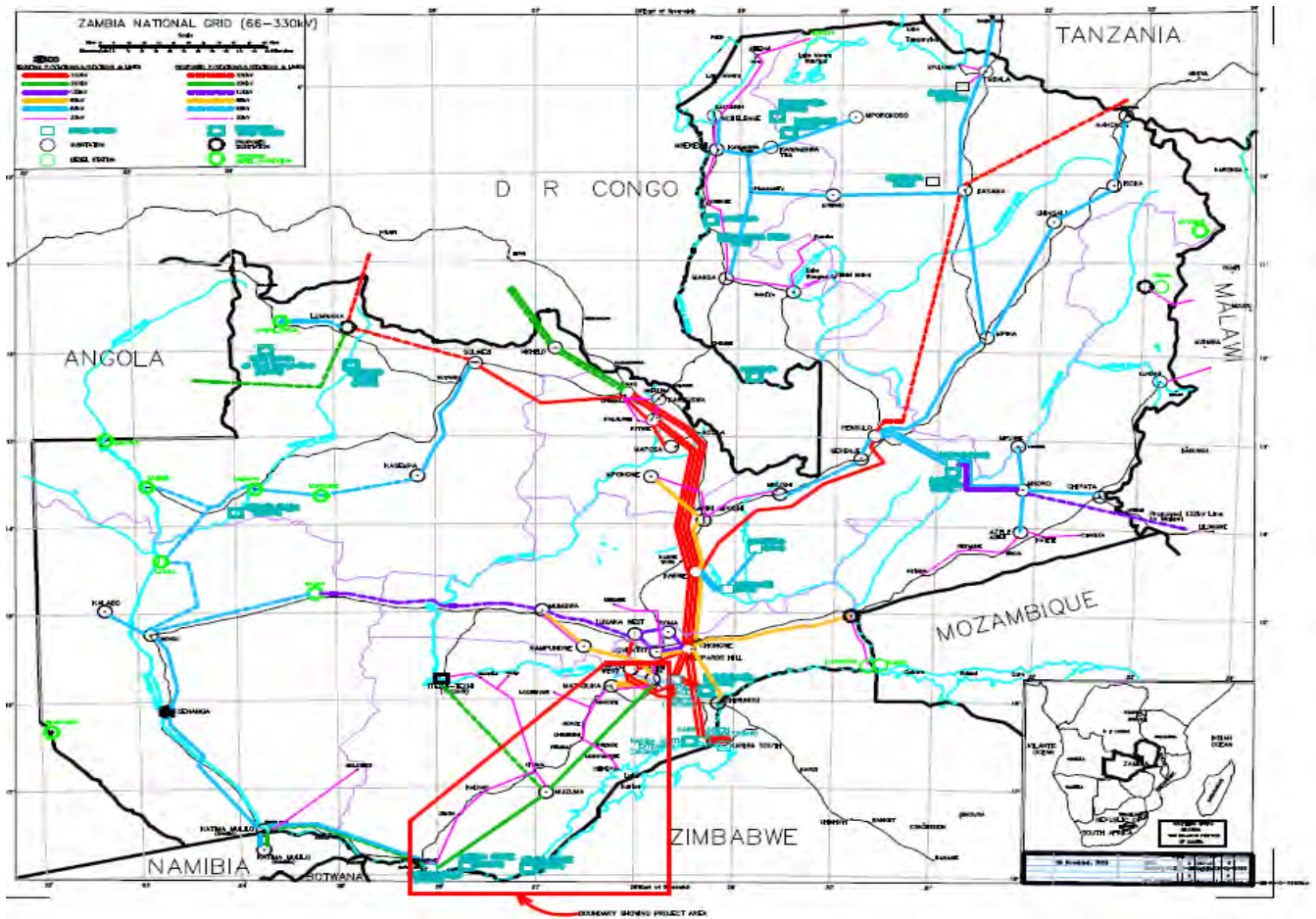


Figure 5 Map showing the project area

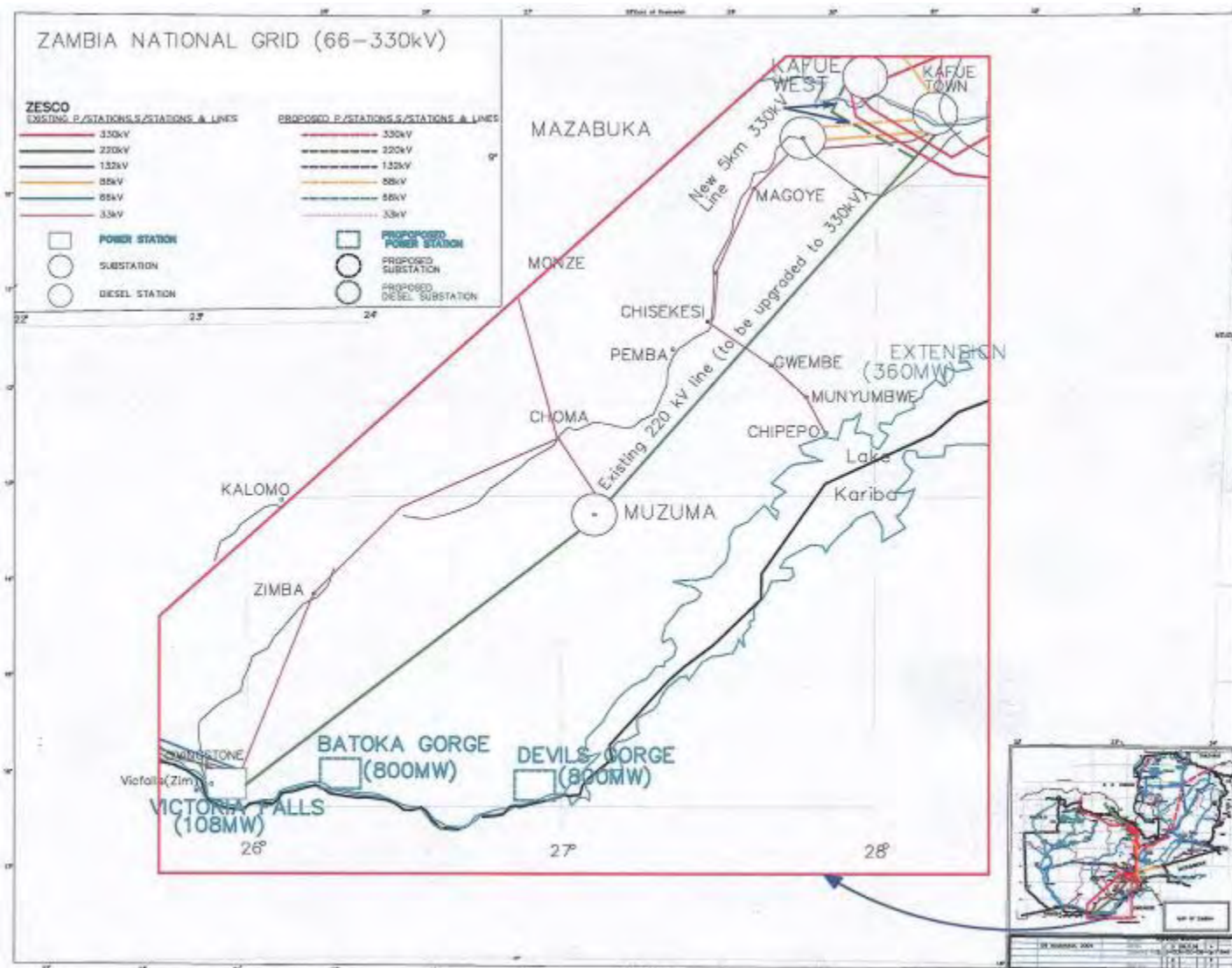


Figure 6: Outline of the existing 220kV line in the project area.



LIVINGSTONE - MUZUMA - KAFUE TOWN EXISTING 220KV LINE



LEGEND

- Existing Line from Kafue Town S/S to Kafue West S/S
- Existing 220KV Livingstone-Muzuma-Kafue Town
- Existing 330KV Line from Kafue Gorge to Kafue West S/S

Figure 7: Clear view of the Kafue Town substation.



4.1.1 Kafue town substation

At Kafue town substation, the following equipment shall be installed:

- One (1) 125MVA 330/88/11kV transformer
- One(1) 330kV equipped transformer bay
- One (1) 88kV equipped transformer bay
- All the associated protection, metering and control equipment

4.1.2 Muzuma Substation

At Muzuma substation, the following equipment shall be installed:

- Two (2) 330kV equipped line bays for Lusaka West and Livingstone Lines
- Two (2) 30MVA 330/132-88/11kV transformers to replace the existing transformers
- Two (2) 330kV equipped transformer bays for the two transformers
- Two (2) 88kV equipped transformer bays for the two transformers
- One (1) 35MVAr 330kV Shunt Reactor
- All the associated protection, metering and control equipment

4.1.3 Livingstone Substation

At Livingstone 330/220kV substation the following equipment shall be installed;

- One (1) 220kV line bay for Vic Falls line
- One (1) 330kV line bay for Muzuma Line
- 330kV and 220kV single bus bars
- Two (2) 330kV transformers bays
- Two (2) 250MVA 330/220kV Auto transformers
- Two (2) 220kV transformer bays
- One (1) 45MVAr 220kV Shunt Reactor
- All the associated protection, metering and control equipment

4.1.4 Project Cost

The total project cost of the project with taxes (Duty and VAT) excluding is estimated at USD 64,483,000.00. The total cost without Duty and VAT is estimated at USD 49,350,000.00 (note that the project is tax exempt).

The costing of the Project was based on the equipment requirement as determined from the detailed system studies that were carried out. The prices for the individual equipments were obtained from recent tenders and quotations obtained from reputable vendors of the equipment. Refer to table 2 for a breakdown of project costs.



Table 3: Summary of Project Cost Estimates

S/N	ITEM DESCRIPTION	FOREIGN COST [USD'000]	LOCAL COST [USD'000]	TOTAL COST [USD'000]
1	Kafue Town Substation	9,373	1,125	10,498
2	Muzuma Substation	16,832	2,020	18,852
3	Transmission Line	14,220	1,706	15,926
	Subtotal	40,424	4,851	45,275
4	Environmental Management			352.33
5	Project Management			1,811.01
6	Contingency			2,263.77
	Total	43,811	8,924	49,350



5.0 DESCRIPTION OF THE ENVIRONMENT

This section provides a description of the baseline of key environmental aspects. Though this project will have minor impacts on most of the aspects, it is required that there is a clear understanding of the environment in which a particular project will take place in order to be able to determine potential impacts and their significance.

5.1 Physical Environment

The physical environment on the route refers to the natural environment associated with the upgrade of the existing 341km Kafue Town-Muzuma-Victoria Falls 220kV power line to 330kV power line. The physical environment then includes: the geology, topography, soils, climate, wetlands and hydrology of the study area

5.1.1 Geology

The geology of the Lusaka and Southern Provinces is of a complex nature. The basement rocks are overlaid by the Muva, Lower and Upper Roan, Mwashia Upper and Lower Kundelungu series. Large parts of these have been irregularly deposited and irregularly eroded over time.

The Basement complex and the Muva system comprise a series of Schist, Quartzites, Gneisses and intrusion of Granite. On the Muva and Basement rocks are sedimentary rocks of the Katanga system which are considered to be of the late Pre - Cambrian age. The rocks of the Katanga System are widespread on the Kafue and parts of the Mazabuka District and are divided into three groups, which have a fairly well defined sequence throughout the study area. The lowest of the three is predominantly arenaceous and is formed of conglomerates, sandstones and quartzites, where all the mineral ore deposited are said to occur. The second and upper group comprises dolomites, shales and limestones with thin beds of sandstones while the uppermost group comprises inter-bedded argillites and dolomites.

The above mentioned rock groups have undergone the process of structural folding forming a series of north-west / south-east trending anticlines and synclines plunging generally to the north-west. The subsequent erosion has removed the higher parts of these structures and the Katanga sedimentary rocks are now represented by a series of pedi-plains composed of synclinal basins and anticlines.

Most of the reported and exploited mineral deposits within the vicinity of the project area occur elsewhere. These include: gypsum in Lochinvar, granite in the Munali Pass, Shikoswe Quarry in Kafue Area and alluvial clays on Karoo sandstones, shales, fire clays etc in Nega Nega. Refer to Figure 8 for the geology through which the existing line traverses.



LIVINGSTONE-MUZUMA-KAFUE TOWN EXISTING 220KV LINE SUPERIMPOSED ON GEOLOGY MAP

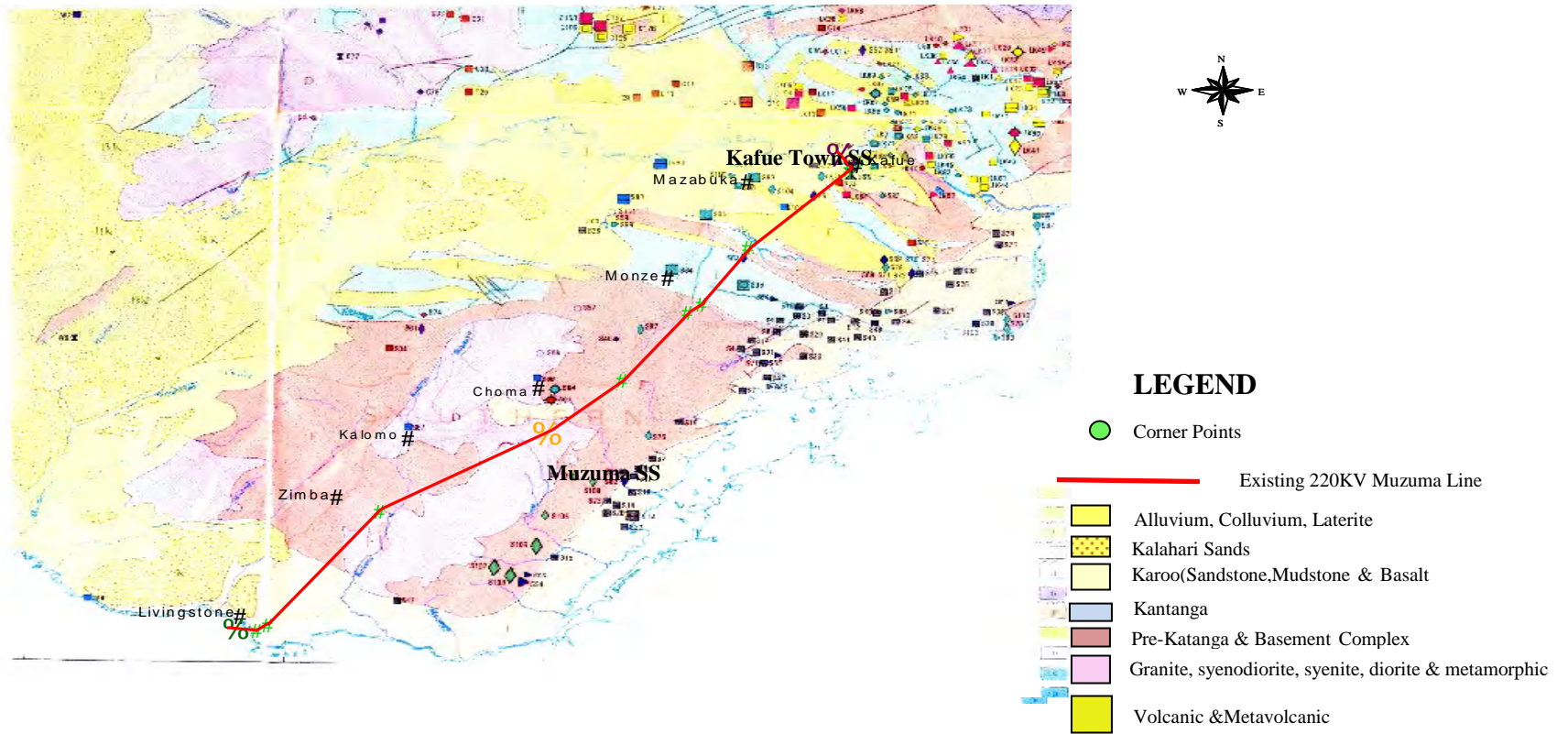


Figure 8: Map showing the Geology along the existing 220kv line



5.1.2 Topography

Southern Province and Kafue District are situated at an average elevation of about 1200 metres above sea level. The area forms a gently undulating plateau rising to low hills of about 1400m in Kafue – Mazabuka and dropping area to about 1,130m to the south. The plateau is broken by isolated low ranges of granite or quartzite hills rising to heights of 100m above the general level of the plateau. The significant hills in the project are the Munal Hills which lies between Kafue and Mazabuka districts

A widely occurring and very noticeable characteristic of the greater part and one arising from a combination of topography and hydrology are the flood plains and dambos. The headwater dambos are a very common feature occurring on all gently sloping valleys. The headwater dambos are significant for the hydrology of the project area.

The cross-section of the route of the proposed power line in Victoria Falls – Muzuma – Kafue is located within the physiographic region of Zambia. The area has steep sided valley of high relief and represents the topographic boundaries between the plateau and the Zambezi Rift valley. The plateau area has elevations ranging from 1000m and 1100m above sea level. In the Kafue area the relief varies from about 1200m on local peaks to about 380m.

Relief of the Kafue Flats is generally flat ranging from 950m to 1000m above the sea level. The flood plain itself ranges from 975m to 981m above the sea level.

The Lower Kafue sub-basin has an area of 8,730 km². It is characterized by steep hillsides, shallow soils and little settlement, but from the bottom of the gorge to the Zambezi River the topography is gently undulating and the natural vegetation is dominated by Mopane and Munga, especially *Acacia*, woodland and thickets.

5.1.3 Soils

The soils of Southern Province and part of the Kafue District are ferrallitic in nature and are derived from various parent rocks, including granite, gneiss, sandstone and schist. These are old soils and are heavily leached due to high rainfall with lower base saturation of pH between four and five, having a red or reddish-yellow colour. The clay content is generally higher: soil textures change from clays to sandy clays or sandy clay loams, showing gradually increasing clay content from the coarse-grained surface soil to the sub-soils. Although they are clay-dominated soils with low permeability, they are generally well drained. They are variable in depth and frequently underlain by quartz rubble or concretionary ironstone/laterite developed under conditions of pene planation from the Miocene epocha about 25 million years ago. The soils described above are typical Mopane soils that are occasionally broken by peaty clay water logged dambo soils.

These are vertisols derived from siliceous parent material. They are characterized by a peaty organic horizon, ranging from under 25 to over 180cm in thickness. The black top soil horizon is sometimes underlain by quartz sands ranging in colour from dark grayish brown to pale gray. The peat horizon usually has a pH of 3.5 to 4.5 if not drained



Due to the gently undulating topography, the vegetation and soils show a regular toposequence, with the Mopane woodland areas having the ferrallitic soil type while the depressions of dambos are characterized by water logged grasslands usually devoid of trees having peaty vertisols.

The route corridor has Miombo, Mopane woodland soils and dambo characteristic soils as a number of dambos are traversed.

5.1.4 Climate

The Southern and Lusaka Provinces, like any other province in Zambia have a tropical climate with three distinct seasons: the warm-wet season, stretching from November through April; cool dry cold season from May to August with the mean temperatures varying between 14 degrees Celsius and 30 degrees Celsius. The hot dry season is experienced during the months of September and October. The annual rainfall averages 1240mm, most of which falls in the months of December to February.

The rains on the Lusaka and Southern Provinces like the rest of the country are caused by the convergence of the North-east and South-east Trades that form the Inter-tropical Convergence Zone (ITCZ). The rainy season of the two Provinces is relatively short and the mean annual rainfall relatively low. The average length of the rainy season is just over five months with the December, January and February period experiencing greatest rainfall while November and March have less.

5.1.5 Hydrology

The study area stretches over Livingstone, Kazungula, Kalomo, Choma, Monze, Mazabuka, and Kafue Districts that are drained by various rivers and streams some of which are perennial. The existing Victoria Falls – Muzuma – Kafue town substation 220kV power line crosses various streams and rivers. The streams of interest include: Matezi, Nandukala, Nekoya, Chibelele, Siamambo, Chifusi, Nachinde, and Nakanega streams. Rivers of interest in the project area include;imba, Kalomo, Ruyala, Muzuma, Ngwesi and Kafue rivers.



Table.4. **Watercourses crossed by the preferred corridor starting from Livingstone to Kafue**

Crossing Number	Watercourse
1	Zimba River
2	Matezi Stream
3	Nandukala Stream
4	Nekoya Stream
5	Chibelele Stream
6	Kalomo River
7	Ruyala River
8	Muzuma River
9	Siamambo Stream
10	Chifusi Stream
11	Nachinde Stream
12	Ngwesi River
13	Nakanega Stream
14	Kafue River

5.1.6 Wetlands

The existing line which will be upgraded crosses the narrow part of Kafue Flats before crossing the Kafue River. Figure 9 shows the terrain of characteristics of Kafue Flats and tower river crossing.



Figure 9: *Kafue River crossing within the Kafue Flats wetland area*



5.1.7 Air Quality

The existing line traverses mostly the rural southern province districts. The rural areas are associated with good air quality in the absence of polluting industrial activities. The air quality of the project route can generally be described as good and fall within acceptable World Health Standards. However, Kafue District in particular has a lot of industrial activities that may cause air pollution. Kafue Town industries include: Nitrogen Chemicals of Zambia Limited, Kafue Stone Quarry and the newly constructed steel plant. However, ambient air quality data has not been collected in the area.

Along the Livingstone – Lusaka road, there are a few activities such as road construction (from Zimba to Livingstone) and periodic maintenance that cause dust pollution. It is however, generally noticed that due to denuded tree cover, during the windy months of July-August, dust pollution is experienced. However, the route for the Victoria Falls – Muzuma – Kafue Town line is far away from the Livingstone – Lusaka road in most cases and it only crosses the road once between Mazabuka and Kafue towns.

5.1.8 Noise

Livingstone – Lusaka road in the project area is one of the national highways that is used for the transportation of goods of various types and tonnage. However, the existing line passes through the rural areas of southern province whose main land use is agriculture. Such type of land use is characterised by low noise levels. During the construction phase, most of the noise generating activities will be done during the day.

5.2 Biological Environment

5.2.1 Flora

A general description of the flora in the project area is presented below and Figure 13 shows the general classification of the vegetation of the project area.

5.2.1.1 Woody plants

The study area between Livingstone and Kafue has different types of vegetation. The woody plants form a good habitat for both birdlife and wild animals in the area. The most dominant vegetation is Miombo woodland type of vegetation which is found in most parts of the project area. The vegetation includes; *Brachystegia* species such as *B. Longifolia*, *B. hockii*, *B. isoberlinia*, *B. speciforms*. *Julbernardia* species found in the area are *J.globiflora* and *j.paniculata*. The area around Livingstone is dominated by *Pterocarpus angolensis* and *Adonsenia digilata*. *Burkea* spp are also common in the area and form part of the miombo woodland in the project area.

Baikiaea plurijuga which is a deciduous, semi deciduous or sometimes evergreen is common in the areas around Kalomo. The wood is hard, heavy, strong, stable and



durable with a fine texture. It is widely used for railway sleepers and most valuable as flooring timber owing to its stability and very hard wearing properties. Acacia species mostly of which are trees, some are shrubs are common in most parts of the project area. Acacia species include *A. albida*, *A. erioloba*, *A. polyacantha* and *A. tortilis*. Figure 8 below shows the Acacia species in the area.

The existing 220kV power line has a way-leave of 50 meters which is cleared of vegetation on an annual basis. This is a safety requirement for high voltage lines. The woody plants described above are those found along the route corridor (see figure 10 below). Figure 9 and 11 shows the existing 220kV way-leave. There are access roads to the way-leave which are used during maintenance of the line and also used by the locals in the area. The same roads will be used by the contractor during the upgrade.



Figure 10: *Acacia spp* in the project area along the existing way-leave

5.2.1.2 Grasslands

The study area has no pronounced grassland except for some stubby species that occur in sections that have clay soils. The common grasses found are; *Eragrostis brizoids*, *Alloteropsis semialata*, *Anthephora acuminata*, *Aristida adscensionosis*, *Monocymbium spp*, *Bewsia biflora*, *Heteropholis sukata*, *Sporobolus rhodesiensis*, *S. rhodesiensis*, *Thysia huillensis*, *Thysia huillensis*, *S. pyramidalis*, *Chloris gayana*, *Digitaria scalarum*, *Tristachya hubbardiana*, *Brachiaria brizantha*, *Homozeugos cylesi*, *Piptostachya inameona*, *Pennisetum pupureum*, *Erythrophloem africanum*, *Trichopteryx lanata*, *Andropogon spp.* and *Hyparrhenia cymbaria*. Figure 12 below shows the common grasses in the project area.



Figure 11: Way-leave for the 220kV line



Figure 12: Common grasses in the project area

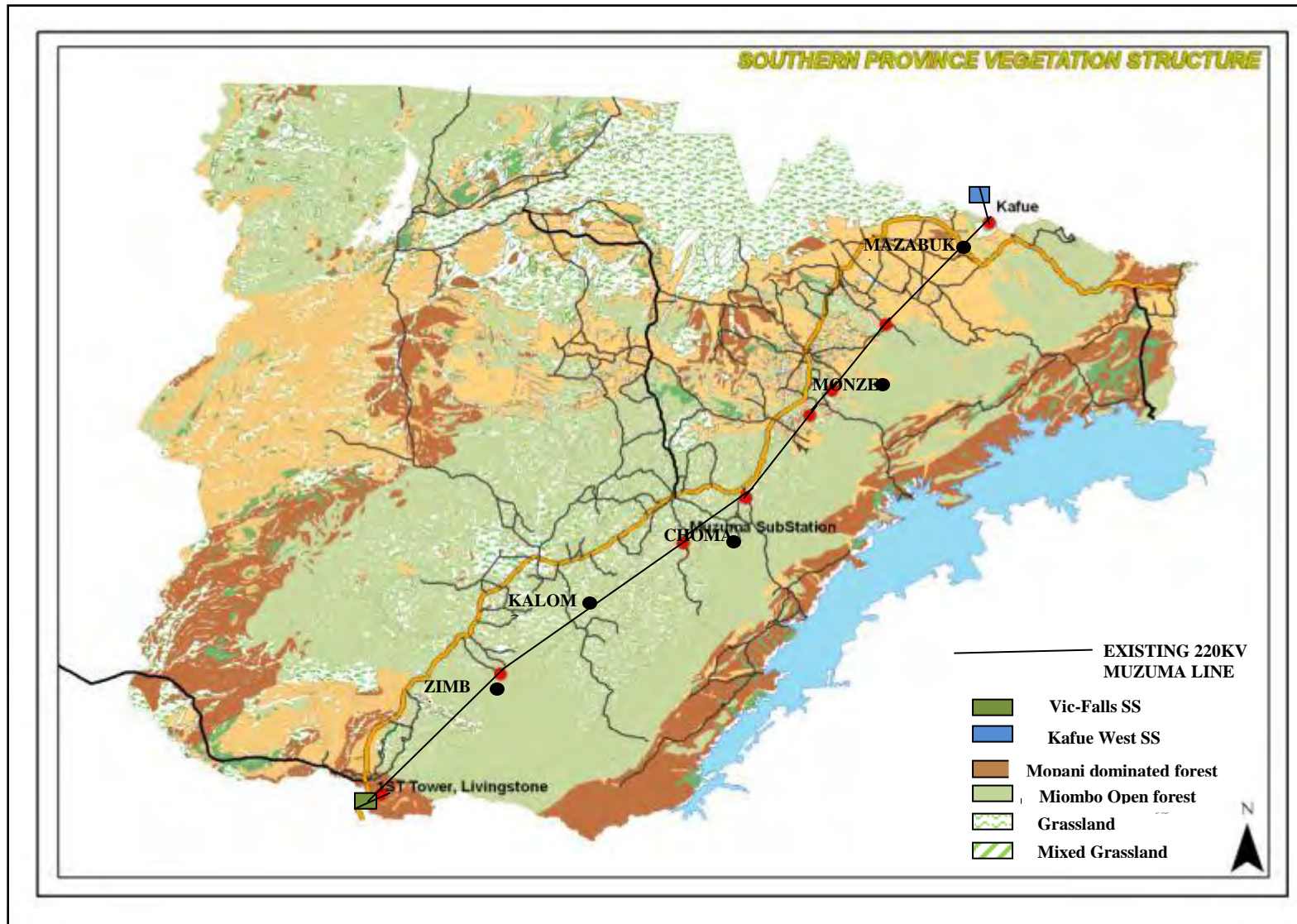


Figure 13: Map showing Vegetation of the project area



5.2.2 Protected Areas (National Parks and Forest Reserves)

The existing line does not traverse any National Park or National forest reserves, however it does pass close to two National Parks in the project area, the Mosi-oa-tunya found in Livingstone and the Lochinvar in Monze. The line also traverses close to some Forest Reserves and these include; Simwami Muzuma National Forest in Choma, Lusengezi National Forest No. 204 (32,363 hectares) in Mazabuka, Ntobolole Local Forest No. 422 in Kafue which is about 9,700 Hectares, Magoye Reserve No. F 50 (935 hectares). The main vegetation is the Miombo woodland and the grasses. The existing line also traverses close to two Game Management Areas, Kafue Flats North and Kafue Flats South. Refer to figure 14 showing the line in and the national and local forest reserves.

