



**Powering The Nation**

**ENVIRONMENTAL IMPACT STATEMENT FOR  
THE PROPOSED CONSTRUCTION OF THE KAFUE  
GORGE LOWER 200MW SOLAR PHOTOVOLTAIC  
POWER GENERATION AND 330KV  
TRANSMISSION LINE PROJECT**



**Prepared By**

**ZESCO LIMITED  
FOR**

**JIGSCO ENERGY CORPORATION LIMITED  
June 2025**

## **ACKNOWLEDGEMENTS**

JIGSCO Energy Corporation Limited wishes to tender its indebtedness to Her Royal Highness Chieftainess Sikoongo, the Sikoongo Royal Establishment and the local communities for the support rendered during the Environmental and Social Impact Assessment (ESIA) process for the Project. The Corporation further wishes to extend gratitude to the Heads of Government Departments, local authorities, Nongovernmental Organisations (NGOs) and other stakeholders for availing valuable information for the successful undertaking of the studies. Lastly, but not the least, we wish to express our appreciation to all participants for their valuable contributions, without which the process would not have been a success.

## **EXECUTIVE SUMMARY**

The Government of the Republic of Zambia (GRZ) seeks to achieve universal access to clean, reliable, and affordable energy at the lowest economic, financial, social, and environmental cost, as outlined in the Country's long-term Vision 2030 and medium-term Eighth National Development Plan (8NDP). Given the abundant and largely untapped renewable energy resources in the Country, renewable energy is expected to contribute significantly to Zambia's future energy mix, drive National socio-economic development and contribute to the achievement of the United Nations Sustainable Development Goals (SDGs).

As an executing arm of the Government, ZESCO Limited aims to increase power generation capacity, diversify the energy mix, and address the impact of climate change on hydropower energy production, which has resulted in extended hours of load shedding. Solar energy presents a promising solution as solar radiation levels in Zambia are among the highest in the world, with annual Global Horizontal Irradiation translating into a yearly PV electricity output in the range of 1,550 - 1,700MW, suitable for both small- and large-scale applications.

In line with ZESCO's ambitious plan to expand its power generation mix, to include at least 800MW of solar energy over the next 10 years, as espoused by the ZSECO Strategic Plan, the Corporation proposes the development of the Kafue Gorge Lower (KGL) 200MWac Solar PV Power Project (SPP). This initiative builds on a 2019 feasibility study conducted by PowerChina, which investigated key aspects such as topography, geomorphology, engineering geology, grid connection, site access, flood control, and construction power and water supply. The study concluded that the KGL SPP is technically feasible, paving the way for its implementation.

To facilitate the development of this Project, Jigsco Energy Corporation Limited has been established as a Special Purpose Vehicle (SPV), with ownership shared between Jigsaw Investments Limited and ZESCO Limited. This partnership underscores the collaborative effort between the private sector and public institutions to deliver sustainable energy solutions.

The Project site is located 11km off the Kafue-Chirundu Road and 11km south-east of the Kafue Gorge Lower Hydropower Plant (HPP). The Project will occupy approximately 285 hectares and be implemented in two phases, each with a capacity of 100MWac. The availability of stable power supply will drive economic and social development in the Country, contributing to poverty alleviation and attracting meaningful investment. The total investment cost for the Project is estimated at USD\$90 million, with construction expected to take 15 months and an anticipated operational lifespan of 25 years.

## **Project Objectives**

The objective of this Project is to avail additional generation capacity in the Zambian Integrated Power System (IPS) and diversify the generation mix, reducing the reliance on hydropower. By doing so, the Project aims to increase electricity access, enhance the security of supply, and improve the quality of power supply across the Country.

## **Project Description and Design**

The KGL 200 MWac SPP will include the installation of photovoltaic (PV) solar modules and the construction of approximately 14.2km of 330kV overhead transmission line. This line will evacuate power from a 33/330kV substation to be established at the proposed solar plant site to the KGL Hydro Power Plant (HPP) Substation.

The KGL SPP has a rated power output of 110.0 MWac and a peak power output of 110.0 MWdc, resulting in a DC/AC ratio of 1.00. The Project will utilize the JAM72D42-630/LB bifacial solar module model, manufactured by JA Solar. Each module has a peak power output of 630.0W and is based on monocrystalline silicon (Si-mono) cell technology. To maximize energy generation, the solar modules will be mounted on single-axis trackers. These trackers will adjust the orientation of the PV modules throughout the day to minimize the angle of incidence between the incoming sunlight and the surface of the modules, thereby optimizing energy capture.

Other infrastructure will include a complex building, parking area, internal paths and access roads, and utilities. The Project design does not include dedicated worker accommodations for the operational phase, as the permanent workforce requirements will be minimal.

## **Project Alternatives**

The Project evaluated a range of alternatives across key areas to ensure optimal planning and implementation. Site location alternatives were carefully assessed, taking into account factors such as topography, geomorphology, engineering geology, grid connection feasibility, site access, flood control, construction power and water supply, and alignment with the social and environmental context of the area. The proposed site was selected for its strategic location near the Kafue Gorge HPP. This proximity is a significant advantage, as one of the primary objectives of the Project is to strengthen Zambia's energy resilience by addressing climate-related risks to hydropower generation. By integrating the solar PV plant with the existing hydropower infrastructure, the Project will enhance operational flexibility. This hybrid approach leverages the complementary nature of solar and hydropower, where solar energy can offset reduced hydropower generation during periods of low rainfall. Additionally, the

preferred site for Solar will not result in any physical displacement, save for loss of agricultural fields and trees of economic value.

Solar energy generation design and technology alternatives were also evaluated to identify the most efficient and cost-effective solutions. This included assessing photovoltaic modules, inverters, and tracking systems to optimize energy output and Project viability.

Additionally, transmission line route alternatives were analyzed to determine the most viable pathways for connecting the Solar Power Plant to the grid. Key considerations included technical feasibility, environmental and social impact, and cost efficiency. Three route alternatives were assessed. The preferred route originates from Mwiinga Village in Chirundu District at the Solar Plant site and runs north-east across Kapiri Hills and other elevated areas until it reaches the KGL HPP Substation. Unlike the other two alternatives, this route will traverse entirely through customary land, avoiding private land. It is also the shortest route, making it the most practical and cost-effective option.

This preferred route will not affect any trees of economic value or result in physical displacement. Further, it is located approximately 2km away from the Kafue River, providing sufficient clearance from water bodies as espoused by the Water Resources Management Act. Furthermore, it does not traverse any protected area.

### **The Identified Significant Environmental and Social Impacts of the Project**

It is a requirement in the Environmental Management Act (EMA) No.12 of 2011 as amended by the Environmental Management Act No 8 of 2023, read together with Section 3 (1) of Statutory Instrument (SI) No. 28 of 1997 that, "A developer shall not implement a project for which a Project Brief or Environmental Impact Statement is required under these Regulations, unless the Project Brief or an Environmental Impact Statement has been concluded in accordance with these Regulations and the Zambia Environmental Management Agency (ZEMA) has issued a Decision Letter". The Project under consideration requires an Environmental Impact Statement (EIS).

The proposed Project falls within the Second Schedule "Electricity generation station" and thus requires an EIS. The Environmental and Social Impact Assessment (ESIA) for this proposed Project has been conducted in order to comply with the provisions of this SI.

The ESIA has identified potential impacts and recommended measures to mitigate adverse effects while enhancing positive outcomes. This ensures that the Project aligns with Sustainable Development Goals and maximizes its benefits for the local community and the Nation as a whole.

The Project will affect the general physical, biological and socio-economic environments in the immediate Project area, through the works associated with construction and operation of the Solar Plant.

The 285 hectares of land required for the Solar Plant and associated 14.2km, transmission line route will not displace any households, as no residential structures are located within the project area. However, agricultural fields and trees of economic value will be affected, and affected property owners will be adequately compensated. Other negative social impacts include;

- Increased in-migration due to an influx of job seekers into the area, leading to social cohesion and strain on the available social amenities such as medical facilities; and
- Potential for increased incidence of communicable diseases including acute respiratory infections (ARI) and tuberculosis (TB), as well as Sexually Transmitted Infections (STIs), including HIV/AIDS.

Major anticipated biophysical negative impacts include:

- Visual intrusion from the clearing of vegetation and introduction of infrastructure into the landscape;
- Air quality deterioration from dust and exhaust emissions during construction;
- Noise and vibration due to heavy machinery, blasting and the presence of workers at the site;
- Soil erosion and contamination from the removal of vegetation, operation and movement of heavy-duty vehicles and machinery as well as from excavation of the soil;
- Change in quality of water resources as a result of siltation from soil erosion, leakages or spills of chemicals and oils, improper waste management and abstraction of water for domestic and construction purposes;
- Loss of vegetation as a result of vegetation clearance at the Solar Plant site and along the transmission line wayleave;
- Habitat fragmentation and edge effects from wayleave and Solar Plant site vegetation clearance;
- Introduction of invasive species from the continual movement of heavy vehicles into the Project area;
- Mortality of avifaunal and terrestrial species due to habitat disturbance potential and poaching incidences by construction workers; and
- Disturbance to aquatic ecosystems from water quality changes and potential illegal fishing by construction workers.

Nonetheless, the Project has significant positive impacts over and above those realized by the primary Project objective. In the long term, the KGL SPP is expected to deliver significant trickle-down National economic benefits. These include generating profits through electricity trade, enabling business growth and household benefits by providing reliable power, and creating increased employment opportunities through spin-off economic activities.

Additionally, JIGSCO, in collaboration with the Sikoongo Royal Establishment, will enter into a Corporate Social Responsibility (CSR) Memorandum of Understanding (MoU). Under this agreement, JIGSCO will allocate a portion of its annual profits to fund a CSR program for communities in the project area focused on key areas such as education, health, electrification, environmental management, climate change, water and sanitation, agriculture, skills development, cultural heritage, sports development, and women's enterprise development. This initiative aims to ensure meaningful and sustainable benefits for the local community, throughout the operational lifespan of the Solar Plant.

In the short term, there will be skilled and unskilled employment opportunities at the local level, as well as potential for skills enhancement that will be created, directly and indirectly by the proposed Project.

### **Mitigation and Enhancement Measures**

To mitigate the anticipated adverse impacts and to enhance the opportunities available, mitigation and enhancement measures have been proposed and shall be operationalized through the implementation of the Environment and Social Management Plan (ESMP).

Vegetation loss and land degradation will be minimized by cutting trees at stump height instead of uprooting, along the transmission line route, preserving root systems for soil conservation. At the Solar Plant site, vegetation clearance will be limited to the footprint of infrastructure development.

Soil erosion and siltation will be controlled through appropriate drainage systems, protection of excavated soil materials, and promoting the use of existing access roads. To reduce soil compaction, heavy machinery with floating tires will be prioritized. Surface and groundwater contamination risks will be mitigated through the safe storage and disposal of construction waste, oils and lubricants, and wastewater.

Air quality will be protected by employing dust suppression techniques, such as water spraying, and ensuring that construction equipment is well-maintained to limit exhaust emissions. Noise pollution will be controlled by fitting mufflers on equipment, restricting activities to daytime hours, and providing ear protection for workers.

Solid waste from construction activities will be sorted, collected, and disposed of at approved facilities, while hazardous materials like oils and lubricants will be managed to prevent spills.

Wildlife and aquatic ecosystems will be protected by planning construction activities to avoid critical habitats, minimizing disturbances to small fauna, and using sediment traps and buffer zones to prevent water contamination and safeguard aquatic life.

Additionally, environmental awareness campaigns shall be carried out for the construction team to introduce conservation measures necessary to minimize environmental degradation including, a ban on illegal hunting/fishing, good waste management and appropriate vegetation control/clearance.

Social and health impacts will be addressed through compensation for affected structures and livelihoods, as well as awareness campaigns on HIV/AIDS, sexually transmitted infections (STIs), Gender Based Violence (GBV), and Sexual Exploitation, Abuse, and Harassment (SEAH). Additionally, occupational and community health and safety awareness will be conducted for to promote safe and healthy responsible practices throughout the project. This will be guided by the Health and Safety Management Plan (HSMP) that will be developed for the Project.

These measures aim to ensure that the Project is developed sustainably and responsibly, minimizing negative impacts on the environment and surrounding communities.

## **Conclusion**

The proposed Project is critical for the improvement of National electricity supply, while pursuing a low-carbon, climate-resilient developmental pathway. Correspondingly, improved electricity supply will support the development of various sectors of the economy such as mining, manufacturing, agriculture, tourism, and social infrastructure (such as health centers, schools, police posts, Government institutions and community social facilities).

The need for the proposed KGL 200MW Solar PV Project cannot be overemphasized. The Project meets the demands of the sustainable development principles and its favorable consideration will greatly benefit not only local development but the Nation and the Region at large.

In this regard, the proposed Project is recommended for implementation.

**OTTO KHOZA**  
**DIRECTOR - JIGSCO ENERGY CORPORATION LIMITED**

## **NON-TECHNICAL SUMMARY**

The Kafue Gorge Lower (KGL) 200MW Solar PV Project (SPP) is a key and immediate initiative by the Zambian Government, in its quest to add 1000MW of solar power to the National grid by the end of 2025, to address the current power challenges the Country is facing. This intervention, among others, aims to diversify the portfolio of renewable energy projects, and reduce reliance on hydropower, which is vulnerable to climate change. The Project is expected to improve the electricity network performance, thereby driving National socio-economic development and contribute to the achievement of the United Nations Sustainable Development Goals (SDGs).

The Project involves the construction a solar power plant with photovoltaic modules and evacuation of power into the National grid at the Kafue Gorge Lower Hydropower Plant (HPP) Switching Station, via an approximately 14km of 330kV transmission line. The Project is proposed to be implemented in two phases, each at 100MW. The total Project cost of USD90 million, with an estimated construction period of 15 months. The operational lifespan of the Solar Plant is 25 years.

The construction of the Solar Plant is earmarked on a parcel of land measuring 285 hectares in Mwiinga village, Chirundu District. The said land is customary, under the stewardship of Her Royal Highness Chieftainess Sikoongo.

For the purpose of developing this Project, JIGSCO Energy Corporation Limited has been incorporated, as a Special Purpose Vehicle, with shareholding between Jigsaw Investments Limited and ZESCO Limited.

To address environmental and social issues that may arise from the proposed solar project, a comprehensive Environmental and Social Impact Assessment (ESIA) study has been undertaken in accordance with the Environmental Management Act, No.12 of 2011 as amended by the Environmental Management Act No. 8 of 2023 – The Environmental Impact Assessment Regulations (Statutory Instrument No.28 of 1997). The ESIA study identifies potential impacts and recommends measures to mitigate adverse impacts while enhancing positive impacts.

The Project will affect the general physical, biological and socio-economic environments in the immediate project area through the works associated with construction and operation of the Project. The Project has significant positive impacts over and above those realized by the primary project objective. In the long term the KGL 200MWac Solar PV Project is expected to deliver significant trickle-down National economic benefits. These include generating profits through electricity trade, enabling business growth and household benefits by providing reliable power, and creating increased employment opportunities through spin-off economic activities.

JIGSCO is partnering with the Sikoongo Royal Establishment to establish a comprehensive CSR program. Through a formal CSR MoU, the JIGSCO will dedicate a percentage of annual profits to fund sustainable community development initiatives ensuring broad-based benefits for local communities. The CSR interventions will be implemented with a focus on the following thematic areas: health, education, electrification, social welfare, environmental management, climate change, water and sanitation, agriculture, skills development and entrepreneurship, cultural heritage, sports development, and women's enterprise development.

Negative impacts associated with the bio-physical conditions addressed by this Environmental Impact Statement (EIS) include impacts on: wildlife; water quality ; soil; vegetation; air quality; noise quality, and ecosystem functions and services. Negative impacts associated with the socio-economic conditions include social cohesion, potential strain on local resources and social services due to an influx of people, loss of access to farmland, and potential spread of communicable diseases such as HIV/AIDS and waterborne diseases.

Accordingly, the EIS has proposed enhancement and mitigation measures for positive and negative impacts, respectively, to ensure that positive impacts are maximized while negative impacts are prevented or minimized, as much as possible. Enhancement measures for positive impacts include prioritizing the local community for employment, sourcing building materials locally, and ensuring the successful implementation of the project. Mitigation measures for negative impacts include soil erosion control, waste management plans, dust suppression techniques, noise reduction strategies, fishing regulations, resettlement and livelihood restoration and measures to prevent the spread of communicable diseases.

The KGL SPP represents a significant step toward leveraging Zambia's abundant solar resources to strengthen energy security and support economic growth. Beyond power generation, the Project's commitment to environmental stewardship and community development through targeted social programs will create lasting benefits at both local and National levels. It is therefore recommended for approval and implementation.

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## **ABBREVIATIONS AND ACRONYMS**

|                    |   |
|--------------------|---|
| CSR                | Corporate Social Responsibility               |
| DDCC               | District Development Coordinating Committee   |
| DNPW               | Department of National Parks and Wildlife     |
| EIA/ESIA           | Environmental and Social Impact Assessment    |
| EIS                | Environmental Impact Statement                |
| EMA                | Environmental Management Act                  |
| FD                 | Forestry Department                           |
| GRZ                | Government of the Republic of Zambia          |
| HPP                | Hydropower Plant                              |
| IDC                | Industrial Development Corporation            |
| kWh/m <sup>2</sup> | Kilowatt hours per square meter               |
| KGL                | Kafue Gorge Lower                             |
| KGLSPP             | Kafue Gorge Lower Solar Power Plant           |
| KGLHPP             | Kafue Gorge Lower Hydro Power Plant           |
| MoE                | Ministry of Energy                            |
| MW                 | Mega Watts                                    |
| NHCC               | National Heritage and Conservation Commission |
| PIIM               | Project Induced In-Migration                  |
| PV                 | Photovoltaic                                  |
| RCAP               | Resettlement and Compensation Action Plan     |
| SO                 | Safeguards Officer                            |
| ToRs               | Terms of Reference                            |
| ZEMA               | Zambia Environmental Management Agency        |

## **1.0 INTRODUCTION**

### **1.1 Background of the Project**

The Government of the Republic of Zambia (GRZ) seeks to achieve universal access to clean, reliable, and affordable energy at the lowest economic, financial, social, and environmental cost, as outlined in the Country's long-term Vision 2030 and medium-term Eighth National Development Plan (8NDP). Given the abundant and largely untapped renewable energy resources in the Country, renewable energy is expected to contribute significantly to Zambia's future energy mix and drive National socio-economic development and contribute to the achievement of the United Nations Sustainable Development Goals (SDGs). This approach promotes a low-carbon, climate-resilient developmental pathway, while enhancing socio-economic development.