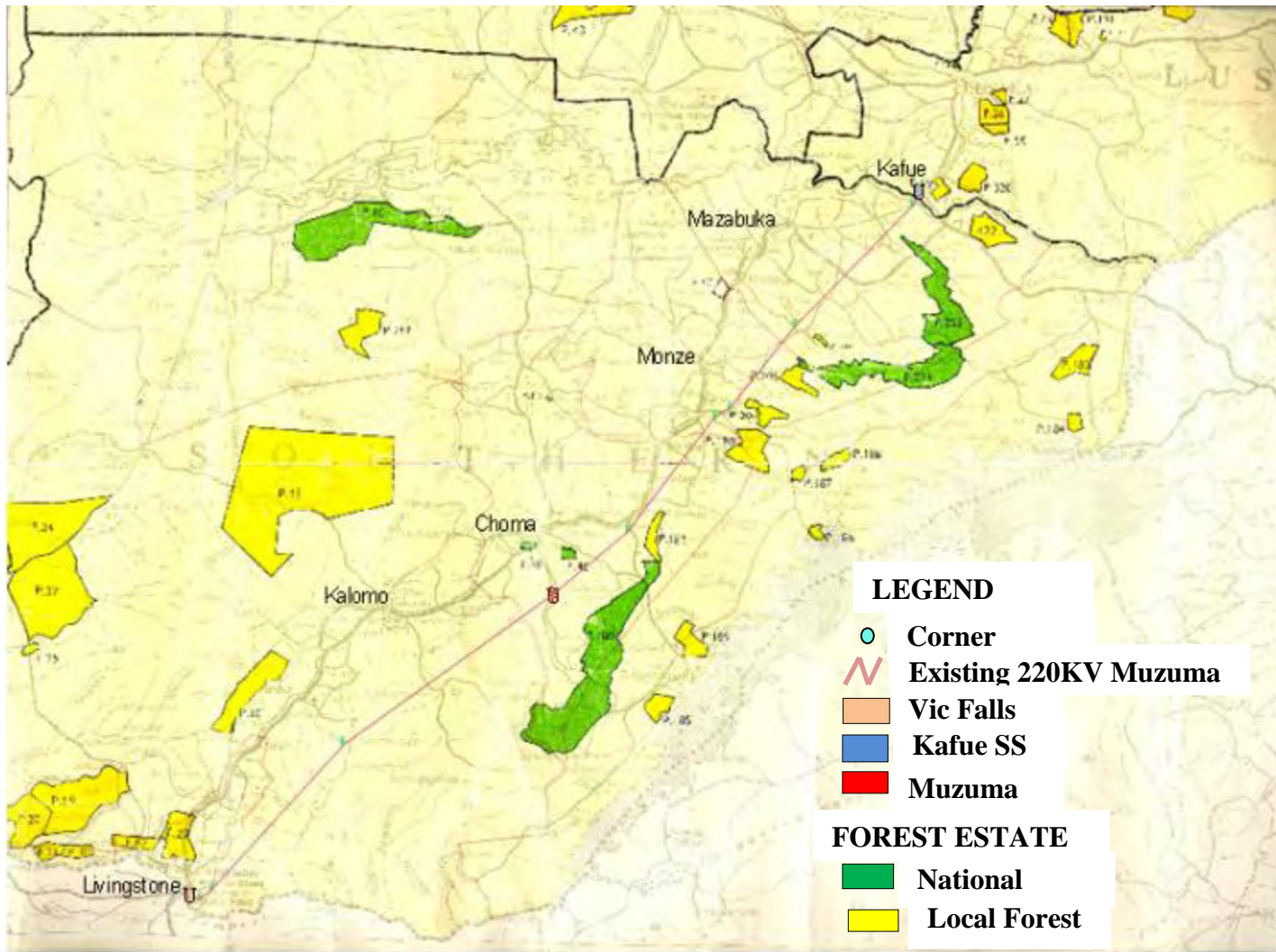


Figure 14: Protected forest estate areas



5.2.3 Fauna

5.2.3.1 Mammals

The project area has a variety of wildlife species. The Mosi-oa-tunya National Park in Livingstone records a number of large Game which include buffalo (*Syncerus caffer*), elephant (*Loxodonta Africana*), zebra (*Equus burchelli*), giraffe (*Giraffa camelopardalis*), warthog (*Phacochoerus aethiopicus*), white rhino (*Ceratotherium simum*) and hipoptamus (*Hippoptamus amphibious*). Some Game ranches have enclosed lions (*Panthera leo*). Smaller Game includes common duiker (*Sylvicaapra grimmia*), Vervet monkey (*Cercoopithecus aethops*) and Impala (*Aepyceros melampus*).

In addition, the Kafue flats in Mazabuka District also have the Kafue Lechwe (*Kobus leche subsp*), Kudu (*Tragelaphus strepsiceros*), Waterbucks (*Kobus ellipsiprymnus crawshayi*), Wildbeest (*Connohaetes taurinus*) and antelopes like sable and roan (*Hippotragus Niger*). Other wildlife species existing in the area are rabbits and rodents. There are no known rare and endangered species occurring in the project area as the transmission line avoids the protected areas.

5.2.3.2 Reptiles

The route corridor of the power line crosses a number of rivers and streams which are good habitats for reptiles. The largest reptile in the area is the Crocodile (*Crocodylus niloticus*). Other reptiles include representatives of lizards such as Monitor lizard (*Varantus niloticus*), Geckos, Chameleons and skinks. Snakes are represented by cobra (*Naja mosambica*), Python (*Python sebae*), puff adder (*Bitis arietans*) and Black mambas (*Dendroaspis angusticeps*). Representative of the tortoises, Terrapins and Turtles are also found in the area. There are no known rare and endangered reptile species occurring in the project area.

5.2.3.3 Birds

The line corridor has a good number of bird species. The Miombo woodlands provide good habitats for terrestrial birds while the damp and plains support water fowls. The common bird species include; black cheeked love bird (*Agapornis nigrigenis*), finfoot (*podica senegalensis*), spoonbill (*platelea alba*), long-crested eagle (*Lophaetus occipitalis*), western banded snake eagle (*circaetus cineroscens*), African skimmer (*Rynchops flavirostris*). The rare or endangered bird species include, Helmeted guinea fowl (*Numida meleagris*) Hornbill (*Tockus spp*) and rock pratincole (*Glareola nuchalis*). Common water birds include spurwing goose (*Plectopterus gambensis*), crowned crane (*Bulirica Regulorum*) Openbill (*Amustomus Lamelligerus*), Francolin (*Francolinus swainsonii*), Saddle billed stock (*Ephippiorhynchus senegalensis*) and a variety of duck species.



5.2.3.4 Fish

Fishing activities in the project area are not so significant. This is because there are not so many big rivers in the area. The only area where fishing activities are significant is along the Kafue River. Fish species common in the area are; Yellow-belly Bream (*Serranochromis robustus*), Red breasted bream (*Tilapia rendalli*), Green headed bream (*Oreochromis machrochir*), Snake Barbel (*Clarias theodora*), Silver barbel (*Shilbe mystus*), Smooth –Spined Barb (*Barbus poechii*), Blunt toothed barbel (*Clarias mellandi*), Three spotted bream (*Oeochromis anersonnii*), Parrot fish (*Gnathonenus macroleptus*) and Banded bream (*Tilapia sparmannii*). The endangered species include Dwarf bream (*Haplochronis philander*), Bottlenose (*Mormyrus lacerda*) and stripe tailed citharinid (*Alestes lateralis*).

5.3 Socio-Economic Environment

5.3.1 Population

Southern Province is one of the most populous provinces in Zambia while North Western Province is least populous of all the nine provinces. In the year 2000, Southern Province had a population of 1,212,124. Lusaka Province is also one of the most populated provinces with the population of 1,391,329 in year 2000. Lusaka province had the highest average population growth rate of 3.5% between 1990 – 2000 while the 1980 – 1990 period had a growth rate of 2.7%. The population of Southern Province grew at 3.2 % during the 1980 - 1990 period and 2.3 % between 1990 and 2000, which were above the average national growth rates of 3.1% and 2.9% for the respective periods. Refer to table 4 below for the population distribution.

The high rate of growth of the population in these Provinces could be attributed to the high rates of migration from the Copperbelt Province. The low economic activities in the mining sector led to the shrink in employment opportunities. This in turn led to the decline in the number of people migrating to the Copperbelt from the rural provinces in search of jobs. This made Lusaka and Southern provinces more attractive to the migrants from other provinces. Some of the people who lost jobs in the mines opted to migrate to Lusaka where employment opportunities were perceived to be higher.

Table 5: **Population Size and Growth Rates of Project Area by District, 1990 - 2000**

District	Population						Growth Rate
	1990			2000			
	Male	Female	Total	Male	Female	Total	
Kafue	59,668	57,686	117,354	77,001	73,216	150,217	2.5
Mazabuka	81,418	80,903	162,321	102,585	100,634	203,219	2.3
Monze	65,190	68,481	133,671	80,697	82,881	163,578	2.0
Choma	83,288	87,399	170,687	100,791	104,107	204,898	1.8
Kalomo	62,109	65,653	127,762	88,175	86,328	169,503	2.9
Livingstone	42,230	41,550	83,780	51,828	51,460	103,288	2.1
Total	428,564	438,670	867,234	459,958	569,584	1,143,423	2.1

Source: Central Statistics Office (CSO), 2000 Census of Population and Housing, Preliminary Report, April 2001

Livingstone is the tourist capital of the nation and has a high population in the Province. Its population has been growing at a fast rate. The 2000 census showed that the population of Livingstone had increased from 83,780 in 1990 to 103,288 in 2000 representing a growth rate of 4.0%. The high rate of growth of the population could be attributed to the in-migration of people from other parts of the country as well as natural increase arising from high birth rates.

It is important to note that none of the people in the districts mentioned above will be adversely affected by the proposed project as it will use the existing way-leave. A social survey that was conducted showed that there are a number of fields in the way-leave. These fields may be affected if the project starts before people harvest their crops. Adequate compensation will be provided to those whose crops will be damaged during the project.

Most of the people in the project area are Tonga by tribe and speak Tonga. The other languages common in the area are Tokaleya and Leya. However, a small number of people in the area originate from other parts of the country, and still speak Tonga. There are no category of people that fall under indigenous people in Zambia.

5.3.2 Settlement Pattern and Traditional Authority

The project area has both urban and rural areas. In the urban areas located at the district headquarters, towns are planned and zoned into residential, industrials and commercial/offices areas. Houses are built in designated residential areas.

Settlements in the rural part of the project area are organized in form of villages. A village is made of many of households living in a defined geographical area under the leadership of the village headman. A group of villages in a defined geographical area make up a chiefdom, which is headed by a chief. Village headmen report to the chief in the area.

The rural part of the project area is under many chiefs: Some of the Chiefs in the project area are, Syanjalika, Musokotwane, Sipatunyana, Simwatachela, Singani, Hamaundu, Hanjalika,



Chikanta, Chona, Mukuni, Naluwama and Chieftness Mweenda. In the urban areas of the project, people live in townships which have been so designated by the municipal councils.

As no settlements are allowed within the wayleaves of high voltage lines, the way-leave of the existing line does not have any house dwellings.

5.3.3 Local Economy

The economy of the districts in Southern Province is mainly dominated by agriculture and tourism. The crops grown in the districts are consumed locally in the province and some of it is exported outside to earn Zambia some revenue. Industries in the province include the sugar plantation, mill plants like Choma milling, breweries, and textiles. Commercial farming is also common to provide foodstuff to the residents of the province. In years of good harvest, some of the agricultural produce, especially maize, is exported to the Democratic Republic of Congo and other towns.

The districts have a few commercial farmers, but majority of the farmers are subsistence farmers. The agricultural produce from both the commercial and subsistence farmers is transported to the Copperbelt and Lusaka for sell. The local economy along the proposed route is also predominantly agricultural, mainly subsistence farming.

5.3.4 Land Tenure

There are several Acts governing the administration of land, viz; Cap 292, 289, 288 for the allocation and alienation of land, Land Acquisition Act which provides for the compulsory acquisition of land and the Local Government Act (No. 22 of 1991) which provides for control of land by Local Authorities. Under the Land Act, land has been demarcated into categories, namely: state, local authority and traditional land. The traditional authorities (Chiefs) have rights over the traditional land, with a mandate to recommend to Government lease to those who want to acquire land.

Land is still abundant in the province and developers who need land can apply to the Local Authorities and the traditional chiefs. Most of the land in the project area is traditional land under the jurisdiction of traditional chiefs. Some of it is state owned land under districts councils and a small proportion is in the hands of farmers who have title to the land.

5.3.5 Land Use

The area along the proposed route is mainly used for subsistence farming, especially using simple hoes and machetes in the rural sections of the project area. Other land uses in the area include small scale quarrying and part of the land is occupied by forest reserves and villages. The existing power line route avoids all protected areas as can be seen from Figure 9



5.3.6. Agriculture

Most of the land along the proposed corridor is under subsistence farming, largely on areas less than 1 hectare. The major crops grown include maize, beans, sweet potatoes, sorghum, cowpeas, cassava, groundnuts, cotton, oranges, millet, sunflower and sugarcane. Refer to figure 15 for an example of an agricultural field.

Livestock is also reared in the project area. The predominant ones include cattle, sheep, goats and pigs. Cattle rearing is very common in both the commercial sector and the traditional sector. Other forms of livestock include goats, sheep and pigs on a small scale. Fish farming is also practiced in the province on a very small scale.



Figure 15: Sunflower field

5.3.7. Mining

Mining is slowly becoming an important economic activity in some districts in Southern province. In Mazabuka, the newly opened Albidon Munali Nickel Mine produces nickel. In Sinazongwe, Maamba Collieries Ltd and Collum Mines are producing Coal. The African Energy Resources Limited has started explorations for uranium in the Njame and Gwabe areas which are located in Sikoongo and Chirundu areas of Siavonga District. Other explorations for Uranium are being conducted in Sinadambwe area in Siavonga District by Denison Mines. Illegal mining of semi precious metals such as Quartz is also common in Kaloma District.

Stone mining is the most significant mining activity in Kafue District in Lusaka province. Kafue Quarry is one of the largest producers of various sized crushed stones for construction purposes. However, it is important to note that there are no major mining activities in the project area.



5.3.8. Tourism

Southern province has a lot of tourist attractions including national parks or game management areas. Livingstone is the tourist capital of the nation. The main sources of attraction to the province are the Victoria Falls which is one of the Seven Wonders of the World, the Mosi-oa-Tunya National Park and the Lochinvar in Monze. The lodges, which have been built along the shores of Lake Kariba in Siavonga and Zambezi river in Livingstone and Kafue river in Kafue, provide leisure to tourists from different parts of the country and abroad. Boat cruises, sport fishing and game viewing are the main leisure activities. Livingstone in the country is a popular place for holding workshops and seminars. Lusaka province has few tourist attractions such as Munda Wangwa gardens and game ranchers.

5.3.9 Employment

According to the 2006 national employment statics from the CSO website:

- The proportion of the unemployed among persons aged 12 years and above for the nation was 14percent.
- Looking at sex differentials at national level, 13 percent of the males and 15 percent of the females were unemployed.
- Urban areas recorded higher unemployment rates (32 percent) than rural areas (5 percent).
- Copperbelt and Lusaka provinces recorded higher unemployment rates than the other provinces with 31 percent each.
- Eastern and Luapula provinces recorded the lowest unemployment rates with 2 percent and 3 percent, respectively.
- The highest unemployment rates for females were recorded in Lusaka Province at 41 percent followed by Copperbelt with 40 percent.

In Southern Province, the agricultural and tourism sectors are the largest providers of employment. The manufacturing, commercial and service sectors also provide employment. The Government departments, like the different ministries including the council employ teachers, health personnel and other public service workers. These among others are among the major providers of formal employment in both Southern and Lusaka province.

In the rural areas of the project area, majority of the people are subsistence farmers. The few people in formal employment are employed by the Government and some NGOs. The incidence of poverty is high due to a number of people being engaged in not so gainful employment. Refer to Table 6 for poverty incidents by provinces.



Table 6 : Incidence of poverty by province, 1991 - 2006

Provinces	1991	1993	1996	1998	2004	2006
	Incidence of poverty	Incidence of poverty	Incidence of poverty	Incidence of poverty	Incidence of poverty	incidence of poverty
Central	70	81	74	77	76	72
Copperbelt	61	49	56	65	56	42
Eastern	85	91	82	79	70	79
Luapula	84	88	78	82	79	73
Lusaka	31	39	38	53	48	29
Northern	84	86	84	81	74	78
North Western	75	88	80	77	76	72
Southern	79	87	76	75	69	73
Western	84	91	84	89	83	84

Source: CSO website, <http://www.zamstats.gov.zm/lcm.php>

5.3.10 Public Health

There are a number of health facilities available in Southern Province, Kafue district and the project area in general. Each District has a district hospital which acts as a referral hospital to all the rural health centres. Some of the district hospitals include Kafue, Mazabuka, Monze, Choma, Kaloma and Livingstone. The District Hospitals mainly caters for people in towns and Rural Health Centres in the entire districts cater for the rest of the district. There are also a number of Rural Health Centres along the project area which are mostly used by people along the project route and use the main hospitals for referred cases. Some of the RHC's along the project route include Katapazi, Kasiya, Vic Falls, Mukuni, Singani, Simango, Kasiya, Simwatachela and Simalundu just to mention a few.

The most common diseases in the project area are malaria, diarrhea (non-blood), respiratory infections (non-pneumonia) and sexually transmitted infections (STIs), upper respiratory infections, eye infection, skin infection, T.B, acute abdominal like appendicitis. Water borne diseases like typhoid and dysentery are common in the province especially in the fishing camps. In some years, including the 2008/09 rain season, some districts in the province experienced cholera outbreaks. However, some of districts have a Cholera Prevention programme to sensitize the people about the prevention of cholera in the Districts. Bilharzia is also common some districts, however prevention programmes have been introduced by the District Health Administration.

The prevalence of HIV/AIDS and STIs in the project area is low according to the statistics from the rural health centers. Various HIV/AIDS and STIs programmes have been initiated by the Government and some NGOs. For the infected people, there are programmes that have been introduced by NGOs such as Home Based Care. The project areas have Voluntary Counseling and Testing (VCT) services and ARVs are provided to HIV/AIDS patients. Refer to Table 7 for



statistics on HIV/AIDS for Zambia. The Government is the major provider of health services in all the Districts. Statistics for other elements

Table 7.: HIV/AIDS statistics for Zambia:

Estimated adult HIV prevalence rate (aged 15–49), 2007	15.2
Estimated number of people (all ages) living with HIV, 2007 (thousands), estimate	1100
Estimated number of people (all ages) living with HIV, 2007 (thousands), low estimate	1000
Estimated number of people (all ages) living with HIV, 2007 (thousands), high estimate	1200
Mother-to-child transmission, Estimated number of women (aged 15+) living with HIV, 2007 (thousands)	560
Paediatric infections, Estimated number of children (aged 0–14) living with HIV, 2007 (thousands)	95
Prevention among young people, HIV prevalence among young people (aged 15–24), 2007, male	3.6
Prevention among young people, HIV prevalence among young people (aged 15–24), 2007, female	11.3
Prevention among young people, % who have comprehensive knowledge of HIV, 2003–2008*, male	37
Prevention among young people, % who have comprehensive knowledge of HIV, 2003–2008*, female	34
Prevention among young people, % who used condom at last higher-risk sex, 2003–2008*, male	48
Prevention among young people, % who used condom at last higher-risk sex, 2003–2008*, female	38
Orphans, Children (aged 0–17) orphaned by AIDS, 2007, estimate (thousands)	600
Orphans, Children (aged 0–17) orphaned due to all causes, 2007, estimate (thousands)	1100
Orphans, Orphan school attendance ratio, 2003–2008*	93

Source: UNICEF 2010, http://www.unicef.org/infobycountry/zambia_statistics.html#66

5.3.11 Goods and Services

Most of the goods and services are available at the district centres in the project area, which include household commodities, equipment and agricultural inputs. There are many business



houses in the province where various goods and services are sold. In the rural areas, there are some small shops where limited stocks of groceries and other small household commodities are sold. However, many people from the smaller districts prefer going to Mazabuka, Monze, or Choma when they have many things to buy because prices are lower there than in the villages.

5.3.12 Transport and Communication

Southern Province is well serviced with public transport since the Lusaka – Livingstone Road is in a good condition. Most of the people in the project areas use buses for transport for long distances. Bulk goods are transport by road on heavy duty trucks.

The feeder roads in the outlying areas in the province are in a poor condition due to lack of maintenance and area is avoided by bus operators and the transporters. Hence, people rely on bicycles and ox-carts.

The area is linked to the rest of the country by Zamtel's microwave satellites. There are three mobile phone operators in the area namely, Airtel, MTN, and Cell Z. Zamtel also provides landline phone services to people in the area. They can also communicate with the rest of the country and the world through the internet. Television and radio networks are available in most parts of the project area.

5.3.13 Water Resources and Sanitation

The proportion of households with access to safe water was 59 percent. Access to safe water was higher in urban (about 89 percent) than in rural areas (about 43 percent). Lusaka province had the largest proportion of households with access to safe water (96 percent) while Northern Province recorded the smallest proportion of households with access to safe water with about 16 percent.

About 59 percent of households in Zambia had own pit latrine, 7.3 percent communal latrine, and another 4.6 percent used neighbours' pit latrines. Fifteen percent used flush toilets (9 percent own flush toilet inside house, 5 percent own flush toilet outside house and 1 percent shared flush toilet). About 13 percent of the households regrettably did not have any toilet facility. More of the rural households than the urban households used pit latrines (76.8 percent) compared to 59.8 percent of the urban households. The proportion of households without a toilet facility was 53.4 percent in Western Province, 33.2 percent in Southern Province and 21.5 percent in Eastern Province.

Piped and treated water is provided to the urban residents of the districts along the project route. The sewage reticulation is also available. People in the villages along the project route rely on unprotected shallow wells and a few boreholes provided by the Government. Pit latrines are commonly used in the villages.



5.3.14 Education

The Province has many institutions of learning which provide education to the residents. There are several High Schools, basic schools and community schools in the project area. The majority of the basic and community schools are concentrated in the rural areas and few in town. Pupils who make it to grade 10 in the districts and the surrounding schools go to High Schools within the districts while some are sent to other high schools in other districts. The province has few high schools. Hence, there is need to build other high schools to adequately accommodate pupils from the basic schools.

Educational facilities exist along the route line but are, however, inadequate forcing some people to walk long distances especially that most of the secondary schools are concentrated in towns. Staffing in the rural schools in the districts is generally low as many teachers, especially female teachers, shun rural areas and prefer to work in urban areas.

5.3.16. Planned development activities

There are many developments that have been planned in the project area. There are plans to allocate more land to both local and foreign investors to boost agricultural production to the benefit of not only the Southern Province but the nation as a whole. There are plans to upgrade one of the middle basic schools in Choma District to a full secondary school to cater for pupils from basic schools. There are also plans to build more lodges, office blocks, residential houses, restaurants, expand other high schools, hospital and other social facilities.

5.3.17 Recreation

Recreation facilities in the project area include sports facilities, restaurants and night clubs. Urban areas like Livingstone have a lot more recreation facilities than the rural areas. In the rural areas, recreation is provided through localized celebrations, games (especially football), beer drinking, and traditional ceremonies.

5.3.18 Archaeological and Cultural Heritage

Archaeological and Paleontological materials (artifacts) are very important as they give an insight into Zambia's ancient past. Hence, there is need to preserve them whenever and wherever they may be found. They are found in such forms as rock paintings or engravings;

- Pottery
- Ironworks, slag or other metal-craft
- Beads, bangles or other personal adornments
- Stone implements
- Human bones
- Fossils
- Or any other thing that seems to be records of the past life.



In order to ascertain the heritage resources present in the project areas, the National Heritage Conservation Commission Register and the local people were consulted. The assessment helped to determine the potential impact of the project as relates to archaeological and cultural heritage. As the line is already existing, in close proximity to the identified areas, it was seen that the project was going to have no impact on the existing sites.

5.3.18.1 Cultural Heritage

There are three cultural sites in the projects area; the Iron Age site called the Hebert Young Drive in Kalomo district and two Stone Age sites. However, there are no known cultural sites in the immediate project area. Refer to Figure 11 for the location of Kalomo in proximity to the existing line.

5.3.18.2 Natural Heritage

The Victoria Falls is a gazette national monument and it is an important natural heritage in Livingstone, the surrounding areas and the country as a whole. It contributes to the scenic beauty of the area. The Munali Hills national monument is also an important natural heritage in Mazabuka and the surrounding areas and Isamupati in Kalomo District.

6.0 ENVIROMENTAL AND SOCIAL IMPACTS

6.1 PHYSICAL ENVIRONMENT

The project will utilize the existing way-leave and existing tower structures for a distance of 341 km, therefore, the impacts on the physical environment are minimal.

6.1.1 Air Quality

The construction of the 330kV line shall have little impact on air quality since such pollution shall be confined to the construction period and maintenance. The construction activities that may cause air pollution during construction due to equipment operation and movement, grubbing and clearing of access roads.

Release of gaseous emissions may also cause an effect on the quality of air.

6.1.2 Noise

Noise pollution shall be created during construction especially since heavy-duty equipment shall be used in the stringing of conductors. Noise pollution shall however, be limited to the construction period.



However, during operations transmission conductors will produce noise under certain conditions because of corona discharge. Corona discharge is the ionization of the air next to the conductor by the electric field which is related to the voltage on the conductors. The loudness of the noise depends on conductor conditions, voltage level, and weather conditions under these conditions the power lines will make a hissing, popping or cracking sound.

6.2 BIOLOGICAL ENVIRONMENT

6.2.1 Flora

6.2.1.1 Woody plants

The project will utilize the existing way-leave therefore, vegetation clearing will be minimal. In some sections at the edge of the Kafue Flats there will be minimal clearing of woody vegetation since it is mainly grassland (refer to Figure 10 for the general terrain and vegetation).

6.2.1.2 Grasslands

The sections on the line that has some stubby grassland species will be affected due to use of construction equipment during stringing. The grass within the existing way-leave will also be minimally disturbed during transportation of conductors, insulators and during the removal of old conductor and stringing new conductor.

6.2.2 Protected Areas (National Parks and Forest Reserves)

There are no significant anticipated impacts in the National Parks and Forest Reserves as the proposed power line does not pass through any protected area. However for the existing way-leave that traverses close to the existing forest reserves, there will be minimal disturbance due to increased traffic of both construction vehicles and workers. This may expose the area to minimal illegal exploitation of forest resources.

6.2.3 Fauna

6.2.3.1 Mammals

Poaching and disturbance to wildlife would be the major adverse impacts on large animals by construction workers. However this may only occur during construction and line maintenance. Vervet monkeys (*Cercopithecus aethiops*) and baboons (*papio ursinus*) are also likely to get disturbed during line construction and maintenance due to their inquisitive nature. However there is a known pattern of interaction between these animals and power lines that already



exists in the study area. Vegetation clearance within the way-leave would create a conducive environment for small mammals by way of improving herbivory for grazers and browsers. Some small animals may be killed by project vehicles during construction.

6.2.3.2 Reptiles

The short term activities such as line construction works may have an adverse effect on reptiles within the way-leave, the edge effect created may create habitat requirements for certain species thereby improving population status of certain species. Some reptiles may be killed accidentally by vehicles during construction in the section where there is existing way-leave.

6.2.3.3 Birds

Poaching would be a major adverse impact on birds by construction workers. However, there is likely to be positive impact on the raptors, which use power line towers for nesting. Other birds use the power lines for perching and use way-leave for roosting.

6.2.3.4 Fish

As the existing line crosses only one major river, the Kafue, important for fishing, for the period of works on the section of the river, the construction workers may engage in fishing for food. This will have minimal impact on the fish resources. Main fish species found along the Kafue river include: barbel fish (*clarias qariepinus*), squaker (*syndontis macrostigma*) stripe tailed citharinid (*Alestes lateralis*) red breasted bream (*Tilapia rendalli*), *Oreochromis niloticus*, silver barbel (*Schilbe mystus*), three spotted bream (*Oreochromis andersonii*), kafue pike (*Hepsetus odoe*), darlings bream (*Tilapia sparmanii*), dwarf bream (*Haplochromis philander*) and green headed bream (*Oreochromis macrochir*). The increased activities during the removal of old conductors and stringing at the river crossing may disturb the fish habitat for a brief moment. The impact is anticipated to be minimal and temporal as the works will not be so intensive and will be for a shorter period of time.

6.3 SOCIAL ECONOMIC IMPACTS

6.3.1 Population

During construction, there shall be an influx of people in the project area from other Districts beyond the project area. Most of them shall be unskilled and semi-skilled in search of jobs. The contractor is also expected to come with a team of skilled personnel from various parts of the country and some from outside the country to carryout various specialized tasks during the entire construction phase. However, this influx shall be restricted to the construction phase. Once construction is completed, workers are expected to go back to their respective places of origin or any other place they may desire to settle in. However, only a few may opt to settle in the project area.



6.3.2 Settlement Patterns and Traditional Authority

There shall be no significant impact on settlement patterns in the project areas as no houses in the villages will be demolished because the upgrade project will use the existing way-leave and tower structures. There will be no structures to be affected during the rehabilitation of old access roads, as people do not normally construct structures on roads and in the way-leave.

During the upgrading, the contractor will build temporal camps in different places along the proposed route for the power line. They will not alter the settlement patterns in the areas because the camps will be demolished upon completion of the construction activities.

6.3.3 Social and Cultural set-up

From experience derived from past projects, it has been learnt that most of the construction workers leave their wives in their respective places of residence as it is assumed to be burdensome to carry along their spouses from place to place during the construction phase. Arising from this, some workers develop the tendency of getting women from the areas where they have camp, in some cases married ones. This could create conflict between the villagers and the construction workers which could even culminate into social strife leading to delays in complete some project activities.

The influx of people into the project areas may breed social problems such as theft, prostitution and drug abuse. Some of the people coming into these areas could be people with questionable characters and may bring their bad habits into the areas.

6.3.4 Local Economy

Some people in the project area shall be employed on the project during construction and this shall lead to an improvement in the income levels and, in turn, in the standard of living. From the improved incomes, people will be able to buy foodstuffs, groceries, clothes and other essential commodities and this will have a multiplier effect. Some of the income will be used for paying school fees, medical expenses and other domestic needs. Some materials, such as sand and crushed stones may be bought locally within the Districts and this will benefit the local economy. Other materials like cement, timber, poles and conductors will also be bought within the Districts and the Country, which will benefit the national economy.

Electricity provides an important source of energy that can boost the development of any area. It is expected that the availability of firm and reliable power supply will lead to the development of the project area and the nation as a whole.

6.3.5 Land Tenure

There are no anticipated impacts on land tenure. The existing land tenure will not be disturbed. Chiefs, local authorities, the state and farmers will maintain their land ownership during both during the construction and operation phases of the project.



6.3.6 Land use

Utilization of the land under the power line and within the way-leave will be restricted. Building of houses, planting of fruit and other trees and similar activities under the power line will not be allowed. However, growing of low crops such as groundnuts, beans, sweet potatoes and maize is permitted, but no ploughing is allowed at the foot of the tower to avoid destabilizing the foundations of the towers.

6.3.7 Agriculture

There shall be no anticipated significant impacts on agriculture. The line also traverses a few agricultural fields where low lying crops are cultivated. Farmers will continue with their usual farming activities and will be allowed to utilize even the land under the power line. The way-leave cleared of vegetation will provide good grazing grounds for cattle, sheep, goats and livestock. During construction, the workforce will provide a ready market for various agricultural produce and will boost farmers' incomes.

There is a possibility that some crops in the fields will be damaged during construction, especially when rehabilitating the access road along the power line.

6.3.8 Employment

There shall be temporary employment opportunities to the local communities during the period of construction, especially during bush clearing and construction of foundations for the towers. When recruiting workers, the contractor shall ensure that the local people are given priority. Some construction materials, such as crushed stones and sand will be obtained within the area and this will indirectly contribute to employment creation for those engaged in crushing stones and mining of sand.

6.3.9 Education

Most of the workers who will come from beyond the project area will not bring their children with them as the period of construction. The children and their mothers are likely to remain in their usual places of residence. Hence, there will be no added pressure on the existing education facilities in the project areas from the project workforce.

6.3.10 Health

The interaction of construction workers from outside the project areas with the local people may lead to the spread of HIV/AIDS and other communicable diseases. This interaction could also lead to spread of water borne diseases such cholera, dysentery and typhoid. The workers may be exposed to the risk of accidents during construction phase which may lead to injuries.



6.3.11 Water and Sanitation

There is likely to be more pressure on the existing water and sanitation facilities with an increase in the population during the construction phase. It is envisaged that appropriate and adequate sanitary facilities like pit latrines and places to bath shall be constructed for the workers.

Domestic waste generated at the camps for workers could adversely affect the sanitation in the area. Domestic waste such as leftover foodstuffs and human waste could pollute the environment if not well managed.

6.3.12 Industries

No industries will be required to relocate as a result of this project. The project will make power available to the Industries to support various activities.

6.3.13 Minerals / Mining

There are no anticipated adverse impacts on the mining activities because proposed power line does not pass through any mining area.

6.3.14 Tourism

The project has no direct adverse impacts on tourism. Indirectly, the power that will be transmitted by the proposed upgrade will make more electricity available to support tourism activities not only in Livingstone but also in other places.

6.3.15 Transport and Communication

When construction commences, project vehicles will lead to an increase in traffic on the Livingstone road and feeder roads in the project area. This may in turn lead to an increase in road traffic accidents.

6.3.16 Infrastructure and Social Services

Construction workers will provide a market for goods and services. Business people will be encouraged to build more and even bigger shops and other social amenities.

During project implementation, some feeder roads will be graded and some bridges repaired to facilitate the movement of construction equipment and materials. The improvements in some of the roads will greatly benefit the local people.



6.3.17 Planned Development Activities

The project once completed will make more power available to Southern Province and the entire country and this will make it possible to implement the planned developments in all the sectors of the economy. It will boost agriculture (especially irrigation farming), mining of Uranium, Nickel, Copper and other minerals, manufacturing, education expansion (upgrading of some basic schools to high schools, provision of boarding facilities and construction of new schools), expansion of health centre and construction of new ones and tourism development through the construction of new lodges and other tourism facilities.

6.3.18 Archaeological and Cultural Sites

The proposed upgrade of the power line is not passing through any known archaeological or cultural site.

6.3.19 Safety

During construction, surveyors and construction workers may be exposed to some risks such as electrocution, falling from the towers, snake bites and injuries from various construction activities. There are also risks of road traffic accidents for both construction workers and other road users.

7.0 MITIGATION MEASURES

7.1 PHYSICAL ENVIRONMENT

There will be no significant negative impacts to be mitigated on the geology, soils, topography, hydrology and climate of the project area since the project scope is just to change the conductors on the existing power line. However, there will be little negative impacts on the air quality and noise in the project area of which mitigation measures have been identified.

7.1.1 Air Quality

During construction it is recommended that surface particulate near sensitive areas (e.g. residential developments) be controlled by the use of water sprays and dust suppressants, as required.

While a certain level of gaseous emissions from construction equipment will be unavoidable during the construction phase, certain operational practices can be employed to reduce or mitigate emissions to acceptable levels, including ensuring that equipment is kept in good condition and operates efficiently. It is recommended that all equipment be kept in good working order to avoid smoking.



7.1.2 Noise

The production of noise is inevitable during construction and maintenance of the line. In extreme case, construction workers shall be provided with noise protectors as stipulated in the Factories Act and other construction related legislation. If any extreme noise producing activities are anticipated local communities in the surrounding areas will be notified and such activities will be conducted during day time.

7.2 Biological Environment

7.2.1 Flora

During the line upgrade vegetation clearing will be minimal as the way-leave is already in existence. Way-leave clearance of woody plants will not be a major adverse impact. Clearing of vegetation shall be limited to the 50m way-leave swath. Vegetation shall be stumped (cut at ground level) as opposed to uprooting. This will allow re-growth up to the allowable 30-40cm height.

Burning for purposes of bush clearing shall not be allowed in the way-leave. Any trees cut that have economic or local use shall be donated to local people in the vicinity of the project area. Grasses cut if still usable can be used by people in the area for various uses.

7.2.2 Protected Areas (National Parks and Forest Reserves)

The proposed Livingstone substation where the 220 kV line upgrade will terminate is actually outside the National Park, however the access to the site is through the Mosi-oa-Tunya National Park. Permission will be sought from the Forestry Department and ZAWA to ensure minimal disturbance to wildlife in the Park. Collaborative work with the two authorities on the project shall be developed in order to develop specific management plans for construction activities that will reduce potential negative impacts along the protected areas.

7.2.3 Fauna

7.2.3.1 Mammals

As a mitigation measure, it would be important that the construction company observes conservation measures. The contractor will be required to set up rules that prohibit poaching activities by construction workers if they come across wildlife. Carrying out conservation awareness campaigns to construction workers is the key to reduce poaching. ZAWA shall be engaged to educate the workforce on the need to conserve wildlife, to ensure that there is no illegal hunting.



7.2.3.2 Reptiles

Line upgrade in close proximity to the Kafue River will be carried out during low river flows to avoid adversely disturbing the wetland and aquatic habitat. Reptiles that may be found in the way-leave will be moved to safe places. However, in the existing way-leave there will be no impacts.

7.2.3.3 Birds

Works in the Kafue Flats section of the line, shall be done with extra caution to avoid disturbance to bird habit and nesting areas. The Kafue Flats is an area rich in bird life. Where some level of interaction with these areas is unavoidable, bird diversion equipment shall be incorporated into the line design.

7.2.3.4 Fish

It is important to avoid construction activities in water courses as much as possible and to implement the standard, proven erosion and sediment control measures. Ideally all tower structures should be located greater than 30m from all water courses. The key element is a program to minimize potential adverse effects on aquatic habitat resulting from erosion and sedimentation and the risk of effects on fish populations. Other mitigation measures that can be taken to minimize potential adverse effects on aquatic habitat from structural habitat changes are; limiting the removal of riparian zone vegetation, promote re-growth of vegetation in areas adjacent to watercourses following disturbance and minimize the use of heavy equipment adjacent to water courses. Fishing by construction workers shall also be controlled to avoid depletion of the resource due to overfishing.

7.3 Socio-Economic

7.3.1 Population

The influx of people into the area will be temporal and will only happen during the construction period. Once construction is completed, the workers will be laid off and they will go back to their respective home areas.

Adequate compensation shall be paid to the people whose crops may be affected by the project. As a common practice, an officer from the Ministry of Agriculture and Cooperatives shall be hired to assess the affected crops.

7.3.2 Settlement Patterns and Traditional Authority

During construction, the Contractor will build temporal camps in different places along the proposed route for the power line. Once the workers have shifted from the camps, the temporal



structures built should be demolished by the Contractor and general clean up undertaken. All waste shall be cleared from site and disposed of in designated places.

Selection of the contractor's camps should be done in close consultation with the local people to avoid major disturbance to their life style. Awareness shall be undertaken on the workers to ensure they exercise respect and courtesy when dealing with the local people in the close proximity to their camps.

7.3.3 Social and Cultural set-up

When employing workers, the contractor should carefully scrutinize the potential workers so that people with questionable character are left out. Those who have criminal records and those with bad habits should not be employed. In addition, for unskilled labour needs, the contractor shall give employment priority to the local people to minimize disturbance to their social-cultural way of life.

In order to minimize social rivalry between the local people and the construction workers, counsel should be given to the workers to avoid going out with other people's wives and girl friends. They should also be counseled to respect the local people and their culture.

Graveyards and any sacred places are respected by the Zambian people. Therefore, the contractor shall take precaution when working near such areas to avoid causing any disturbance.

7.3.4 Land use

The local people are allowed by ZESCO to grow low crops such as groundnuts, beans, sweet potatoes and maize in the way-leave, but no ploughing is allowed at the foot of the tower to avoid destabilizing the foundations of the towers.

7.3.5 Agriculture

In order not to disturb agricultural production, farmers will be allowed to grow low crops such as groundnuts, beans, sweet potatoes and maize in the way-leave, but no ploughing is allowed at the foot of the tower to avoid destabilizing the foundations of the towers.

To minimize damage to crops in the fields traversed by the existing line, the works on the line should be timed well. Works should commence after harvest so that the crops are not destroyed. In the event that the crops are destroyed, adequate compensation shall be given to the affected farmers.

Before commencement of works, written notifications shall be served on the owners of farms where the existing power line traverses in order to get authority to undertake works in the farms and fields.



7.3.6 Employment

In order to maximize benefits to the local community, local people shall be given priority when employing workers during the upgrading of the power line as well as during annual way-leave maintenance. The Contractor should collaborate with the local leadership when recruiting the workers. The headmen, chiefs, councilors and other community leaders know the people better. Hence, it is necessary that they play a role in the recruitment process.

7.3.7 Health

In order to prevent the spreading of communicable diseases, health education on the dangers and prevention of communicable diseases should be given to the construction workers and the local community at regular intervals throughout the upgrading period. First Aid and Safety training shall be given to the workers and First Aid kits shall be available on site for emergencies.

7.3.8 Water and Sanitation

Pit latrines should be constructed in designated areas for use by construction workers. Rubbish bins shall also be provided for the disposal of domestic waste such as leftover foodstuffs and this shall be disposed of in designated places as directed by the local authorities.

7.3.9 Transport

Road signs should be put on the major and feeder roads in the project areas to warn road users about the presence of heavy trucks and plant on the road. Drivers of vehicles involved in the project should be educated on road safety so that they drive carefully to avoid accidents. Traffic Police shall be notified on the sections where increased traffic will be anticipated. The local communities shall also be notified on the anticipated increased traffic.

Speed limit shall be strictly adhered to by all contract workers to minimize road traffic accident incidents.

7.3.10 Archaeological and Cultural Sites

The Contractor workers shall be educated on the high incidence of archaeological artifacts especially in the Mosi-ou-tunya area. During works at the substation site the National Heritage Conservation Commission shall be notified at the start of work. In case any artifacts are found the workers shall be educated to stop works and notify NHCC and work will only resume when the Conservation specialist has completed the work. In consultation with the NHCC Contractors will be required to prepare a management plan for opportunistic archaeological artifact finds.

7.3.11 Safety



To reduce the risks of snakebites and injuries, surveyors and construction workers shall wear gumboots, helmets and other appropriate protective clothing. To prevent road traffic accidents, road signs and speed limit signs shall be placed in appropriate places to warn people and enforced. As safety is of paramount importance, the contractor shall be required to prepare safety rules and guidelines which shall be adhered to by all the workers. Safety and first aid awareness shall be undertaken for all contractors and their workers.

7.4 Summary of Potential Impacts, Mitigation Measures and Evaluation of Significance

Table 7 below gives a criteria for assessing significance while Table 8 gives a summary of potential impacts and the recommended mitigation measures which have to be adhered to during the construction and operational phases of the power line. An attempt has been made to evaluate the significant of the impacts.

Table 8.: Criteria considered in the assessment of Potential Environmental Effects

Key Terms	Criteria
Adverse	<ul style="list-style-type: none">• Loss of species of a special status• Reductions in species diversity• Loss of critical habitat• Transformation of natural landscapes• Toxic effects on human health• Reductions in the capacity of renewable resources• Loss of current land use• Loss of property due to the project• Relocation of affected households
Significant	<ul style="list-style-type: none">• Magnitude• Geographical extent• Duration and frequency• Reversibility• Ecological context
Likely	<ul style="list-style-type: none">• Probability of occurrence• Scientific uncertainty

Scores: 1. Very High 2. High 3. Moderate 4.Low 5.Very Low,



Table 9: **Potential Impacts and Mitigation Measures**

Environmental Aspect	Type of impact	Significance	Mitigation Measures and Comments
1.0 Physical Environment			
1.1 Geology and Soils	Soil erosion and mudslides	High	Stumping as opposed to uprooting shall be employed to clear vegetation along the power lines in order to avoid soil erosion.
1.2 Hydrology	Increased sediment loads to the Kafue river	Moderate	To minimize disturbance to riverine vegetation, construction works shall be done with care and all drainage areas shall be fitted with sediment traps.
1.3 Wetlands Water quality	Pollution of surface and ground water	Low	Hazardous waste such as oil and fuel from vehicles should not be drained in water channels, but shall be put in containers for possible re-use or disposal. Water pollution from workers camps will be minimized as camps will be far from water sources
1.4 Air Quality	Air pollution	Low	When approaching villages, vehicles shall slow down to minimize dust emission. Where necessary, water shall be sprinkled in dust areas, especially near villages.
1.5 Noise	Noise disturbance to the community	Low	Where there are villages, vehicles shall slow down to minimize noise.
1.6 Waste Products	Pollution from Cable drums and cement bags	Low	Cable drums shall be removed from site and stored for reuse. Empty cement bags shall be collected from site for disposal.
	Pollution from Leftover pieces of metal	Low	Leftover pieces of metal shall be removed from site and stored for reuse. Those which cannot be reused can be sold as scrap metal.
	Pollution from Transformer oil	Low	Transformers to be procured for the project shall be PCB-free.
	Pollution from liquid waste	Low	Oil leakages shall not be allowed. Non-reusable oils shall be put in drums and transported to a suitable storage site and shall be disposed of according to the governing environmental regulations.
Waste Products Continued	Pollution from domestic waste	Low	Pit latrines shall be built in designated areas for use by the workers. Rubbish bins shall be provided for disposal of



Environmental Aspect	Type of impact	Significance	Mitigation Measures and Comments
			domestic waste and waste shall be disposed of in designated places as directed by the local authorities.
	Pollution from concrete waste	Low	Leftover concrete shall be removed from site.
	Soil, gravel and aggregates	Low	Dugouts shall be buried and trees and grass shall be planted to facilitate ecological restoration.
1.7 Visual	Scenic beauty distortion	Moderate	Power line is away from main roads and this will reduce the inevitable visual intrusion.
2. Biological Environment			
2.1 Fauna	Disturbance to wildlife	Low	Poaching of wild life is prohibited Workers shall be sensitized on the need to conserve wildlife.
2.2 Flora	Bush clearing debris	Low	Stumping as opposed to uprooting shall be used to clear vegetation along the power line in order to avoid soil erosion. Trimming as opposed to cutting the whole tree is encouraged for trees at the edge of the way-leave. Debris from vegetation should be removed from the way-leave. Local people shall be allowed to use the debris for firewood and charcoal. Fire shall not be used for bush clearing. Workers shall be sensitized on the need to conserve vegetation.
3. Socio-economic Environment			
3.1 Population	Relocation of people	Low	During line upgrading no houses, shops and other buildings will be affected and the use of the existing way-leave will be maintained.
3.2 Land Tenure and Landuse	Disturbance to Land tenure and landuse	Low	The existing land tenure system will be maintained. Where the power line passes through agricultural fields, a written consent has to be obtained from the owner allowing ZESCO to pass the line through the farm.
3.3 Agriculture	Encroachment on agricultural land	Low	Care shall be taken to avoid agricultural fields as much as possible. Adequate notification should be given to the farmers through whose land the line passes. In case there are damages to crops, owners shall be



Environmental Aspect	Type of impact	Significance	Mitigation Measures and Comments
			adequately compensated.
3.4 Employment	Employment opportunities	Moderate	In order to maximize benefits to the local community, local people shall be given priority when recruiting workers during construction of the power line as well as during annual wayleave maintenance. Headmen and chiefs shall be consulted when recruiting workers.
3.5 Health	Spreading of communicable diseases	Moderate	Health education shall be provided to the workers and local people on communicable diseases. Construction workers shall be supplied with condoms in addition to health awareness campaigns
3.6 Water and Sanitation	Sanitation problems	Low	Pit latrines shall be constructed in designated areas for use by construction workers. Rubbish bins shall be provided for the disposal of domestic waste such as leftover foodstuffs and shall be disposed of in designated places.
3.7 Archaeological and Heritage sites	Disturbance to Archaeological and Heritage sites.	Low	Within the way-leaves of existing line, there are no known archaeological sites. However workers shall be educated on how to identify any such artifacts during their work. A management plan shall be developed for change finds and the National Heritage Conservation Commission shall be notified on any opportunistic finds. All graveyards shall be avoided.
3.9 Safety	Accidents from work and attacks from wildlife	Moderate	To prevent snake bites and injuries, workers shall wear gum boots, helmets and other protective attire. To prevent road traffic accidents, road signs shall be placed in places where the construction team is working to warn motorists and other road users.



8.0 ENVIRONMENTAL MANAGEMENT PLAN FRAMEWORK

8.1 Introduction

An Environmental Management Plan (EMP) has been developed and is presented in appendix 2. The EMP will facilitate the implementation of the mitigation measures. The EMP has various sections outlining procedures, activities and stages of implementing the mitigation measure.

8.2 Main Components of the EMP

The main components of the EMP shall include:

- **Awareness and training:** with general code of conduct (for contractors, employees etc), employment and recruitment procedures, protection and management of cultural, heritage and archeological sites, protection of infrastructure and property (communal and private), anti-poaching (protection of fauna), health, safety, compensation procedures, grievance procedures, working hours. etc.
- **Waste Management:** refuse and waste management, water pollution control, sanitation, waste oil and solid waste, stock piles and spoil dumps management.
- **General guidelines on project implementation:** that shall include: camp site selection criteria, temporal works, road signage, plant and equipment service area, explosives and other construction materials storage, fuel storage and workshop area, borrow pits and quarry sites, access roads and road transport, water supply and services on site.
- **Environmental Management:** slope protection, erosion protection, noise pollution control, air pollution control, water pollution control, vegetation management (bush clearing, plant species protection, cut wood management), landscaping and rehabilitation of construction sites, monitoring and audit programme.
- **Work plan** and phasing of environmental management plan implementation activities with responsible persons or parties.

It is envisaged that project staff shall include a full time Environmental Coordinator to enhance implementation of the environmental mitigation measures through the Environmental Management Plan. It is envisaged also that all awareness programmes (on health, safety, wildlife conservation) to construction workers and communities in the project area shall be conducted in liaison with the respective line ministries and in consultation with community leaders in the project area. Refer to Appendix 2 for a detailed Environmental Management Plan.

8.3 Monitoring Programme

The Kafue-Muzuma-Livingstone line has been in existence for over 30 years now. The line was constructed under an old set of national laws that rarely took into account environmental issues. However, under the proposed upgrade project, an Environmental Impact Assessment statement was prepared based on environmental field studies. Arising from the EIS, an Environmental Management Plan (EMP) was developed. The EMP provides guidance on ensuring that mitigation measures are implemented during project execution. However, there is also need to



monitor the implementation of the provisions of the EMP through a monitoring plan (section 1.3 of the EMP).

The Project Management Team (PMT) and in particular the Environmental Coordinator (ECO) and any external agency such as the Environmental Council of Zambia, Ministry of Health, Internal National Security and others agencies and or officers will be responsible for environmental monitoring to ensure compliance to all the outlined mitigation measures in the monitoring plan. The ECO on the project will be responsible for coordination the monitoring programme on the project.

8.3.1 Project Monitoring

Monitoring of various project aspects will be carried out at various stages of project implementation:

- Pre-mobilization stage
 - Compensation issues; to ensure smooth site hand over
 - Camp site selection
- During mobilization
 - Health, safety, security and conservation awareness programme for both workers and local communities in the project area
- During project implementation
 - Health, safety, security and conservation awareness programme for both workers and local communities in the project area
 - Implementation of mitigation measures on noise, dust, water pollution, abatement and waste management.
 - Site compliance – site markings and other safety requirements
- During pre-commissioning
 - Environmental auditing
- And at post commissioning stage
 - Environmental auditing.

An outline of project phases and monitoring activities are given in table 9 below.

The outlined monitoring activities would require financial support to be implemented successfully. Table 10 below shows indicative budget requirements to implement the monitoring programme.