As an executing arm of the Government, ZESCO Limited aims to increase power generation capacity, diversify the energy mix, and address the impact of climate change on hydropower energy production, which has resulted in extended hours of load shedding. Solar energy presents a promising solution as solar radiation levels in Zambia are among the highest in the world, with annual Global Horizontal Irradiation translating into a yearly PV electricity output in the range of 1,550- 1,700MW, suitable for both small- and large-scale applications (GRZ 2022).

The KGL Solar 200MW Solar PV Project (SPP) is in line with the developmental strategies adopted by the Government in harnessing the renewable energy potential and to promote the much-needed generation mix in Zambia. The Project was conceptualized as a mitigation measure in response to the hydrological risk associated with the impact of climate change on hydropower generation.

For the purpose of developing this Project, JIGSCO Energy Corporation Limited has been incorporated, as a Special Purpose Vehicle, with shareholding between Jigsaw Investments Limited and ZESCO Limited.

In 2019, PowerChina conducted investigations (topography, geomorphology, engineering geology, grid connection, site access, flood control, construction power supply and water supply) to assess the project feasibility. The study conducted by PowerChina in August 2019 concluded that 200 MW KGL Solar PV project is technically feasible. In 2020, ZESCO conducted a Grid impact study for the Project that concluded, and augmented the PowerChina findings. It further established that with proposed 200MW Solar PV injection into the National grid from the KGLSPP and considering 616MW of other Solar PV, the Integrated Power System (IPS) would not experience any loading or voltage violation under normal and contingency conditions.

Commencement of Project implementation has previously been delayed due to challenges in sourcing for finances. The secured financing and the incorporation of the SPV now presents an opportunity to actualise the Project. The target market comprises of residential, agriculture, manufacturing, mining, and industrial customers in Zambia.

## **1.2 Summary Description of the Project including Project Rationale**

As part of ZESCO's ambitious plan to expand its power generation mix to include at least 800MW of solar energy over the next 10 years, as espoused by the ZESCO Strategic Plan, the Corporation proposes the development of the KGLSPP. Further, to address the current power challenges the Country is facing, the Government has instituted an immediate initiative to add 1000MW of solar power to the National grid by the end of 2025. The Project will be implemented in phases, with an initial 100MW developed and commissioned in the first phase, followed by the subsequent 100MW in the second phase. The Project represents a significant step in leveraging Zambia's natural resources to enhance the Country's energy security and support economic growth, while upholding the tenets of environmental and social sustainability.

The Project will involve the construction of a 33/330kV substation on site, which would be linked to the Kafue Gorge Lower Hydroelectric Power Plant (KGLHPP) Substation, via a 330kV transmission line, approximately 14km long. Additionally, the 65MVA transformer at the KGLHPP Substation will be upgraded to facilitate power evacuation.

## **1.3 Objectives the Project**

The objective of this Project is to avail additional generation capacity in the Zambian IPS and diversify the generation mix, reducing the reliance on hydropower. The Country is currently experiencing load management due to low water levels in the reservoirs as a result of insufficient rainfall, induced by climate change.

This Project therefore, aims to:

- Increase electricity access;
- Increase security of supply; and
- Improve power supply quality throughout the Country.

## **1.4 Brief Description of the Location**

The Project is located in Chirundu District, approximately 23km from Chirundu Town. The site itself is uninhabited, with no settlements nearby, though several agricultural fields are present in the area. The closest landmark is Kabanana Village, situated 12km

away from the site. The Project area is accessible via Chirundu Road, which is located 12km away.

To the north, the area is bordered by three hills: Tibwe, Kapiri, and Mabwaye. To the east and south, the Kafue River is located approximately 2.2km from the Project area, while to the west, the Musuya Stream is situated 1.5km away. Ecologically, the Project area is 27km from Mutulanganga Forest, 41km from Lusitu Forest, and 2.4km from the Chiawa Game Management Area which is across the Kafue River.

### **1.5 Particulars of Shareholders/Directors**

For the purpose of developing this Project, JIGSCO Energy Corporation Limited has been incorporated, as a Special Purpose Vehicle, with shareholding between Jigsaw Investments Limited and ZESCO Limited. This is pursuant to the provisions of the Companies Act, providing for the construction of a power plant, to generate electrical power by conventional and non-conventional methods including coal, gas lignite, oil, biomass, waste, thermal, solar, hydel, geo-hydel, wind and tidal waves.

The affairs of JIGSCO Energy Corporation Limited are managed by a Board of Directors, listed hereunder:

- I. Otto Khoza– Board Chairperson;
- II. Mrs. Joyce Muwo’ Mwansa;
- III. Deolinda Guilherme Langa Wicht;
- IV. Florence Kabati;
- V. Justin Loongo;
- VI. Racheal Inonge Zekko; and
- VII. Choice Corporate Services Limited - Board Secretary.

### **1.6 Percentage of Shareholding by each Shareholder**

Shareholding between Jigsaw Investments Limited and ZESCO Limited in JIGSCO Energy Corporation Limited is as follows.

- Jigsaw Investment Limited: 70%
- ZESCO Limited: 30%

### **1.7 The Developer’s Physical Address and the Contact Person Details**

JIGSCO Energy Corporation Limited  
Stand No. 3509/No.7  
Matandani Close  
Rhodespark  
P.O. Box 32565  
Lusaka

Mr. Otto Khoza  
Director  
JIGSCO Energy Corporation Limited  
Stand No. 3509/No.7  
Matandani Close  
Rhodespark  
Email:[choicecorp@zamnet.zm](mailto:choicecorp@zamnet.zm)  
Tel: +20955834322

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

ZESCO Limited, a shareholder of JIGSCO Energy Corporation Limited, has conducted numerous Environmental and Social Impact Assessment (ESIA) studies over the past 29 years for various generation, transmission, and distribution projects, including but not limited to;

- **Chisamba 200MW Solar PV Project** – Currently under construction, the objective of the Project is to create a green alternative to hydropower generation and address the challenges faced by hydropower generation such as low water levels caused by climate change. The Solar Plant is Located in Chisamba District and about 25km southeast of Kabwe Town and is currently under Construction. The Project involves construction of a 100MW power station and 2km transmission line to the Kabwe 330/88/66kV Substation.
- **The Power Rehabilitation Project** - The Zambia Power Rehabilitation Project's (PRP) overall objective was to support the Government's objectives of enhancing the ability of the country's electricity supply industry to provide electricity at least cost and in an efficient and sustainable manner to stimulate more and inclusive growth in the economy. The works involved rehabilitation of generation, transmission and distribution infrastructure that included power line repairs and replacements, and reinforcement of substations. Upon completion of the rehabilitation works at the power stations there was an additional 210MW added to the total generation capacity.
- **Kafue Gorge Lower Hydro Power Project (750MW)** - The Kafue Gorge Lower (KGL) Hydro Power Project included the construction of a generation plant with a capacity of 750MW as well as the construction of a 330kV transmission line from the KGL power station into the National Grid.
- **Kariba North Bank Extension Project (360MW)** - The Project was aimed at increasing the capacity of Kariba North Bank power station by adding two generating units of 180MW each to the existing four units. A dam with sufficient capacity exists and provision for the addition of two machines to the existing

four was made. For this project, a transmission line was constructed to take the power to the Kafue west substation.

- **Optic Fibre Communication Project** - The state-of-the-art optic fibre is aimed at replacing the existing ground wire on the high voltage power lines. The fibre has been installed on strategic line networks. The optic fibre offers better clarity, has a higher bandwidth and thus offers a better channel of communication for the various services that ZESCO uses. The project has resulted in improved overall corporate effectiveness and efficiency in ZESCO.
- **Itezhi Tezhi 330kV Transmission Line** - The project is aimed at constructing a 273 km long line from the Itezhi Tezhi Power Station to the existing Lusaka West Substation, through the proposed Mumbwa 220kV/330kV Substation. The objective is to transmit the 200MW to be generated by the new power station into the national grid.
- **Muzuma Upgrade 220kV- 330kV Transmission Line** - The project involves upgrading the existing Livingstone – Kafue Town 220kV transmission line to a 330kV line. The objective of the project is to increase the line's voltage capacity in order to transmit more power.
- **Leopards Hill – Luangwa 132kV Transmission Line** - The project involves constructing a 187km long 132kV line from the existing Leopards Hill Substation to the proposed 132/33kV Chitope substation in Luangwa District, through a 132/33kV substation in Rufunsa District. The Project will also include a 33kV reticulation line in Rufunsa and another 33kV line from the Chitope substation to Luangwa Town (62km) and to the Great East Road turn off (25km). The objective of the project is to connect Rufunsa and Luangwa Districts to the National Grid. The Project will also lead to the decommissioning of the less environmentally friendly Luangwa diesel powered power plant.
- **Pensulo – Kasama 330kV Transmission Line** - ZESCO constructed a 330kV transmission line from Pensulo substation in Serenje District to Kasama substation in Kasama District via Mpika substation in Mpika District. The project also involved the expansion of Pensulo, Mpika and Kasama substations. The project was aimed at reinforcing power supply to Muchinga, Northern and Luapula Provinces.
- **Pensulo – Chipata 330kV Transmission Line** - The project involved constructing a 285km long line from the existing Pensulo substation in Serenje to the proposed Chipata 330kV substation, through the proposed 330kV substation in Msoro. The Project aimed at extending the 330kV network to Chipata in order to provide reliable supply to the Eastern Province.
- **Luano – Kansanshi - Lumwana Mine 330kV Transmission Line** - ZESCO Limited constructed the Luano – Kansanshi Mine 330kV and the Kansanshi Mine – Lumwana Mine 330kV transmission lines in order to support economic

activities in the mineral rich North-Western Province. ZESCO also constructed the Victoria Falls – Katima Mulilo 220kV transmission line.

- **North-Western Grid Extension Project** - ZESCO connected Mwinilunga, Mufumbwe, Kabompo, Manyinga, Zambezi and Chavuma in Northwestern Province as well as Lukulu in Western Province to the National Grid. The project involved the construction of approximately 830km of 132kV line from Lumwana Mine Substation in Kalumbila District to Mwinilunga and then from the aforesaid substation to Chavuma via Mufumbwe, Mumbeshi, Manyinga, Kabompo and Zambezi. The project was aimed at connecting all the districts of North-western Province to the National Grid and eliminating the economically and environmentally unsustainable diesel generation stations.
- **Leopards Hill – Luangwa 132kV Transmission Line** - The project involved constructing a 187km long 132kV line from the Leopards Hill Substation to the 132/33kV Chitope Substation in Luangwa District, through a 132/33kV substation in Rufunsa District. The project also included 33kV reticulation line in Rufunsa and another 33kV line from the Chitope substation to Luangwa Town (62km) and to the Great East Road turn off (25km). The objective of the project was to connect Rufunsa and Luangwa Districts to the National Grid. The project led to the decommissioning of the less environmentally friendly Luangwa diesel powered power plant.

## **1.9 Total Project Cost/Investment**

The Project is estimated at **USD 90 million** or kwacha equivalent **ZMW 2,610,000,000.00**.

## **1.10 Proposed Project Implementation Date**

The Project shall be implemented over a period of 15 months upon obtaining approval for the Environmental Impact Statement (EIS) from the Zambia Environmental Management Agency (ZEMA), in addition to other regulatory requirements.

## **2.0 POLICY, INSTITUTIONAL AND ORGANISATIONAL FRAMEWORK**

### **2.1 Policy Framework**

#### **2.1.1 Zambia Vision 2030**

The National Long-Term Vision 2030 (Vision 2030) is Zambia's first comprehensive long-term development plan, outlining the Nation's aspirations for the year 2030.

For the energy sector, the vision is to achieve “universal access to clean, reliable, and affordable energy at the lowest total economic, financial, social, and environmental cost, in alignment with national development goals by 2030”.

This vision is supported by key goals including:

- i. Abundant and reliable supply of affordable energy to both urban and rural areas;
- ii. Increased renewable alternative sources of energy;
- iii. Export led energy industry; and
- iv. Reduce the share of wood fuel to 40 percent by 2030.

The Vision is operationalized through five-year national development plans, currently the Eighth National Development Plan (8NDP) for 2022 to 2026.

#### **2.1.2 Eighth National Development Plan**

The 8NDP is the Country’s medium-term blueprint designed to unlock the potential in all sectors of the economy for sustainable, holistic and inclusive National development. It introduces strategic interventions anchored on Economic Transformation and Job Creation, Human and Social Development, Environmental Sustainability and Good Governance Environment.

Energy is one of the important driving forces behind the development of an economy as it cuts across most economic and social activities. However, the Project aims to directly contribute to the following Strategic Development Area’s:

- Strategic Development Area one (1) which focuses on the attainment of economic transformation that will be marked by advancements in industrialisation and economic diversification for sustained growth driven by agriculture, mining, manufacturing and tourism. Specifically, Strategy Six (Enhance Generation, Transmission and Distribution of Electricity) which focuses on increasing electricity generation capacity and promotion of alternative green and renewable energy sources.

- Strategic Development Area Three (3) which emphasizes development that is anchored on sustainable environment, ecosystems and natural resource management principles.

### **2.1.3 National Energy Policy (2019)**

The overall objective of the Policy is to achieve an optimal energy resources utilization to meet Zambia's domestic and non-domestic needs at the lowest total economic, financial, social, environmental and opportunity cost and establish Zambia as a net exporter of energy. Among its primary objectives is to steer the development of electricity generation, transmission, and distribution capacity and to encourage the growth and implementation of renewable and alternative energy sources. Placing a strong emphasis on sustainable sector development and increased access to clean and efficient energy.

The Project directly supports the policy's objective of achieving optimal energy resource utilization by leveraging Zambia's abundant solar energy potential, to meet domestic energy needs and reduce reliance on hydropower, which is vulnerable to climate change. The Project will generate 200MW of solar energy, contributing to Zambia's goal of improving the energy mix.

### **2.1.4 National Policy on the Environment (2007)**

The National Policy on the Environment was developed in 2007 to safeguard the environment and ensure the sustainable use of natural resources. The purpose of the policy is "to create an umbrella policy for the welfare of the Nation's environment so that socio-economic development will be achieved effectively without damaging the integrity of the environment or its resources".

The Policy emphasizes that it is the duty of any institution, Government or Non-Governmental Organisation (NGO), any community group or people's organisation or any individual that uses or otherwise carries out activities that affect the environment in any way, to exercise appropriate control to maintain the productivity and integrity of the environment.

The policy emphasizes the responsibility of all stakeholders to maintain environmental integrity, which is reflected in the Project's commitment to conducting a comprehensive Environmental and Social Impact Assessment (ESIA).

### **2.1.5 National Forestry Policy (2014)**

The Policy provides for a multi-sectoral approach that underpins the principle of local community and private sector participation in sustainable forest management. Further, it emphasizes equity and justice that vigorously motivates responsible sustainable

forest management. It also provides for the domestication of international environmental agreements on the premise that forests play a key role in improving the global environment and sustainability. These include the United Nations Framework Convention on Climate Change (UNFCCC), Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES), the Convention on Wetlands of International Importance, the Convention on Biological Diversity (CBD), the Convention to Combat Desertification and other relevant international agreements to which Zambia is a party.

While the Project is not directly related to forestry management, it supports the policy's broader goals of environmental sustainability and climate resilience by promoting renewable energy and reducing deforestation pressures associated with alternative energy sources like biomass. Further, the Project will ensure that any loss of biological resources is mitigated through sustainable practices.

### **2.1.6 National Policy on Climate Change (2016)**

The vision of the 2016 National Policy on Climate Change is to attain a prosperous climate resilient economy by 2030. One of the policy objectives is to promote and implement sustainable land use management practices in order to contribute to reducing the Green House Gas (GHG) emissions from Forest and Land Use and Land Use Change and Forestry (LULUCF). Some of the identified measures to reduce emissions from forests are through reduction of forest degradation and loss of forest ecosystems and, strengthening fire management and soil conservation efforts.

The Project aligns with the policy's vision of a climate-resilient economy by promoting renewable energy and reducing greenhouse gas emissions.

### **2.1.7 Zambia's National Resettlement Policy (2015)**

Involuntary resettlement involves the displacement of people arising from development projects which encroach on their productive assets, cultural sites and income sources viz, land, grazing fields, other assets, etc.

The National Resettlement Policy was adopted with the overall objective of establishing and protecting resettlement schemes that are economically productive, socially secure and environmentally sustainable for persons settled voluntarily or involuntarily.

Section 5 of the Policy sets out a number of guiding principles, including:

- The right to alternative land, which is safe, secure, accessible, affordable;
- Legal title to land to which people are resettled;
- The need to provide basic services;

- Involuntary resettlement should be in line with the international human rights and humanitarian law;
- Displaced people should be compensated and assisted, so that their economic and social future would be generally as favourable as it would have been in the absence of the project or better; and
- Involuntary resettlement should be conceived and executed as part of the project.

Lastly, the full cost of resettlement and compensation should be included in the presentation of project costs and benefits.

The Project is expected to impact agricultural fields; therefore, a Resettlement and Compensation Action Plan (RCAP) has been developed in accordance with relevant policy guidelines to address these impacts.

### **2.1.8 National Gender Policy (2023)**

The National Gender Policy aims to accelerate the achievement of gender equity and equality in the Country.

Gender considerations will be mainstreamed across all Project activities, including but not limited to employment, stakeholder engagement, grievance redress mechanisms, resettlement, and compensation.

As part of this commitment, the Project team conducted community engagement campaigns to educate local residents about the project's objectives, benefits, and potential impacts. These efforts ensured that both women and men received information equitably and had the opportunity to express their concerns or ask questions.

Additionally, two local focal point persons—one male and one female—were selected to be part of the grievance redress mechanism (GRM), ensuring that community concerns are effectively addressed in a gender-inclusive and transparent manner throughout the Project implementation.

During Project implementation, ZESCO Limited and its contractors will endeavour to provide equal employment opportunities for women and men throughout the Project lifecycle. This involves fair recruitment processes, training programs, and promoting a work environment that is free from gender-based discrimination.

## **2.2 Organisational/ Administrative Framework**

### **2.2.1 Ministry of Green Economy and Environment**

The Ministry is responsible for facilitating and coordinating the development and implementation of policies, programmes and projects on the environment to ensure sustainable management and conservation of the environment. The proposed Project will interact with the following Departments/Agencies under the Ministry, listed hereunder.

### **(A) Zambia Environmental Management Agency**

The general functions of the Zambia Environmental Management Agency (ZEMA) are to ensure the sustainable management of natural resources, the protection of the environment, and the control of pollution.