8.4 Estimated Cost of Mitigation and Monitoring Activities

The cost of mitigating the effects of the project and monitoring the management programme shall be included as part of the total project cost. This cost shall consist of a number of some small capital component for one-time expenses that will occur during or just after construction



and an annual cost for continuing operations. The total mitigation budget is estimated to be US\$ 327,500.00



Table 10. OUTLINE OF THE ENVIRONMENTAL MONITORING PLAN

Project Phase/Activity	Activities	Responsible	Schedule/Frequency
Pre-Mobilization/construction	<ul style="list-style-type: none"> • Compensation payments • Camp site selection & site permits 	<ul style="list-style-type: none"> • PMT – the ECO • PMT & Contractor 	<ul style="list-style-type: none"> • Before project implementation • Before site project mobilization
Mobilization	<ul style="list-style-type: none"> • Local labour recruitment • Awareness meetings for workers: health, safety, security and environmental conservation 	<ul style="list-style-type: none"> • PMT, Contractor & community leadership • ECO with Local health Team • ECO with safety officers • ECO with security officer • ECO with any appropriate Conservation Team 	<ul style="list-style-type: none"> • Recruitment – once prior to project execution • Health – twice during project implementation • Safety – twice during project implementation • Security – before project commencement • Environmental conservation – early
	<ul style="list-style-type: none"> • Health, safety, security and environmental conservation awareness for local people in the project area 	<ul style="list-style-type: none"> • ECO with Local Health Team • ECO with safety officer • ECO with local conservation team 	<ul style="list-style-type: none"> • Health – soon after mobilization • Safety – soon after mobilization • Security – soon after mobilization • Conservation – soon after mobilization
	<ul style="list-style-type: none"> • Waste management 	<ul style="list-style-type: none"> • PMT & Contractor 	<ul style="list-style-type: none"> • Before camp occupation and throughout camp operations



Project Phase/Activity	Activities	Responsible	Schedule/Frequency
Construction	<ul style="list-style-type: none"> Health awareness and monitoring for both Local people and construction workers Safety & security awareness and monitoring for both Local people and construction workers 	<ul style="list-style-type: none"> ECO with Health Team ECO, Safety & Security Officers & Contractor 	<ul style="list-style-type: none"> Health – once Safety & security – periodic during project implementation
	<ul style="list-style-type: none"> Noise & dust mitigation 	<ul style="list-style-type: none"> ECO, Safety, Security, Civil Engineering & contractor 	<ul style="list-style-type: none"> Throughout project execution
	<ul style="list-style-type: none"> Water pollution 	<ul style="list-style-type: none"> PMT & contractor 	<ul style="list-style-type: none"> Periodic in selected locations
	<ul style="list-style-type: none"> Conservation monitoring s 	<ul style="list-style-type: none"> ECO with local conservation body 	<ul style="list-style-type: none"> Conservation - once
	<ul style="list-style-type: none"> Labeling of work areas, posting notices, observing site rules, etc 	<ul style="list-style-type: none"> Contractor & PMT (ECO/Safety/Civil engineer/Security) 	<ul style="list-style-type: none"> Throughout project execution
	<ul style="list-style-type: none"> General Monitoring of compliance to outlined environmental mitigation measures 	<ul style="list-style-type: none"> PMT (ECO) 	<ul style="list-style-type: none"> Throughout project execution
	<ul style="list-style-type: none"> Ensure implementation of environmental mitigation measures 	<ul style="list-style-type: none"> PMT (Site manager & ECO) The ECZ PMT (ECO & Civil Engineer) 	<ul style="list-style-type: none"> Throughout project execution Once or twice during project execution Throughout project execution
	<ul style="list-style-type: none"> Erosion control measures 		
Pre commissioning	<ul style="list-style-type: none"> Environmental Auditing 	<ul style="list-style-type: none"> ECO with the ESU Auditing Team 	<ul style="list-style-type: none"> Prior to project commissioning
Operational	<ul style="list-style-type: none"> Environmental Auditing 	<ul style="list-style-type: none"> ECO with the ESU Auditing Team 	<ul style="list-style-type: none"> A year after project commissioning



Table 11. Mitigation and project monitoring plan budget estimates

Project Phase/Activity	Activities	Cost element	Cost Estimate (US\$)
Pre-Mobilization/construction	<ul style="list-style-type: none"> • Compensation payments • Camp site selection & site permits 	<ul style="list-style-type: none"> • Valuation services • Compensation cost • Transport (new vehicle) 	<ul style="list-style-type: none"> • 02,500=00 • 20,000=00 • 60,000=00
Subtotal	•	•	• 82,500=00
Mobilization	<ul style="list-style-type: none"> • Local labour recruitment • Awareness meetings for workers: health, safety, security and environmental conservation 	<ul style="list-style-type: none"> • Transport (operations) • Staff allowances • Transport (operation) • Allowances for officers 	<ul style="list-style-type: none"> • 05,000=00 • 05,000=00 • 08,000=00
	<ul style="list-style-type: none"> • Health, safety, security and environmental conservation awareness for local people in the project area 	<ul style="list-style-type: none"> • Staff allowances • Venue and other logistics 	<ul style="list-style-type: none"> • 08,000=00 • 05,000=00
	<ul style="list-style-type: none"> • Waste management monitoring 	<ul style="list-style-type: none"> • Transport (operations) 	<ul style="list-style-type: none"> • 05,000=00
	Subtotal		



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Project Phase/Activity	Activities	Cost element	Cost Estimate (US\$)
Construction	<ul style="list-style-type: none"> Health awareness and monitoring for both Local people and construction workers Safety & security awareness and monitoring for both Local people and construction workers 	<ul style="list-style-type: none"> Transport (operations) Resource persons & Staff allowances Transport (operations) Resource persons & Staff allowances 	<ul style="list-style-type: none"> 05,000=00 10,000=00 10,000=00 10,000=00
	<ul style="list-style-type: none"> Noise & dust mitigation 	<ul style="list-style-type: none"> Transport (operation) Air quality measurements 	<ul style="list-style-type: none"> 05,000=00 10,000=00
	<ul style="list-style-type: none"> Water pollution 	<ul style="list-style-type: none"> Transport (operation) Water sampling & analysis 	<ul style="list-style-type: none"> 05,000=00 10,000=00
	<ul style="list-style-type: none"> Conservation monitoring 	<ul style="list-style-type: none"> Allowances for officers 	<ul style="list-style-type: none"> 08,000=00
	<ul style="list-style-type: none"> Labeling of work areas, posting notices, observing site rules, etc 	<ul style="list-style-type: none"> Payments for labeling services (contractor's budget) 	<ul style="list-style-type: none"> 20,000=00
	<ul style="list-style-type: none"> General Monitoring of compliance to outlined environmental mitigation measures 	<ul style="list-style-type: none"> Transport (operation) Staff allowances 	<ul style="list-style-type: none"> 05,000=00 08,000=00



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Project Phase/Activity	Activities	Cost element	Cost Estimate (US\$)
	<ul style="list-style-type: none"> Implementation of environmental mitigation measures monitoring Erosion control measures 	<ul style="list-style-type: none"> Transport (Operation) Staff allowances Transport (operation) Erosion control measures (contractor's budget) 	<ul style="list-style-type: none"> 05,000=00 08,000=00 05,000=00 20,000=00)
Subtotal			<ul style="list-style-type: none"> 144,000=00
Pre commissioning	<ul style="list-style-type: none"> Environmental Auditing 	<ul style="list-style-type: none"> Staff allowances Transport (operation) Audit report product 	<ul style="list-style-type: none"> 20,000=00 10,000=00 02,500=00
Subtotal			<ul style="list-style-type: none"> 32,500=00
Operational	<ul style="list-style-type: none"> Environmental Auditing 	<ul style="list-style-type: none"> Staff allowances Transport (operation) Audit report product 	<ul style="list-style-type: none"> 20,000=00 10,000=00 02,500=00
Subtotal			<ul style="list-style-type: none"> 32,500=00
Total budget estimate			<ul style="list-style-type: none"> 327,500=00



9.0 RECOMMENDATIONS AND CONCLUSION

The Environmental Impact Assessment (EIA) for the proposed Kafue West-Muzuma-Livingstone upgrade followed the laid down EIA format in accordance with the Environmental Impact Assessment Regulations, Statutory Instrument No. of 1997. During this process, the various options and alternatives were considered to come up with potential environmental Impacts and the mitigation measures for the negative impacts and enhancement measures for the positive impacts.

By opting to upgrade the existing line from the current voltage level of 220kV to 330kV with its current towers structures as opposed to constructing a new line, minimizes the impacts that are normally associated with line transmission construction. By taking this option, environmental and social impacts are reduced immensely. There are no resettlement issues as there are no people living in the power line is will be relocated. The identified impacts of the project will be addressed by the mitigation measures recommended in this report.

To ensure implementation of the proposed mitigation, monitoring and positive impact enhancement aspects, it is recommended that the environmental costs totaling US\$ 327,500.00 should be included in the total project cost. Further, the actual implementation of the various environmental aspects recommended in this report will be guided by the Environmental Management Plans for the different project components and will be strictly monitored by the Environment and Social Affairs of ZESCO.

It is further recommended that this EIA report, the Environmental Council of Zambia Decision letter and all associated Environmental Management Plans shall form part of the tender documents and all subsequent contracts related to the implementation and supervision of the Transmission line Project.

Taking into account the available options and all the identified negative and positive environmental impacts of the proposed project and the recommended mitigation measures for the identified negative impacts and enhancement measures for positive impacts, the development of the Kafue Town-Muzuma-Livingstone upgrade is recommended for implementation. The project will boost power supply in the country in the face of anticipated power deficit in the near future.



10.0 REFERENCES

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11.0 APPENDICES

**11.1 Appendix 1 List of People Consulted During the Study**

NO.	NAME	POSTION	DISTRICT
1	Mr. E. Tembo	Assistant Superintendent- ZESCO Ltd	Kafue substation
2	Mr. Chilembo	Acting Senior Agricultural Officer	Kafue
3	Ms. M. Mbozi	District Forestry Officer	Mazabuka
4	Mr. Busiku	Block Supervisor Agriculturalist	Mazabuka
5	Ms.S. Malambo	Extension assistant- Forest Department	Mazabuka
6	Mr. J. Mukamba	Coopperative Inspector- Agriculture	Mazabuka
7	Mr. B. Mhone	Agriculture Assistant- Mogoye Block	Mazabuka
8	Mr. Ngoma	Area warden- ZAWA	Monze
9	Mr. M. Kaimbe	District Forestry Officer	Monze
10	Mr. Hanseluke	Chief Security Inspector- Muzuma substation	Choma
11	Mr. J. Choonga	Farmer	Choma
12	Mr. a .Muntanga	Post orderly Forestry	Choma
13	Mr. V. Chiiba	Principal Extension Officer- Forestry	Choma
14	Mr. Wakumelo	District Fisheries Officer	Choma
15	Mr. E. Mutanuka	Principal Fisheries Officer	Choma
16	Ms. L. Mwiinga	Research Technician- ZAWA	Livingstone
17	Mr.F. Wacata	Businessman/ Farmer	Livingstone
18	Mr.N. Muyumbwa	Acting Director South west Region	Livingstone
19	Mr. E. H. Koma	Chief Environmental Health Officer	Livingstone
20	Mr. A. Kwami	District Forestry Officer	Livingstone
21	Mr. G. Milumbe	Provincial Health Adminstrator	Livingstone
22	Mr. R. Mbewe	Head of Cultural Heritage, NHCC	Livingstone
23	Mr. F. H. Mungo	Provincial Education Officer	Livingstone
24	Mrs. M. Musela	Sales and Information Officer- ZNTB	Livingstone
25	Mr. S. Chilala	Headman/Chilala village	Choma
26	Mr. A. Chilala	Peasent farmer/ Chilala Village	Choma
27	Mr. C. Chilala	Peasent farmer/ Chilala Village	Choma
28	Ms. R. Chilala	Peasent farmer/ Chilala Village	Choma
29	Mr. J. Syamuka	Peasent farmer/Chifwepa	Choma



		Village	
30	Ms. H. Chilala	Peasant farmer/ Chilala Village	Choma
31	Mrs. S. Shonga	Peasant farmer/ Gamela Village	Choma
32	Ms. J. Shonga	Peasant farmer/ Gamela Village	Choma
33	Mr. F. Simasiku	Peasant farmer/ Ndele Village	Choma
34	Mr. F. Mushabati	Peasant farmer/ Ndele Village	Choma
35	Mrs. A. sibalela	Peasant farmer/ Ndele Village	Choma
36	Mr. S. Chikwanchi	Peasant farmer/ Ndele Village	Choma
37	Mr. Muyunda	Substation superintendent, ZESCO Ltd, Muzuma	Choma
38	Mr. E. Kandela	Trader/ Farmer/ Mukonde/Village	Choma
39	Mr. W. Mwewa	Substation superintendent	Kafue west
40	Mr. R. Mununka	Lines man, ZESCO Ltd	Kafue west
41	Mr. C. Kalwangi	Lines man, ZESCO Ltd	Kafue west
42	Mr. W. Chisala	Senior Electrician, ZESCO Ltd	Kafue
43	Mr. M. Chungu	Senior Electrician, ZESCO Ltd	Kafue
44	Mr. D. Phiri	Agricultural executive officer	Kafue
45	Mr. S. Malambo	Director of works	Kafue
46	Mr. H. Hichilema	Kafue city council Administrator	Kafue
47	Mr. I. chibale	Director of Planning Dept	Mazabuka
48	Mrs. A. Mukonko	Office Orderly	Mazabuka
49	Mr. O. Halubinga	Clerks of Works	Mazabuka
50	Mr. C. Matantabala	Engineering Department	Mazabuka
51	Mr. J. P. Phiri	Senior Procecutor	Mazabuka
52	Ms. E. Tembo	Water Affairs	Mazabuka
53	Mrs. Jenna conventry	Green land farm	Mazabuka
54	Mr. Munsaka	District Administrative Officer	Monze
55	Mr. A. Kabinda	Area Manager	Monze
56	Dr. J. Peter	Director, Monze Health	Monze
57	Mrs. Moonga	Nurse, Chikuni Health	Monze
58	Mrs. J. M. Chimbwati	Director of planning, council	Monze
59	Mr. Moya	Director of Works. Council	Monze
60	Mr. S. Kulundu	Acting deputy Director of Works	Monze
61	Mrs. M. Nkandela	Moonga village, Chief Singani	Monze



62	Mrs. J. M. Muchelema	Ngalema village	Choma
63	Mr. T. Gamela	Headman/Gamela village	Choma
64	Mr. C. Musaka	Headman/Gamela village	Choma
65	Mrs. G. Siamuyanga	Headman/Gamela village	Choma
66	Mrs. J. Musaka	Headman/Gamela village	Choma
67	Mrs. J. Muyamba	Headman/Gamela village	Choma
68	Mrs. L. machona	Community development Officer	Choma
69	Mr. E. Mutamika	Fisheries Department	Choma
70	Mr. R. Wakumelo	District Fisheries Officer	Choma
80	Ms. L. Chibola	Choobe Village, Chief Ufewuka	Monze
81	Mrs. C. Kachesa	Choobe Village	Monze
82	Mr. C. Shawa	Choobe Village	Monze
83	Mr. C. Chulu	Choobe Village	Monze
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11.2 Appendix 2 – Environmental Management Plan

ENVIRONMENTAL MANAGEMENT PLAN

FOR

THE KAFUE TOWN-MUZUMA-LIVINGSTONE LINE UPGRADE PROJECT

1.0 BACKGROUND

The Kafue Town – Muzuma - Victoria Falls 220 kV line upgrade project will involve upgrading the existing line segment between Kafue Town Substation to a 330kV power line into the new substation in Livingstone. The entire 341Km transmission line will be upgraded using the already existing towers and already acquired 50m wide way leave (acquired in the early 1970's).

The Kafue Town – Muzuma - Victoria Falls 220kV transmission line upgrade is one of the projects that are being implemented as one of the midterm measures intended to reduce the impact of power shortages in the country. It will also assist in providing an alternative route for power flows into the Southern African Region.

Arising from the environmental impact assessment studies on the project, it is a requirement that a sound environmental management plan is put in place to guide line contractors during project implementation. The environmental management plan (EMP) is important to assist in minimizing adverse impacts arising from project implementation.

This Environmental Management Plan (EMP) outlines the duties and responsibilities of the Client (ZESCO Limited) and the Contractor and or subcontractors with respect to environmental management and protection during project implementation. The requirements herein are based on the provisions of the national environmental law. The EMP also takes into consideration the established international environmental practices applicable on such projects.

The requirements herein and the costs of compliance are deemed to be included in the contract price and in the overall budget of the project. All parties on the project shall carry out the specified environmental protection measures in this EMP based on the provisions of the local environmental laws and following approval by the ZESCO Project management. However, if so instructed by the project management the Contractor shall implement additional mitigation measures whose costs shall be appropriately paid under applicable rates.

This EMP is mainly intended for use on the line contract. However, most elements in it shall be adapted for use by the substation contractor(s).

1.1 The Purpose of the EMP



The overall purpose of the EMP is to ensure environmental compliance during project implementation and to ensure that environmental impacts associated with the line and substation upgrades and construction of the new substation are mitigated.

The Environmental Impact Assessment provides information on the potential impacts identified, and mitigation measures to be undertaken. The EMP, therefore, seeks to give a comprehensive plan on how the proposed mitigation measures will be implemented during and after project implementation.

In this EMP, environmental management activities and responsibilities are clearly outlined to ensure successful implementation, monitoring and subsequent environmental audits during all project phases.

The project team will include an Environmental Coordinator (ECO) whose responsibility will be to ensure that mitigation measures are implemented.

The ECO will be on site on full time or part time basis to monitor the works. The ECO will report to the Project's Site Manager and participate in all project meetings and the day-to-day running of the project. The Site Manager and the ECO will be ZESCO employees. The ECO will be responsible for the organization and scheduling of awareness meetings for construction workers and the local community, environmental monitoring and audits for various environmental aspects.

Government Departments and institutions that may be contacted if and when necessary to ensure successful implementation of this EMP are;

- Environmental Council of Zambia
- Lands Department
- Department of Water Affairs
- Ministry of Local Government and Housing
- Department of Fisheries
- Department of Forestry
- Zambia Wildlife Authority
- Ministry of Tourism, Environment and Natural Resources
- National Heritage Conservation Commission
- Ministry of Education
- Ministry of Health
- Ministry of Mines and Mineral Development
- Ministry of Agriculture and Cooperatives
- Respective Local Authorities
- Local Chiefs and Headmen

1.2 Awareness Campaigns



The ECO shall be responsible for scheduling and organizing of the awareness campaigns for both construction workers and local people along the route corridor.

1.3 Monitoring

The ECO will be responsible for monitoring compliance to all the outlined mitigation measures in this EMP. The ECO will be responsible for coordination and monitoring programme for various environmental aspects.

The project monitoring will involve aspects of preventative, mitigation or potential impacts minimization measures during project implementation:

- site access permits/notices
- bush clearance
- camp and storage site selection and establishment
- soil erosion control measures
- noise and dust nuisance mitigation
- water pollution mitigation
- archaeological and cultural sites disturbance
- wildlife poaching
- general pollution
- waste management issues
- disruption of the socio-economic state in local communities
- employment issues from local communities.

2.0 COMPONENT OF THE ENVIRONMENTAL MANAGEMENT PLAN

2.1 Contractor's Code of Conduct

As the various works will be undertaken by a Contractor on behalf of ZESCO LIMITED, it is imperative that ZESCO ensures that the contractor will comply with all laid down environmental mitigation measures, through a well articulated code of conduct. Therefore, the Contractor shall prepare a draft code of conduct for the workforce for submission to ZESCO before commencement of work. The code of conduct shall be discussed and approved by the project management team before project implementation. This code of conduct shall form part of the work method statement for each project component.

2.2 Employment and Sub-contracting

2.2.1 Employment

The Contractor will be encouraged to employ from locals communities where the transmission line passes. The Contractor shall tighten controls on employment to ensure



that people from outside the area are not employed at the expense of locals, except in the case of skilled and or specialized workers who may not be available in the local areas. Recruitment of workers from the local communities should be done in close consultation with the local leadership such as Chiefs, Village headmen, Councilors and the Residence Development Committees.

2.2.2 Sub-Contracting

The Contractor shall endeavor to engage local Sub-contractors, particularly in areas not requiring specialist construction skills, such as:

- Bush clearing;
- Access road improvement and maintenance;
- Haulage of any locally available building materials such as sand;
- Watering of access roads for dust abatement;
- Re-instatement or rehabilitation and maintenance of disturbed areas;
- Construction and maintenance of any buildings required for site establishment;
- Catering
- Waste disposal;
- Security.

2.3 Environmental Aspects of Design

General Conditions of the **Contract** could indicate that the Contractor shall be responsible for the safety of all activities on the **Site**.

The following safety measures shall be followed:

- Use of the internal ZESCO Safety Rule book
- Obtaining permits and issuing of notices to access site;
- Tower-foot earthing for lightning and over voltage protection.
- Adherence to statutory electrical clearances.

2.4 General Guidelines for Construction

In general the Contractor shall conduct his activities so as to cause the least possible disturbance to existing amenities, whether natural or man-made, so as to comply with all relevant statutory requirements. The Contractor shall abide by the following general environmental guidelines during the course of undertaking the works.



The Contractor shall not establish or undertake any activities that, in the opinion of the ECO, are likely to permanently affect the scenic quality of the works area. Where required, the ECO may direct the Contractor to refrain from such activities or to take ameliorative actions to reduce the adverse effect of such activities on the scenic quality of the environment:

- Painting or marking on natural features such as trees and rocks shall not be permitted.
- No work shall be carried outside the defined area of the Works without the prior written approval from the Site Manager or ECO.
- The Contractor shall take all necessary action to ensure that water quality in nearby rivers and streams is not adversely affected.
- The effects of runoff and erosion within construction areas shall be minimized.
- To minimize air and noise pollution, contractors shall use only equipment in good condition, which shall be properly maintained.
- On-or off-site, workers shall not wantonly kill or injure any creatures except those (such as flies and mosquitoes) known to be vectors of disease.
- The Contractor's Health & Safety Officer and the ECO shall document accidents at a construction site. Safety rules and procedures shall be tightened in the light of that information to reduce the chances of recurrence.
- Contractors shall at all times exercise due care and diligence not to damage fences, roads, tracks, buildings, fields, pasture, hedges and trees. All damage shall be made good at first opportunity, at the Contractor's or ZESCO's cost depending on the type of damage.
- Disturbance or disruption of the daily lives of local communities and their livelihood, including noise and dust pollution, shall be minimized in as far as is practicable.
- The Contractor shall ensure that the construction site is maintained in a neat and tidy condition at all times.
- The Contractor shall employ as many locals as is practically possible for the execution of the Works. A register shall be kept of the employees, showing village, Chief and District.

The following specific environmental guidelines shall be observed and implemented by ZESCO Limited through the Contractor in mitigation of the potential environmental impacts in areas of activity, access roads, borrow areas, spoil disposal areas, labor camps and storage areas.

2.4.1 Temporary Works

- Use of existing facilities such as access roads and/or their improvement shall be preferred to the construction of new ones.
- Public access roads used by the Project shall be maintained in a trafficable, safe and minimum dust condition, at all times. Driving speeds shall be limited to appropriate speed limits on construction sites. Courtesy shall be extended to other road users with all construction traffic expected to give way to members of the public.



- A minimum of two toilets at temporary camps, and full ablution facilities for permanent camps shall be provided. The use of the bush for relieving oneself shall be strictly prohibited. Pit latrines at camps will be closed and sealed after completion of works.
- Camps and storage areas shall be located away from drainage courses and wetlands. Wherever possible, they will be sited within serviced areas.
- Camps and work-sites shall be kept clean and tidy.
- Fuel, lubricants and other chemicals shall be stored in above ground storage facilities such that the entire surface area can be visually inspected. Tanks shall be inspected daily and any leakage stopped immediately.
- Sumps surrounded by low bunds and floored with impermeable material shall be constructed beneath all oil storage tanks.
- Oil changes in machinery and equipment including vehicles shall take place only in depots (never in the field). Drip pans will be placed under the equipment throughout oil changes and lubrication.
- Construction workers are discouraged from wood cutting and fishing, and shall be dismissed for un-authorized hunting. Contractors and their workforce may use local supplies of wood, with moderation, if there is no local shortage; but they should purchase wood from the local people rather than just taking it freely.
- Demobilization from a site will include removal and safe disposal of all temporary structures and wastes. Stored top-soil shall be restored to soil which will be planted with indigenous grasses, where instructed by the ECO. No un-drained water will remain on site.

2.5 Protection of Vegetation

2.5.1 Bush Clearing in the line

General guidelines on bush clearing shall be provided for under – Construction Specification of this EMP, and way-leave clearance guidelines.

2.5.2 General Woodland Vegetation

The Contractor shall ensure that all work is undertaken in a manner that minimizes negative impact on vegetation, outside the immediate area of Works. The following shall apply with respect to the protection of areas of vegetation adjacent to the area of the Works:

- Vegetation clearance shall only take place within the 50m wide way-leave.
- No tree or shrub outside the Works area shall be felled, topped, cut or pruned, or otherwise interfered with, without the prior approval of the any team member of the ZESCO project management.
- No tree or shrub outside the area of Works shall be felled, topped, cut or pruned until it has been clearly designated for this purpose by the ECO.



- No tree or other combustibles outside the area of works shall be burned for any purpose.
- Where the Works involve clearing and ground excavation, top-soil and sub-soil shall be selectively removed, to facilitate reinstatement of sites and their subsequent natural rehabilitation.
- No open fires shall be permitted in the way-leave.
- Earth-moving equipment shall be thoroughly washed before bringing to site, this shall include and the washings caught in a sump, and incinerated to destroy adhering seeds and soil. Equipment brought from outside Zambia shall be sprayed with insecticide on arrival, to reduce the risk of introducing exotic pests to country.

2.5.3 Rare and endangered plant species

In the existing transmission line way-leave, vegetation disturbance occurs on a yearly basis during annual way-leave maintenance. However, if during project implementation a protected plant species is found, the ECO on the project shall be informed before proceeding with the works. The ECO, in consultation with appropriate authorities, will provide specific guidelines for removal and or transplanting of such plant species.

2.6 Wetland Areas

Wetlands are frequently nesting areas for reed nesting bird species and are natural habitats for a variety of animal, bird and plant species. Disturbance of some portions of the Kafue Wetland has not been avoided from the time the transmission line was constructed. However, the following construction guidelines shall apply:

- Construction work in this section of the line, where possible, will be restricted to the late dry season.
- Wetlands shall be traversed with approved equipment that avoid the development of quagmire conditions and subsurface compaction that could arise from the use of heavy machinery.

2.7 Protection of Fauna

The Kafue-Muzuma-Livingstone line traverses through areas some of which are private properties with cattle and game ranches. The Contractor shall therefore ensure that all work is undertaken in a manner that will minimize negative impacts on cattle and game. The following guidelines shall apply with respect to fauna management and protection:

- Under no circumstances shall any Contractor, subcontractor or project service provider be engaged in poaching activities.
- Appropriate permits shall be obtained to work in these restricted areas.



- The Contractor, his subcontractors or their employees shall not bring any domestic animals onto the site.
- The Contractor shall ensure that the site is kept clean and tidy and free from rubbish which would attract animal pest species.

2.8 Protection of archaeological and cultural heritage sites and materials

The existing 220kV line was constructed in the early 1970s during which no special surveys for archeological and cultural heritage sites were conducted. It therefore assumed that there are no such sites in the way-leave of the line. However, the following guidelines shall apply during project implementation:

- In carrying out the Works, the Contractor, subcontractors and their suppliers of materials shall comply with the provisions of Zambian law on protection of archeological and cultural heritage sites.
- The Contractor shall ensure that key members of his staff are familiar with archaeological and cultural heritage sites that could be found in the general project area.
- Should the Contractor expose any archaeological or cultural arte-facts during excavation, work shall cease immediately and the ECO shall be notified as soon as possible, who will liaise with relevant authorities for advice on how to handle the arte-fact.
- Under no circumstances shall archaeological arte-facts be removed from site, destroyed or interfered with by the Contractor, his employees, his subcontractors or his Sub-contractors' employees.

2.9 Protection of infrastructure and private property

The following guidelines shall apply in order to mitigate the impacts of project implementation on public infrastructure and private property in the project area:

2.9.1 Roads and Road Transport

In carrying out construction of the works, the Contractor, Sub-contractors and their suppliers of materials shall comply with the provisions of the relevant laws of Zambia.

Where designated access routes are indicated in the Contract, the Contractor shall use no other routes without the approval of the ECO. Appropriate vehicles including medium-sized vehicles, shall be used in transporting labour and materials in order to minimize noise and general wear of public road sections that the line traverses.

Where black cotton soils are prevalent, heavy construction vehicles and plant should not be used on access roads during the rainy season, unless the access roads are



upgraded by laying suitable gravel and installing drainage to prevent the occurrence of quagmire conditions.

Maintenance of Roads;

- All public and private roads that will be used by the Contractor, Sub-contractors or suppliers for the construction of the Works shall be kept trafficable and free of excessive dirt and mud arising from the Works.
- Where existing gravel roads will be used frequently by the contractor as access roads for transporting labour, plant and materials, the Contractor shall contribute towards the maintenance or upgrading of the roads in any one of the following ways:
 - Routine maintenance, consisting of gravelling and dust control by watering. The level of contribution, specific programme and equipment to be used shall be agreed with the project management.
 - Negotiate a road maintenance/users “fee”, payable to the relevant authorities in lieu of road maintenance described above.
- Any area of public road, which is closed because of the Works, shall not be reopened until appropriate safety and traffic management measures have been completed and until the ECO in liaison with the local office of the Road Transport and safety Agency confirms that it is in a suitable condition for use by the public.
- The Contractor shall periodically water all gravel roads in the proximity of dwellings, where these are heavily used by construction traffic, to minimize dust emission.

Third Party Access

- The Contractor shall, at all times, allow access for the authorized representatives of service providers and allow emergency operations to be carried out on any utility or service facilities within the site.
- The Contractor shall not use public or private rights of way for depositing or storing plant or materials, and shall maintain those parts of the public or private right of way not temporarily occupied by the Works in a clean, passable and safe condition at all times.
- The Contractor shall execute the Works in such a manner that safe access, to all properties is maintained all the times. Methods of construction and programming of the Works shall be such that vehicular access to properties affected by the Works is not restricted. Normal access shall be reinstated immediately after completion of the Works.
- The Contractor, his employees, Sub-contractors and their employees, in all instances shall exercise utmost driving control and care.

Traffic Safety and Management



- Where work is carried out on or adjacent to a trafficked highway, the Contractor shall ensure that personnel shall, at all times wear appropriate and reflective garments.
- All proposals, details, execution, maintenance, removal and necessary reinstatement associated with safety and management, temporary decking, road crossing for transmission lines, and other structures on public roads, shall be subject to the approval of the Roads Transport and Safety Agency. The Contractor shall apply all information required for consultation with appropriate authorities, including the Local Authority and Police.
- All traffic safety and management measures necessitated by the Works shall be fully operational before the Contractor commences work which affects a highway.
- The Contractor shall provide suitable entry and exit signs, at points of access to and from the site, for vehicles and plant engaged on the Works.
- The Contractor shall make all necessary arrangements including notices to relevant authorities for the provision, erection, maintenance, repositioning, covering and uncovering and final removal of all the traffic signs as the progress of the Works requires.

2.9.2 Private, community and institutional properties

The transmission line traverses through several properties hence the following guidelines shall apply to mitigate the impacts of project implementation on such properties:

- All works on the transmission line where infrastructure such as livestock fences and gates are found shall be carried out after obtaining appropriate permits or after issuing adequate and appropriate notices to affected people.
- Where feasible, the Contractor shall confine construction work through such properties during periods when less disturbance would arise.
- Work through crop fields shall, if possible, be carried out during the agricultural off-season.
- Where fences and or gates are breached for project implementation purposes, the Contractor shall reinstate them immediately after completion of construction. Where required, alternative access shall be provided.
- The Contractor shall ensure that access to services, fields, water supply by private property owners is not disrupted.
- Any reasonable conditions demanded by land owners shall be respected and complied with, in as far as it is practicable.
- Where any of the above cannot be avoided or is infringed upon, fair compensation shall be negotiated and paid by ZESCO according to the ZESCO's Compensation Policy and resettlement policy framework.

2.10 Erosion Protection

The transmission line crosses some slopes that may require stabilization. Appropriate slope stabilization work methods shall be developed and approved by the project



management team before implementation. The contractors shall also submit erosion protection measures where the transmission line crosses streams and drainage paths.

For sites prone to land slip erosion, grouted stone pitching with weep holes for drainage shall be used. The Project Site Manager, ECO and the Contractor shall agree beforehand areas where erosion protection is required.

2.11 Waste management

The contractor shall prepare a waste management method statement that will be part of the camp site selection criteria. The statement will be subject to approval of the project team. For instance, all waste shall be initially placed in bins provided by the Contractor for such purposes, and subsequently disposed of in approved refuse dumps. No burning of wastes shall be permitted.

All waste management including hazardous wastes shall be in accordance with the provisions of the local waste management regulations. For instance, materials soiled with hazardous wastes and non – biodegradable matters, shall not be disposed of on the site. All such waste shall be stored in an approved manner, on site, and removed at regular intervals to offsite waste disposal facilities designed to handle such hazardous waste as required by law.

2.12 Water Pollution Control

The Contractor shall design, construct, maintain and operate suitable temporary pollution control facilities necessary to prevent the discharge of polluting matter or visible suspended materials into private or communal properties, rivers, streams or existing drainage systems.

All waste water from camp sites shall be discharged at locations or appropriate facilities such as septic tanks or soak-aways so as not to cause pollution or nuisance to communities. In addition, the following shall be followed:

- disposal of waste oil from workshops and other areas shall not cause pollution. Oil separators shall be constructed where necessary;
- the burning of plastic materials shall not be permitted and all such materials shall be disposed of in a manner acceptable to the ECO;
- soil contaminated by cement or other chemicals shall be removed and placed in approved disposal areas, identified by the Contractor;
- before any work is carried out in any area of the site, all specified or directed or approved pollution control measures shall be put in place and operational.
- All wastewater effluent from camp sites or construction sites that shall be of acceptable standard based on the local regulations.

2.13 Fuel Storage and workshop areas



- Fuel dispensing areas and workshop areas for machinery shall be provided with concrete hard standing surfaces draining to oil separators.
- Drainage into watercourses from fuel storage and machinery maintenance areas shall not be permitted and or treated to remove oil and/or fuel
- Soil contaminated by fuel and oil leakage shall be removed and disposed of off Site in an approved manner.

2.14 Ablution and toilet facilities

- The contractor's camp sites shall be provided with approved and adequate ablution and toilet facilities.
- Pit latrines and septic tank soak- away shall be sighted a minimum distance of 50m down – slope from wells, boreholes and springs. Distances should be greater in sandy soils, or fissured material through which water can easily percolate.
- Relieving oneself in the bush or bathing and washing utensils, vehicles and equipment in rivers and streams shall be strictly forbidden.

2.15 Groundwater

The contractor's working methods and systems shall be designed so as not to significantly affect groundwater around work areas. Removal of ground water shall not cause damage to the Works, or to properties of third parties, and shall not cause nuisance. For instance;

- Lowering of natural ground water table for use shall be avoided or done using approved methods.

2.16 Air Pollution Control

The Contractor shall take measures, as necessary, to reduce the emission of particulate matter from excavation, road transport, rock crushing, material sieving, borrow areas, and other related construction activities. The following measures should be put in place;

- Equipment and vehicles that exhibit excessive emissions of exhaust gas due to poor engine adjustment or other inefficient operating conditions shall be serviced or not be used.
- Burning of cleared trees and brush, combustible materials, construction materials and rubbish shall only be permitted when the ECO considers atmospheric conditions favourable.

2.17 Noise Pollution Control

Construction activities such as blasting, operation of plant and equipment, and heavy vehicles will result in noise nuisance to residents and animals in the project area. The following guidelines shall be followed to restrict noise levels to acceptable limits.

- Restriction on Working Hours; the Contractor shall restrict any of his operations, which result in undue noise disturbance to nearby communities and dwellings to



between the hours of 06.00 hrs and 18.00 hrs, unless otherwise approved by the project team.

- Plant and Equipment; As far as practicable, the Contractor shall bring to site, and employ on the works, only environmentally acceptable and appropriately operating plant and equipment, compatible with the safe and efficient construction of the works.
- All plant shall be properly maintained and regularly serviced to maintain efficiency and subsequently reduce noise levels.
- If and where there will be need to use explosives, the contractor shall follow and observe all relevant laws and regulations on explosives procurement, transportation, storage and use. The contractor shall also prepare a method statement on explosives use with details on the locations, time, safety measures, warning signs and other preparatory procedures. The method statement shall be approved by the project team.

2.18 Stockpiles and Spoil Dumps

Where no longer required, stockpiles and spoil dumps shall be shaped and re-vegetated to blend with the local environment as far as is practicable.

Drainage shall be provided to control base water flow such that migration of fines is kept within the stockpile or dump.

Where possible, old borrow pits shall be used for disposal sites in preference to undisturbed sites.

2.19 Borrow Areas and Quarry Sites

The contractor is expected to use materials from existing borrow pits and quarry sites within the project areas.. Outsourcing of laterite and sand will reduce on the impacts associated with borrow pit excavations and stone crushing for construction purposes.

2.20 Labour Camps

In establishing labour camps, the following general guidelines shall apply:

- Camps shall be sited on natural level ground and on deep soil suited to the construction of ablution and toilet facilities.
- Sites shall not impinge on scenic undisturbed areas or other areas used by the public, and shall be screened from major roads.
- Drainage facilities shall be installed in and around the site to prevent storm water from flooding the site.
- Cutting of indigenous trees for firewood for cooking and warming shall be restricted to dry wood. The Contractor shall supply the labour force with adequate firewood from other sources if dry wood is not available in the vicinity of the camp
- Grass and forest fires shall be prevented by sound control of cooking and warming fires.



- Proper security measures shall be employed to ensure that public property in the vicinity of the site is not pilfered or damaged by the labour force.
- The Contractor shall provide own medical facilities so as to avoid over-stretching of existing local medical facilities.
- Adequate accommodation and ablution facilities shall be provided to avoid overcrowding.
- All non-migratory labour camps shall be fenced and gated. Access into and out of the camps shall ensure human health and safety, at all times.
- On demobilisation, the area shall be made good and re-vegetated in accordance with the provisions in these specifications.

2.21 Health and safety

The contractor shall be obliged to conduct the project activities in such a way that spread of communicable disease spread is minimised and that safety measures are put in place. The following guidelines shall apply during project implementation;

- The contractor shall provide the necessary medical support medical on the project
- Health awareness programmes shall be conducted by the respective local Ministry of Health workers in liaison with the ZESCO project team and the contractor(s).
- Where practicable, and without prejudice to the Contractor's other contractual obligations, preferential employment shall be given to members of the local community through which the work front or fronts will be located during project implementation. This policy will minimise migrant labour and the spread of communicable diseases.
- The contractor shall provide malaria prevention medicines since malaria is prevalent.
- In the case of serious injuries on site, traffic accidents etc., the Contractor shall formulate a plan to deal with such emergencies, prior to possession of site, for approval by the ECO.
- Protective clothing shall be issued to categories of the workforce who require such clothing, free of charge.

2.22 Training of Employees

The Contractor in collaboration with the ECO and relevant authorities shall arrange that all employees and those of his sub-contractors are trained to ensure the following:

- A basic understanding of the key environmental features and security issues on the project
- Thorough familiarity with the environmental protection requirements as they apply to the works.
- Awareness of any other environmental matters, which are deemed to be necessary by the ECO (Refer to the EIA on the awareness programmes for Contractor's workers).
- Basic First Aid



2.23 Respect for cultural values, beliefs and property rights

Sacred sites may exist in the project area. Even if these sites do not fall within the transmission line impact zone, there is always a risk that members of the Contractor's workforce might stray into them and desecrate the shrines therein. This could create unnecessary friction between the project and the local communities.

With respect to Contractor/community relations, the following guidelines and rules shall apply:

- The Contractor and his Sub-contractors shall conduct their operations in a manner that will not upset the socio-religion order of communities in the project area. Local traditional beliefs shall be respected.
- The ECO shall be responsible to ensure that an arte fact chance find procedure is followed in an event that any cultural or artefacts are are found during construction work.
- In the interest of harmony and good public relations, the Contractor is strongly encouraged to develop rapport with local chiefs and traditional leaders through regular consultations and communications.
- The Contractor or his sub-contractors are prohibited from entering places considered to be sacred.

2.24 Compensation

The existing 220kV transmission line way-leave was acquired over 30years ago under some old legislation. However, in order to mitigate any loss or damage to property or land arising from project implementation, a separate compensation policy framework has been developed. However, any damage that may occur as a result of non-compliance with the provisions of this EMP shall be made good by the Contractor at his own expense with guidance from the project management team. All claims of accidental or intentional damage to private property such as livestock fencing, gates etc, by the Contractor shall be made good and or repaired by the Contractor within a reasonable period of time.

All compensation claims related to land acquisition for camp sites and access during project implementation shall be the responsibility of the Contractor with guidance from the project team.

2.25 Rehabilitation of Works Areas

The Contractor shall rehabilitate disturbed areas of both Permanent and Temporary Works, including but not limited to access areas, material sites, Contractor's works and accommodation areas (including the areas designated for the Employer's use) and the areas required for the construction of temporary access roads, as well as such other areas as may be specified or instructed by the ECO;

- Implement erosion protection measures where this may be deemed necessary
- Heavily compacted soils shall be lightly ripped to encourage re-vegetation in areas not prone to erosion



- Rehabilitation measures shall be at the latest carried out immediately following completion of construction of the permanent works
- Rehabilitation measures may include vegetation planting of grass or shrubs as the case may be.

3.0 DOCUMENT PROVISIONS

- The Contractor is expected to incorporate as many aspects of the provisions of the EMP as possible in all the method statements.
- The EMP shall form part of the contract documents
- The Contractor's environmental, health and safety policy shall include relevant aspects from this EMP.



11.3 Appendix 3: Terms of Reference for the EIA for the proposed project

**ENVIRONMENTAL IMPACT ASSESSMENT FOR THE
KAFUE TOWN - MUZUMA – VICTORIA FALLS 220KV –
330KV UPGRADE PROJECT**

**TERMS OF REFERENCE FOR UNDERTAKING AND
PREPARATION OF THE ENVIRONMENTAL IMPACT
ASSESSMENT STUDY FOR THE KAFUE TOWN -MUZUMA –
VICTORIA FALLS 220KV – 330KV UPGRADE PROJECT**

PREPARED BY ZESCO LIMITED,

ENVIRONMENT AND SOCIAL AFFAIRS UNIT



TERMS OF REFERENCE FOR KAFUE TOWN-MUZUMA-VICTORIA FALLS 220KV UPGRADE PROJECT

1.0 INTRODUCTION

ZESCO is intending to undertake the upgrading of the Kafue Town-Muzuma-Victoria Falls 220kV transmission line to 330kV from Kafue town to the proposed Livingstone substation via Muzuma. The purpose of the upgrade is to increase the power transfer capacity of the line.

The 220kV power transmission line upgrade will require a comprehensive Environmental Impact Assessment (EIA) study in accordance with the Environmental Pollution and Protection Control Act of 1990, statutory instrument No. 28 of 1997- The Environmental Impact Assessment Regulations. An EIA has to be done to facilitate commencement of the implementation of this important project.

The Terms of Reference presents the first phase in undertaking the EIA study with the main purpose of providing a guide for undertaking and preparation of an EIA for the proposed Kafue Town- Muzuma-Victoria Falls 220kV upgrade project.

The Terms of Reference contain the following information; a brief description of the proposed project, scope and intent of the EIA, a detailed description of the baseline information and the likely impacts which may arise from the proposed development.

2.0 BRIEF DESCRIPTION OF THE PROPOSED PROJECT

The proposed project designated as the Kafue town-Muzuma-Victoria falls transmission power line upgrade will originate from Kafue west substation to the proposed Livingstone substation via Muzuma. The power line will be upgraded from 220 kV to a 330 kV line with a Way-leave of 50meters (25m on either side of the power line).

3.0 INTENT AND SCOPE OF THE EIA

3.1 INTENT

The intent of preparing an EIA for this project will be;

- To describe the Kafue town-Muzuma-Victoria falls project and characterize the environment in which the project will be.
- Provide a description of the regulatory framework within which the proposed project will be planned, built and operated
- Identify potential bio-physical, social – economic and cultural effects related to the proposed project.
- Describe the scientific analysis of ecosystem effects, local knowledge and the experience of locals in the project area and other sectors of the public that are to be used by the study team in the assessment of the environmental effects.
- Describe how the analysis of potential effects to valued ecosystem components (VEC's) contributed to judging the significance of the effects on



the well being of the environment and the communities within the area affected by the project.

- Provide a summary of regional, provincial or national objectives, standards guidelines and relevant land and resource related agreements which are used in the evaluation of the significance of the environmental effects;
- Describe the consideration given to comments received from the public during the environmental assessment; and
- Propose mechanisms for follow-up to identify and manage the effects of the project and to confirm the effectiveness of mitigation measures employed.

3.2 SCOPE

3.2.1 The project:

The environmental assessment for the Kafue town-Muzuma-Victoria falls 220KV transmission line upgrade shall include consideration of the environmental effects associated with upgrading of the power line including any required infrastructure development. The main project components will include:

- Expansion works at Kafue town substation and Muzuma Substation
- Construction of a new substation in Livingstone
- Changing of Conductors
- Changing of insulators

The assessment must consider the purpose of the project and alternative means of carrying out the project that are technically and economically feasible.

The Environmental Assessment:

The scope of the environmental assessment shall include examination of:

Potential changes to the environment that may result from the upgrading of the Kafue town – Muzuma - Victoria Falls 220KV transmission line, including consideration of effects to:

- Land, water and air – including all layers of the atmosphere;
- Aquatic environment
- The biological environment, including terrestrial and aquatic ecosystems – all organic and inorganic matter and living organisms;
- Present and planned resource use, including land and water; and
- Human health, socio-economic and cultural conditions, physical and cultural heritage, the current use of lands and resources for traditional purposes, or any structure, site or thing that is of historical, archaeological, paleontological or architectural significance that will be affected by any changes to the environment caused by the project;

The significance of the environmental effects;

- The implications of the Kafue town – Muzuma – Victoria Falls project in terms of land and resource-related agreements;



- The environmental effects of potential malfunctions or accidents that may occur in connection with the project;
- Environmental and social effects on the existing way-leave and land use activities
- The environmental effects of any alternative means of carrying out the project that will be considered as part of the assessment;
- Cumulative environmental effects of the project that are likely to result from the project in combination with other projects or activities that has been or will be carried out;
- The effects of the influx of workers, equipment and materials on residents, land and resources of the area;
- The technically and economically feasible measures that would mitigate any significant adverse environmental effects of the project;
- The adequacy of measures proposed to mitigate adverse environmental effects of the project and to compensate for residual adverse effects, where appropriate;
- Any change to the project that may be caused by the environment;
- The need for, and requirements of any follow-up programme in respect of the project; and
- The capacity of renewable resources, if any that are likely to be significantly affected by the project.

The study route, i.e. the geographic scope of the investigations, shall include those local areas directly impacted by the construction of the transmission line, the uprating activities of the old line and the extensions to the existing substations and also the zones within which there may be environmental effects that are regional or global in their nature.

4.0 REGULATORY FRAMEWORK

The Environmental Impact Assessment shall identify the legislation, policies, necessary approvals, land and resource related agreements and current planning initiatives to the review of the project. The report shall discuss the primary focus of each regulatory or policy requirement, such as resource allocation, environmental protection, land-use designation or development control.

5.0 PUBLIC CONSULTATION AND INVOLVEMENT

Throughout the EIA process and during construction there will be public consultation and involvement of the public. Generally, the public shall include but not limited to: local residents; community groups; environmental groups; the private sector; local governments; and other interested parties. Public involvement shall be included in the Environmental Impact Assessment (EIA) and the results of the public's input reported and evaluated.

The EIA shall describe the proponents' community consultation program that will have been undertaken with respect to the project, including the following:



The role of community contacts in the consultation program; the use of any communication tools employed to provide information to other communities, including newsletters, television broadcasts and briefing documents;

The TOR's also plan for on-going consultations with the affected public even after completion of the environmental assessment.

The environmental impact assessment shall describe how concerns and issues raised by the public were incorporated into the development of the project including its design, impact, mitigation and monitoring. Any unresolved issues that were raised by the stakeholders during the assessment process shall be discussed. In addition, efforts made to involve organizations and persons residing beyond the project area in issue identification and problem resolution shall be documented and evaluated in the EIA.

6.0 PROJECT DESCRIPTION

The environmental impact assessment shall provide an overall description of the upgrading of the power transmission line. The description shall mainly be based on the various work components that are part of the upgrading of the power line.

6.1 PROJECT ALTERNATIVE AND SITE SELECTION

The environmental impact assessment shall include a discussion of the alternative means of carrying out the project that were considered technically and economically feasible. A discussion of the potential environmental effects that were considered relevant to any such alternative means shall also be included. Consideration of alternative means for achieving the goals of the project, for the purpose of the environmental impact assessment, will include discussion of other processes that could have been implemented or another alternative that could have been embarked on to achieve a similar end result. The purpose of and the rationale for upgrading of the line shall be presented.

6.2 OVERVIEW OF THE KAFUE TOWN- MUZUMA – VICTORIA FALLS 330KV TRANSMISSION LINE

The environmental impact Assessment shall provide an overview of the Kafue Town- Muzuma –Victoria falls transmission line upgrade Project, including a general description of the upgrade, operation and maintenance of the facilities, and the final disposition of all components of the project. Included in this overview shall be the designed location of the towers on a route development plan, phasing and sequencing of the various undertakings associated with the components, a description of activities relating to the project that have been undertaken to date, and a description of how the developer has incorporated consideration of traditional ecological knowledge in the project's design.

6.2.1 Site preparation



The Environmental Impact Assessment shall describe all undertakings associated with preparing for the upgrade along the selected route. Detailed descriptions of timing and the methods associated with the various undertakings that were and are required including surveying, clearing, test drilling, and establishing dump and borrow areas, setting up camps and work areas, and the development of the infrastructure requirements to access and service the selected route. This will include providing:

- topographical maps of suitable scale showing the location of the proposed generating station, related access road, work camp, borrow and disposal sites, power source and utility corridors with inclusion of the local topography, watercourses, wetlands and lakes; and
- a description of the extent of clearing, excavation, quarrying and earthworks required to prepare for, identification of borrow sites for construction materials such as sand, gravel, clay and stone, and the proposal for removal of waste materials including transportation methods. This applies to the new portion of the line and the substation works.

6.2.2 Construction

The environmental impact assessment shall describe all elements of the upgrading of the proposed Kafue town – Muzuma - Victoria Falls 220kV transmission line project. Detailed descriptions of timing and the methods proposed for the various undertakings related to the upgrading of the transmission power line and related facilities shall be required including the following:

- plans and descriptions of any existing works, temporary works including work areas, and the proposed permanent facilities like buildings and infrastructure.
- a description of the proposed construction methods that could have an effect on the environment such as those requiring large scale clearing, grading or earth removal and disposal, including a discussion of possible alternative construction methods;
- an estimate of the size and composition of the workforce required during different times of construction;
- a description of measures that will be taken to protect the health and safety of workers and the general public in and around the construction areas;
- a description of the living accommodations and servicing required for camps provided for the construction workers, including water supply (location of source and intake), and waste disposal;
- an analysis of the need for a construction-phase, waste disposal ground, and the specific site requirements, including access;
- a description of the character and volumes of waste streams generated during the construction phase of the project and how each waste stream would be managed, consistent with best industry practices, with specific references to waste oil and other potentially hazardous or recyclable material;
- a description of the proposed environmental surveillance and monitoring proposed during construction along with proposed contingency plans that consider the effects associated with serious malfunctions or accidents;



- a description of the proposed construction schedule including sequencing of the various undertakings; and.
- subsequent removal of camp facilities and clean up of construction infrastructure.

6.2.3 Operation and Maintenance

The environmental impact assessment shall describe how the transmission project would be operated and maintained.

The environmental impact assessment shall:

- describe waste disposal practices and long-term facility recycling practices in-place during the operation of the project along with the operation of any waste disposal facilities planned to accommodate the project;
- provide a description of the progressive decommissioning practices that will occur during the operation of the project, with specific reference to infrastructure that would no longer be required after the construction phase; and
- describe the size and composition of the proposed labour force involved in the operation and maintenance of the transmission line, along with a description of measures that will be taken to protect the health and safety of workers and the general public along the proposed project route.

6.2.4 Final Disposition

The Environmental Impact Assessment shall provide a general description of plans for decommissioning the proposed transmission line at the end of its operational life.

7.0 DESCRIPTION OF THE EXISTING ENVIRONMENT

The Environmental Impact Assessment shall describe the existing environmental setting for the proposed project. This will include a broad overview of the local area and the zones within which there may be environmental effects that are regional or global in their nature. This description is intended to provide a context for a detailed understanding of the potential effects of the project. A description of any deficiencies or limitations in the existing environmental database shall be reported.

The Environmental Impact Assessment shall provide a discussion of the rationale for the determinations taken regarding the spatial and temporal boundaries chosen for the study areas used for the assessment.

7.1 PHYSICAL ENVIRONMENT



The physical environment on the route refers to the natural environment associated with the upgrading of the Kafue town-Muzuma-Victoria falls 220kv transmission line. The physical environment part in the EIA then shall include the following;

- Geology
- Topography
- Soils
- Climate
- Hydrology
- Wetlands
- Air Quality
- Noise

7.2 BIOLOGICAL ENVIRONMENT

The Environmental Impact Assessment shall describe the existing biological resources including the flora and fauna of the area. The Environmental Impact Assessment shall describe;

7.2.1 Fauna

- Mammals
- Reptiles
- Birds
- Fish

7.2.2 Flora

- Woody plants
- Understorey plants
- Protected areas; these include National parks and forest reserves.

7.3 SOCIO ECONOMIC ENVIRONMENT

- Settlement patterns and Traditional Authority
- Population
- Local Economy
- Land Tenure
- Land Use
- Agriculture
- Planned development activities
- Employment
- Goods and Services
- Recreation
- Public Health
- Water Resources and Sanitation



- Education
- Transport
- Communication
- Industries
- Minerals/ Mining
- Tourism

7.4 CULTURAL ENVIRONMENT

Archeological/Heritage Resources

- Cultural properties

8.0 ENVIRONMENTAL & SOCIO-ECONOMIC EFFECTS & MITIGATION

The environmental impact assessment shall provide information on all environmental effects associated with a power line transmission project. Both positive and adverse environmental effects shall be described. The following criteria will be used to evaluate the significance of adverse effects:

- nature of the effect;
- magnitude of the impact;
- duration of the impact;
- frequency of the impact;
- reversibility of the impact;
- temporal boundaries (short or long term);
- spatial boundaries (project site, local area or regional); and
- ecological context (sensitivity of valued ecosystem components (VEC) to environmental disturbance).

The following criteria will be used to determine the likelihood of significance of the effects:

- probability of occurrence; and
- scientific uncertainty

The environmental and socio-economic effects and associated mitigation shall relate to each phase of the project including site preparation, upgrading and post upgrade, operation and maintenance, and eventual decommissioning and shall assess all components of the environment in the context of section “DESCRIPTION OF THE EXISTING ENVIRONMENT” of this document. The assessment shall consider scientific analysis of ecosystem effects, local knowledge and available experience in determining the significance of potential effects. Mitigation and habitat enhancement measures to manage or avoid adverse effects shall be described for these components and for each undertaking in relation to the project.

Cumulative effects assessment (CEA) shall form an integral part of the environmental and socio-economic assessment. The cumulative effects assessment shall look at all effects that are likely to result from the project when they are anticipated to occur in combination with other projects or activities that have been, or will be carried out.



All assessment conclusions shall be supported by technical information based on experience elsewhere as well as traditional ecological and local knowledge. Any deficiencies in the information about potential effects shall be clearly noted and addressed as stated in section “ENVIRONMENTAL MONITORING” of this document.

9.0 RESIDUAL EFFECTS

The environmental impact assessment shall describe the nature and extent of any residual environmental effects of the project, and include a characterization as to whether residual environmental effects are significant or insignificant, and the rationale for such characterization. It shall provide a detailed plan for responding to any known or predicted residual effects, and provide a procedure for identifying and responding to effects that were not predicted or foreseen.

10.0 ENVIRONMENTAL MONITORING

The environmental impact assessment shall provide a detailed description of the proposed monitoring activities of effects of the project on the physical, biological, socio-economic and cultural environments arising from the site preparation, construction, operation, and eventual decommissioning of the power transmission project. It shall describe the equipment to be used, the parameters to be measured, the methodology and frequency of measurement and the mechanism for reporting results of proposed monitoring of the environmental conditions affected by the project. The design of the environmental monitoring proposal and its implementation shall incorporate scientific, ecological, and local knowledge.