The responsibility of environmental impact assessment is vested in ZEMA, which administers the Environmental Management Act (EMA) No. 12 of 2011 as amended by the EMA No. 8 of 2023, Statutory Instrument No. 28 of 1997 – The Environmental Impact Assessment (EIA) Regulations. By administering the EMA, ZEMA is the lead agency on environmental management in Zambia.

The services provided by ZEMA specifically in relation to ESIA studies include:

- Assisting the developer to determine the scope of ESIA studies;
- Reviewing project briefs, terms of reference, and environmental impact statements (EIS) and decision making;
- Disclosure of environmental and social safeguard instruments to the public through the media and/or via public hearing meetings;
- Conducting verification surveys of the affected environment;
- Monitoring the project once implemented;
- Conducting compliance audits of the project between 12 and 36 months after implementation; and
- General administration of all the Regulations under the EMA.

As prescribed by SI No. 28 – The EIA Regulations, JIGSCO, as the developer of the KGL 200MW Solar PV Power Generation Project, “may have an effect on the environment” is required to submit an EIS to ZEMA for approval before “undertaking” this Project and is required to abide to the “conditions compulsory by the ZEMA in that approval”.

### **(B) Forestry Department**

The Forestry Department (FD) is established under the Forests Act No. 4 of 2015. The Department is responsible for managing, protecting and conserving forests in order to ensure their sustainable utilization and management for socio-economic development. Whilst the Project does not directly affect any protected areas, the Forestry Department was engaged in identifying potential impacts on forest resources and

proposing mitigation measures. A reconnaissance survey of the proposed site and transmission line route was undertaken, and a biomass assessment study shall be conducted by the Department, for the issuance of a tree felling Permit for the loss of trees in the affected by the Project.

## **2.2.2 Ministry of Tourism**

### **(A) Department of National Parks and Wildlife**

Established under the Zambia Wildlife Act, No. 14 of 2015 to manage and conserve Zambia's wildlife estate comprising 20 National Parks, 36 Game Management Areas and one bird sanctuary, which cover 31 percent of the Country's land mass. The functions of the Department of National Parks and Wildlife (DNPW) include; to control, manage, conserve, protect and administer National Parks, Community Partnership Parks, bird and wildlife sanctuaries and Game Management Areas and coordinate activities in these areas; and issue licenses, certificates and permits.

There are no National Parks or Game Management Areas (GMA's) directly affected by the Project, however, Chiawa GMA across the Kafue River is about 2.5km away. The DNPW has been engaged to carry out a biodiversity assessment in order to evaluate potential ecological impacts and ensure compliance with conservation requirements. Furthermore, all wildlife that may be encountered during the project implementation phase will be protected as prescribed in the Act.

### **(B) The National Heritage Conservation Commission**

The National Heritage Conservation Commission (NHCC), formerly known as the Commission for the Preservation of Natural and Historical Monuments and relics (National Monuments Commission), is the National institution mandated to manage and conserve Zambia's cultural and natural heritage resources, including significant:

- Historic/architectural/buildings;
- Historic sites;
- Anthropological sites;
- Archaeological sites;
- Geomorphological sites;
- Geophysical sites;
- Paleontological sites; and
- Ecological and other sites.

NHCC is a key stakeholder in the review of the Project's potential cultural and heritage impacts. Community stakeholder engagement revealed that there is an active graveyard within the Project site. NHCC has been engaged to carry out a Heritage Impact Assessment (HIA). Any future cultural sites or artifacts that may be discovered

in the Project area, will be managed as prescribed in the Chance Finds Procedure (Appendix 1).

### **2.2.3 The Ministry of Energy**

The Ministry of Energy (MoE) is responsible for the development and management of energy resources in a sustainable manner for the benefit of the people. The mandate and portfolio functions of MoE, as outlined in the Government Gazette Notice No. 836 of 2016, are as follows:

- Development of Renewable Energy Sources;
- Electricity;
- Energy Policy;
- Nuclear Energy Policy;
- Oil Pipeline and Refineries;
- Petroleum; and
- Petroleum Storage and Pricing.

In executing its mandate, the Ministry supervises the Energy Regulation Board (ERB) and ZESCO Limited.

#### **(A) The Energy Regulation Board**

The ERB has the mandate of regulating the energy sector in line with the provisions of the Energy Regulation Act of 2019. The ERB has the responsibility of ensuring that power generating utilities earn a reasonable rate of return on their investments that is necessary to provide a quality service at affordable prices to the consumer.

In order to carry out this role, the ERB, among other functions, ensures that all energy utilities in the sector are licensed, monitors levels and structures of competition, and investigates and remedies consumer complaints.

The license to operate the proposed Project will be approved by ERB.

#### **(B) ZESCO Limited**

ZESCO is a shareholder in JIGSCO Energy Corporation, the Project developer. A parastatal under the MoE, ZESCO Limited was formed in 1970 after the Zambia Electricity Supply Act was passed in Parliament. This Act brought together the electricity undertakings that were previously managed by the local authorities. ZESCO Limited is a vertically integrated electricity utility, which generates, transmits, distributes and supplies electricity in Zambia. It is a public utility, owned by the Government of Zambia (GRZ), through the Industrial Development Corporation (IDC)

as the sole shareholder. ZESCO is committed to providing safe and reliable electricity to improve the quality of life for all.

ZESCO Limited produces approximately 80% of the electricity consumed in the Country and has historically been the main player in the generation, transmission and distribution of electricity in Zambia. In addition, ZESCO Limited is among the utilities that represents Zambia in the Southern African Power Pool (SAPP), which is a cooperation of the national electricity companies in Southern Africa, under the auspices of the Southern African Development Community (SADC). SAPP has created a common power grid among its 12 member countries and a common market for electricity in the SADC region due to the increasing demand for electricity.

#### **2.2.4 Other Ministries and Authorities**

Environmental and social issues cut across a wide variety of sectors and as such, there are a number of Government institutions and agencies which are involved in environmental and social management. Some of the ministries, sectorial agencies and authorities that will interact with the proposed KGLSPP include:

- Ministry of Labour and Social Security;
- Ministry of Health;
- Ministry of Community Development and Social Services;
- Ministry of Water Development and Sanitation (Water Resource Management Authority (WARMA), Department of Water Affairs);
- Ministry of Local Government and Rural Development (Department of Chiefs and Traditional Affairs and Chirundu Town Council);
- Ministry of Agriculture;
- Ministry of Livestock and Fisheries;
- Road Development Agency (RDA); and
- The Sikoongo Royal Establishment

### **2.3 Regulatory and Legal Framework**

The principle environmental legislation in Zambia is the EMA No. 12 of 2011 as amended by the EMA No. 8 of 2023. This legislation sets out a framework for Environmental Impact Assessments (EIAs) as well as establishing ZEMA as the regulatory body charged with overseeing the application of the environmental legislation. It also provides for integrated environmental management and the protection and conservation of the environment and the sustainable management and use of natural resources.

JIGSCO Energy Corporation will ensure that it adheres to the principles of sustainable development in the utilization of natural resources during all phases of project development. This shall be done by ensuring that all the identified negative impacts

are minimized in accordance with the mitigation measures to be stipulated in the EIS and the Environmental and Social Management Plan (ESMP).

The Environmental Management Act No.12 of 2011 as amended by the EMA No. 8 of 2023, Statutory Instrument No. 28 of 1997 instructs that "A developer shall not implement a project for which a Project Brief or Environmental Impact Assessment is required under these regulations, unless the project brief or environmental impact statement have been concluded in accordance with these regulations and the Zambia Environmental Management Agency (ZEMA) has issued a decision letter". In the category of electrical infrastructure, the types of projects that require project briefs and environmental impact statements include: electric generation stations and transmission lines more than 1km long. The project under consideration falls within the second schedule, and thus requires an Environmental Impact Statement (EIS).

The environmental impact assessment for this proposed Project has been conducted in order to comply with the provisions of this SI.

Table 1 below presents relevant National legislation which are applicable to the Project.

Table 1: Legislation Relevant to the Project

| Legal Instrument   | Main Provisions  | Responsible Institutions                                     | Relevance to the Proposed Project   | Compliance with Legislation  |
|--|--|--|---|--|
| <p><b>Environmental Management Act (EMA) No.12 of 2011 as amended by the EMA No. 8 of 2023</b></p> | <p>This Act provides for integrated environmental management and the protection and conservation of the environment and the sustainable management and use of natural resources. It also provides for the prevention and control of pollution and environmental degradation so as to provide for the health and welfare of persons, animals, plants and the environment.</p> <p>Section 29 (1) of the Act provides that "A person shall not undertake any project that may have an effect on the environment without the written approval of the Agency, and except in accordance with any conditions imposed in that approval". The Act also covers the management of water, air, waste (hazardous and municipal), pesticides and toxic substances,</p> | <p>Ministry of Green Economy and Environment</p> <p>ZEMA</p> | <p>The Act provides a framework for undertaking the ESIA study. Additionally, development of this Project is subject to the issuance of the Decision Letter of approval, which is a prerequisite permit, in addition to other statutory requirements.</p> | <p>Carrying out this ESIA study is in compliance with the EMA No. 12 of 2011 as amended by the EMA No. 8 of 2023 in particular, Statutory Instrument No. 28 of 1997, The EIA Regulations,</p> <p>The principles of sustainable development during all phases of project implementation shall be adhered to. This shall be done by making sure that all identified negative impacts are minimized and positive impacts are enhanced in accordance with the ESIA and the mitigation measures thereof to enhance environmental protection.</p> <p>Environmental monitoring/audit shall be carried out on various aspects of the Project in relation to air and water pollution; waste management; hazardous waste</p> |

| Legal Instrument  | Main Provisions   | Responsible Institutions  | Relevance to the Proposed Project   | Compliance with Legislation   |
|---|---|---|---|---|
|   | noise, ionizing radiation and natural resources, etc.   |   |   | and ozone depleting substances.   |
| <b>The Water Supply and Sanitation Act No. 28 of 1997</b> | <p>Framework for providing and regulating water and sanitation services to all areas. Creates the Council i.e., National Water Supply and Sanitation Council (NWASCO) which administers the Act.</p> <p>Section 24 (3) of the Act provides that a utility or service provider and a local authority in its service area shall establish procedures for adequate consultation to be carried out for developmental planning or for implementing physical works.</p> | <p>Ministry of Water Development and Sanitation (MWDS)</p> <p>NWASCO</p>                                      | <p>JIGSCO Limited will work in consultation with the Chirundu District Council and local utilities on the best approach of implementing the Project without disturbing the water and sanitation installations.</p>  | <p>All sanitation and water aspects arising from the project will abide by the Water Supply and Sanitation Act No.28 of 1997, thus preventing pollution of ground water and disturbance of water and sanitation utility services.</p> <p>Any agreement/instructions from utilities and Local Authorities shall be followed.</p> |
| <b>Water Resources Management Act, No 21 of 2011</b>      | <p>The Act provides standards and regulations to follow as well as steps to control or prevent water pollution.</p>   | <p>Ministry of Water Development and Sanitation (MWDS)</p> <p>Water Resource Management Authority (WARMA)</p> | <p>Regulates aspects of water resources in order to conserve, preserve and protect water related environments, such as wetlands, quarries, dambos, marshlands and head waters.</p> <p>The Project area may affect water resources such as the Kafue River, eastward of the Project site and the</p> | <p>The Act shall be adhered to, to ensure all procedures to avoid polluting ground and surface water are followed.</p>  |

| <b>Legal Instrument</b>                                  | <b>Main Provisions</b>  | <b>Responsible Institutions</b>  | <b>Relevance to the Proposed Project</b>   | <b>Compliance with Legislation</b>   |
|--|---|--|--|--|
|  |   |  | Musaya River, southward the Project site.  |  |
| <b>Natural Resources Conservation Act, Cap 315, 1970</b> | Conservation and improvement of natural resources.  | Ministry of Green Economy and Environment.                                   | Regulates aspects of natural resources to ensure protection of land, water and biodiversity.   | The Act shall be adhered to, to ensure sustainable natural resources conservation.   |
| <b>The Forestry Act No. 4 of 2015</b>                    | Provides for the establishment and management of National and Local Forests, conservation and protection of forests and trees, and licensing and sale of forest products, and to provide for matters connected with or incidental to the foregoing.   | Ministry of Green Economy and Environment.<br><br>Forestry Department        | Whilst the Project is unlikely to affect protected Forest areas, the existing vegetation is a habitat to a range of fauna within the area. | The contractor and all employees working on the project will not fell, cut, burn, or remove any trees without prior consent from the Forestry Department.                  |
| <b>Zambian Wildlife Act No. 14 of 2015</b>               | Provides for the removal of the Zambian Wildlife Authority and the establishment of the Department of National Parks and Wildlife (DNPW) in the Ministry responsible for tourism. The Act provides for the regulation of National Parks and the protection of certain species of fauna and flora. | Ministry of Tourism.<br><br>Department of National Parks and Wildlife (DNPW) | Whilst the Project is unlikely to affect any Game Management areas, project activities may impact local wildlife.                          | Care shall be taken during the implementation of the Project to minimize wildlife that may be subjected to injury or death, in accordance with the provisions of this Act. |
| <b>Local Administration (Trade Effluent)</b>             | Develops standards for and regulates discharging of effluent into the aquatic environment; and  | Ministry of Local Government and Rural                                       | Project activities may include the transportation and storage of   | The Act shall be adhered to. Activities shall be monitored to  |

| Legal Instrument                            | Main Provisions  | Responsible Institutions                     | Relevance to the Proposed Project   | Compliance with Legislation   |
|---|--|--|---|---|
| <b>Regulations, No. 161 of 1986</b>         | defines permissible effluent limits for industry.  | Development (MLGRD)<br><br>Local Authorities | hazardous waste such as used oil on site.   | ensure no contamination of the ground water and soil occurs.  |
| <b>Energy Regulation Act No. 12 of 2019</b> | <p>An Act to provide for the licensing of enterprises in the energy sector; continue the existence of the Energy Regulation Board and re-define its functions</p> <p>Relevant clauses include;</p> <p>"4 (f) approve the location and construction of a common carrier or an energy facility or installation or the carrying out of any works by a licensee or enterprise and regulate that location and construction by attaching terms and conditions to the license or a permit held by a licensee and enterprise under this Act or any other applicable written law;</p> <p>(g) stipulate conditions relating to the location, installation or construction of a common carrier,</p> | ERB  | <p>License for operation of all energy facilities is required before commencement of the Project.</p> <p>The operation of the solar plant and transmission line and all upgrades on the existing substations and associated facilities shall be monitored by ERB to ensure conformity to the provisions of the Act.</p> | To ensure safe and reliable supply of electricity safety and awareness programs will be conducted with the people in and around the Project area as well as to the employees. This will be done in accordance with the provisions of the Energy Regulation Act. |

| Legal Instrument                                    | Main Provisions   | Responsible Institutions   | Relevance to the Proposed Project   | Compliance with Legislation   |
|---|---|--|---|---|
|   | <p>or an energy facility or an installation;</p> <p>(i) in collaboration with ZEMA, formulate measures to minimise the environmental impact of activities carried out in the energy sector.”</p>  |  |   |   |
| <b>The Petroleum Act Chapter 435, No. 8 of 1995</b> | <p>To make provision for regulating the importation, conveyance and storage of petroleum and other inflammable oils and liquids;</p> <p>To provide for incidental matters.</p>  | <p>Ministry of Energy<br/>ERB</p>  | <p>Storage and dispensing of all oils during the construction and operation phase of the Project shall comply with the provisions of the Act.</p> | <p>The Project shall comply with the Act to ensure proper transportation, utilisation and storage of inflammable liquids.</p> |
| <b>Local Government Act, No. 2 of 2019</b>          | <p>The Act provides for the establishment of Councils in districts which function as Local Authorities. Some of their functions relate to control of the development, use of land and buildings, erection of buildings, conservation of natural resources, prevention of soil erosion, protection of life, property and natural resources from age by fire, control of grass weeds and wild vegetation, and maintenance of environmental health services.</p> | <p>Ministry of Local Government and Rural Development (MLGRD)<br/><br/>Chirundu Town Council</p> | <p>The Act is relevant to the Project as some pollution control and environmental protection functions are handled by the local authority.</p>    | <p>JIGSCO Limited will consult and work together with Chirundu Town Council, during and after Project implementation.</p>     |

| Legal Instrument   | Main Provisions   | Responsible Institutions                | Relevance to the Proposed Project  | Compliance with Legislation   |
|--|---|---|--|---|
|  | Other functions include control of the storage, sale and use of petroleum, extermination of insects, rodents and snakes, dealing with all kinds of refuse and effluent, controlling the provision of drains and sewers, and conservation and the prevention of the pollution of supplies of water.                                |   |  |   |
| <b>Occupational Health and Safety Act No. 36 of 2010</b> | This Occupational Health and Safety (OHS) Act regulates the Conditions of Employment in places of work as regard to the health, safety and welfare of persons employed therein. The Act also provides for the prudent examination and inspection of certain plant and machinery/equipment in order to ensure safety at all times. | Ministry of Labour and Social Security. | More so during the construction phase, the proposed Project will have high potential for the public and occupational health and safety risks covered by the Act and hence the relevance. | ZESCO operational Health and Safety Guidelines will govern project operations, and all undertakings under the proposed Project will be guided by these guidelines in compliance with the Act. |

| <b>Legal Instrument</b>   | <b>Main Provisions</b>  | <b>Responsible Institutions</b>   | <b>Relevance to the Proposed Project</b>  | <b>Compliance with Legislation</b>  |
|---|---|---|---|---|
| <b>Public Health Act No. 19 of 2020</b>                                     | The Act provides for the prevention and suppression of diseases and general regulation of all matters connected with public health in the country.  | Ministry of Health.   | When Project implementation commences, there will be an influx of people from outside the project area who will be employed on the Project. These people will be interacting with the local people and may lead to the spread of communicable diseases such as cholera, STIs, HIV/AIDS, COVID-19 and dysentery. | Involvement of local health practitioners for counselling to the workmanship of the contractor prior to commencement and during construction works as well as to the locals as they will be interacting with the new people in the area.  |
| <b>The Lands Act No. 20 of 1996 and Land Acquisition Act No. 13 of 1994</b> | The Department of Lands administers the Lands Act for alienation of land under statutory leaseholds. Under the Land Act of 1996, land has been divided into the following categories: State, Local Authority and Traditional Land. The proposed developments fall under Local Authority and Traditional Land. | Ministry of Lands and Natural Resources.<br><br>Ministry of Local Government and Rural Development (MLGRD). | The proposed Project will entail acquiring Land from the Chirundu District Council. Cautious measures have been taken to utilize un-occupied land away from settlements as much as possible.  | Prudent measures shall be taken during the survey of the proposed Project in order to ensure that the number of affected settlements is minimised. The provisions of this Act shall be adhered to as far as land acquisition is concerned and compensation of affected people will be done where necessary. The local and traditional authorities shall extensively be consulted on the proposed Project. |
| <b>The Chief's Act No. 13 of 1994</b>                                       | Provides for the recognition, appointment and functions of Chiefs and Deputy Chiefs, for the exclusion of former Chiefs and Deputy Chiefs from specified areas in the interest of public order for  | MLGRD – Department of Chiefs.   | The proposed project will be implemented in traditional land thus the relevance of this Act, as the land is under the jurisdiction of Her Royal Highness Chieftainess Sikoongo.   | The functions of the Chief will be recognized and respected in accordance with this Act.  |