The environmental impact assessment shall describe how the proposed monitoring activities will help to verify and manage environmental effects and confirm the performance of mitigation and habitat enhancement measures to be employed.

If regulatory approval for the project is provided, and prior to upgrade, an Environmental Management Plan (EMP) shall be developed. The EMP will be designed to commit the proponent to a long term monitoring program, including accountability and reporting, that would encompass both the construction and operational phases of the project in order to confirm predictions of effects and to determine whether unexpected effects are occurring. The EMP shall be developed to accomplish the following goals:

- to facilitate the mitigation of environmental effects throughout the full-life cycle of the project by providing field construction and operating personnel with clear instructions on the mitigation measures to be implemented and on the appropriate lines of communication and means of reporting to be followed;
- to incorporate issues and concerns identified, including protocols put in place.
- to identify modifications to construction methods or schedules, summarize environmental sensitivities and mitigation actions, list emergency response plans and reporting protocols, describe a closure plan for aggregate quarries, including



mitigation of potential hazards to public safety and mitigation to address land reclamation concerns;

- to provide specific information on waste management practices to be utilized during the construction phase of the project, including consideration of all liquid and solid wastes generated; and
- to monitor construction practices to ensure that the work proceeds in accordance with the EMP

11.0 SOURCES OF INFORMATION

All assessment conclusions shall be backed up by credible technical information and traditional ecological and local knowledge. The environmental impact assessment shall describe the primary sources of information used to conduct the environmental assessment of the proposed project. This information shall include:

- technical studies of similar facilities and processes which are operating elsewhere;
- original studies performed by qualified engineers or scientists commissioned by the proponent specific to the power transmission line project;
- identification of facility design documents prepared by qualified engineers as they become available;
- scientific reports and papers on topics relevant to the power transmission project; and
- scientific, ecological and local knowledge.

Credible analysis and documentation shall support all conclusions of ‘no or insignificant effect’.

12.0 REPORT FORMAT

The Environmental Impact Assessment for the Kafue town – Muzuma - Victoria Falls power transmission project shall include:

- An executive summary
- Introduction
- Need for proposed action
- Regulatory framework
- Project description
- Project construction activities
- Description of present environment (Physical, Biological, Socio-economic, and Cultural)
- Potential impacts of the proposed project
- Mitigation measures
- Environmental monitoring and follow up programmes
- Environmental mitigation budget
- References
- Appendices of important field data and public consultation supporting the assessment



In addition to the above, the information in the environmental impact assessment shall maximize the use of maps, charts, diagrams and photographs for presentation. To the extent possible, maps and diagrams shall be presented at a common scale, appropriate to represent the level of detail considered, and where possible, allowing for direct overlay for ease of reference. Specifically, maps indicating zones of effect on land and water use and habitat areas shall be on maps of a common scale.

The report shall as much as possible follow the way the information requirement is outlined in these TORs.

13.0 THE STUDY TEAM

The EIA study team for the Kafue town – Muzuma - Victoria Falls upgrade project shall comprise the following

Name & Qualification	Professional / Title	Position on the Team
Elenestina M. Mwelwa (Mrs.): BA, MSc.	Senior Manager - ESU	Team Leader
Mellon H. Chinjila: Bsc, MSc.	Chief Environmental Scientist	Project Coordinator
Flaviour S. Chanda : (Mrs.) BA, MA	Environmental Information Specialist	Forestry, Wildlife and Environmental
Kandi Shikabi: BA	Social Scientist	Socio-economist
Bonje M. Michelo (Mrs.) BSc, MSc	Senior Environmental Scientist	Hydrologist
Lwanda K. Kahongo (Mrs.) BSc. Forestry	Senior Ecologist	Ecology/Biological
Arnold Habeenzu B.Eng	Transmission Engineer/Planning& Power System Design	Site Engineer
Mwalimu Silwembe: B. Eng (Civil), M.Eng	Civil Engineer	Civil Engineer
Kelvin Mutunga: Dip. (Land Surveying)	Surveyor	Surveyor
Chetwaile Nyendwa Dip. (Land & Mine Surveying)	Wayleave Officer	Wayleave land acquisition
Anthony Mando Dip (Fisheries Science)	Environmental Technologist	Aquaculture and Water quality
Cholwe H. Chanda (Mrs.) Dip (Fisheries Sciences)	Environmental Technologist	Physical Environment



11.4 Appendix 4: Checklist of Some of the Common Plant Species in the Study Area

FAMILY NAME	SCIENTIFIC NAME	LOCAL NAME
Caesalpiniaceae	<i>Brachystegia longifolia</i>	Muombo (B), Mbovu (N)
	<i>Julbernardia paniculata</i>	Mutondo (B), Mtondo (N)
	<i>Piliostigma thonningi</i>	Mufumbe (B), Musekese (T)
	<i>Brachystegia spiciformis</i>	Muputu (B), Musewe (B)
	<i>Swartzia madagascariensis</i>	Ndale (B), Mulundu (T)
	<i>Colophosphermum mopane</i>	Tsanya (N), Mupane (T)
Euphorbiaceae	<i>Croton scheffleri</i>	Mupasila (L)
	<i>Pseudolachnostylis maprouneifolia</i>	Musangati (B), Mukunyu (T)
	<i>Euphorbia ingens</i>	
	<i>Croton megalobotrys</i>	Mutuatua (L), Mutua (T)
	<i>Sapium ellipticum</i>	
	<i>Securinea virosa</i>	Mubwanga (B), Mwilatuba (T)
Combretaceae	<i>Combretum zeyheri</i>	Mufuka (B), Mukutabulonga (T)
	<i>Combretum collinum</i>	
	<i>Terminalia species</i>	
Rubiaceae	<i>Feretia aeruginescens</i>	Munyansankula (T)
	<i>Rothmannia fischeri</i>	Mulyansengele (B),
Loganiaceae	<i>Strychnos madagascariensis</i>	
	<i>Strychnos usambarensis</i>	
Flacourtiaceae	<i>Onchoba spinosa</i>	Malaza (N), Mukumbuzu (T)
Anacardiaceae	<i>Ozoroa paniculosa</i>	
	<i>Lannea stuhlmannii</i>	Muonga (B), Mungongwa (T)
Fabaceae	<i>Colophosphermum mopane</i>	Mopane (T, L, N)
	<i>Dalbergiella nyase</i>	Lupweshya (B), Mukanganzovu (T)
	<i>Baphia massaiensis</i>	
	<i>Pterocarpus angolensis</i>	Mulombwa (B), Mukula (T)
	<i>Pterocarpus antunesii</i>	Mukambo (T)
Bignoniaceae	<i>Markhamia obtusifolia</i>	Mubu (B), Mupetankwale (T)
Mimosaceae	<i>Albizia antunesiana</i>	Musase (B), Kawizi (T)
	<i>Albizia anthelminitica</i>	Mzanga (N), Chondwe (T)
Annonaceae	<i>Uvaria lucida</i>	
Dipterocarpaceae	<i>Monotes glaber</i>	Mutembo (L and T)
Ochnaceae	<i>Ochna afzeli</i>	Musengu (L)
Apocynaceae	<i>Diplorhynchus condylocarpon</i>	Mtowa (N), Mutowa (T)
Ebenaceae	<i>Diospyros mespiliformis</i>	Mchenjasumu (N), Muchenja (T)
Capparaceae	<i>Capparis tomentosa</i>	Chiwezeze (L), Chonswe (T)
Clusiaceae	<i>Garcinia livingstonei</i>	Mutungwa (L), Mukwananga (T)
Olacaceae	<i>Ximenia americana</i>	Mtundu (L), Muchonfwa (T)
Bombaceae	<i>Adansonia digitata</i>	Mubuyu (L & T), Mulambe (N)
Verbenaceae	<i>Duranta repens</i>	

NB: T-Tonga, N-Nyanja, L-Lozi, B-Bemba



11.5 Appendix 5: Curriculum Vitaes for EIA Team Members



PROPOSED POSITION: EIA TEAM LEADER
NAME OF STAFF: ELENESTINA MWAPE MUTEKENYA MWELWA
PROFESSION: ENVIRONMENTALIST / HYDROLOGIST
YEARS OF EXPERIENCE: 25
GENDER: FEMALE
NATIONALITY: ZAMBIAN

Membership in Professional Societies:

Association for Women in Science and Technology (ZAWIST)	1998	
Zambia-Netherlands Alumini Association		1998
Southern African FREIND (Association for Hydrologists)	2000	
Impact Assessment Association of Zambia		2009

Key Qualifications:

Mrs. Elenestina Mwelwa is an experienced environmentalist with over 20 years of professional experience in the water resources and hydropower sectors in Southern and East Africa, with specialization in recent years in environmental and social assessment of hydroelectric projects including transmission line routing and compensation. Environmental assessments have been carried out in compliance with national legislation and generally to World Bank or other ILA guidelines. Full EIA studies have included multi-disciplinary studies covering all aspects of environmental, socio-economic and resettlement planning, as well as preparation and implementation of Environmental Management Plans and Environmental Monitoring Plans. She has been responsible for co-ordination of environmental and socio-economic teams, including experts carrying out surveys and reporting on vegetation, wildlife habitat, wildlife, fish, water supplies, public health, agricultural systems, cultural and historical sites, socio-economy and compensation and other mitigation measures.

Mrs. Mwelwa is Senior Manager of the Environment and Social Affairs Unit at ZESCO in Lusaka. In her international role, she is currently the Chairperson of the Environmental Subcommittee of the Southern African Power Pool (SAPP). This committee considers environmental and social issues related to the generation and transmission of electricity for both existing facilities and proposed projects. As part of this work, she has spearheaded the development of Hydropower Environmental Impact Assessment Guidelines for the SAPP. Necessarily, this work has involved consideration of standardizing EIA practices where transmission lines cross political borders.

Mrs. Mwelwa is a member of the Environmental Working Group of the Power Institute for East and Southern Africa (PIESA) – a regional body that considers aspects of electricity distribution and supply in the region. Mrs. Mwelwa is also a member of the National Steering Committee for the Zambezi River Basin Commission – a committee comprising stakeholders with interest in the management of the Zambezi river basin. The Committee’s main objective is to ensure Zambia’s interests, as one of the riparian states, are taken into account in the proposed Zambezi River Commission.

Thus, Mrs. Mwelwa’s EIA project work on hydropower and transmission line systems, SAPP, PIEASA and the National Steering Committee for the Zambezi River Basin Commission provides a combination of expertise and experience which is well suited for working, coordinating surveys and EIA reporting of all EIA Team Members on the proposed ZIZABONA Interconnector.



Education:

MSc degree (Distinction) in Hydrology, Institute of Water Research, Rhodes University, Grahamstown, South Africa 2002–2004

Post-graduate Diploma in Water Resources Surveys, International Institute for Aerospace Survey and Earth Sciences (ITC), Enschede, The Netherlands 1992–1993

BA degree in Physical Geography, University of Zambia 1984–1988

Employment Record:

Employer and Position Title:

2007 to date	ZESCO, Environment & Social Affairs Unit - Senior Manager
1999 – 2007	ZESCO, Environment & Social Affairs Unit - Chief Environmental Scientist
1997 – 1999	ZESCO, Environment and Social Affairs Unit - Hydrologist
1988 – 1997	Department of Water Affairs - Hydrologist

Experience in Last 10 Years:

Management of the Environment and Social Affairs Unit (ESU), ZESCO, 2007-08

As Manager of the ESU, main on-going functions are to supervise and coordinate the work of staff to ensure that assignments are executed to acceptable quality and within the specified timeframe. This main task includes: organising the development, staffing and training of the ESU; ensuring that environmental procedures are developed in accordance with national regulations and international standards for the hydro power industry; ensuring that environmental procedures are documented for reference in manuals and all staff are trained in the use of the manuals; ensuring that the company operates in accordance with national environmental regulations; ensuring development of environmental guidelines and operations plans for all company operations; developing a working program with all external ministries involved in environmental and social issues in the country; representing the company on environmental and social issues in national and international fora; developing direct liaison between engineering staff and the Unit to ensure that environmental standards are adhered to in the company's engineering operations and projects.

Chief Environmental Scientist at Environment and Social Affairs Unit, ZESCO, 1999 – 2007

As Chief Environmental Scientist, main responsibilities included attending to environmental issues related to the company's operational areas in hydroelectric power generation, transmission and distribution; coordination of the implementation of the company's Environmental Management System after ISO 14001; development of an environmental information system for all data; execution and coordination of Environmental Impact Assessments and Environmental Mitigation Plans; coordination and implementation of environmental monitoring programs; coordination of preparation of environmental guidelines and manuals for each operational area; conducting yearly environmental audits of all company facilities and preparation of a status report on environmental performance within the company; familiarisation with all national environmental regulations and international regulations governing hydro power; coordination of planning efforts with other ministries and international donor agency programs to avoid duplication of effort and to promote data sharing.



Southern Africa Power Pool (SAPP) Environmental Subcommittee, (2006 – 2008)

This committee considers all environmental and social issues related to the generation and transmission of electricity for both existing facilities and proposed projects. During this period Mrs Mwelwa has spearheaded the development of Environmental Impact Assessment Guidelines for Transmission Lines and Hydropower Generation for the SAPP. As part of the strategy to encourage interconnectivity of the SAPP region, the following key transmission projects have been adopted as SAPP projects and are reported on during all Environmental Subcommittee meetings:

- Mozambique-Malawi 220 kV line interconnector
- Zambia-Tanzania-Kenya 330 kV line interconnector
- DRC-Zambia (Luano-Karavia) 220 kV existing line upgrade
- DRC-Zambia (Luano-Karavia) 220 kV line interconnector
- Zambia-Kolwezi 330 kV line interconnector
- Zimbabwe-Zambia (Hwange-Livingstone) 220 kV line interconnector
- Zambia-Namibia 220 kV line interconnector (already commissioned)
- Cambambe-Luanda 3rd 220 kV line (transmission line within Angola which seeks to strengthen the system to facilitate exports to neighbouring countries)
- Western Power Corridor 800 kV interconnector (DRC-Angola-Namibia-Botswana-South Africa)

Specific Environmental Assessment Projects in last 10 years:

Kansanshi-Lumwana 330 kV Transmission Line and Substations Project, Nov 2006 – Dec 2007

Environmental Coordinator for this 90 km segment from Kansanshi mine to Lumwana Mine in North Western Province of Zambia. This segment is part of the larger Luano-Kansanshi-Lumwana-Kolwezi 330 kV Line Project Environmental Impact Assessment. The assignment involved developing comprehensive Environmental Management Plans for both the line and substation components of the project. The EMPs were included in the contracts of all contractors on the project. Specific tasks on the project involved the following: coordination of stakeholder meetings to achieve project acceptability and obtaining of wayleave/servitude consents from all affected individuals and organisations; coordination of assessment and valuation of all structures, fruit trees and farming activities affected by the project and ensuring that the affected people are adequately compensated; supervision of adherence to the stipulated environmental mitigation measures by all contractors of the project, both for the line construction and the substation construction; coordination of environmental clean-up for all construction sites and camps by the time the line was being commissioned in November 2007; reporting on environmental issues related to the project.

This line passes through small scale farm lands and villages, the 10 rural families were resettled. These were given monetary compensation and they were given six months in which to build new houses and shift from the wayleave areas, the process was closely monitored and all the resettled people managed to build better houses than the ones which were broken. The larger part of compensation went to the project's impact of agricultural activities such as areas the farmers gave up to the project and could not grow their crops, the crops that were affected by the project and the fruit trees that had to be cut within the wayleave.

The section of the line close to Solwezi was found to have cumulative impacts on a few families who were affected by the earlier constructed 66 kV line to Kasempa. The affected peasant farmers had to shift their farming fields to another area and that area happened to have fallen in



the wayleave of the new 330kV wayleave. Higher amount of compensation was considered for such farmers for being inconvenienced twice.

Zambia-Namibia 220kV line and Substations Project, Jan 2006 – Nov 2006

Environmental Coordinator for this 250 km long 220 kV power line from Livingstone in Zambia to Katima Mulilo in Namibia. The assignment involved developing comprehensive Environmental Management Plans for both the line and substation components of the project. The EMPs were included in the contracts of all contractors on the project. Specific achievements included: coordination of stakeholder meetings to achieve project acceptability and obtaining wayleave/servitude consents from all affected individual and traditional authorities; coordination of valuation of all structures and agricultural activities affected by the project and ensuring that adequate compensation is paid to the affected people before commencement of construction phase of the project; coordination of obtaining Forestry Permits, as the line passed through four Forestry Reserves; coordination of the payment of all forestry charges demanded by the Forestry Authority in order to ensure smooth implementation of the project; coordination of obtaining Game Reserve Permit as the line passed through one National Park and ensuring that all conditions attached to the permit were adhered to by all contractors; coordination and supervision of adherence to all stipulated Environmental Mitigation measures as outlined in the approved EIA for the project; reporting on environmental issues of the project. Some of the mitigation measures for the line through the environmentally sensitive areas were the painting of towers with a colour that blends well with the environment such as jungle green colour, and the installation of bird diverters in areas identified as migratory routes for the birds.

Luano-Kansanshi 330 kV line and Substation Project, Aug 2005 – Jan 2007

Environmental Coordinator for the 270 km segment of the line from Luano substation on the Copperbelt Province to Kansanshi mine in North Western Province of Zambia. This segment is part of the larger Luano-Kansanshi-Lumwana-Kolwezi 330 kV Line Project Environmental Impact Assessment. The assignment involved developing comprehensive Environmental Management Plans for both the line and substation components of the project. The EMPs were included in the contracts of all contractors on the project. The specific tasks involved the following: coordination of Stakeholder meetings to achieve project acceptability and obtaining of wayleave/servitude consents from all affected individuals, organizations and traditional authorities; coordination of assessment and valuation of all structures, fruit trees and farming activities affected by the Project and ensuring that the affected people are adequately compensated; supervision of adherence to the stipulated environmental mitigation measures by all contractors of the project, both for the line construction and the substation construction; coordination of environmental clean-up for all construction sites and camps by the time the line was being commissioned in November 2007; reporting on environmental issues related to the project; coordinating and undertaking environmental monitoring during implementation, and environmental audit on completion of the project implementation.

The line project involved resettlement of 30 households, this was done according to a resettlement plan that was worked out to guide all resettlement aspects. The rural communities preferred to be given monetary compensation and another piece of land was allocated by the village headmen, however for the urban communities in Solwezi, the project had to apply for a piece of land from the Council to allow for resettling of 10 families who also preferred to receive monetary compensation to allow them build their own houses. Close monitoring was maintained to ensure the money was used for the intended purpose. 20% of the line route went through some commercial farm areas. Consent had to be negotiated from all the farmers and where compensation had to be paid, the affected crops were valued by professional agriculturalists.



Luano-Kansanshi-Lumwana-Kolwezi 330 kV power line project, Jan 2005 – Aug 2005

Manager of the Environmental Impact Assessment study and process for the 330 kV line proposed from Luano substation in Chingola to Kansanshi mine in Solwezi, then to Lumwana Mine in Solwezi and then to be extended to Kolwezi to form another 330 kV Zambia-DRC interconnector. The key tasks on this project were: environmental screening and scoping at the preliminary stage of the EIA process; managing the Environmental Impact Assessment Study process - supervision of all the EIA study team members field data collection and analysis, compilation and consolidating the EIA report; coordination of Public hearing meetings in two Districts affected by the project - Chingola in the Copperbelt Province and Solwezi in the Northwestern Province; submission of the EIA report to the Environmental Council of Zambia for approval. Among the mitigation measures recommended are the installation of bird diverters in areas close to wetlands which are observed to be bird sanctuaries.

Kafue Gorge Lower Hydroelectric Power Project, Aug 2005 – Dec 2005

Project Coordinator for a 13 member multi-disciplinary team of EIA experts involved in the data collection, analysis and environmental scoping for the various aspects of the proposed development of a 750 MW hydroelectric Power station and other associated infrastructure such as the dam and the 2.5 Km 330 kV power cables to connect to the existing transmission system at Kafue Gorge Upper Power Station. There were three proposed dam sites, the dam site 5 was highly recommended in the EIA as it was found to be the most environmentally friendly location.

As project Coordinator, the key role was to coordinate and schedule stakeholder consultation meetings, data collection activities of all the team members, receiving the team members' input in the various sections of the report and putting all the various reports together to produce one report that would be ready for submission to Environmental Council of Zambia for approval. The key components of the report were the proposed mitigation measures and the comprehensive resettlement plan for the 17 households and 1 farmer that were identified for resettlement. A total amount of US\$1,506,450.00 was estimated to meet all proposed mitigation measures which included resettlement, health aspects and setting up of a nature reserve around the two power stations.

At completion of the Environmental Assessment Study, but before submission of the report to the Environmental Council of Zambia, 3 Public Hearing Meetings involving various stakeholders were held in the districts affected by the project, meetings were held in Lusaka, Kafue and Mazabuka. The comments from stakeholders and the minutes of meetings were included in the main EIA report to serve as record of consultation. Upon Submission of the report in March 2007, the report was successfully approved by Environmental Council of Zambia in June 2007.

Strategic Environmental Impact Assessment, Zambia, 2002 – 03

Project Manager for ZESCO for the multidisciplinary consultancy study of the Kafue river basin where water use conflicts are increasing. Work involved directing the 13-month consultancy study from the Client's side which produced a State of the Environment Report (7. No. Volumes) of the river basin (157,000 km²) and involved conducting workshops for stakeholders in 12 districts and in Lusaka in the first phase. In the second phase, work involved direction of consultants carrying out the Strategic Environmental Impact study including development and interpretation of results of simulation models using a 95-year river flow database to investigate impacts on other sectors of policies to a) maximise firm energy (from 1,860 MW installed capacity, b) promote additional irrigation development (up to 30,000 ha to improve food security and improve livelihoods), and c) improve conservation of Kafue Flats wetland functions in an area of some 5,000 km².



Kalungwishi 220 MW hydropower station and 220 kV power line, Nov 1999 – Dec 2000

Coordinator of team of consultants for the EIA process including pro-active coordination and organization of stakeholder meetings and public hearing meetings in all four Districts that would be affected by the projects: Kasama, Kawambwa, Mporokoso and Mansa.

Zambia-Congo 220 kV interconnection Transmission line, June 1998 – Dec 1998

Manager of the EIA study of the 75 km line on the Zambian side (from Luano substation), and 250 km on the Democratic Republic of Congo side (to Karavia). Key tasks included coordination of the team of environmentalists for the EIA process and actively coordinating and organizing stakeholder meetings and public hearing meetings in all the two Districts that would be affected by the projects on the Zambian side - Chingola and Chililabombwe.

Zambia-Tanzania 330 kV interconnection Transmission line, Sep 1997 – March 1998

Contributor, as hydrologist, to the Environmental Impact Assessment study of this proposed 800 km 330 kV line from Pensulo substation in Zambia to the Tanzanian border with the closest town being Mbeya on the Tanzanian side. Engaged in data collection, analysis and the compilation of the report and actively involved in the organization of public hearing meetings on the Zambian side.

Publications – contributions, as single or joint author:

Environmental Impact Assessment Report for the Kafue Gorge Lower Hydroelectric Power Project, ZESCO, Lusaka, 2005

Environmental Impact Assessment for the Luano – Kansanshi 330 kV line, ZESCO, Lusaka, 2003

Environmental Impact Assessment for the use of herbicide Roundup for control of aquatic weeds Water Hyacinth in the Kafue River Basin, Ministry of Environment and Natural Resources, Lusaka, 1998

Environmental Impact Assessment for the Zambia - Congo 220 kV Interconnection line. ZESCO, Lusaka 1997

Environmental Impact Assessment Guidelines for Transmission Lines, Southern African Power Pool (SAPP), Harare, 2006

Guidelines for Management of Power line Wayleaves, ZESCO, Lusaka, 2003

The Status of Wetlands of Zambia: Management and Conservation Issues. Environmental Council of Zambia, 1994.

LANGUAGES

	Speaking	Reading	Writing
English	Excellent	Excellent	Excellent
Bemba	Excellent	Excellent	Excellent
Nyanja	Good	Poor	Poo



PROPOSED POSITION	PROJECT CORRINATOR
NAME	MELLON CHINJILA
PROFESSION	Agricultural Engineer
YEARS OF EXPERIENCE	12
GENDER	Male
NATIONALITY	Zambian
SPECIALISATION	Land use planning and environmental studies

SUMMARY OF KEY EXPERIENCE AND RESPONSIBILITIES

Project Management and Environmental Coordination

A member of the Project Management Unit (PMU) for the Gwembe Tonga Development Project (GTDP) under the Zambia Power Rehabilitation Project. The GTDP had the overall objective of mitigating the impact of the construction of the Kariba dam to displaced communities. The project has many components such as: the construction of dams, weirs, boreholes, water treatment plants, clinics, schools, road rehabilitation, electrification of the lake shore area, implementation of an agricultural programme (with rain fed and irrigated agriculture, seed multiplication, animal disease control and livestock improvement), flood control and land conservation programmes.

Environmental impact assessment, mitigation and environmental management planning - Responsible for conducting environmental studies for projects including resettlement plans for the affected communities in the project areas.

EDUCATION BACKGROUND

- Certificate of attendance Hydropower and Environment
-
- Certificate of attendance in Cleaner Production and Waste Management, Park Hyatt, Johannesburg South Africa, 2004
- Certificate in Cleaner Production ZACCI Lusaka, Zambia, 2001
- Diploma in Environmental Management: Galilee College, Israel, 1998.
- Master of Science in Agricultural Engineering: Sokoine University of Agriculture, Morogoro, Tanzania, 1996.
- Bachelor of Agricultural Sciences: University of Zambia, Lusaka, 1990.
- Soil Conservation Certificate: UNZA, Department of Soil Science, Lusaka, 1991.

SUMMARY OF PROFESSIONAL SKILLS AND EXPERTISE

- Project Coordinator, Environmental Study for the West Lunga Mini hydropower plant and associated 33kV distribution network under a joint project with the Rural Electrification Authority, ZESCO Limited and the Department of Energy 2007.
- Project Coordinator, Environmental Study for the proposed Mujila Mini hydropower plant and associated 33kV distribution network a consultancy assignment with Tokyo Electric Power Company (TEPCO) as part of the Rural Electrification Master Plan Development for Zambia 2007.



- Lead Environmentalist; Kaputa Biogasification project a UNIDO/GRZ project 2006
- Lead Environmentalist: Ndola Biogasification project, a UNIDO/GRZ project 2006
- Environmental Coordinator: Victoria Falls – Katima Mulimo 220kV transmission Project: 2005-2006
- Project Manager - Environmental study; Mkushi Electrification project, 2003 - 2006
- Project coordinator Environmental study: Nyimba - Petauke 33kV electrification project 2002.
- Project coordinator Environmental Impact Assessment study: Kafue West - Lusaka West 330kV line (1998-1999);
- Project Coordinator Environmental study for the Kafue Gorge Power station rehabilitation (1998)
- Project Coordinator, Environmental study for the Zambia - Malawi 33kV power line interconnection (Lundazi - Mqocha) (1998-2000).
- Project Manager, Environmental study for the Zambia - Malawi 33kV power line interconnection (Chama - Mbalachanda) (1998-2000).
- Lead Environmentalist; Kariba North Bank Polychlorinated Biphenyls (PCBs) storage facility 1999
- Lead Environmentalist; Luano Polychlorinated Biphenyls (PCBs) storage facility 1999
- Computer literate: Lotus, Word Perfect, Microsoft Word, ERDAS, DOS, Excel etc.