| Legal Instrument                                     | Main Provisions   | Responsible Institutions       | Relevance to the Proposed Project  | Compliance with Legislation   |
|--|---|--------------------------------|--|---|
|  | the appointment and functions of chief retainer and for matters incidental to or connected with the foregoing.  |                                |  |   |
| <b>Urban and Regional Planning Act No. 3 of 2015</b> | This Act provides for development, planning and administration principles, standards and requirements for urban and regional planning processes and systems; provide for a framework for administering and managing urban and regional planning for the republic, provide for a planning framework, guidelines, systems, and processes for the republic; establish a democratic accountable, transparent, participatory and inclusive process for urban and regional planning that allows for involvement of communities, private sector, interests groups and other stakeholders in the planning, implementation and operation of human settlement development. The Act also provides for sustainable urban and rural development by promoting environmental, social and | MLGRD – Chirundu Town Council. | Approvals of site plans for the solar plant and transmission line wayleave has been done in consultation with the local authority and taking into consideration the provisions for sound environmental management through the preparation of the EIA report as part of the detailed design and planning. | The development of the Project shall comply to ensure synchronization with existing and planned developments. |

| Legal Instrument  | Main Provisions   | Responsible Institutions                | Relevance to the Proposed Project  | Compliance with Legislation  |
|---|---|---|--|--|
|   | economic sustainability in development initiatives and controls at all levels of urban and regional planning among others.  |   |  |  |
| <b>The Electricity Act, No. 11 of 2019</b>                  | An Act to regulate the generation, transmission, distribution and supply of electricity so as to enhance the security and reliability of the supply of electricity; provide for the sale and purchase of electricity within and outside the Republic; facilitate the achievement of the efficient, effective, sustainable development and operation of electricity infrastructure. Repeal and replace the Electricity Act, 1995; and provide for matters connected with, or incidental to, the foregoing. ZESCO power projects and operations are carried out in line with the provisions of the Electricity Act. | Ministry of Energy<br>ERB               | It is the governing Act for the operations concerning the acquisition of land, wayleave management of transmission and distribution lines as well as compensation relating to the supply of electricity. | Project development will be in conformity with the provisions of the Electricity Act.              |
| <b>National Council for Construction Act No. 10 of 2020</b> | An Act established to provide for the establishment of the National Council for Construction and to define its functions while promoting  | Ministry of Infrastructure, Housing and | As the project will require the integrity of its structures and scope  | Only registered and qualified contractors will be used for the construction of the Project and all |

| Legal Instrument                                | Main Provisions  | Responsible Institutions                    | Relevance to the Proposed Project  | Compliance with Legislation  |
|---|--|---|--|--|
|   | <p>the development of the construction industry in Zambia, and the registration of contractors. The affiliation to the Council of professional bodies or organisations whose members are engaged in activities related to the construction industry from regulation of the construction industry; the establishment of the Construction School; the training of persons engaged in construction or in activities related to Construction and matters connected with or incidental to the fore-going.</p> | <p>Urban Development.</p>                   | <p>of works to be engineered accordingly as stipulated in this Act.</p>                          | <p>requirements of this Act shall be employed.</p>   |
| <p><b>The Fisheries Act, No. 22 of 2011</b></p> | <p>Provides for the protection and sustainable utilization of fish in natural water bodies and control of fish farming.</p>  | <p>Ministry of Fisheries and Livestock.</p> | <p>The Project lies in close proximity to the Kafue River, Musaya River and Nantumba Stream.</p> | <p>Some of the workers might engage in fishing activities. The workers will thus be sensitised on sustainable fishing methods.</p> <p>Should any of the project implementation activities coincide with a period of fish ban, staff and contractors will adhere to such a ban.</p> |

| Legal Instrument                         | Main Provisions   | Responsible Institutions                      | Relevance to the Proposed Project  | Compliance with Legislation  |
|--|---|---|--|--|
| <b>Employment Code Act No. 3 of 2019</b> | <p>An Act to regulate the employment of persons; prohibit discrimination at an undertaking; constitute the Skills and Labour Advisory Committees and provide for their functions; provide for the engagement of persons on contracts of employment and provide for the form and enforcement of the contracts of employment; provide for employment entitlements and other benefits; provide for the protection of wages of employees; provide for the registration of employment agencies; regulate the employment of children and young persons; provide for the welfare of employees at an undertaking; provide for employment policies, procedures and codes in an undertaking; repeal and replace the Employment Act,1965, the Employment (Special Provisions) Act,1966, the Employment of Young Persons and Children Act, 1933 and the Minimum Wages and Conditions of Employment Act, 1982; and provide for matters</p> | <p>Ministry of Labour and Social Security</p> | <p>This Act is relevant to the project as it will entail employment of skilled and unskilled labour. The subcontracting of contractors makes it cardinal as extracts of this Act will be utilised for contractual obligations.</p> | <p>Contractors and subcontractors will be expected to adhere to this Act and work in conformity to the provisions of this Act.</p> |

| Legal Instrument                                | Main Provisions   | Responsible Institutions                              | Relevance to the Proposed Project   | Compliance with Legislation  |
|---|---|---|---|--|
|   | connected with, or incidental to, the foregoing.  |   |   |  |
| <b>Workers Compensation Act No. 27 of 1994</b>  | Comprehensive compensation for disabilities suffered or diseases contracted during the course of employment. Regulates rights to compensation, deals with liability for compensation and amount of compensation.                          | Ministry of Labour and Social Security                | The Act provides for the protection of worker's conditions of service that will be employed by the contractor, including the subcontractor who shall be guided and directed by the Act. | Contractors and subcontractors will be expected to adhere to this Act and work in conformity to the provisions of this Act.  |
| <b>Anti-Gender Based Violence Act No.1 2011</b> | Provides for protection of victims of gender-based violence, constitutes the anti-gender-based violence committee, establish the anti-gender-based violence fund, and provides for matters connected with or incidental to the foregoing. | Ministry of Community Development and Social Services | The project is expected to employ both male and female.   | The Project will not discriminate on the basis of gender as it will ensure non-physical, mental health, social or economic abuse to workers and the project community. |

## **2.4 International Agreements and Conventions**

Zambia, as a signatory to international and regional conventions and protocols, has made significant commitments to addressing global, regional and local environmental challenges. These Agreements reflect the Country's dedication to sustainable development, conservation, and climate resilience. Notable conventions and protocols include:

- The International Plant Protection Convention;
- The United Nations Framework Convention on Climate Change;
- The United Nations Convention on Biological Diversity;
- The Convention on International Trade in Endangered Species;
- The United Nations Convention to Combat Desertification;
- The African Convention on the Conservation of Nature and Natural Resources;
- The Convention on Wetlands of International Importance, particularly as Waterfowl Habitats; and
- The Paris Agreement.

Zambia's international relations is also evident at Continental and Regional levels through memberships in the African Union (AU) and Southern Africa Development Community (SADC). Through these organisations, several environmental and social related protocols aimed at fostering sustainable socio-economic development have been developed and endorsed by member states and governments. Among these protocols that have influence on the proposed project are:

- African Convention on Conservation of Nature and Natural Resources
- New Partnership for Africa's Development (NEPAD)
- Action Plan for the Environment Initiative (APEI)
- SADC Regional Indicative Strategic Development Plan (RISDP) 2020-2030
- SADC Protocol on Gender and Development

## **2.5 International Standards and Good Practice**

This EIS makes due reference to internationally recognised standards in order to establish a transparent, efficient and effective safeguards framework for the Project, which is in line with both National requirements and the expectations of local and international stakeholders.

The key referenced international standards for the Project ESIA are the International Finance Corporation (IFC) Policy and Performance Standards (PS) on Environmental and Social Sustainability (2012), the World Bank's Environmental and Social Standards (ESS) and the African Development Bank Integrated Safeguard System (ISS).

Table 2 gives a summary of IFC standards aimed at preventing /mitigating potential adverse impacts.

*Table 2: Application of Relevant Standards*

| Standard  | Objective   | Relevance   |
|---|---|---|
| <p>IFC PS 1: Assessment and Management of Environmental and Social Risks and Impacts</p> <p>WB ESS 1: Assessment and Management of Environmental and Social Risks and Impacts</p> <p>AfDB OS 1: Assessment and Management of Environmental and Social Risks and Impacts</p> | <ul style="list-style-type: none"> <li>• To identify, assess, and manage environmental and social risks and impacts of projects through a systematic and risk-based approach, improving environmental and social performance.</li> <li>• To systematically identify, evaluate, and manage environmental and social risks and impacts throughout the project life cycle.</li> <li>• To provide opportunity for stakeholder engagement and consultation in assessing and managing the environmental and social risks and impacts.</li> </ul>  | <p>This Environmental and Social Impact Assessment (ESIA) has been prepared in line with this requirement. Comprehensive baseline studies have been conducted to identify potential risks and impacts associated with the Project. An Environmental and Social Management Plan (ESMP) has been developed to address these risks, including mitigation measures, monitoring protocols, and a grievance redress mechanism. Public consultation was also an integral part of the ESIA process, ensuring that stakeholder concerns were incorporated into the Project design.</p> |
| <p>IFC PS 2: Labor and Working Conditions</p> <p>WB ESS 2: Labor and Working Conditions</p> <p>AfDB OS 2: Labor and Working Conditions</p>  | <ul style="list-style-type: none"> <li>• To promote the fair treatment, non-discrimination, and equal opportunity of workers.</li> <li>• To establish, maintain, and improve the worker management relationship.</li> <li>• To promote compliance with national employment and labour laws.</li> <li>• To protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties, and workers in the client's supply chain.</li> <li>• To promote safe and healthy working conditions, and the health of workers.</li> <li>• To avoid the use of forced labour.</li> </ul> | <p>ZESCO Limited, as a key stakeholder and shareholder in the project, has established operational health and safety guidelines under its Safety, Health, Environment, and Quality (SHEQ) procedures, which govern its operations. Additionally, ZESCO is ISO 45001 certified, demonstrating its commitment to international standards for occupational health and safety management systems. JIGSCO Energy Corporation Limited will adopt and adhere to ZESCO's SHEQ guidelines and ISO 45001 standards during the development of the Project.</p>                           |

|   |   |   |
|---|---|---|
| <p>IFC PS 3: Resource Efficiency and Pollution Prevention</p> <p>WB ESS 3: Resource Efficiency and Pollution Prevention and Management</p> <p>AfDB OS 3: Resources Efficiency and Pollution Prevention and Management</p> | <ul style="list-style-type: none"> <li>• To avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities.</li> <li>• To promote more sustainable use of resources, including energy and water.</li> <li>• To reduce project related GHG emissions.</li> <li>• To avoid or minimize generation of hazardous and nonhazardous waste</li> <li>• To minimize and manage the risks and impacts associated with pesticide use</li> </ul>   | <p>As described in this EIS, an approach for pollution prevention and resource efficiency has been proposed and will be implemented as detailed in the ESMP.</p>  |
| <p>IFC PS 4: Community Health, Safety, and Security</p> <p>WB ESS 4: Community Health and Safety</p> <p>AfDB OS 4: Community Health, Safety, and Security</p>   | <ul style="list-style-type: none"> <li>• To anticipate and avoid adverse impacts on the health and safety of the Affected Community during the project life from both routine and non-routine circumstances.</li> <li>• To ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to the Affected Communities.</li> <li>• To promote quality and safety, and considerations relating to climate change in the design and construction of infrastructure</li> <li>• To avoid and minimize community exposure to project-related traffic and road safety risks, diseases, and hazardous materials</li> <li>• To help prevent against sexual exploitation, abuse and sexual harassment of members of the community by project workers</li> </ul> | <p>As described in this EIS, an approach for managing community health and safety has been proposed and is included in the ESMP.</p>  |
| <p>IFC PS 5: Land Acquisition and</p>   | <ul style="list-style-type: none"> <li>• To avoid, and when avoidance is not possible, minimize displacement by exploring alternative project designs.</li> <li>• To avoid forced eviction.</li> </ul>  | <p>The proposed Project was designed to minimize land acquisition; however, it will still result in some loss of property. As described in this EIS, an approach for managing involuntary resettlement has been developed</p> |

|  |  |  |
|--|--|--|
| <p>Involuntary Resettlement</p> <p>WB ESS 5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement</p> <p>AfDB OS 5: Land Acquisition, Restrictions on Access to Land and Land Use, and Involuntary Resettlement</p>                                       | <ul style="list-style-type: none"> <li>• To anticipate and avoid, or where avoidance is not possible, minimize adverse social and economic impacts from land acquisition or restrictions on land use by (i) providing compensation for loss of assets at replacement cost and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected.</li> <li>• To improve, or restore, the livelihoods and standards of living of displaced persons.</li> <li>• To improve living conditions among physically displaced persons through the provision of adequate housing with security of tenure at resettlement sites</li> <li>• To conceive and execute resettlement activities as sustainable development programs, providing sufficient investment resources to enable displaced persons to benefit directly from the project, as the nature of the project may warrant.</li> <li>• To ensure that resettlement activities are planned and implemented with appropriate disclosure of information, meaningful consultation, and the informed participation of those affected.</li> </ul> | <p>and will be implemented as detailed in the Resettlement Action Plan (RCAP). Further, a grievance redress mechanism to address any concerns raised by affected communities will be implemented.</p>  |
| <p>IFC PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources</p> <p>WB ESS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources</p> <p>AfDB OS 6: Habitat and Biodiversity Conservation, and Sustainable</p> | <ul style="list-style-type: none"> <li>• To protect and conserve biodiversity.</li> <li>• To maintain the benefits from ecosystem services.</li> <li>• To promote the sustainable management of living natural resources through the adoption of practices that integrate conservation needs and development priorities</li> <li>• To apply the mitigation hierarchy and the precautionary approach in the design and implementation of projects that could have an impact on biodiversity</li> <li>• To support livelihoods of local communities and inclusive economic development through the adoption of practices that integrate conservation needs and development priorities</li> </ul>   | <p>A biological environment assessment has been conducted to evaluate the ecological characteristics of the project area. Additionally, the Forestry Department has been engaged to carry out a biomass assessment, while the Department of National Parks and Wildlife (DNPW) is conducting an ecological assessment to identify potential impacts on biodiversity.</p> <p>Mitigation measures to address biodiversity impacts are outlined in the ESMP to ensure sustainable project implementation.</p> |

|   |   |  |
|---|---|--|
| Management of Living Natural Resources  |   |  |
| <p>IFC PS 8: Cultural Heritage</p> <p>WB ESS 8: Cultural Heritage</p> <p>AfDB OS 8: Cultural Heritage</p> | <ul style="list-style-type: none"> <li>• To protect cultural heritage from the adverse impacts of project activities and support its preservation.</li> <li>• To promote the equitable sharing of benefits from the use of cultural heritage.</li> <li>• To promote meaningful consultation with stakeholders regarding cultural heritage.</li> </ul> | <p>Stakeholder engagement revealed that there are no known heritage sites in the Project area. However, a chance find procedure will be adopted to ensure that any cultural heritage discovered during construction is protected. This procedure will include immediate cessation of work in the affected area, notification of relevant authorities, and implementation of measures to preserve the heritage.</p> |

## 2.6 Corporate Standards and Guidelines

ZESCO Limited, is a key stakeholder and shareholder in the Project, and therefore, its Corporate Standards shall apply to the Project, ensuring compliance with both National and international best practice.

ZESCO Limited is an International Standard Organization (ISO)-certified entity that adheres to international standards through the implementation and maintenance of an Integrated Management System (IMS). This IMS complies with the following ISO Standards:

- ISO 9001:2015 – Quality Management System;
- ISO 14001:2015 – Environmental Management System; and
- ISO 45001:2018 – Occupational Health and Safety Management System.

In addition to these ISO standards, the following ZESCO Corporate standards and guidelines will be applied to this Project:

- Waste Management Procedure (2023);
- Hydrocarbon Management Procedure (2023);
- Resettlement and Compensation Action Plan Procedure (2024);
- Identification and Evaluation of Environmental Aspects and Impacts Procedure (2024);
- Environmental and Social Management Plan Procedure (2024);
- Environmental and Social Impact Assessment Procedure (2024);
- Management of Emergency Preparedness Plans Procedure (2025);
- Management of Operational Risks (2022); and
- Management of Incidents (2023).

These policies, procedures, and guidelines ensure that ZESCO projects and operations align with best practices in quality, environmental management, health and safety, and social responsibility.

### 3.0 PROJECT DESCRIPTION

#### 3.1 Location

The proposed Solar Plant site is situated on 285 hectares of land in Chirundu District, approximately 23km from Chirundu Town. The site is uninhabited, with no settlements in the immediate vicinity. The closest landmark is Kabanana Village, situated 12km away from the site. It is accessible via the Chirundu Road, which is located 12km away.

To the north, the area is bordered by three hills: Tibwe, Kapiri, and Mabwaye. To the east and south, the Kafue River is located approximately 2.2km from the project area, while to the west, the Musuya Stream is situated 1.5km away. Ecologically, the Project area is 27km from Mutulanganga Forest, 41 km from Lusitu Forest, and 2.4km from the Chiawa Game Management Area (across the Kafue River).

The Solar Plant site plan and coordinates are provided in Figure 1.

Evacuation route surveys were conducted to acquire right of way for the Transmission Line, from the substation at the proposed Solar Plant to the KGL HPP Substation. A map showing the line route is provided in Figure 2.

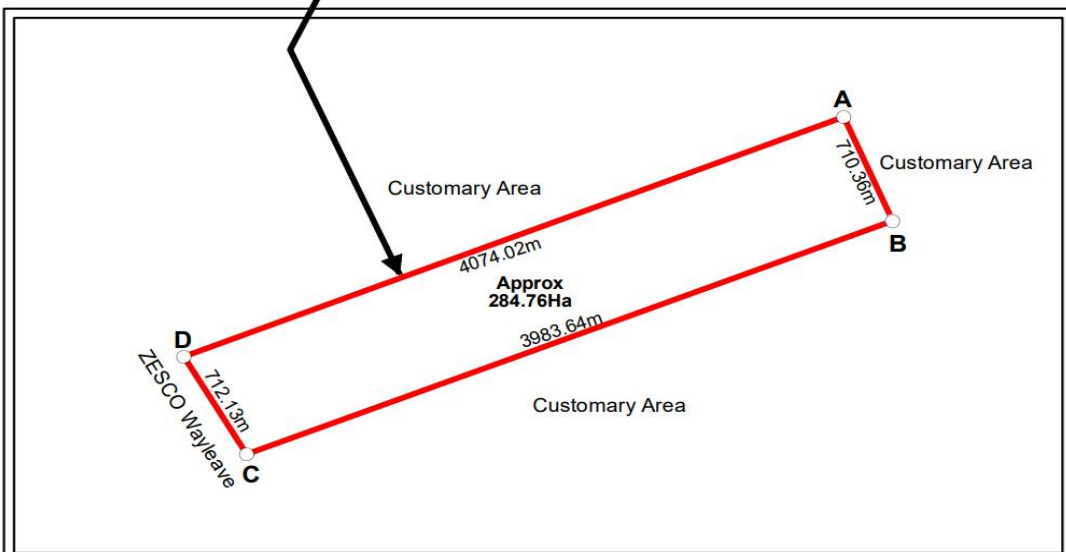
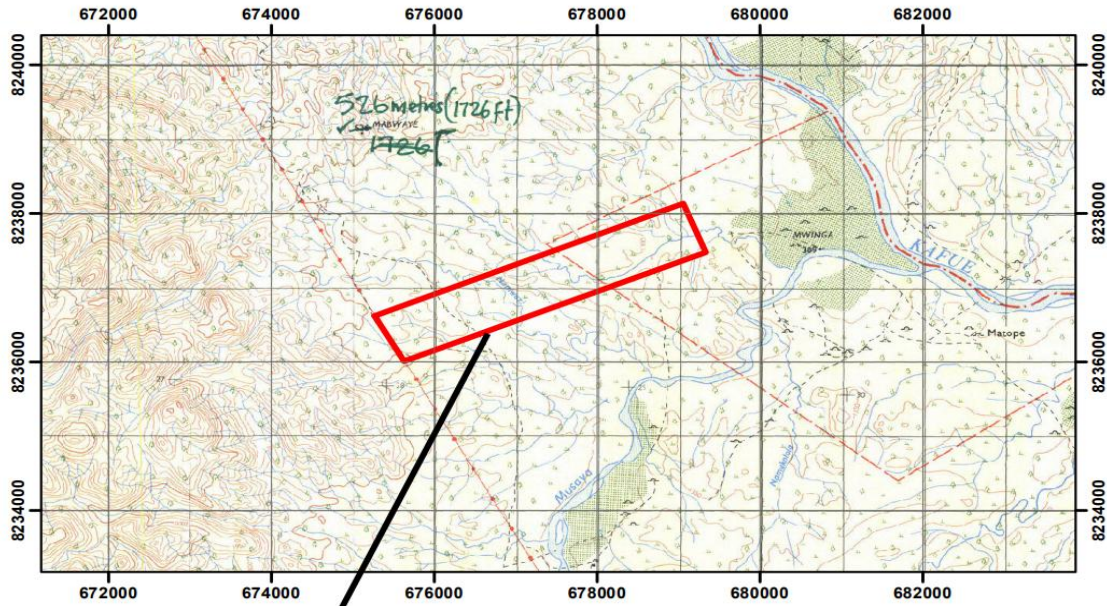
*Table 3: Transmission Line Coordinates*

| <b>Point_ID</b> | <b>Easting</b> | <b>Northing</b> | <b>Comment</b>     |
|-----------------|----------------|-----------------|--------------------|
| 1               | 675372.89      | 8235664.83      | Solar site         |
| 2               | 662538         | 8242429         | KGL HPP Substation |

**PROPOSED SITE PLAN BORDERED RED  
FOR THE ZESCO - KAFUE GORGE LOWER 200MW SOLAR PV SITE  
IN SIKOONGO'S CHIEFDOM - CHIRUNDU DISTRICT  
SOUTHERN PROVINCE**

MAP SCALE 1:75,000

MAP REFERENCE 1528D3



| Arc 1950 UTM - Zone 35S |            |             |
|-------------------------|------------|-------------|
| Point ID                | E(m)       | N(m)        |
| A                       | 679056.725 | 8238133.589 |
| B                       | 679337.013 | 8237480.864 |
| C                       | 675634.617 | 8236011.682 |
| D                       | 675272.725 | 8236625.002 |

MAP SCALE 1:35,000



|             |                         |
|-------------|-------------------------|
| Prepared By | Mutunga, K              |
| Checked By  | Phiri, M.K (MZIP/1/906) |
| Date        | Mar-25                  |
| File. No    |                         |

Figure 1: Solar Plant Site Plan

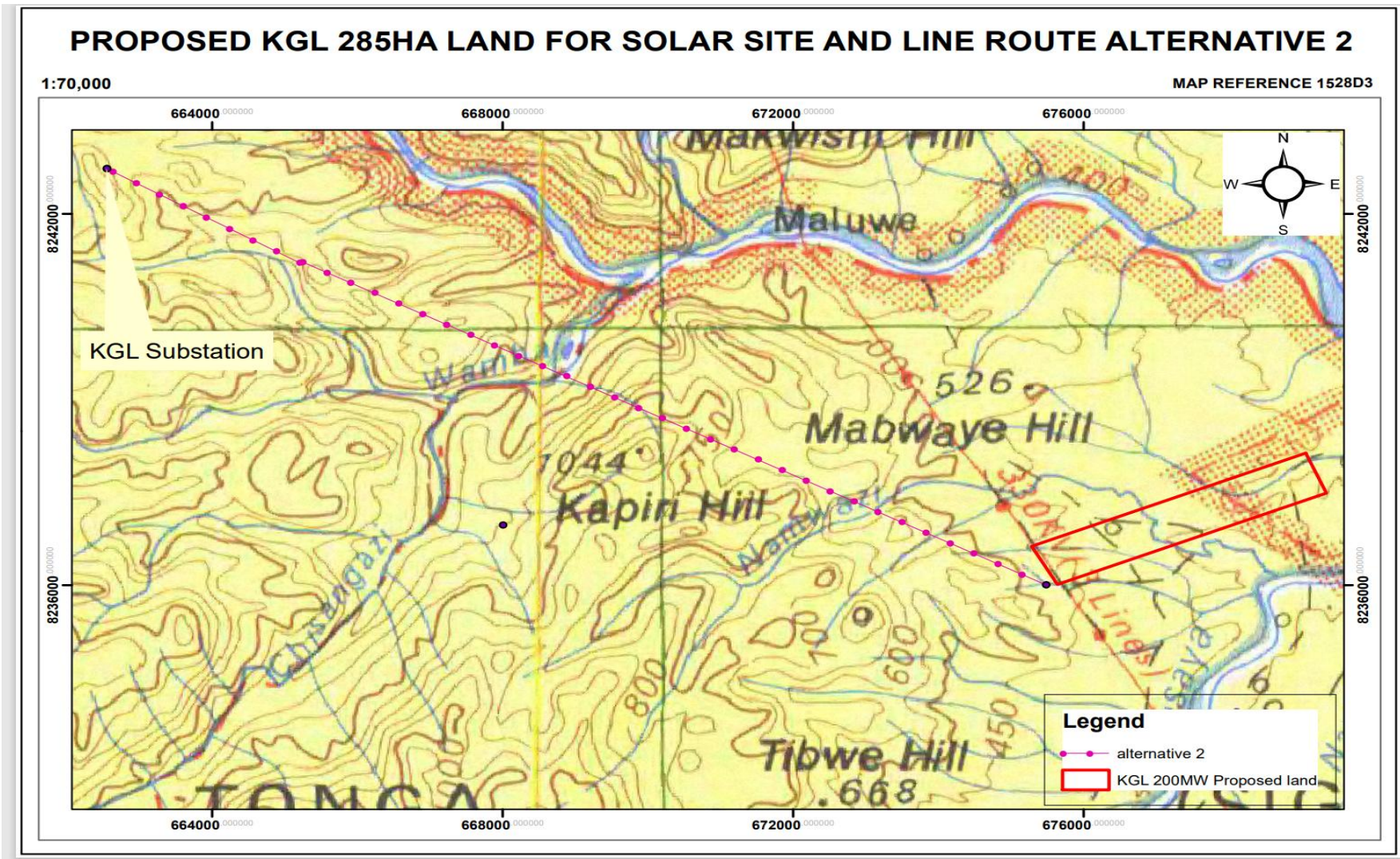


Figure 2: Transmission Line Route

### 3.2 Nature of the Project

The KGL SPP will involve construction of PV solar modules and 330kV Overhead lines to evacuate power from the power plant to the KGL HPP 330/33kV Substation.

Additional works for the Project include:

- Construction of a building complex;
- Installation of water and sanitation systems;
- Erection of a security fence and gate; and
- Development of access roads.

#### 3.2.1 Raw Materials

The main construction materials on the Project include, but not limited to the following materials and components:

*Table 4: Project Raw Materials*

| Raw Material   | Source   | Mode of Delivery |
|--|--|------------------|
| <b>Solar Plant</b> <ul style="list-style-type: none"> <li>• Photovoltaic modules,</li> <li>• The single-axis tracker,</li> <li>• String inverters, which convert DC from the solar field to AC;</li> <li>• Power Transformers, which raise the voltage level from low to medium; and</li> <li>• Power Stations, which hold the necessary equipment to convert the DC power to AC.</li> </ul>   | Imported, ensuring compliance with Zambian standards and regulations | Delivery Truck   |
| <b>Transmission Line</b> <ul style="list-style-type: none"> <li>• BISON double-bundle conductor system with 450mm intra bundle spacing</li> <li>• Ground wires               <ul style="list-style-type: none"> <li>o One 48-core Optical Ground Wire (OPGW) for communication.</li> <li>o One Aluminum-Clad Steel (ACS) stranded wire for additional grounding.</li> </ul> </li> <li>• Insulation               <ul style="list-style-type: none"> <li>o Porcelain insulators for tension insulator strings.</li> <li>o Composite insulators for suspension insulator strings</li> </ul> </li> <li>• Towers               <ul style="list-style-type: none"> <li>o Lattice steel structures from Q420 galvanized steel for main members</li> <li>o Q235 steel for diagonal and auxiliary members</li> </ul> </li> <li>• Square ground rings using 7x3.25mm galvanized steel wires.</li> <li>• Lightning arresters</li> <li>• Stockbridge dampers</li> </ul> | Imported, ensuring compliance with Zambian standards and regulations | Delivery Truck   |

|  |  |  |
|--|--|--|
|  |  |  |
| • Sand, aggregates, laterite and cement for the concrete structure's installation.   | Local suppliers/ borrow areas within project area  | Delivery Truck   |
| General building materials (e.g., timber for shuttering, polythene sheeting, brick force and mesh reinforcement, timber purlins, Cement Blocks Clay bricks etc.) | Local / International suppliers  | Delivery truck   |
| Diesel for operation of plant and machinery and diesel genset during construction (on site storage)  | Local ERB approved supplier  | Fuel Bowser  |
| Water for construction, dust suppression and worker's domestic use; total demand estimated at 1.55m <sup>3</sup> /day  | <ul style="list-style-type: none"> <li>• Borehole on site'</li> <li>• Nearby river/stream i.e Kafue River</li> </ul> | <ul style="list-style-type: none"> <li>• Pumping and reticulation</li> <li>• Water bowser</li> </ul> |
| Electricity during construction  | <ul style="list-style-type: none"> <li>• KGL HPP</li> </ul>  | <ul style="list-style-type: none"> <li>• Temporal 33kV Line</li> </ul>                               |

### 3.2.2 Products and By-products

The main product of the Project is electric power that will be generated by the Solar Plant and evacuated to the National grid via a 330kV transmission line. Associated substations will be constructed and upgraded, respectively.

By definition a by-product is a secondary product derived from a manufacturing process or chemical reaction. It is not the primary product or service being produced. A by-product can be useful and marketable or it can be considered waste. In this case the following waste materials are expected to be generated;

#### a) Waste generated during Site Preparation and Construction

Waste materials expected during the site preparation and construction phase of project development encompass excavation debris, packaging materials such as polystyrene and cable drums, concrete waste, and effluent from on-site welfare facilities.

Excavation spoil will be utilized to fill designated areas, while non-recyclable solid waste, including packaging from worker food, will be appropriately disposed of at licensed waste disposal sites. Mobile sanitary facilities will be employed, and the waste from these facilities will be managed through either Engineered Septic Tanks or a Sewage Treatment Plant.

#### b) Waste generated during Operation

Potential waste materials during the operational phase may include maintenance related waste, faulty PV units, office waste, and effluent from site control rooms.

The system neither involves chemical usage nor generates chemicals as by products. Non-recyclable solid waste, like certain packaging materials and office waste, will be appropriately disposed of at designated, licensed waste disposal sites. Management of any hazardous waste from the Solar PV Plant will adhere to relevant legislation and international best practice. To promote responsible waste management, JIGSCO aims to collaborate with reputable PV module manufacturers offering voluntary take-back and recycling programs. These manufacturers will assume responsibility for the modules throughout the project's lifespan, ensuring proper collection and transportation for recycling or certified industrial recycling.

Anticipated maintenance activities on the site are not expected to yield substantial waste. It is proposed that all liquid and solid waste from the operational site will be directed to a centralized waste collection and treatment system within the site, adhering to National standards. Hazardous waste, such as used oils and solar modules, will be managed in accordance with National requirements and international best practice. Given the project's nature and operations, minimal waste generation is anticipated on-site.

#### c) Waste Generated at Decommissioning and Closure

At the end of life of the project estimated to extend to at least 25-30 years, used solar modules, associated electrical components and cabling will be the main waste types. These will require removal from the site for safe disposal or recycling. Site buildings will need to be demolished if there will be no agreed alternative use for them and the site will need to be restored to near pre-project conditions.

A comprehensive decommissioning plan for the Project will be developed and continuously updated. This Plan will be put into action to ensure the secure removal and appropriate disposal of all Project components that have reached the end of their useful life or are no longer necessary for the ongoing operation of the Project.

#### d) Hazardous Waste from the Project

The Project is expected to use some materials that will generate some hazardous waste during the whole project cycle. Examples of some of the hazardous waste that will be generated from the Project include but not limited to the following (including the storage mechanisms):

- Waste from Fluorescent bulbs and tubes – will be stored in dedicated areas for safe disposal at an approved dump site;
- Spent Batteries (car batteries) – will be stored in dedicated areas pending transportation for recycling.
- Oils and greases – (where necessary) will be stored in dedicated areas pending transportation for recycling

### **3.2.3 Production Capacity**

The Solar Power Plant will generate 200MWac of electrical power which shall be evacuated at 330kV to the KGL HPP Substation, then injected into the National Grid.

### **3.2.4 Schedule and Lifetime of the Project**

The Project is scheduled to be implemented over a period of 15 months, following approval of this EIS and other applicable legislative requirements. The Solar Power Plant is expected to be in existence for approximately 30 years.

## **3.3 Main Activities**

### **3.3.1 Preparation Phase**

The pre-construction phase will include the following activities:

- Site rankings and selection;
- Reconnaissance and route alignment survey. A reconnaissance survey is essential for the purpose of establishing control points and collection of first-hand information of various important field data required;
- Feasibility Studies;
- Obtaining relevant approvals from regulatory authorities and other stakeholders;
- Carrying out of wayleave acquisition for the proposed line corridor and obtaining of relevant consent, including land acquisition for the substation and related infrastructure;
- Resettlement and/or compensation of affected persons and assets;
- Detailed survey works;
- Geotechnical Surveys;
- ESIA studies;
- Tendering process and awarding of contract(s); and
- Training of personnel. Environmental, Health and Safety, (EHS) training will be given to appropriate contracted personnel prior to the commencement of the works. The level of training will be commensurate with the type of duties of the personnel. The training program shall cover plans and procedures specific to the project and shall also include environmental policy, wayleave clearing, waste management guidelines and general environmental awareness campaigns and programmes.

### **3.3.2 Implementation Phase**

The implementation phase will include the following activities:

- Detailed survey;
- Bush clearing, site preparation including all civil ground works and construction of access roads to Project site;
- Installation of earthing equipment and earthing resistance measurements;
- Erection of Mounting structures;
- Installation of primary equipment (PV Modules and Inverters);
- Construction of Control Building and offices;
- Construction of High Voltage substation and transmission line;
- Erection of Transformers;
- Laying of cables and associated equipment;
- Installation of metering, control panels, SCADA systems, telecommunication systems and protection equipment;
- Construction of water reticulation system;
- Equipment pre- commissioning tests and verification;
- Preparation and submission of a grid connection application;
- Submission of Building Drawings and manuals for all plant equipment;
- Commissioning tests and functional guarantees;
- Training of plant operators and maintenance personnel (Local training); and
- Equipment handover and signing of completion certificates.

The construction of the powerline will also involve several activities which include:

- bush clearing (14km x 50m width);
- Digging of foundations;
- Tower erection;
- Stringing conductor;
- Installation of counterpoise; and
- Clean-up and re-vegetation.

The construction of the access road to the Solar Power Plant will involve survey, bush clearing, grading and clean-up.

### **3.3.3 Operation and Maintenance Phase**

The proposed Solar Power Plant and powerline will be operated and maintained in accordance with standard procedures designed to ensure the integrity of the power system.

Routine inspections will be conducted on the Solar Power Plant and powerline to ensure security of supply and occupational/public safety. During operation, routine maintenance of the proposed Power Plant and powerline will be carried out every year during maintenance by ground patrol.

The vegetation within the Power Plant and powerline wayleave will be controlled to ensure solar modules and conductor ground clearances are not exceeded.

In terms of technical activities, the following will be undertaken during the Operation and Maintenance (O&M) phase:

**Preventive Maintenance:**

- Routine maintenance in line with plant and equipment O&M Manual;
- Measurement of output comparing current and nominal values;
- Remote monitoring and daily review of data;
- Bi- annual site inspections and cleaning of solar modules;
- Periodic measurement of the array I-V curves and hot spot analysis;
- Periodic measurement of transformers and invertors; and
- Module cleanings to ensure performance guarantee obligations are met.

**Corrective Maintenance:**

- Onsite SCADA system with near real-time readings;
- Response targets – incidents to be reported and resolved accordingly;
- Minimum Spare Parts Inventory;
- Spare parts inventory management; any spare parts used to be replenished.
- Monthly and Bi- annual reporting;
- Monthly communication of production data, evacuation data, availability, spare parts status;
- Monthly and Bi-annual reporting;
- Monthly communication of production data, evacuation data, availability, spare parts status; and
- Monthly and Bi-annual reporting on production and performance data, corrective and preventative maintenance.