SUMMARY OF RELEVANT WORK EXPERIENCE

1997 - To date Principal Environmentalist

Environment and Social Affairs Unit of ZESCO Limited: The main responsibilities includes: coordinating the social mitigation programme for the Gwembe Tonga Development Project as part of the Project Management Unit. The GTDP project had several components that included: electrification, water supply, borehole drilling, road rehabilitation, agricultural (irrigation, rain fed, animal health, seed multiplication, income generation activities, co-operative formation), building of health and schools. Major assignments include: carrying out environmental studies for new projects; carrying out environmental audits and developing environmental management plans, obtaining and compiling essential soils information needed for: planning, construction, transmission and distribution of hydro-electric power and to develop soil management plans for land reclamation and erosion control in way leaves (servitudes) that conform to national environmental regulations. Other responsibilities include: liaison with civil engineering department geo-technical staff, to develop an understanding of agricultural development and its effect on ZESCO operations, to co-ordinate and carryout environmental impact assessments and screening and studies, conducting in-house environmental awareness seminars and to customers and to disseminate the use of soil information in construction, safety, civil engineering, health and compensation claims. Other assignments include; co-ordinating the construction of oil interceptors in diesel power stations to prevent and control oil pollution. Carried out a national inventory, sampling and testing of equipment containing dielectric fluids that could contain Polychlorinated Biphenyls (PCBs), a hazardous dielectric fluid. Developed guidelines on soil management in way-leaves (servitude) and sensitive areas of operation.



1996 - 1997: **Laboratory Technician**

Employed by a Belgian Contractor (CFE Zambia \branch) on the 64km Mazabuka-Monze road rehabilitation project, in Southern Zambia. Head of the Bitumen Section of the site laboratory. Activities at the site laboratory included: Carrying out various tests such as; bitumen penetration grade, coating and striping, Marshall stability, indirect tensile strength, additive levels, bitumen spray rates and aggregate spread rates; concrete tests (slump and compressive strength). Carrying out soil and natural gravel aggregate tests for civil engineering and construction purposes like densities (by sand replacement, by nuclear gauge) and laboratory (proctor mould) densities. Other tests included: Atterberg limits, California Bearing Ratio, grading, linear shrinkage, aggregate impact and crushing values and flakiness. In addition, I was assigned to the Survey Office: To draw road cross section levels for levels for structures such as culverts and curbs. To prepare bill of quantities for base and surface materials (using Excel) and new road levels. Also assisted the Deputy Project Manager in preparing schedules and works certificates.

1991 - 1996: **Head Drainage Section**

Zambia Sugar Nakambala Estate. Main responsibilities: Designing, construction, rehabilitation and maintenance of the drainage network (surface and subsurface) on the sugar estate. Operational budget preparation and control. Drawing up bill of quantities for all civil works and materials (field roads, siphons, culverts, drainage pipes, excavation and surveying). Putting into place erosion control measures (stone pitching, drain lining, building of gabions and growing of Vetiva grass (*Vetiveria zizaniodes*). Land reclamation in waterlogged and abandoned fields and estate margins. Relocating affected communities in the surrounding estate marginal areas and allocating new areas for vegetable farming mainly, using runoff and drainage water from the estate. Supervision and managing a team of about 120 people of various backgrounds and experiences employed as drivers, excavator operators, surveyors, clerks and supervisors under the section. Drain construction and maintenance was done mainly by excavation (mechanically using excavators) and hand labour.

1995: **Research Scientist**

Employed by the European Union on the Regional Tsetse and Trypanosomiasis Control (RTTCP) project to conduct research on tsetse fly biology at Kakumbi Research Station in Mfuwe, eastern Zambia and at Rekomitjie research station, Northern Zimbabwe. The studies were aimed at developing environmentally friendly chemical and biological methods of controlling common tsetse flies (*Glossina morsitans morsitans*) found in south Luangwa and Zambezi valley of Zambia and Zimbabwe using traps and chemical baits.

1990 - 1991: **Research Officer**

Employed in sugarcane agronomy research at Nakambala Estate, Mazabuka, southern Zambia and main responsibilities included the following: Studying the performance of imported varieties/cultivars of sugar cane under local climatic, soil and management conditions. Studying and evaluating the effectiveness of new herbicides and pesticides



before making recommendations for commercial usage. Sugarcane pest monitoring and control; sugarcane flowering monitoring and control, ground water measurements and monitoring. Sugarcane growth measurements, carrying out soil and land evaluation surveys. Conducting field demonstrations to field officers on the application methods of fertilizers, herbicides and pesticides. Provision of extension services to Field Officers to disseminated research information through, workshops, field days and demonstrations.

1985 **Research Assistant**

A vacation job on the World Bank sponsored project (Educational Reforms Implementation Programme, ERIP), that evaluated the educational system in Zambia before the introduction of school fees in schools, colleges and universities. The specific responsibilities involved processing of raw data from nation wide questionnaires for computer inputting for further analysis.

OTHER EXPERIENCE AND SHORT TRAINING

- Certificate of attendance in Cleaner Production and Waste Management Workshop, Park Hyatt, Johannesburg South Africa, 2004: (January 29-30):
- Hydro Africa 2003 International Conference, Arusha Tanzania, 2003: (November 17-19):
- Attended the 2nd Zambia Hydropower Association Conference, Kafue Gorge, Zambia, 2003 (November 13-14):
- Attended the Workshop on Persistent Organic Pollutants (POPs), Mulungushi International Conference Centre, Lusaka, Zambia, 2002 (August 14–16):
- Short training course in noise and dust measurements, University of Zambia, School of Mines, Lusaka, Zambia, 2002 (August 12–13):
- Attended the Cleaner Production Training Workshop, Fairview Hotel, Lusaka, Zambia.2001 (April 18 - 20):
- Attended the National Action Plan for the Management of Polychlorinated Biphenyls (PCBs) Meeting, Kitwe, Zambia, 2001 (April 10 - 12):
- Attended the Hydrology and Poverty Alleviation Workshop, A Working Conference on the role of hydrology in mitigating poverty, Taj Pamodzi, Lusaka, Zambia, 2001 (March 15 - 16):
- Attended the National Conference on the Management of Polychlorinated Biphenyls (PCBs) Edinburgh Hotel, Kitwe. 2000 (August 16 18):
- Attended the Environmental Policy, Strategy and Monitoring Programme workshop for The Zambezi River Authority, Caribbea Bay Hotel, Kariba Zimbabwe, 1999.
- Capacity Building workshop for IUCN Members, Pamodzi Hotel, Lusaka, 1999
- Training in Environmental Management Systems and Environmental Impact Assessments. SIDA funded Project, Swedpower, Sweden, 1998.
- Attended the stakeholders meeting on the Management of Hazardous Wastes in Zambia, Lake Safari Inn, Siavonga,1998.
- Cleaner Production Second Stakeholders workshop, Intercontinental Hotel, Livingstone, Zambia, 1998.
- Awareness Seminar on Cleaner Production for Chief Executives and Decision-Makers, Ibis Gardens, Chisamba, Zambia, 1997.
- Middle Management Development Course. ESBI, Lusaka Zambia, 1997.



- Presented a paper to ZESCO staff in Livingstone, Ndola and Lusaka, on Application of Soil and Land Survey Information in Environmental Management and for Engineering purposes in electricity transmission and distribution, compensation claims and land use management in project areas, 1997 - 1999.
- Attended the Conference on The Role of Agricultural Research in National Development at the Institute for Continuing Education (ICE), Sokoine University of Agriculture, Morogoro Tanzania, 1995.

PUBLICATIONS AND PRESENTATIONS

Teaching Materials as a Guest lecturer (1997 to date), in environmental Management at Kafue Gorge Regional Training Centre.

“Water use conflict between hydropower generation and tourism: Victoria Falls Power Station and the Zambezi sun” a paper presented at the first Regional conference for International Association of Impact Assessment, Southern Africa, Lord Charles Hotel, Cape Town, South Africa.

Environmental Study: Zambia – Malawi: Chama – Mbalachanda 33kV hydropower line, ZESCO Limited, Lusaka 1999.

Management of Equipment and Wastes Containing Polychlorinated Biphenyls (PCBs). Inventory Report. 1999. CIDA Project: 994/19808. Lusaka, Zambia.

Environmental Study: Zambia – Malawi: Lundazi-Mqocha 33kV hydropower line, ZESCO Limited, Lusaka 1999.

Environmental Screening Study: Kafue Gorge Hydropower Station Rehabilitation, ZESCO Limited, Lusaka 1999.

Lusaka Power Reinforcement High Voltage Kafue West Lusaka West 330kV line, Environmental Impact Assessment. ZESCO Limited, Lusaka 1998.

Environmental Degradation Assessment in Nakambala. Sokoine University Tanzania, (Academic), 1995.

Evaluation of Furrow Irrigation at Nakambala. UNZA, (Academic) 1990.

LANGUAGES

	Speaking	Reading	Writing
English	Excellent	Excellent	
Tonga	Good	Good	Good
Nyanja	Fair	Poor	Poor
Bemba	Fair	Poor	Poor
Swahili	Fair	Poor	Poor

**PROPOSED POSITION**

ENVIRONMENTALIST

NAME	Flaviour S. Chanda
PROFESSION	Environmental Specialist
YEARS OF EXPERIENCE	5
GENDER	Female
NATIONALITY	Zambian
SPECIALISATION	Environment/ Environmental information Analysis

SUMMARY OF KEY EXPERIENCE AND RESPONSIBILITIES

Communications and Environmental Education Officer

A member of the Education and Communications Unit (ECU) for the Environmental Council of Zambia. The ECU had the overall objective of disseminating environmental information to the general public on the various environmental issues affecting our society and some of the remedial measures that could be employed. As Communications and Environmental Education Officer, I also accompanied Environmental Inspectors in the field to document various environmental issues.

Environmental impact assessment, mitigation and environmental management planning - Responsible for conducting environmental studies for projects including resettlement plans for the affected communities in the project areas.

EDUCATION BACKGROUND

- Diploma in **Hydropower and Environment**, Sweden, 2007
- Certificate of attendance in **Geographical Information Systems**, NISIR, Lusaka, 2008
- Certificate of attendance in **Financial Audit and the Environment**, Lusaka, Zambia, 2006
- Certificate in **Mainstreaming Biodiversity in Environmental Impact Assessment**. Boston Massachusetts, U.S.A, 2005
- **Master of Education Degree (Environment)**. University of Zambia, Great East Road Campus, Lusaka, Zambia, 2006
- **Bachelor of Arts with Education** with a major in Geography and minor in Religious Studies University of Zambia, Great East Road Campus, 2000

SUMMARY OF PROFESSIONAL SKILLS AND EXPERTISE

- Project Coordinator, Environmental Study for the Luangwa hydrokinetic power plant and associated 33kV distribution network.
- Project Coordinator for the 33kV distribution network to Munali Nickel Mine
- Project Coordinator for the Electrometer and Transformer factories in Ndola
- Environmental Coordinator for the Upgrading of the Kafue West- Muzuma-Victoria Falls 220kV transmission Project
- Project team member of the Environmental Study for the proposed Chilambwe Mini hydropower plant and associated 33kV distribution network a consultancy



assignment with Tokyo Electric Power Company (TEPCO) as part of the Rural Electrification Master Plan Development for Zambia 2007.

- Assistant Environmentalist for the generation project of the Kariba North Bank Extension Project
- Project team member for the Environmental study of the proposed 750 MW Kafue Gorge Lower hydropower station
- Member of the Man and Biosphere (MAB), a national committee tasked with the responsibility to establish a Biosphere Reserve (BR) in Zambia
- Computer literate: Word Perfect, Microsoft Word, Publisher, Excel, Power point, internet programmes etc.

SUMMARY OF RELEVANT WORK EXPERIENCE

2005- To date Environmental Information Specialist (ZESCO limited)

Environment and Social Affairs Unit of ZESCO Limited: The main responsibilities includes: carrying out environmental studies for new projects; carrying out environmental audits and developing environmental management plans, obtaining and compiling essential environmental and social information needed for: planning, construction, transmission and distribution of hydro-electric power and to develop environmental mitigation measures that conform to national environmental regulations. Other responsibilities include: liaison with civil engineering department geo-technical staff, to develop an understanding of environmental impact and its effect on ZESCO operations, to co-ordinate and carryout environmental impact assessments, screening and studies, conducting in-house environmental awareness seminars and to customers and to disseminate the importance of environmental impacts in construction, safety, civil engineering, and in human health. Other assignments include; coordinating the construction of oil interceptors in diesel power stations to prevent and control oil pollution. Carried out a national inventory, sampling and testing of equipment containing dielectric fluids

2003- 2004: Education and Communications Officer: Environmental Council of Zambia (ECZ)

Facilitated communication, environmental education and public awareness programmes targeted at decision makers, industries, and general public using print and electronic media. Organized the World Environment day celebrations and other environmentally significant days including full media coverage annually. This included collaborating with other stakeholders such as schools, local authorities and other relevant government ministries. Carried out routine environmental education and communication work to the members of the general public relating to various environmental issues. Accompanied inspectors in the field to document various environmental problems

2002- 2002: Teacher at Eden Institute (private education institution)

Teaching senior and junior secondary school pupils Geography and Religious Education.

1998- 1999: Research Assistant: Water Sector Reform Support Unit

A vocational job on the urban water research project for Southern, Western and North Western Provinces. The specific responsibilities involved entering and analyzing customer



information captured from the field, processing of raw data from questionnaires for computer inputting for further analysis and compiling provincial reports with analysis on the human resource situation and capacity in the urban water schemes. Working on the filing system for the unit for the water sector reports which involved sorting the documents and classifying them for easy reference and locating.

1999: Student teacher: Kamwala Secondary School

School Teaching Practice for the first-degree programme. During this period, i taught the senior secondary school pupils Geography and Religious Education.

PUBLICATIONS AND PRESENTATIONS

Thesis for the Master’s degree entitled “Proposed Educational Activities for University of Zambia Water Users arising from an Environmental Water Audit of the Institution”

Teaching Materials as a Guest lecturer (2006), in environmental Management at Kafue Gorge Regional Training Centre.

“Strengthened Civil Society Key to Good Governance and Corporate Stewardship through Impact Assessment in Zambia” a paper presented at the International conference for International Association of Impact Assessment, Seoul, South Korea.

Environmental Study: (Scoping and Terms Of Reference) Upgrading of the Kafue West– Muzuma– Victoria Falls 220kV transmission power line, to a 330kV power line, ZESCO Limited, Lusaka 2008.

Environmental Study: Luangwa Hydrokinetic generation project- Luangwa District and the associated 33kV hydropower line, ZESCO Limited, Lusaka, 2008.

Environmental Study: Munali Nickel mine 33kV distribution network, ZESCO Limited, Lusaka, 2007.

Environmental Study: Kariba North Bank Extension generation Project, ZESCO Limited, Lusaka, 2006

Environmental Study: Proposed 750MW Kafue Gorge Lower Hydropower station, ZESCO Limited, Lusaka, 2005

LANGUAGES

	Speaking	Reading	Writing
English	Excellent	Excellent	
	Excellent		
Lamba	Excellent	Excellent	Excellent
Bemba	Excellent	Very Good	Very Good
Nyanja	Fair	Poor	Poor



PROPOSED POSITION PLANNING ENGINEER – TRANSMISSION DEVELOPMENT

NAME ARNOLD HABEENZU
PROFESSION Electrical Engineer
YEARS OF EXPERIENCE 14
GENDER Male
NATIONALITY Zambian
SPECIALISATION Transmission system Planning and Design

MEMBERSHIP TO PROFESSIONAL BODIES: MEIZ, RengERB

SUMMARY OF KEY EXPERIENCE AND RESPONSIBILITIES

Transmission system planning and design

Carrying out system studies i.e. load flows, short circuit and dynamics, on the ZESCO and SAPP networks.

Preparation of Tender documents and equipment specifications for identified and selected projects

Supervising Project implementations

EDUCATION BACKGROUND

- Certificate of Attendance : Leadership and Management team training presented by DBSA Vulindlela Academy ,Livingstone, Zambia 2008
- Certificate of attendance in Power Systems Analysis Training Seminar (Protection and Basic Training for PowerFactory) presented by GigSilent SA (Pty) Ltd - Lusaka ,Zambia , 2006
- Certificate in Management Planning and Control from Managa, Centre for Regional integration and Management Development, Mbabane, Swaziland -2004
- Certificate of Attendance in Management Development presented by ESB International, Lusaka, Zambia – 2003
- Certificate of Attendance in Distribution Network Planning and Operation arranged by SwedPower International, Kafue Gorge Regional Training Centre - 2002
- Post Graduate Diploma in Electrical Power Systems: NTNU , Trondheim, Norway -1999.
- Bachelor of Engineering (Power and Electrical machines) : University of Zambia, Lusaka, 1993.

SUMMARY OF PROFESSIONAL SKILLS AND EXPERTISE

- Electrical Engineer: Review of the Updated feasibility study report, in conjunction with TEC consulting Engineers of India, for Itezhi tezhi Power station Project ; 2007
- Attached to the Victoria Falls – Katima Mulimo 220kV transmission Project during Implementation period: -2006



- Regional Manager – ZESCO, Central Province (2003 – 2006);
- Regional Manager – ZESCO, Luanshya Region on the Copperbelt province (2001 – 2002)
- Regional Manager – ZESCO, Lusaka East Region (1999 – 2001).
- Operations Engineer , ZESCO, Lusaka Central Region (1997 – 1998).
- Planning Engineer – Distribution system for Lusaka Division, ZESCO (1995-1997)
- Graduate Engineer, ZESCO Ndola (1993- 1994)
- Computer literate: Microsoft Word, Power point, Microsoft Project, Excel etc.

SUMMARY OF RELEVANT WORK EXPERIENCE

2006 - Todate Principal Planning Engineer – Transmission Development, ZESCO

Working as a Principal Planning Engineer in Transmission Development at ZESCO Head office, Lusaka. Main Responsibilities: Carry out system studies(loadflow, fault and dynamic studies) using power system analysis software like PowerFactory or other approved tools on the ZESCO and SAPP network. Preparation of equipment specifications and tender documentation, drawings and schedules etc. Carrying out necessary engineering activities eg. ascertaining that the equipment, material, design, supply and construction specifications and that proposals submitted for approval by suppliers or contractors are of internationally acceptable standard, for the various projects: Carrying out appraisal studies and analysis(Preparation of full costs, life-cycle costs) for project identification and selection: Participate in procurement process of services and contractors whenever required: Effective Project supervision and management of contractors by ensuring that the contractual obligations of employer and contractor, as per tender documents and contracts, and all specifications are clearly understood; Preparation of long-term network expansion and reinforcement plans, based on the short-term, medium or long-term demand forecast, generation plans and SAPP requirements.

1999 - 2006: Regional Manager - ZESCO

Worked as a Regional Manager in three different regions namely Lusaka East, Luanshya and Central province. Main responsibilities: Ensuring that all client queries and complaints are attended to expeditiously, Timely preparation and implementation of the Distribution system maintenance schedules in order to provide clients with reliable and good quality electricity supply. Implementing the corporations Distribution system operation procedures and safety regulations. Ensuring timely procurement of required materials and tools for optimum delivery of service and prevent material wastage by carrying out regular audits on all materials booked out. Ensuring that all faults are attended to expeditiously. Ensuring that regular metering audits, installations and reticulations are carried out to guarantee accuracy of billing and reduction of non technical losses. Enforcing sound financial and budgetary controls to ensure expenditure is according to the budgeted activities. Work out sound debt collection strategies to ensure that revenue collection targets are achieved. Carry out Distribution system



equipment testing and commissioning in liaison with other relevant departments. Encourage the members of staff to be innovative .and keep the working moral high.

1997 - 1999: Operations Engineer - ZESCO

Worked as an Operations Engineer in Lusaka Central region. The principal responsibilities included writing switching schedules and carrying out switching operations on the system, ensuring that the site of work is safe and relevant safety documents are issued before any work is carried out on the system,. Ensuring that there was safe and continuous supply of electricity to all our customers and if a system breakdown occurred, it was the responsibility of the Operation engineer to ensure that power is restored as soon as was possible.

Testing and commissioning new equipment in liaison with other relevant departments..

1995 - 1997: **Planning Engineer- ZESCO**

Employed as a Planning Engineer in the then Distribution and Supply Directorate in ZESCO, Lusaka. The main responsibilities included carryout system studies from which appropriate system reinforcement and expansion solutions were recommended to management. For instance a Group scheme Master plan would be worked out for new load centres with a number of potential customers.

The cost of the scheme/project was estimated and the customer's capital contribution was then calculated, and a customer would then be issued with a quotation. Once the Customer paid the required connection fees, it was the responsibility of the Planning engineer to prepare the Works Order. This document would specify the scope of work to be carried out and the materials that were required (Bill of Quantities)

1993 - 1995 **Graduate Engineer- ZESCO**

An Induction programme arranged by ZESCO management to familiarise fresh graduate engineers to the operations of various departments/ units in ZESCO. Some of the Departments covered were Protection, Systems operations and Maintenance, stores , transformer workshops, metering, accounts etc:

The specific responsibilities were varying depending on the department you are in.

OTHER EXPERIENCE AND SHORT TRAINING

- Attended the 7th PIESA –IERE Africa Regional forum, Victoria falls, Livingstone, Zambia (Sept. 24- 28, 2007)
 - Attended the UPDEA Workshop on African Power Sector Databank, Kafue Gorge, Zambia (Aug. 27 – 29, 2007)
 - Transmission line tower and Foundation design training presented by KALPATARU Power Transmission LTD in Mumbai , India (6th Dec- 15th Dec,2006:
 - Certificate of attendance in Top Management Programme organised by Swedpower - 2002
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LANGUAGES

	Speaking	Reading	Writing
English	Excellent	Excellent	
	Excellent		
Tonga	Excellent	Excellent	Excellent
Nyanja	Good	Fair	Fair



PROPOSED POSITION	WAYLEAVE OFFICER
NAME	CHETWAILE NYENDWA
PROFESSION	LAND SURVEYOR
YEARS OF EXPERIENCE	13
GENDER	MALE
NATIONALITY	ZAMBIAN
SPECIALISATION	LAND SURVEYOR AND LAND USE PLANNING

SUMMARY OF KEY EXPERIENCE AND RESPONSIBILITIES

Land Surveying, Land Use Planning and Management

A member of the team that conceptualized and planned the commercialization of Major farm blocks in all the nine provinces of Zambia. The projects are ongoing.

Carrying out Reconnaissance Surveys, Land Surveying, Wayleave and Land acquisition for all existing and new Company projects.

EDUCATIONAL BACKGROUND

- Certificate of attendance Environmental Assessment Information Management-Kafue Gorge Regional Training Centre-2007.
- Certificate in Agriculture Extension Planning and Management-Japan 2005
- Diploma in Land and Mine Surveying –Copperbelt University -2003
- Certificate of attendance- Use of Remote Sensing and Geographical Information Systems (GIS) in Urban Land Use Management based on Environmental Consideration.
- Certificate in Cartography- In House training –Ministry of Agriculture -1995

SUMMARY OF PROFESSIONAL SKILLS AND EXPERTISE

- Team leader of the Survey team that undertook the survey and demarcation of the Nansanga Farm Block (155,000 Ha), the first on the Governments Commercialisation of farm Blocks Programme-2006.
- Team leader of the Survey team that undertook the Topographical Survey of the Sioma Forest in Sesheke (6000Ha) for the Zambia – Namibia Agriculture Joint Project (ZANAP)-2006.
- Part of the Environmental Study team of the West Lunga Mini Hydropower plant and associated 33kv distribution network under a joint project with the Rural Electrification Authority, ZESCO Limited and Department of Energy 2007. Line Route Planning.
- Part of the Environmental Study team of the Mujila Mini Hydropower plant and associated 33kv distribution network- a consultancy assignment with Tokyo



Electric Power Company (TEPCO) as part of the Rural Electrification Master plan Development for Zambia 2007. Line Route Planning.

- Computer Illiterate: Microsoft Word, Arcview, AutoCad, word Perfect, Excel.

SUMMARY OF RELEVANT WORK EXPERIENCE

2006 – To date Wayleave Officer

Environmental and Social Affairs Unit of ZESCO Limited: The main duties include:

- Conducting of reconnaissance surveys to determine and recommend the best cost – effective routes for power lines.
- Acquiring land for the construction of substations, power lines (overhead and underground) and other developments.
- Advising the Corporation on the most economic route for power lines.
- Preparing Wayleave drawings for planning and implementation purposes.
- Preparing site and location plans for the purpose of numbering and title at the Ministry of Lands.
- Inspecting line Wayleaves periodically to ensure that there are no encroachments.
- Ensuring that Environmental and Resettlement guidelines are adhered to when handling Wayleave issues.
- Ensuring that Environmental guidelines are followed during site and line route selection.
- Liaising with the Litigation Department and ZESCO Police on all Wayleave encroachment issues.
- Performing any other duties as may be assigned by the higher authorities.

March 1998 – 2006: Junior Technical Officer

Retained in the Ministry of Agriculture, after the Governments Restructuring programme of all Line Ministries.

Key Result Areas:

Planning Designing of farm layout plans and Land use planning with consideration to Environmental considerations.

Data Management- Collection and storage of resource data to enhance effective planning and implementation.

Field Work Carrying out all Survey activities including demarcations, cadastral and topographical surveys.

Mapping Mapping of all survey works to make available quality maps, plans and drawings. Continuous revision of all Cadastral maps.

Remote Sensing – Collection and interpretation of all remote sensed data, including Aerial photographs and satellite scan images for effective planning.



- G.IS Digitising and storage of all maps and Geo-information obtained from field surveys.
- Printing Conduct the reproduction of relevant maps and diagrams at all scales to facilitate the planning process.

June 1995-March 1998: Assistant Technical Officer
 Employed in the Ministry of Agriculture with main duties being: Carrying out Mapping and remote sensing assignments to ensure effective assessment and quality data management and storage for the province (Lusaka Province).

Key Result Areas:

- Data Management Effective arrangement of resource data to enhance planning and Implementation.
- Field Work Carry out periodical field work to enhance Mapping assignments.
- Mapping Map and draught efficiently to make available quality maps, plans and drawings. Continuous revision of Cadastral Maps.
- Printing Conduct the reproduction of relevant maps and diagrams to facilitate the land -use planning process.

PUBLICATIONS AND PRESENTATIONS

Part of the team that produced and adopted the National Geographical and Cartographic Symbols – 1997.

Development of a Copperbelt University Property Management System through creation of a Geographical Information System (G.I.S) using Arcview. (Academic)-2003

LANGUAGES

	Speaking	Reading	Writing
English	Excellent	Excellent	
	Excellent		
Bemba	Excellent	Good	Good
Ngoni	Excellent	Good	Goo
Nyanja	Excellent	Good	Good



PROPOSED POSITION	ENVIRONMENTAL TECHNOLOGIST
NAME	CHOLWE HAMUSUNSE
PROFESSION	Fisheries Scientist
YEARS OF EXPERIENCE	5 years
GENDER	Female
NATIONALITY	Zambian
SPECIALISATION	Natural resources conservation

SUMMARY OF KEY EXPERIENCE AND RESPONSIBILITIES

Environmental Technologist

Working with ZESCO Limited under the Environment and Social Affairs Unit (ESU). The duties involve obtaining and compilation of essential data necessary for the planning and implementation of generation transmission and distribution projects, i.e., preparing environmental project briefs for various projects, collection and compilation of essential vegetation, fisheries and wildlife data in project areas for planning purposes, obtaining relevant permits and conducting relevant studies in project areas that affect Forest Reserves, National Parks and Game Management Areas, Writing ecological reports about catchments and project areas, Collection and compilation of essential vegetation, fisheries and wildlife data in project areas for Environmental Impact Assessment (EIA) purposes, Carrying out awareness campaigns in the project areas and Carrying out environmental audits for the power stations and the power lines.

EDUCATION BACKGROUND

- Certificate in Environmental Auditor, Brakpan, Johannesburg South Africa, 2008
- Certificate in Environmental Assessment and Information Management, Kafue Gorge Training Centre, Zambia, 2006.
- Diploma in fisheries science, Natural Resources Development College (NRDC), Lusaka, Zambia, 2001.