**3.3.4 Decommissioning and Abandonment Activities**

The Solar Plant is designed and will be operated and maintained to provide safe and efficient service throughout its entire lifespan. If some facilities need to be decommissioned or abandoned, appropriate methodology will be used to ensure that regulatory requirements are met. Decommissioning and abandonment of facilities will be carried out in a safe, efficient and environmentally sound manner.

Decommissioning and abandonment plans will be developed after consulting with the Zambia Environmental Management Agency (ZEMA) and relevant Government Agencies.

It is expected that the proposed Solar Power Plant will have an estimated useful lifetime of approximately 30 years or more with equipment replacement/recycling and repowering.

The decommissioning and closure phase activities will include:

- Dismantling and removal of solar power plant components from site;
- Demolition of buildings and ripping concrete bases;
- Appropriate management of waste generated; and
- Re-profiling of all disturbed areas to allow for vegetation regeneration and restoring of natural drainage systems for the area.

## **4.0 PROJECT ALTERNATIVES**

### **4.1 Site Location Alternatives**

The site selection process relied on comprehensive constraint mapping of the study areas to identify possible sites and evacuation routes for the Solar Power Plant. Three (3) sites—Itezhi-Tezhi, Kariba, and Kafue Gorge Lower Hydropower Plant (HPP)—were assessed for their suitability for hydro-solar hybrid projects. The evaluation was based on criteria such as topography and geomorphology, engineering geology, grid connection, site access, flood control, and construction power and water supply. All three sites met the technical feasibility criteria and are recommended for implementation. However, Kafue Gorge Lower and Kariba Solar Plants were prioritized for execution, after have conducted Grid Impact Studies.

The proposed site is strategically located near the Kafue Gorge Lower Hydropower Plant. This proximity is a key advantage, as one of the primary objectives of the Project is to strengthen Zambia's energy resilience by addressing climate-related risks to hydropower generation and diversifying the energy mix. By integrating the Solar PV Plant with the hydropower infrastructure, the Project will enhance operational flexibility, reduce dependency on water resources during dry seasons, and ensure a more stable and reliable energy supply. This hybrid approach leverages the complementary nature of solar and hydropower, where solar energy can offset reduced hydropower generation during periods of low rainfall, thereby mitigating the impacts of climate change on Zambia's energy sector.

### **4.2 Technology Alternatives**

#### **4.2.1 Power Generation**

Whereas there is still a lot of hydropower generation development potential in the Country, the effects of climate change have exposed the vulnerability of this energy source. Detailed assessments have shown that there are other forms of energy that the Country can exploit easily, such as solar, wind and geothermal energy, to diversify the energy mix, while pursuing a low-carbon, climate-resilient developmental pathway.

The proposed Kafue Gorge Lower (KGL) 200MWac Solar Photovoltaic Power Generation Project is a strategic response to the changing energy landscape in Zambia. While the Country has historically relied heavily on hydropower due to its abundant water resources, the effects of climate change and increasing electricity demand driven by socio-economic growth have highlighted the need for diversification in the energy mix. The Project aims to harness Zambia's significant solar energy potential, which is one of the most viable and readily exploitable renewable energy sources in the Country.

## **4.2.2 Power Transmission**

### a) Overhead Transmission Lines

Overhead lines were the preferred option owing to the following advantages:

- High power transmission;
- Low installation and material cost;
- Favourable for long distance transmissions;
- The fault or damage in overhead lines can easily be located and rectified;
- Maintenance of the line is easier; and
- Extension or joining on overhead lines can be performed easily and also it facilitates easy replacing.

### b) Underground Transmission Cables

Underground cables (UGC)s are also used in transmitting power. However, despite having less environmental impacts, it is not economically viable to install a transmission UGC of this high voltage (330kV), as the cost is estimated to be ten (10) times more than for the conventional overhead transmission line.

In addition to the cost aspect, from the environmental point of view, it must be noted that some underground transmission cables are oil-cooled, requiring sealed conductors significantly larger in diameter than overhead conductors which are air-cooled. Of significance with this wayleave is that the line would need to be buried to a depth between 1.5m and 2m, thereby generating significant spoil that will need to be disposed of. There is also a danger of water and soil contamination from leaks in the underground cables.

With due consideration of the cost implication, technical complexities and environmental concerns associated with underground transmission cables, this option will not be considered further in the EIS.

## **4.3 Transmission Line Route Alternatives**

### **4.3.1 Description of Alternatives**

The route selection process relied on comprehensive constraint mapping of the study areas to identify possible routes for the proposed evacuation power line. Physical features and the social setup of the area were among the main considerations in the route selection process. Regarding the evacuation routing, three route alternatives for the 330kV line were considered for implementation, taking into account environmental

factors, access roads to the area, and socio-economic considerations. The alternative routes are described below.

### Alternative 1

The proposed 330kV line route originates from Mwiinga Village in Chirundu District at the proposed Solar Plant Site and runs eastward for approximately 5 km, parallel to the existing Kariba - Leopards Hill 330kV power line. It then turns northward, approximately 100 meters away from the edge of the access road. The proposed line will be placed on the western side of the existing Kariba - Leopards Hill 330kV power line and the access road.

This line route will likely affect some fruit trees of economic value and structures and is about 300 meters away from the Kafue River. The route avoids traversing any forest reserves or national park areas. However, a portion of the line will cross privately owned land that is currently fenced, which will restrict access during construction and maintenance activities.

### Alternative 2

The second proposed route originates from Mwiinga Village in Chirundu District at the proposed Solar Plant Site and runs straight in a north-east direction across Kapiri Hills and succeeding range of hills, until it reaches the Kafue Gorge Lower Substation. This route has no access roads.

This line route will not affect any fruit trees of economic value or structures and is approximately 2km away from the Kafue River. Additionally, the route avoids traversing any forest reserves or national park areas.

### Alternative 3

The third proposed route originates from Katobola Village in Chirundu District at the proposed Solar Plant Site and runs straight northward between Kapiri Hills and Tibwe Hills for about 7km. It then turns toward the Kafue Gorge Lower Substation, traversing the hills of the area until it reaches the Substation. This route also has no access roads.

This line route will not affect any fruit trees of economic value or structures and is approximately 5km away from the Kafue River. It does not traverse any forest reserves or national park areas. However, a portion of the line will cross privately owned land that is currently fenced, which will restrict access during construction and maintenance activities.

Table 5: Coordinates for Transmission Line Alternatives

| Point ID             | Easting   | Northing   | Comment               |
|----------------------|-----------|------------|-----------------------|
| <b>Alternative 1</b> |           |            |                       |
| 1                    | 675474.89 | 8235664.83 | <b>Solar site</b>     |
| 2                    | 672488.48 | 8240442.94 |                       |
| 3                    | 669239.53 | 8239734.53 |                       |
| 4                    | 667875.06 | 8241541.19 |                       |
| 5                    | 665211.44 | 8240929.99 |                       |
| 6                    | 662538    | 8242429    | <b>KGL Substation</b> |
| <b>Alternative 2</b> |           |            |                       |
| 1                    | 675372.89 | 8235664.83 | <b>Solar site</b>     |
| 2                    | 662538    | 8242429    | <b>KGL Substation</b> |
| <b>Alternative 3</b> |           |            |                       |
| 1                    | 675372.89 | 8235664.83 | <b>Solar site</b>     |
| 2                    | 667978.56 | 8236685.63 |                       |
| 3                    | 662538    | 8242429    | <b>KGL Substation</b> |

### 4.3.2 Analysis of Alternatives

In the analysis of each proposed route for the 330kV line, various environmental and social factors were considered. Table 6 below summarizes the environmental and social parameters evaluated for each alternative.

Table 6: Environmental and Social Alternative Analysis

| Type of Constraint         | Alternative 1                          | Alternative 2   | Alternative 3   |
|----------------------------|--|---|---|
| Mountains                  | Very few mountains along route         | Significant range of mountains along the proposed route | Significant range of mountains along the proposed route |
| Schools                    | No schools                             | No schools  | No schools  |
| Agricultural land          | No agricultural land under cultivation | No agricultural land under cultivation                  | No agricultural land under cultivation                  |
| Protected Areas            | No protected Areas                     | No protected Areas                                      | No protected Areas                                      |
| Forest                     | None                                   | None  | None  |
| Wetland Areas              | None                                   | None  | None  |
| National Parks             | None                                   | None  | None  |
| Access Roads               | Access road along line                 | None  | None  |
| Land Ownership             | Private land is traversed              | Line route is entirely on customary land                | Private land is traversed                               |
| Archaeological/ Historical | No known sites                         | No known sites  | No known sites  |

### 4.3.3 Selected Route and Justification

Alternative 2 was selected as the most suitable route due to its minimal adverse environmental and social impacts. Additionally, it is the shortest route and traverses entirely customary land, making it the most practical and cost-effective option.

# PROPOSED KGL 285HA LAND FOR SOLAR SITE AND ALTERNATIVES PROPOSED LINE ROUTES

1:90,000

MAP REFERENCE 1528D3

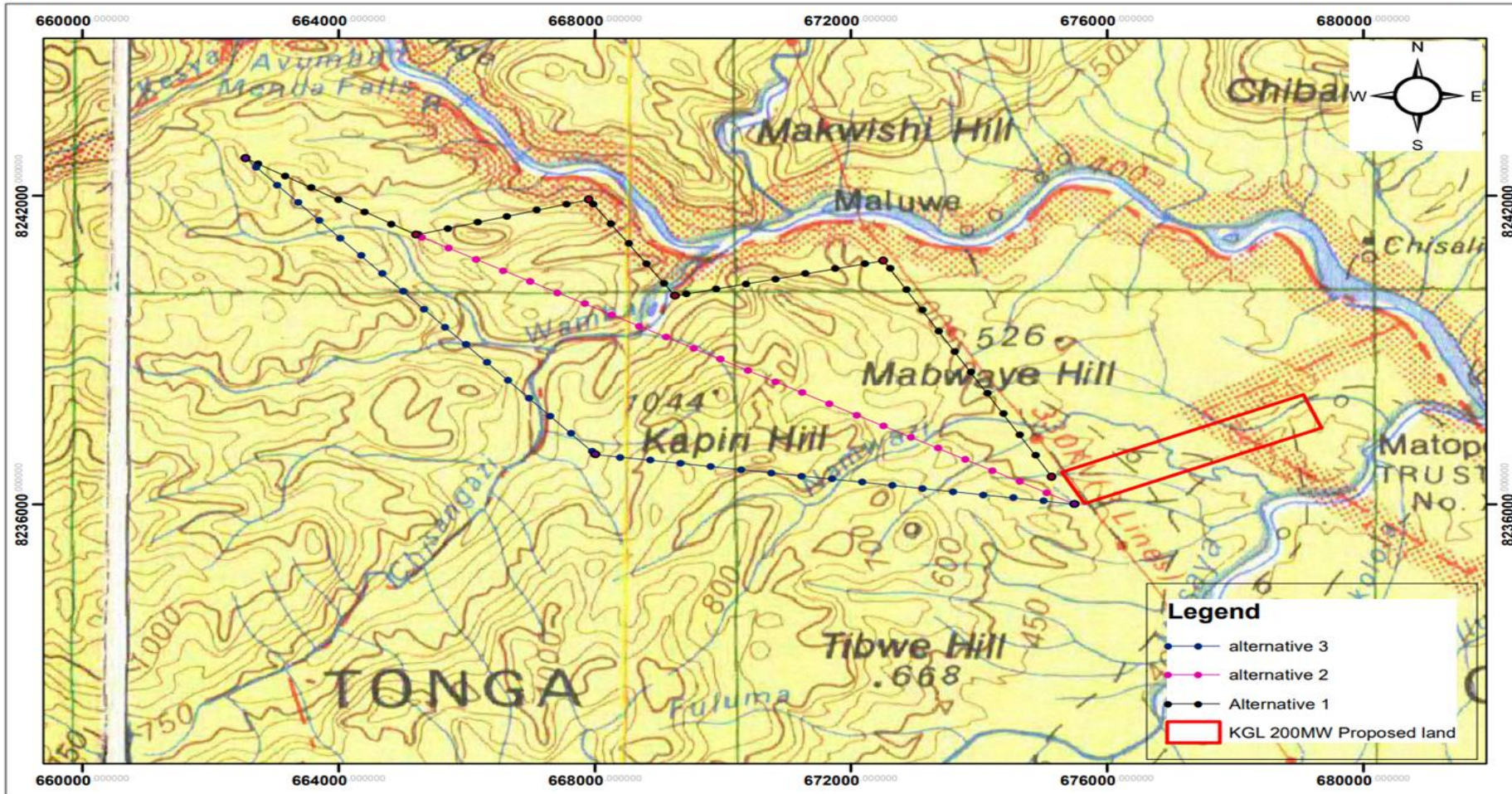


Figure 3: Map Showing Proposed Line Route Alternatives

#### 4.4 'Do Nothing' Option

The 'do-nothing' alternative refers to the option of not establishing the proposed 200MWac Solar Photovoltaic (PV) Generation Plant. Under this scenario, no additional solar energy capacity would be added to Zambia's energy mix.

Without the implementation of this Project, several critical challenges would remain unaddressed:

- **Limited Energy Diversification:** Zambia's energy mix would continue to rely heavily on hydropower, which is increasingly vulnerable to climate change impacts such as prolonged droughts and reduced water levels. This over-reliance on a single energy source would exacerbate the risk of energy shortages and load shedding, particularly during dry seasons.
- **Missed Renewable Energy Opportunities:** The absence of this Project would compromise Zambia's ability to harness its abundant solar energy resources, which are among the best in the world. This would delay the transition to a more sustainable and environmentally sound energy system, undermining efforts to reduce greenhouse gas emissions and combat climate change.
- **Unmet Energy Demand:** The Project is designed to increase Zambia's generation capacity to meet current and future electricity demand. Without the Solar PV Plant, the Country would struggle to address the growing energy needs driven by socio-economic development, urbanization, and industrialization. This could lead to continued unstable power supply, hindering economic growth and development.
- **Economic and Social Impacts:** The do-nothing alternative would result in missed opportunities for job creation, skills development, and local economic benefits during the construction and operation of the Solar Plant. Additionally, the lack of reliable electricity would negatively impact businesses, households, and public services, further constraining socio-economic progress.
- **Energy Security Risks:** Failure to diversify the energy mix would leave Zambia's power system vulnerable to climate-induced disruptions, threatening energy security and resilience. This could deter investment and limit the Country's ability to achieve its long-term development goals, as outlined in Vision 2030 and the Eighth National Development Plan (8NDP).

In summary, the do-nothing alternative would perpetuate Zambia's reliance on hydropower, leaving the energy sector exposed to climate risks and unable to meet growing demand.

## **5.0 ENVIRONMENTAL BASELINE STUDY**

### **5.1 Physical Environment**

#### **5.1.1 Climate**

Chirundu District experiences three main distinct seasons: cool and dry (May to July), hot and dry (August to October), and wet season (November to April). The area faces challenges exacerbated by harsh climatic conditions, including extreme heat and limited rainfall, (Chirundu Town Council, 2025). Temperatures fluctuate between 9.9°C and 42°C throughout the year.

The average annual rainfall ranges between 502.6mm and 1159.2mm, with likelihood of annual rainfall exceeding 1,400-1,500mm once every five years. Evaporation rates surpass precipitation levels for most of the year, with peak evaporation occurring from September to November.

#### **5.1.2 Topography**

Chirundu District has diverse topography which showcases the stability and erosion resistance of its underlying lithologies, with prominent hills like the Kapilingozi and Ibbwemunyama to the north and northeast, composed of pathicquartzites from the basement complex, reaching altitudes between 1,040m and 1,080m. Moving eastwards to the Zambezi River, the terrain gradually descends to a more uniform ranging from 340m to 410m. The District is further characterized by low-lying plains and hills traversed by the Zambezi River.

The project area has Mabwaye Hill to the northwest, Kapini Hill to the west, and Tibwe Hill to the southwest. Some parts of the project site are flat and other parts are hilly. The area becomes flatter towards the Kafue River to the east and Musaya River to the south. Several intermittent streams traverse the Solar Plant site. Refer to Figure 4.

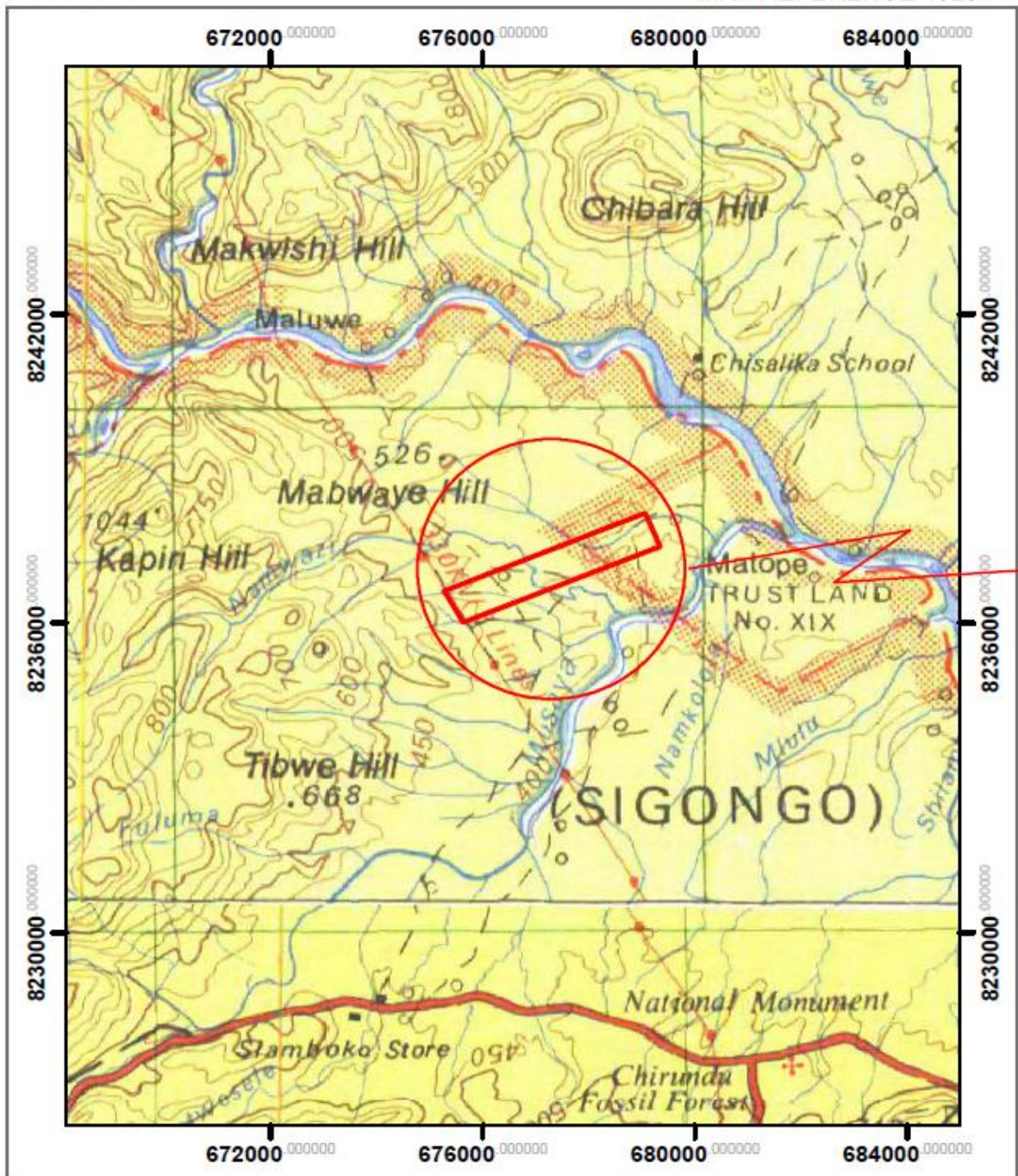


Figure 4: Topographic Map of the Project Area

### 5.1.3. Geology

The Kafue Gorge area has geology that fall partially in two structural and tectonic belts of Zambia, namely, the Zambezi/Mozambique Belt in the upper sections and the Karoo in lower reaches towards the confluence with the Zambezi River. The Zambezi and Mozambique belts exhibit a polycyclic history of formation, metamorphism and intrusive granitoid magmatism. The geology is derived from the Granite complex and

Karoo (sandstones, mudstone and basalt). These are tertiary to recent formation of basement and Katanga Upper Carboniferous to Jurassic age.