SUMMARY OF RELEVANT WORK EXPERIENCE

2005 To date **Environmental Technologist**

Environment and Social Affairs Unit of ZESCO Limited. The main responsibilities involve obtaining and compilation of essential data necessary for the planning and implementation of generation transmission and distribution projects, i.e., preparing environmental project briefs for various projects, collection and compilation of essential vegetation, fisheries and wildlife data in project areas for planning purposes, obtaining relevant permits and conducting relevant studies in project areas that affect Forest Reserves, National Parks and Game Management Areas, Writing ecological reports about catchments and project areas, Collection and compilation of essential vegetation, fisheries and wildlife data in project areas for Environmental Impact Assessment (EIA) purposes, Carrying out awareness



campaigns in the project areas Carrying out environmental audits for the power stations and the power lines and preparing weekly, monthly annual reports for the Unit and any other duties assigned in the Unit.

Feb, 2003 to Nov, 2003 - **Environmental Assistant**

Worked with ZESCO LTD under ESU. The work involved assisting in data collection for compiling EIAs and Environmental Project Briefs for project areas.

April, 2001 to Nov, 2002 - **group facilitator**

Worked with Cooperative League of the United States of America (CLUSA) as a group facilitator. The work involved, assisting small-scale farmers to form democratically self managed, financially viable rural business groups, training farmer groups in technical and entrepreneurship skills to enable them manage an out-grower scheme (OGS), using Participatory Training Methodologies to assist farmers to adopt conservation farming techniques, monitoring farmer groups, identifying problems or obstacles and assisting them to solve them without fostering dependency and distribution of relief food.

LANGUAGES

	Speaking	Reading	Writing
English	Excellent	Excellent	
	Excellent		
Tonga	Excellent	Excellent	Good
Nyanja	Good	Fair	Fair
Bemba	Good	Fair	Fair



PROPOSED POSITION	ENVIRONMENTAL TECHNOLOGIST
NAME	ANTHONY MANDO
PROFESSION	Fisheries Technologist
YEARS OF EXPERIENCE	4
GENDER	Male
NATIONALITY	Zambian
DATE OF BIRTH	18 th MAY 1982
SPECIALISATION	Fisheries & Geophysical

EDUCATION BACKGROUND

- Certificate in Safe Management of Polychlorinated Biphenyls (PCBs) – Kafue Gorge Regional Training Centre (KGRTC), 2007.
- Certificate in Environmental Assessment and Information Management – Kafue Gorge Regional Training Centre (KGRTC), 2006.
- Diploma in Fisheries Sciences – Natural Resources Development College (NRDC), 2004.

SUMMARY OF PROFESSIONAL SKILLS AND EXPERTISE

- Preparation of Environmental Project Brief (EPB) for the electrification of La Frontier Mine 11kV power line project, 2006.
- Preparation of Environmental Project Brief (EPB) for the electrification of Zambezi Portland Cement Plant in Ndola, 33kV power line project, 2006.
- Preparation of Environmental Project Brief (EPB) for the electrification of Mupelekese Farming Block in Chongwe District, 11kV power line project, 2006.
- Preparation of Environmental Project Brief (EPB) for the electrification of Pweto Town in Katanga Province of DRC, 33kV power line project, 2006.
- Preparation of Environmental Project Brief (EPB) for the electrification of Mano Basic School in Samfya District, 33kV power line project, 2007.
- Preparation of Environmental Project Brief (EPB) for the electrification of Chiawa area in Siavonga District, 33kV power line project, 2007.
- Collection and compilation of fisheries, soil and other appropriate geophysical information data for the preparation of the Environmental Impact Assessment (EIA) for the proposed Mujila and Shiwan'gandu Mini Hydro Power Stations in Mwinilunga and Chinsali Districts respectively, 2007.

SUMMARY OF RELEVANT WORK EXPERIENCE

2004 - To date **Environmental Technologist**

Environment and Social Affairs Unit of ZESCO Limited. The main responsibility of Environmental Technologist is to assist the Ecologist in obtaining and compiling essential vegetation and wildlife data necessary for planning and implementation



of generation, transmission and distribution projects. Specifically, the duties include:

- * Responsible for obtaining and compiling essential vegetation and wildlife data necessary for planning and implementation of generation, transmission and distribution projects.
- * Conducting studies on wildlife distribution and densities in project areas.
- * Collecting and compiling data on vegetation, fisheries and wildlife necessary for planning and implementation of projects.
- * Conducting Environmental Impact Assessment (EIA) studies and help prepare Environmental Mitigation Plans.
- * Conducting animal identification and habitat assessments.
- * Identifying endangered species and arranging for their protection during project implementation.
- * Dealing with issues related to habitat disturbance during project implementation.
- * Dealing with issues related to ZESCO projects affecting National Parks, Forest Reserves and Botanical Reserves.
- * Help Audit environmental mitigation measures on projects, wayleaves and diesel generation sets.

05/09/03 – 28/11/03

Worked on Industrial attachment for three months at the Department of Fisheries in Mpulungu under the Ministry of Agriculture and Co-operatives.

LANGUAGES

	Speaking	Reading	Writing
English	Good	Excellent	
	Excellent		
Bemba	Excellent	Excellent	
	Excellent		
Nyanja	Good	Fair	Fair

Certification

I, the undersigned, certify that to the best of my knowledge and belief, these data correctly describe me, my qualifications and my experience.

(Signature of Staff Member and authorized official from the firm)
Day/Month/Year

Full name of staff member:
.....



Full name of authorized representative:
.....

PROPOSED POSITION	SOCIO-ECONOMIST
NAME	KANDI SHIKABI
PROFESSION	SOCIAL SCIENTIST
YEARS OF EXPERIENCE	4
GENDER	MALE
NATIONALITY	ZAMBIAN
SPECIALISATION	Social and Environmental studies

EDUCATION AND TRAINING BACKGROUND

- BA in Development Studies: University of Zambia, Lusaka, 2006.
- Certificate of attendance in Data Survey Methods and Applications for Rural Energy Planning and Environmental Management, In-Service Training Institute Trust (ISTT), Lusaka, Zambia, 2007
- Certificate of attendance in Communication Planning and Mass Awareness Education, Mineral and Energy Education and Training Institute (MEETI), Randbury, South Africa, 2007

SUMMARY OF RELEVANT WORK EXPERIENCE

2009 - Present

Position held: Social Scientist
Environment and Social Affairs Unit of ZESCO Limited

2006 – 2009

Position held: Environmental Assistant
Environment and Social Affairs Unit of ZESCO Limited

2005 – 2006

Position held: Research Assistant
Churches Health Association of Zambia (CHAZ)

SUMMARY OF KEY RESPONSIBILITIES IN CURRENT POSITION



The main responsibilities of a Social Scientist are coordinating environmental projects and dealing with socio economic issues pertaining to projects and operations conducted by ZESCO. Arranging resettlement and compensation issues for people displaced during the construction and operations of ZESCO work.

Other responsibilities include;

- Conducting socio-economic impact assessments for ZESCO projects as part of the Environmental Impact Assessment (EIA) study;
 - Acting as an environmental coordinator to the projects enlisted to me;
 - Arranging for valuation of infrastructure and other property affected by ZESCO projects and operations for compensation purposes;
 - Arranging for the resettlement of people affected by ZESCO operations; Preparing materials for presentation during environmental awareness seminars for ZESCO staff;
 - Working with community leaders and Non-Governmental Organisations to conduct public meetings with local villagers and landowners affected by ZESCO projects and operations;
 - Maintaining inventory of all equipment in the Unit;
 - Preparing monthly, quarterly and annual reports for the Unit.
-

SUMMARY OF PROFESSIONAL SKILLS AND EXPERTISE

- Social Scientist for the proposed Kariba North Bank Extension Power Transmission line project, 2009
- Social Scientist for the proposed Kafue Gorge Lower Hydropower Project, 2009
- Assistant Social Scientist, Collection and compilation of Socio-economist data for the proposed Itezhi-tezhi-Mumbwa- Lusaka West Power Transmission line project, 2008
- Social Scientist for the proposed Shiwan'gandu Mini Hydro Power Station project, 2007
- Social Scientist, Environmental Study for the proposed electrification of 1 Rural growth centre (RGC) in Serenje under the Rural Electrification Projects, 2007;
- Social Scientist, Environmental Studies for the proposed electrification of 3 Rural growth centres (RGCs) in Mumbwa under the Rural Electrification Projects, 2007;
- Social Scientist, Environmental Studies for the proposed electrification of 2 Rural growth centres (RGCs) in Senanga under the Rural Electrification Projects, 2007;



- Computer literate: Microsoft Office (i.e. Word, Excel, PowerPoint, Outlook, etc).

LANGUAGES

	Speaking	Reading	Writing
English	Excellent	Excellent	
	Excellent		
Tonga	Excellent	Fair	Fair
Soli	Excellent	Fair	Poor
Nyanja	Excellent	Fair	Poor

PROPOSED POSITION **ECOLOGIST**

NAME	LWANDA KAFUMUKACHE KAHONGO
PROFESSION	FORESTER
YEARS OF EXPERIENCE	6
GENDER	FEMALE
NATIONALITY	ZAMBIAN
SPECIALISATION	VEGETATION AND WILDLIFE STUDIES

EDUCATION AND TRAINING BACKGROUND

- Bachelor of Science degree in **Forestry**, The Copperbelt University, Kitwe, 2002.
 - Certificate of attendance **Understanding Impact Assessment** training course, Perth, Western Australia, 2008;
 - Certificate of attendance **Hydropower and the Environment** training Course, ICH, Trondheim , Norway, 2007;
 - Certificate of attendance **Protected Area Management**, University of Montana, Missoula, MT, USA, 2007;
 - Certificate in **SADC Rural Energy Project Planning and Environmental Management** Course, ESAMI, Arusha, Tanzania, 2007;
-

SUMMARY OF RELEVANT WORK EXPERIENCE

2005 - Present

Position held: Ecologist
Environment and Social Affairs Unit of ZESCO Limited



2003 – 2005

Position held: Environmental Assistant
Environment and Social Affairs Unit of ZESCO Limited

SUMMARY OF KEY RESPONSIBILITIES IN CURRENT POSITION

The Ecologist is responsible for obtaining and compiling essential vegetation and wildlife data necessary for planning and implementation of generation, transmission and distribution projects. Specifically, the duties include:

- Collecting and compiling data on vegetation, fisheries and wildlife necessary for planning and implementation of projects;
 - Conducting studies on wildlife distribution and densities in project area;
 - Conducting Environmental Impact Assessment (EIA) studies and prepare Environmental Mitigation Plans;
 - Conducting animal identification and habitat assessments;
 - Identifying endangered species and arranging for their protection during project implementation;
 - Dealing with issues related to habitat disturbance during project implementation;
 - Dealing with issues related to ZESCO projects affecting National Parks, Forest Reserves and Botanical Reserves;
 - Audit environmental mitigation measures on projects, wayleaves and diesel generation sets.
-

SUMMARY OF PROFESSIONAL EXPERIENCE AND EXPERTISE

- Ecologist, proposed Lunzua power station upgrade project, 2009;
- Member UNESCO Zambia national Man and Biosphere Committee, 2009;
- Ecologist, proposed Itezhi-tezhi-Mumbwa- Lusaka West Power Transmission line project, 2008.
- Ecologist, Environmental Study for the proposed electrification of 9 Rural growth centres (RGCs) in Mufulira under the Rural Electrification Projects, 2007;
- Ecologist, Environmental Study for the proposed Mujila Mini hydropower plant and associated 33kV distribution network a consultancy assignment with Tokyo Electric Power Company (TEPCO) as part of the Rural Electrification Master Plan Development for Zambia 2007;
- Environmental Assistant; Environmental Monitoring; Kansanshi- Lumwana 330kV power transmission line project, 2007;
- Ecologist; Environmental study for the electrification of Pweto Town, 2007;
- Plant Expert, Restoration Works in the Victoria Falls area after the relocation of the siphon scour under the Power Rehabilitation Project, 2006;
- Ecologist; Electrification of La Frontier Mine, 2006.
- Ecologist, Kaputa Electrification Project 2005;
- Ecologist, Kafue Gorge Lower Hydropower Project, 2004;



- Ecologist, proposed 132kV line project from Chongwe Substation to Luangwa District, 2004;
- Computer literate: Microsoft Office (ie. Word, Excel, PowerPoint, Outlook, etc).

PRESENTATIONS AND PUBLICATIONS

1. Presented a lecture on “Renewable energy Solutions” at the Hydropower and the Environment in Africa training Course at the Kafue Gorge Regional Training Center, November, 2009.
2. Presented a paper on “The Challenges of Balancing Environmental Protection and Development” at the 28th Annual Conference of the International Association for Impact Assessment, Perth, 2008
3. Presented a paper on “State of Protected Areas in Zambia” at the International Seminar for Protected Area Management”, University of Montana, 2007.
4. Presented a paper on “Hydropower Situation in Zambia,” at the International Centre for Hydropower, August 2007.
5. Presented a paper on “ZESCO Wayleave Clearing Guidelines in Relation to Forest Resources Management” at the International Timber Symposium, Mulungushi International Conference Centre, September, 2005.

LANGUAGES

	Speaking		Reading		
	Writing				
English	Excellent		Excellent		
Bemba	Excellent		Good	Good	
Kaonde		Good	Fair		Poor
Nyanja	Fair		Fair		Poor



PROPOSED POSITION

CIVIL ENGINEER

NAME: MWALIMU SILWEMBE
PROFESSION : CIVIL / HYDROPOWER ENGINEER
YEARS OF EXPERIENCE: 16
SEX MALE
NATIONALITY: ZAMBIAN
SPECIALISATION: STRUCTURAL/CIVIL DESIGNS, MAINTENANCE, PROJECTS AND CONTRACTS MANAGEMENT AND ADMINISTRATION

SUMMARY OF KEY EXPERIENCE AND RESPONSIBILITIES

Annual and routine engineering inspections and audits of ZESCO’s civil and other built infrastructures e.g. power stations, dams, small hydro power stations, substations, transmission lines etc., statutory requirements compliance checks and preparing of maintenance schedules including sourcing of plant and machinery for the required works.

Planning and designing of various structural and civil infrastructures, preparation of bids, contract documents and evaluation of bids, negotiating of contract terms for the same and making recommendations to management on suitability of bidders for the works. Further, participation in feasibility studies for development of dams and hydropower stations.

Projects and contracts management and administration through supervision and co-ordination of contracted contractors, consultants and architects and ensuring compliance to specifications and standards, including supervision and management of projects executed in-house.

General structural and civil engineering maintenance works on ZESCO’s built assets (infrastructure), preparation of project status and progress reports, budget inputs to management and ensuring safety of project and maintenance personnel, materials and equipment.

EDUCATION BACKGROUND

- 1985 Secondary School Certificate.
- 1991 Bachelor of Engineering Degree (CIVIL) – UNZA.
- 200 Master of Science Degree in Hydropower Development- NTNU, Norway.

PROFESSION MEMBERSHIP & OTHER CERTIFICATES

- Member of the Engineering Institution of Zambia (**EIZ No. 003905**).



- Registered Engineer – Engineer Registration Board(ERB) No. 001327.
- Member of International Commission on Large Dams(ICOLD).
- Seminar by Copperbelt University School of Environmental Studies on Information Technology for Zambian Construction Industry, Lusaka, Zambia, 1994.
- Feasibility Studies and Design of Hydropower Facilities training, Harza Office, Chicago, USA, 1994.
- SADC Training - A Strategic Framework for Managing the Hydrometric Program, Siavonga, Zambia, 1995.
- Management Development Course by ESB International, Lusaka Zambia, 1997.
- Rehabilitation of Small Hydro Power Station Contract Packaging training, Ashford, UK, 2000.
- ICOLD training in dam construction and operations, Turkey, 2007.
- SIDA funded - Training in Management of Hydro Power Development and Use Part I, Sweden, 2008.

SUMMARY OF RELEVANT WORK EXPERIENCE

2000 - To date Principal Civil Engineer, ZESCO Limited:

Planning, designing, construction and commissioning of 60km long Kafue – Lusaka West 330kV Line, 196km long Luano – Kansanshi 330kV line, 230km long Victoria falls Katima-Mulilo 220kV line and 72km long Kansanshi - Lumwana 330kV power line

The main responsibilities included:

As Lead Project Civil Engineer, participated in planning and designing of the transmission lines components, preparation of drawings and bid documents, bidding, evaluation of bids, contract negotiations, recommending bidders for contract award, supervision and management of construction works vis-a-vis routing of the transmission lines, wayleave clearing, preliminary and detailed surveying, tower spotting and pegging, line profiling, ensuring timely supply of tower and accessories, geotechnical/soil investigations, foundation construction and tower erection including earthing, stringing of conductors, earth-wires and optic fibre cables as specified and in accordance with the Project Environmental Management Plan (EMP). Other responsibilities included liaison with other project team members from various disciplines namely safety department, environment and social affairs unit, health, electrical engineers as they carry environmental impact assessments and screening studies for the lines, conduct environmental, HIV/AIDS and safety awareness seminars to locals and project employees, settle compensation claims and to ensure that electrical clearances and safety requirements for the line are met. Quality assurance and cost control for the various project works was ensured through various monitoring, controls and standard material and equipment commissioning tests.

Rehabilitation and Maintenance of Small hydropower Stations (Lusiwasi, Chishimba Falls, Musonda Falls and Lunzua Power Stations) and other infrastructure.

Key responsibilities included:



Annual inspections of weir dams, intakes, canals, penstocks, power houses, supervision of various required rehabilitation, remedial and maintenance works for these power plant components and residential houses. Major project outsourced at small hydropower stations included; rehabilitation of Lusiwasi power station haulage way, restoration of eroded fuse plug and repair of sink hole at Chishimba Falls B-dam and waterproofing of Lunzua Power house building. As lead civil engineer, participated in the preparation of drawings and bid documents, bidding, evaluation of bids, contract negotiations and making recommendation for contract award, supervision and management of construction works.

As Project Civil Engineer, participated in the design of slope stabilisation and supervision of the executing of the works in-house for Itezhi-tezhi Dam spillway inlet channel.

Planned, designed and supervised the construction of five (5 No.) substation control buildings at Shimabala, Chisamba, Burnet, Landless Corner and Mikango Barracks substation including carrying out of various substation and power stations maintenance works in Lusaka and around the country. Notable among the works were the mobilisation of plant and machinery and execution of civil restoration works for Kafue Gorge Power Station following mudslides that engulfed the station in December 2006 and civil/structural works for restoration of a collapsed transmission tower and the line on Kariba A1 line.

1996 – 2000: Senior Civil Engineer, ZESCO Limited:

As Project Civil Engineer, participated in the Feasibility Studies for the proposed hydropower development on Luapula River and Kalungwishi river Lumangwe Falls carried out by Harza Engineering of USA and Feasibility Studies for the proposed hydropower development in the North Western Province of Zambia covering Chavuma Falls, West Lunga River, Mwinilunga and Chakata Falls, Kabompo, carried out by Norplan Consultants of Norway.

As Project Civil Engineer for facelift and rehabilitation works to turn building into one stop shop ZESCO customer services centres at Northmead, Kabwata, Manda Hill, Chaisa, Matero, Malambo Road and Kariba House customer service centres, supervised designs and tender documents were prepared in liaison with the architect, tendered out, contract awarded and works supervised and completed including those executed in house.

As Project Civil Engineer for rehabilitation of the National Control Centre (NCC – SCADA Project), participated in preparation of drawings and bid documents, bidding, evaluation of bids, contract negotiations, recommending bidders for contract award, supervision and management of construction works for foundations for the telecommunication towers located at Chilanga, Mwambula, Leopards Hill substation and NCC at head office.

As Lead Project Civil Engineer, did preparation of drawings and bid documents, bidding, evaluation of bids, contract negotiations, recommending bidders for contract award, supervision and management of maintenance and construction works for various ZESCO built and new assets among them top and middle management and customer car parks at head office, transformer foundations at Waterworks and Kafue town



substation, rehabilitation of Kaoma diesel power station power house, underpinning of control at Kitwe substation and various buildings, substations and transmission lines maintenance works.

1993 – 1995: Civil Engineer - Projects & Contracts, ZESCO Limited:

After success completion of a two years induction training and being assessed by the Graduate Assessment Panel
Key responsibilities included;

Carrying out of land survey for building sites, design of buildings and other structures, cable trenches, drainage works and foundations for substation equipment, preparation of construction drawings, bills of quantities, material schedules, building works specifications, contract documents, tendering, evaluation of tenders and supervision of construction works for various ZESCO's substations and buildings in Lusaka and around the country. Among the major works done were extension bay at Mazabuka 88kV substation, construction of new Siavonga, Makeni, Bauleni and Nanga Farms 33kV substations, putting up of false roof at Leopards Hill substation control building, extension of control building at Dublin substation, waterproofing of substation concrete roofs and fencing of various substations and ground mounted transformers.

As Counterpart Staff Project Civil Engineer, participated in the Feasibility Studies for the proposed hydropower development for Kafue Gorge Lower H.E.Plant on Kafue River carried out by Harza Engineering of USA. The Feasibility study involved site visits/work and short training in Feasibility Studies and Design of Hydropower Facilities at Consultant's home office in Chicago (1994).

**1991 – 1992: Civil Engineer - Graduate Civil Engineer, ZESCO Limited:
On 2 years attachment at Nicholas O'Dwyer and Partners Consulting Engineers,
Lusaka**

Key responsibilities on induction training involved following tasks:

As Trainee Civil Engineer, participated in the preparation of detailed spot and topographical surveys, contour maps, water pipe line route longitudinal profiles, civil designs and general arrangement/detailed working drawings for storm water and subsurface drainage systems, sewerage reticulation and disposal systems, culverts and access roads, water supply reticulation including water tanks and pumps including fire fighting facilities, carrying out of comprehensive survey of the dilapidated sewerage and water services for existing building including preparation of inspection reports outlining recommendations and proposals for the required rehabilitation works. Prepared tender documents and participated in the tendering process, supervised installation of water, sewerage services and fire fighting facilities and liaised with other consultants and contractors for the following projects;

PTC Housing Development, Leopards Hill Road, Lusaka
Mobil Oil Filling Station (Z) Limited Drainage Works, Parklands, Kitwe
TAZARA Water Supply Project, Mpika
UNZA Staff Housing Development, Chudleigh, Lusaka.
ZISC Housing Development scheme, Choma



Facelift to Profund (Revenue House) House, Lusaka
 Design of Services to Lusaka West Military Camp
 Design of Services to Lusaka Water and Sewerage Company Office Complex
 Design of Services to ZNAD Office Block Development-Lusaka
 CBU Staff Housing Development, Kitwe
 Zimbabwe High Commission-Chancellery Building, Lusaka

As Trainee Civil Engineer, participated in the preparation of detailed structural design calculations and designs, general arrangement and working drawings for the foundation footing, columns, roof slab, floor slabs, beams, pre-cast concrete panels, stair cases, eave beams, roof trusses, access roads and culvert bridges including steel reinforcement drawings detailing and steel bar bending schedules preparation for the following projects;

New ZAF Academy, Livingstone
 CBU Staff Housing Development, Kitwe
 Zambia National Association for the Deaf Office Block Development (ZNAD) - Lusaka
 Zimbabwe High Commission-Chancellery Building, Lusaka
 Design of Lusaka Urban District Council - Chelstone Clinic,

INDUSTRIAL ATTACHMENT (FROM UNZA SCHOOL OF ENGINEERING)

1989 - Attached to Minestone (Z) Limited, based in Kasama.

Key assigned tasks included spot level surveying work at Indeco Milling Company in Kasama and carrying out of setting out and levelling of road ways and car park at ZSIC Flats in Kasama. Supervision of finishing works of the flats and construction of Maize Sheds for the Ministry of Cooperatives in Kasama, Mbala and Mpika Districts.

1988 - Attached to ZCCM, Nkana Division

Key assigned tasks included material quantities taking off from civil engineering working drawings, spot level surveying work and levelling and general supervision of civil works within Nkana Division Plant area.

PUBLICATIONS AND PRESENTATIONS

Assessment of properties of aggregate materials for Asphalt concrete and their suitability for use and the design of Asphalt concrete Mix. University of Zambia (UNZA), Lusaka, (Academic) 1991.

Pre-feasibility Study for hydropower development at Mombututa Falls on Luapula River, Luapula Province, Zambia. Norwegian University of Science & Technology (NTNU), Trondheim, Norway, 2000

LANGUAGES

	Speaking	Reading	Writing
English	Excellent	Excellent	Excellent
Mambwe	Excellent	Excellent	Excellent
Bemba	Excellent	Excellent	Good
Nyanja	Good	Fair	Fair



PROPOSED POSITION	Biologist / Hydrologist
NAME	BONJE MUYUNDA
PROFESSION	BIOLOGIST / HYDROLOGIST
YEARS OF EXPERIENCE	4
GENDER	FEMALE
NATIONALITY	ZAMBIAN
SPECIALISATION	BIOLOGICAL AND HYDROLOGICAL STUDIES

EDUCATION AND TRAINING BACKGROUND

- Master of Science in **Environmental Science – Environmental Planning and Management**, UNESCO – IHE – Institute of Water Education, Delft, Netherlands
 - Bachelor of Science degree in **Biology**, University of Zambia, Lusaka, 2002.
 - Certificate of attendance in **Environmental Management**, Kafue Gorge Regional Training Centre, Mazabuka, 2005
 - Certificate of attendance in **Environmental Impacts on Health**, Kafue Gorge Regional Training Centre, Mazabuka, 2006
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SUMMARY OF RELEVANT WORK EXPERIENCE

2005 - Date

Position held: Hydrologist
Environment and Social Affairs Unit of ZESCO Limited

2003 – 2005

Position held: Environmental Assistant
Environment and Social Affairs Unit of ZESCO Limited

SUMMARY OF KEY RESPONSIBILITIES IN CURRENT POSITION

The Ecologist is responsible for obtaining and compiling essential vegetation and wildlife data necessary for planning and implementation of generation, transmission and distribution projects. Specifically, the duties include:

- Collecting and compiling data on hydrology and water resources management necessary for planning and implementation of projects;
 - Conducting studies on water resources and watershed management in areas where rivers supporting hydropower stations passing or originate from;
 - Sensitising people about watershed management in project areas;
 - Conducting Environmental Impact Assessment (EIA) studies and prepare Environmental Mitigation Plans;
 - Audit environmental mitigation measures on projects, wayleaves and diesel and hydropower stations
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SUMMARY OF PROFESSIONAL SKILLS AND EXPERTISE

- Participated in hydrological and biological studies for the Kafue Gorge Lower Hydropower Project as part of the Environmental Impact Assessment (EIA) study, 2004;
 - Conducted environmental assessment for the new Shang’ombo diesel power station, 2006.
 - Conducted environmental assessment for the Chozi Electrification in Isoka, 2005.
 - Hydrologist for the environmental study for the proposed Chilambwe Mini hydropower plant in Mporokoso, a consultancy assignment with Tokyo Electric Power Company (TEPCO) as part of the Rural Electrification Master Plan Development for Zambia 2007;
 - Hydrologist for the EIA study for the proposed Shiwang’andu Mini hydropower plant in Chinsali
 - Hydrologist, Kaputa Electrification Project 2005;
 - Computer literate: Microsoft Office (ie. Word, Excel, PowerPoint, Outlook, etc).
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PRESENTATIONS AND PUBLICATIONS

1. Environmental Project Brief for the Shang’ombo diesel power station, 2006.
2. Environmental Project Brief for the Chozi Electrification in Isoka, 2005.

LANGUAGES

	Speaking	Reading	Writing
English	Excellent	Excellent	Excellent
Lenje	Excellent	Good	Good
Bemba	Fair	Poor	Poor
Nyanja	Good	Fair	Fair