The study area is underlain predominantly by gneiss blocks of the Precambrian Basement Complex. These rocks of igneous origin comprise of portions of the Mpande Gneiss with exposed schists and metasediments of the Katanga System.

Results from early feasibility studies for the Kafue Gorge indicate that vast majority of bedrock in the study area is hard to very hard and strong to very strong as measured by qualitative assessments of scratch hardness and reaction to hammer blows. Weathered portions of schist and gneiss range from slightly hard to hard and from low to moderate strength.

The rather common occurrence of scapolite porphyroblasts in the biotite schists (and to a lesser extent in gneisses) may require care in intervals that are weathered. Scapolite weathers to clay minerals that are known to be expansive, although previous testing indicates most occurrences are stable and not subject to swelling and slaking. This swelling and slaking can cause deterioration and irregular deformations in excavations if not properly treated.

#### **5.1.4 Soils**

In the Kafue Gorge area, soils are mainly those of typical of hills and faulted scarps of the Zambezi rift valley with variable slopes. The soils are excessively drained to well drained, shallow to moderately shallow, dark brown to yellowish brown, friable, gravelly, course soils commonly grouped as LEPTOSOLS in the rudic soil phase. In a few sections, are alluvial shallow soils on platforms close to the river banks which allow the local settlers to grow crops such as sorghum. Since the soils are shallow and course, they are susceptible to erosion and minor landslides are common especially in the rainy season (ZESCO, 2010).

#### **5.1.5 Hydrology and Drainage**

The major river found in the project area is the Kafue River, eastward the Project site, captured in Figure 5 below. Flows in the River are regulated by the Itezhi-Tezhi Dam, the Kafue Flats, the Kafue Gorge and the Kafue Gorge Lower (KGL) HPP. Second to Kafue River is Musaya River, southward the Project site.



*Figure 5: Kafue River*

Musaya River and several streams such as such as Namwazi, Nantumba and Kaponone Streams drain into the Kafue River, Figure 6. The Kafue River drains into the Zambezi River, southwards. Most of the streams traversing the project area are intermittent and ephemeral streams.



*Figure 6: Musaya River (left), Namtumba Stream (right)*

### 5.1.6 Air Quality

Air quality assessment was undertaken at the Solar Plant site. The key parameters measured included Carbon dioxide (CO<sub>2</sub>), nitrogen dioxide (NO<sub>2</sub>), sulfur dioxide (SO<sub>2</sub>), hydrogen sulfide (H<sub>2</sub>S) and particulate matter (PM) at different size fractions. The results are tabulated in Table 7 below.

*Table 7: Air Quality Measurements Results*

| Point         | Latitude            | Longitude           | CO <sub>2</sub><br>(ppm) | NO <sub>2</sub><br>(ppm) | SO <sub>2</sub><br>(ppm) | H <sub>2</sub> S<br>(ppm) | PM 2.5<br>(µg/m <sup>3</sup> ) | PM 10<br>(µg/m <sup>3</sup> ) |
|---------------|---------------------|---------------------|--------------------------|--------------------------|--------------------------|---------------------------|--------------------------------|-------------------------------|
| 1             | 15° 56'<br>30.11" S | 28° 39'<br>59.02" E | 398                      | 0.24                     | 0.00                     | 0.00                      | 10                             | 16                            |
| 2             | 15° 56'<br>17.32" S | 28° 40'<br>31.39" E | 369                      | 0.17                     | 0.07                     | 0.00                      | 1                              | 1                             |
| 3             | 15° 55'<br>56.02" S | 28° 40'<br>22.80" E | 359                      | 0.16                     | 0.10                     | 0.00                      | 2                              | 2                             |
| 4             | 15° 56'<br>10.17" S | 28° 39'<br>47.87" E | 377                      | 0.18                     | 0.08                     | 0.18                      | 1                              | 2                             |
| 5             | 15° 56'<br>41.64" S | 28° 39'<br>26.31" E | 391                      | 0.18                     | 0.10                     | 0.00                      | 2                              | 3                             |
| 6             | 15° 56'<br>20.81" S | 28° 39'<br>19.29" E | 466                      | 0.23                     | 0.01                     | 0.00                      | 0                              | 0                             |
| 7<br>(Center) | 15° 56'<br>30.08" S | 28° 39'<br>33.85" E | 379                      | 0.18                     | 0.03                     | 0.00                      | 36                             | 73                            |
| 8             | 15° 56'<br>54.62" S | 28° 38'<br>55.09" E | 489                      | 0.19                     | 0.00                     | 0.00                      | 4                              | 6                             |
| 9             | 15° 56'<br>36.05" S | 28° 38'<br>42.50" E | 400                      | 0.18                     | 0.04                     | 0.00                      | 2                              | 2                             |
| 10            | 15° 56'<br>46.30" S | 28° 38'<br>14.90" E | 394                      | 0.17                     | 0.08                     | 0.00                      | 15                             | 30                            |
| 11            | 15° 57'<br>6.19" S  | 28° 38'<br>27.25" E | 373                      | 0.16                     | 0.00                     | 0.00                      | 13                             | 23                            |

From the results given in Table 7 above, the project site exhibits the following air conditions:

- Gaseous Pollutants: CO<sub>2</sub> levels range from 359 to 489 ppm. NO<sub>2</sub> and SO<sub>2</sub> concentrations are generally low, with the highest NO<sub>2</sub> concentration at Position 1 (0.24 ppm). SO<sub>2</sub> is negligible in most areas.

- Dust Levels: PM10 levels vary significantly, with the highest concentration recorded at Position 7 (73 µg/m<sup>3</sup>). Elevated particulate levels in this area may be attributed to windblown dust or localized disturbances.

All the assessed parameters area are within the acceptable levels.

### 5.1.7 Noise

The noise in the area is minimal as there are no industrial activities. The noise levels were measured during the baseline assessments at 11 positions of the Solar Plant site. The results of the noise levels are given in Table 8 below.

*Table 8: Noise Level Measurements*

| Position   | Latitude         | Longitude        | Noise (dB) |
|------------|------------------|------------------|------------|
| 1          | 15° 56' 30.11" S | 28° 39' 59.02" E | 50         |
| 2          | 15° 56' 17.32" S | 28° 40' 31.39" E | 56         |
| 3          | 15° 55' 56.02" S | 28° 40' 22.80" E | 52         |
| 4          | 15° 56' 10.17" S | 28° 39' 47.87" E | 70         |
| 5          | 15° 56' 41.64" S | 28° 39' 26.31" E | 65         |
| 6          | 15° 56' 20.81" S | 28° 39' 19.29" E | 65         |
| 7 (Center) | 15° 56' 30.08" S | 28° 39' 33.85" E | 65         |
| 8          | 15° 56' 54.62" S | 28° 38' 55.09" E | 63         |
| 9          | 15° 56' 36.05" S | 28° 38' 42.50" E | 60         |
| 10         | 15° 56' 46.30" S | 28° 38' 14.90" E | 75         |
| 11         | 15° 57' 6.19" S  | 28° 38' 27.25" E | 59         |

The noise levels at the proposed site are below the acceptable limit of 85dB, it ranges from 50dB to 75dB, with the highest recorded at Position 10. This suggests that certain areas may experience moderate noise pollution, likely due to nearby activities.

Some identified sources of noise in the area includes human voices, birds, animals (cattle), wind and power lines.

### 5.1.8 Water Quality

The water quality in the Project area can be attributed to that of the Kafue River, as it is the major source of water. Generally, the quality of water in the Kafue River is good with exceptions around the Copperbelt towns, Mazabuka and around Kafue Town. Heavy pollution from mining activities, sewage, agricultural activities and effluents from other industries have increased nitrate levels above guidelines.

Domestic animal feecal matter has potential to affect water quality in streams within the Project area.

### **5.1.9 Waste**

The solid waste stream in the District comprises of the following; domestic waste, agriculture, E-waste, and industrial waste. Waste generated from all the sectors of the District are currently not well managed. The solid waste system developed and operated by the Local Authority consists of transfer and disposal facilities which the Authority owns or monitors. In addition to the facilities of the Authority, certain transfer and disposal facilities owned and operated by units of sub-contracted franchise solid waste companies (MOLGRD, 2024).

The Project area is not currently serviced by the Local Authority. Waste generated in the area primarily consists of domestic waste, such as leftover food, which is disposed of in garbage pits. Human waste is managed through pit latrines.

## **5.2 Biodiversity**

### **5.2.1 Flora**

The Project area is primarily defined by a diverse mosaic of Miombo Woodland and termitaria, Figure 7, which forms the backbone of the local ecosystem. Dominating the landscape are *Acacia* species and *Ficus capensis* (Mukuyu), along with various other Miombo tree species, contributing to the richness of the vegetation. Interspersed within this woodland are several dambos—seasonally flooded areas—adding further diversity to the landscape. Along the riverbanks, riparian forests thrive, providing vital habitats for numerous species and playing an essential role in water regulation and soil stabilization.



*Figure 7: Vegetation in the Project Area*

Large, undisturbed patches of Miombo Woodland within the area serve as key ecological corridors, linking the wider Miombo ecosystem to the riparian forests along the riverbanks in the southwest and northwest. These corridors are not only critical for maintaining genetic flow among wildlife populations but also facilitate essential ecological processes such as pollination, seed dispersal, and migration.

In the northeast section of the land, a significant area of relatively undisturbed Miombo Woodland provides an essential refuge for local biodiversity. This area plays a pivotal role in supporting the broader ecosystem's resilience, offering a sanctuary for both flora and fauna. The presence of these diverse habitats ensures that the area remains ecologically dynamic, contributing to a balanced and functioning ecosystem.

## **5.2.2 Fauna**

### **5.2.2.1 Mammals**

Chirundu has historically supported a variety of animal species due to its vegetation and proximity to the Mutulang'anga Forest Reserve (30km from the Project area). Elephants (*Elephantidae*) and buffalos (*Bubalus bubalis*) are the most common species in the Project area coming in and out from Zimbabwe.

The zebra (*Equus burchelli*) and buffalo (*Syncerus caffer*), are primarily found in the national parks. Hippopotamuses (*Hippopotamus amphibious*) inhabit some lagoons and the Kafue River. Other mammals include oribi (*Ourebia ourebi*), vampire bat (*Lavia frons*) bush pig (*Potamochoerus porcus*), reedbuck (*Redunca arundinum*) leopard (*Panthera pardus*), chacma baboon (*Papio ursinus*), vervet monkey (*Cercopithecus ethiops*), bush pig (*Potamochoerus porcus*), porcupine (*Hystrix africaeaustralis*), klipspringer (*Oreotragus oreotragus*), and squirrel (*Paraxerus cepapi*), yellow-spotted dassie (*Dendrohyrax brucei*).

Local residents have reported the occasional presence of lions, buffalos, and elephants in the Project area. Vervet monkeys are seen daily in crop fields as they search for food. The presence of these animals often leads to human-wildlife conflicts, including lions preying on livestock, elephants attacking humans, humans hunting buffalos, and monkeys raiding crops.

In response to these conflicts, local communities have adopted various mitigation measures:

- Avoiding movement at night when lions and elephants are reported in the area;
- Keeping a safe distance from elephants; and
- Guarding crop fields to deter monkeys.

#### **5.2.2.2 Avifauna**

Chirundu is home to numerous waterfowl species, with the migratory crowned crane (*Balearica regulorum*) and wattled crane (*Grus carunculata*) being the most prominent. Other notable bird species include the spur-winged goose (*Plectropterus gambensis*), Egyptian goose (*Alopochen aegyptiacus*), saddle-billed stork (*Ephippiorhynchus senegalensis*), African jacana (*Actophilornis africanus*), glossy ibis (*Plegadis falcinellus*), and black-collared barbet (*Lybius torquatus*), along with various duck species.

In the Project area, the following birds have been recorded: pygmy kingfisher (*Ispidina picta*), swallow (*Hirundo albigularis*), fish eagle (*Haliaeetus vocifer*), canary (*Serinus canicollis*), hornbill (*Tockus hemprichii*), black-eyed bulbul (*Pyconotus barbatus*), starling (*Onychognathus morio*), sunbirds (*Nectarinia amethystina* and *loveridgei*), three-streaked tchagra (Tchagra jamesi), coucal (*Centropus senegalensis*), emerald-spotted wood dove (*Turtur chalcospilos*), shrike (*Prionops plumata*), purple grenadier (*Uraeginthus ianthinogaster*), red-eyed dove (*Streptopelia semitorquata*), ring-necked dove (*Streptopelia capicola*), pied kingfisher (*Ceryle rudis*), blue-capped cordon-bleu (*Uraeginthus cyanocephalus*), and little sparrow hawk (*Accipiter minullus*).

### **5.2.2.3 Herpetofauna**

Over 50 reptile species are found in the Kafue Flats and the Project area. The largest reptile is the Nile crocodile (*Crocodylus niloticus*), which inhabits areas upstream of the dam and below the gorge. Other reptiles include the monitor lizard (*Varanus niloticus*), rock lizard (*V. albigularis*), puff adder (*Bitis arietans*), python (*Python sebae*), as well as the agama (*Agama agama*), skink (*Mabuya capensis*), and plated lizard (*Gerrhosaurus flavigularis*).

Three frog species recorded in the area include the clawed frog (*Xenopus laevispetersii*), ridged frog (*Ptychadena oxyrhynchus*), and grey tree frog (*Chiromantis xerampelina*).

### **5.2.2.4 Aquatic fauna**

The Project area is home to a rich and diverse array of fish species found in Kafue River, many of which hold significant commercial value, contributing to the local economy and ecosystem. Among the most dominant species are the Nile tilapia (*Oreochromis niloticus*), red-breasted bream (*Tilapia rendalli*), tigerfish (*Hydrocynus vittatus*), crayfish (*Cherax quadricarinatus*), catfish (*Clarias gariepinus*), upside down catfish (*Synodontis zambezensis*), yellow-belly bream (*Serranochromis robustus*), African tigerfish (*Brycinus peringueyi*), Cornish jack (*Mormyrops anguilloides*) and chessa (*Distichodus schenga*). The population of these species varies according to the season.

### **5.2.3 Protected Areas**

There are no protected areas within the Project area. However, Mutulanganga Forest (an Important Bird Area) is located 30km away, Lusitu Forest is 41km away, and Chiawa Game Management Area is 24km away. There are no Important Bird Areas (IBAs) within the project area itself.

## **5.3 Socio-Economic Environment**

This section focuses on the social and economic factors that can be affected by the Project. This includes the well-being of individuals, communities, and the broader society, as well as economic conditions and trends. The purpose of assessing the socio-economic environment is to predict potential adverse impacts and develop mitigation measures to minimize negative effects and enhance positive outcomes for the affected communities.

### 5.3.1 Population

According to the 2022 census, the population of Southern Province in Zambia is approximately 2,381,728, up from 1,589,926 in 2010, reflecting an annual growth rate of 3.4%. The population of Chirundu District in Southern Province, Zambia, is approximately 78,780. Sikoongo Ward has a population of 3,223.

Sikoongo Chiefdom is an indigenous Tonga/Gova chiefdom, encompasses 234 villages. In the Project area, village composition ranges from 28 households to 105 households. The population in the District is primarily concentrated in the township and growth nodes along the Lusaka Road. Table 9 below provides the estimated population projections up to 2035.

*Table 9: Projected Population Growth in Chirundu District (2025-2035)*

| Year | Population |
|------|------------|
| 2025 | 87,891     |
| 2030 | 107,339    |
| 2035 | 129,667    |

Source: *Ministry of Local Government and Rural Development (2025)*

### 5.3.2 Settlement Patterns and Traditional Authority

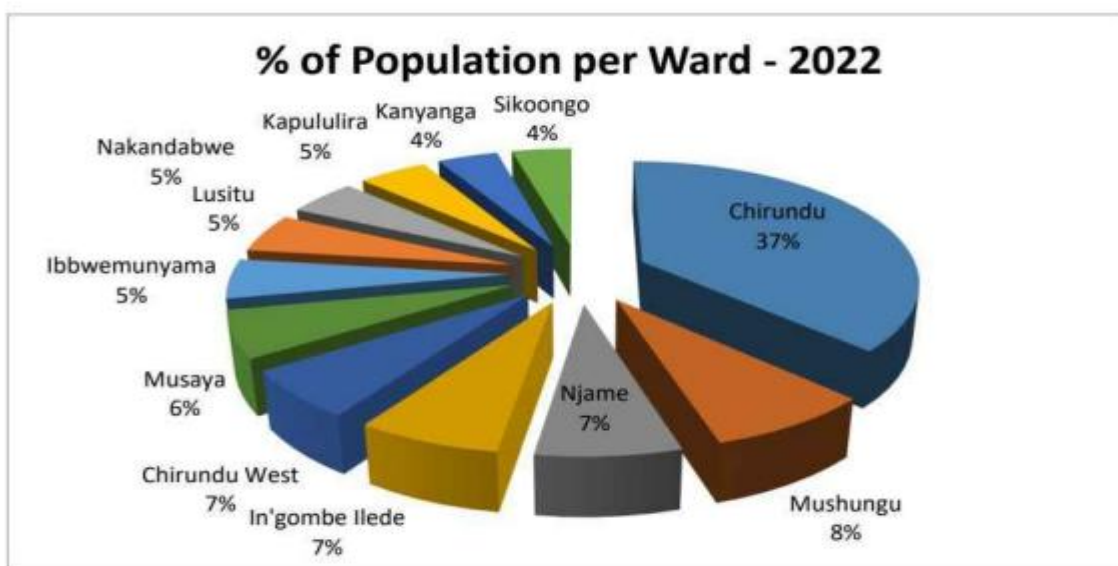
Chirundu District features distinct settlement patterns and traditional authority structures, with both urban and rural areas. The urban center, primarily around the town of Chirundu, serves as a commercial hub due to its strategic location along the Zimbabwean border and is well-developed with infrastructure such as roads, schools, and healthcare facilities. In contrast, rural settlements are dispersed and consist of small villages and homesteads. Below, in Figure 8, is a typical homestead in the Project Area.



*Figure 8: Typical Village in the Project Area*

The District comprises one constituency, twelve wards, and two chiefdoms: Sikoongo and Chipepo. The twelve wards include Musaya, Mushungu, Kanyanga, Ngombellede, Kapulurila, Lusitu, Nkandabbwe, Chirundu Central, Chirundu West, Njame, Ibbwemunyama, and Sikoongo.

These Chiefs play a crucial role in local governance, cultural preservation, and land allocation. Our Project area lies within Chieftainess Sikoongo’s chiefdom, in Musaya ward with eleven (11) villages that make up 6% percent of the District population, Figure 9.



*Source: Zamstats (2022)*

*Figure 9: Percentage Population Per Ward, Chirundu District*

### **5.3.3 Land Tenure and Use**

There are two tenure systems in Zambia namely leasehold and customary tenure. All land is held by the President in trust for and on behalf of the people of Zambia. Customary land is estimated to be 94 percent of the total land area.

Land in Chirundu District is predominantly held under customary tenure, managed by traditional authorities. In addition to customary lands, there are state lands and leasehold lands allocated for various uses, including agriculture, residential, and commercial purposes.

### **5.3.4 Agriculture**

Agriculture is a key economic activity in Chirundu District, with maize, groundnuts, and soya beans being the primary crops. Chirundu is situated in Zambia's Agro-

Ecological Region I, characterized by extremely high temperatures and low rainfall. This makes the District prone to droughts, impacting agricultural productivity as was evident in the 2023/2024 farming season, where about 98% of the crops planted on 33,525 hectares failed. This has affected around 14,000 farming households. Initiatives like the SCRALA Project (Strengthening Climate Resilience of Agricultural Livelihoods in Agro-Ecological Regions I and II in Zambia) have introduced irrigation schemes to improve agricultural productivity.

Livestock farming is a significant component of the agricultural sector. The primary livestock reared include cattle, goats, and poultry. Figure 10 below depicts the livestock in the Project area.



*Figure 10: Goat rearing in the Project Area*

### **5.3.5 Local Economy**

The local economy of Chirundu District is diverse, with agriculture, trade, transportation and small-scale industries being the main contributors, due to its strategic location on the Zambezi River. This serves as a key border crossing between Zambia and Zimbabwe. Serving as a pivotal point for cross-border traffic between Harare in Zimbabwe and Lusaka in Zambia, the Chirundu Bridge play a vital role in facilitating regional connectivity.

The District faces economic challenges, including low-income levels and limited access to resources. However, there are ongoing efforts to improve the economic situation. The District has implemented various programs to support economic development, including the Cash for Work Programme to mitigate the effects of climate change.

Additionally, the Council is focusing on enhancing micro, small, and medium enterprises, improving market spaces, and promoting urban and peri-urban economies.

### 5.3.6 Mining

Mining activities in Chirundu District include artisanal mining of minerals such as copper, gold, and gypsum. The Mulonga Mining Cooperative Society Limited is one of the key players in the District, focusing on artisanal mining to benefit local communities.

The Chirundu Mining License, which includes the Njame and Gwabe deposits, is part of the larger Muntanga Uranium Project managed by GoviEx Uranium Inc. This license was reinstated in 2021 after being previously cancelled.

The Muntanga Project, which encompasses the Chirundu area, involves open-pit mining and heap leaching over an initial mine life of 11 years. The immediate project area has no known mining activities.

### 5.3.7 Forestry

Chirundu District is home to the Chirundu Fossil Forest, a National Monument containing fossilized tree trunks from the Karoo age.



*Figure 11: Entrance to Chirundu Fossil Forest*

The site features well-preserved fossilized logs, some of which are still in their original positions. This area is significant not only for its paleontological value but also as a tourist attraction, offering a unique insight into the region's geological history.

In Chirundu, forestry-related activities are primarily centered around the Chirundu Fossil Forest, a significant paleontological site. This fossil forest contains well-preserved petrified tree trunks from the Jurassic period, offering a unique glimpse into ancient ecosystems.

Notwithstanding, the District also faces challenges with deforestation due to activities like charcoal burning.

### **5.3.8 Fisheries**

Fisheries are an important part of the local economy, with fishing activities primarily taking place along the Zambezi River. The District has initiatives to support sustainable fishing practices and improve the livelihoods of fishing communities.

The Department of Fisheries in Chirundu is actively involved in regulating fishing activities to ensure sustainability. Their efforts include conducting licensing, river patrols, and educating fishers on the importance of sustainable practices. While the local communities engage in fishing for both subsistence and commercial purposes. Ongoing efforts aim to balance fishing activities with conservation to protect the river's ecosystem.



*Figure 12: Fisherman on the Kafue River*

### **5.3.9 Energy**

The District is connected to the National grid for electricity supply, which is the District's primary source of energy. Additionally, there are ongoing efforts to integrate local resources and infrastructure to support energy development.

In the Project area most households rely on firewood and charcoal as a means of energy for cooking due to non-availability of the National grid.

### 5.3.10 Water and Sanitation

The current status of water and sanitation in Chirundu has seen significant improvements recently. The Chirundu Town Council has finalized several water schemes under the 2023 Constituency Development Fund (CDF), including the drilling and installation of four solar-powered boreholes. These efforts aim to provide clean and safe water to over 25,000 people in the District. However, challenges remain, particularly in rural areas where access to water and sanitation services is still limited. The project area is not currently serviced by the local authority. Like many rural areas in the Country, residents rely on nearby water bodies and communal wells for their domestic water needs. Sanitation is managed through pit latrines.

### 5.3.11 Health

Chirundu District has several health facilities, including the Mtendere Mission Hospital and various rural health centers such as those in Ngombe Illede, Jamba, and Lusitu. These key centers provide essential healthcare services to the District's population.

*Table 10: Health Facilities in Chirundu District*

| HEALTH FACILITY            | NUMBER                     |
|----------------------------|----------------------------|
| Hospital                   | 1 Mission General Hospital |
| Clinics                    | 19                         |
| Rural Health Centres (RHC) | 11                         |
| Health Posts (HP)          | 9                          |
| Port Health (PH)           | 9                          |

Source: *Ministry of Local Government and Rural Development (2025)*

The District has limited specialized treatment services and most of the specialized services are referred to other Health Facilities such as the University Teaching Hospital (UTH) in Lusaka. The health services offered include immunization, Male Circumcision, under five services, Maternity, Family Planning, HIV and AIDS treatment. The predominant diseases in the District include, but are not limited to, respiratory tract infections, diarrhoeal diseases, non-communicable diseases, gastrointestinal diseases, musculoskeletal diseases (non-trauma), lower back pain, dental caries, nervous system disorders, nasal diseases, and skin diseases/infections.

Table 11 below shows the distance from health facilities to the hospital and available services.

Table 11: Availability of Basic Services at Health Facilities on the District

| SN | Facility                         | Distance to Hospital |        |       | Maternity Annex | Connection to Grid | Solar Energy | Piped Water | Flushable Toilets |
|----|----------------------------------|----------------------|--------|-------|-----------------|--------------------|--------------|-------------|-------------------|
|    |                                  | Gravel               | Tarred | Total |                 |                    |              |             |                   |
| 1  | Kapulurila Rural Health Centre   | 17                   |        | 17    | NO              | YES                | NO           | YES         | YES               |
| 2  | Chibende HP                      |                      |        |       |                 |                    | YES          | YES         | YES               |
|    | Sikoongo Rural Health Centre     |                      | 26     | 27    | NO              | NO                 |              | NO          | NO                |
| 4  | Ibbwemunyama Rural Health Centre | 36                   | 45     | 81    | NO              | NO                 | YES          | NO          | NO                |
| 5  | Maunga Health Post               | 29                   | 45     | 74    | NO              | NO                 | YES          | NO          | NO                |
| 6  | Chinkanzaya Health Centre        | 26                   | 45     | 71    | NO              | NO                 | YES          | NO          | NO                |
| 7  | Hachipilika Rural Health Centre  |                      | 45     | 47    | NO              | NO                 | YES          | NO          | NO                |
| 8  | Zalaunga Health Post             |                      | 28     | 34    | NO              | NO                 |              | NO          | NO                |
| 9  | Syangweemu Health Post           | 12                   | 28     | 40    | NO              | NO                 |              | NO          | NO                |
| 10 | Jamba Rural Health Centre        |                      | 52     | 51    | NO              | NO                 | YES          | NO          | NO                |
| 11 | Nabbanda Health Post             |                      |        |       | NO              | NO                 |              | NO          | NO                |
| 12 | Lumbembe Health Post             |                      | 38     | 38    | NO              | NO                 | YES          | NO          | NO                |
| 14 | Lusitu Rural Health Centre       |                      | 47     | 47    | YES             | YES                | NO           | YES         |                   |
| 15 | Chipepo Rural Health Centre      |                      | 41     | 48    | YES             |                    | NO           | YES         |                   |

### **5.3.12 Education**

Education in Chirundu District is characterized by a mix of primary, secondary, and tertiary institutions. The District is working to improve educational infrastructure and access to quality education for all residents. The education status of Chirundu is improving, with several initiatives underway to enhance the quality and accessibility of education.

Chirundu District hosts a total of 55 educational institutions, comprising 13 secondary schools and 42 primary and nursery schools. The District is served by 521 teachers, resulting in a teacher-to-pupil ratio of 1:51.6.

This ratio highlights the significant challenge of providing individualized attention to students, underscoring the need for additional educational resources and support to enhance the quality of education in the District. Furthermore, 16 schools are connected to the national grid, while the remaining 41 schools are not. Among the schools without grid connection, one school utilizes a diesel generator for its energy needs while, four schools are equipped with solar energy systems and the remaining 35 schools lack any power supply.

This situation highlights the significant energy challenges faced by the majority of schools in the District, impacting their ability to provide a conducive learning environment. Addressing these energy deficiencies is crucial for improving educational outcomes and ensuring that all students have access to the necessary resources for their academic success.

### **5.3.13 Employment**

Employment in Chirundu District is diverse, with significant contributions from agriculture, trade, and small-scale industries. Agriculture remains a primary source of employment, engaging a large portion of the population in crop production and livestock farming. The District's strategic location along the Lusaka Road facilitates trade and commerce, providing numerous job opportunities in retail, transportation, and logistics. Small-scale industries, including artisanal mining and local manufacturing, also contribute to employment.

The public sector, including local government and educational institutions, provides additional job opportunities. Initiatives like the Zambia National Service (ZNS) projects and capacity-building programs aim to create both skilled and unskilled jobs, enhancing employability and supporting economic development in the District.

### **5.3.14 Tourism, Cultural, National Parks**

Tourism in Chirundu District is centred around natural attractions such as the Chirundu Fossil Forest and the Zambezi River.

Chirundu is renowned for its scenic beauty along the Zambezi River making it a popular destination for various activities:

- Fishing - The Zambezi River is famous for tigerfish, making it a hotspot for fishing enthusiasts.
- Boating and Canoeing - Visitors can enjoy boating and canoeing trips, often starting from Chirundu and heading towards Mana Pools.
- Wildlife Viewing - The area is rich in wildlife, including elephants, which are often seen wandering around the District.

Additionally, Chirundu has a rich cultural heritage, with traditional ceremonies and practices playing a significant role in the community. The people of the Sikoongo chiefdom in Chirundu District observe the Nzambangulwe traditional ceremony. This important cultural event celebrates the heritage and traditions of the Tonga-speaking people in the region. The Nzambangulwe ceremony typically takes place in August.

Chirundu District is in proximity to national parks such as Lower Zambezi National Park, which supports eco-tourism and wildlife conservation. These parks contribute to the local economy through tourism and conservation activities.

## 6.0 IMPACT ASSESSMENT

This Chapter provides information on the assessment of the associated and potential environmental and socio-economic impacts from the proposed Project. An impact is essentially any change to a resource or receptor brought about by the presence of a project component or by the execution of a project related activity.

The assessment has been undertaken following a systematic process that predicts and evaluates the impacts the Project or Project activities could have on aspects of the physical, biological, social and economic environments, and identifies measures that the Project will take to avoid, reduce, mitigate, or offset for adverse impacts and to enhance positive impacts.

### 6.1 Sources of Impact

The sources of impact can be defined as all the activities linked to the Project, including associated facilities that are likely to have an impact on the environment. The sources of impact are grouped by Project phase: preconstruction, construction, operation (including maintenance), and decommissioning, as depicted in Table 12.

*Table 12: Sources of Impacts*

| <b>Project Phase</b>  | <b>Activity/Source of Impact</b>  |
|-----------------------|---|
| Preconstruction Phase | Site survey   |
|                       | Land acquisition  |
|                       | Resettlement/Displacement – physical displacement and land based livelihood and economic displacement.  |
| Construction Phase    | Site clearance and preparation including establishment of labour camp, storage yard, access roads.  |
|                       | Transportation of workers, machinery, construction material, solar modules, tower components, conductors, etc.  |
|                       | Construction activities including; excavation, foundation works, erection of towers, stringing, transformer installation and other infrastructure at substations.   |
|                       | Waste management (hazardous and non-hazardous), handling operations and storage of hazardous waste, including oil and domestic waste.   |
|                       | Dismantling of temporal buildings i.e., workers camp, storage yard.   |
| Operation Phase       | Waste management (hazardous and non-hazardous), handling operations and storage of hazardous waste used during operations, including oil used in transformers at substations.                                       |
|                       | Operation and maintenance of solar modules and transmission line, including; inspection, maintenance, and repairs of solar modules, conductors, towers, and as well as wayleave maintenance and vegetation control. |
|                       | Operation and maintenance of Substations.   |
| Decommissioning Phase | Site clearance and preparation including establishment of labour camp, storage yard and access roads.   |
|                       | Transportation of workers, machinery and dismantled components.   |

|  |   |
|--|---|
|  | Dismantling activities including; Excavation, dismantling towers conductors, revegetation.  |
|  | Waste management (hazardous and non-hazardous), handling operations and storage of hazardous waste, including oil and domestic waste. |

## 6.2 Impact Identification and Assessment Methodology

In general, the assessment of impacts passed through a comprehensive process involving the following four key elements:

- Prediction of potential impacts and their magnitude (i.e., the consequences of the proposals on the natural and social environment);
- Evaluation of the importance (or significance) of impacts taking the sensitivity of the environmental resources or human receptors into account;
- Development of mitigation measures to avoid, reduce or manage the impacts or enhancement measures to increase positive impacts; and
- Assessment of residual significant impacts after the application of mitigation and enhancement measures.

Where significant residual impacts remained, further options for mitigation were considered and impacts re-assessed until they were as low as reasonably practicable for the Project. This is an iterative process that commenced during the scoping stage of the ESIA and continued throughout the impact assessment process. The process informs and runs in parallel with the design of the Project and links in with consultation and stakeholder input regarding the significance of impacts and the suitability of proposed mitigation measures.

### 6.2.1 Types of Impacts

*Table 13: Types of Impact*

| Type of Impact | Definition  |
|----------------|---|
| Positive       | An impact that is considered to be an improvement on the baseline conditions or introduces a positive change.   |
| Negative       | An impact that is considered to be an adverse change from the baseline or introduces a new undesirable factor.  |
| Direct         | Impacts that result from a direct interaction between a planned project activity and the receiving environment/receptors (e.g., the loss of vegetation and habitat as a result of site clearing).   |
| Indirect       | Impacts that follow on from the primary interactions between the Project and its environment as a result of subsequent interactions within the environment (e.g., increased forest loss due to improved access resulting from the construction of a road or loss of part of a habitat affecting the viability of a species population over a wider area). Indirect impacts can also be referred to as induced or secondary impacts. |

|                    |  |
|--------------------|--|
| Cumulative Impacts | The combined effects of the Project and other existing or planned future developments or natural processes on the same resources and/or receptors which are additive or interactive in nature. |
|--------------------|--|

## 6.2.2 Prediction of Magnitude

Magnitude essentially describes the intensity of the change that is predicted to occur in the resource/receptor as a result of the impact. Magnitude ratings are: negligible, low, moderate, high.

The magnitude of each potential impact of the Project has been identified according to the criteria tabulated below in Table 14.

*Table 14: Criteria for Determining Impact Magnitude*

| Parameter      | Description  | Criteria  |
|----------------|--|---|
| Frequency      | A measure of the constancy or periodicity of the impact.       | <i>Rare</i> – As far as possibly recurring impacts are concerned, such as accident or unplanned events (e.g., traffic accident, fire).  |
|                |  | <i>Once-off</i> – Impact occurs just once.  |
|                |  | <i>Intermittent</i> – Impact occurs periodically (repeatedly or sporadically).  |
|                |  | <i>Continuous</i> – Impact occurs continuously throughout project phase/ lifecycle.   |
| Duration       | The time period over which a resource or receptor is affected. | <i>Short-term</i> – predicted to last only for a limited period (i.e., during construction) but will cease on completion of the activity, or as a result of mitigation measures and natural recovery (e.g., non-local construction workforce-local community interactions). |
|                |  | <i>Medium-term</i> – the impact is felt for some time after the completion.   |
|                |  | Long-term – will continue for the life of the project but cease when the project stops operating (i.e., 30 years).  |
|                |  | <i>Permanent</i> – will continue even after project life i.e., after decommissioning.   |
| Spatial Extent | The reach of the modified natural and human environments       | <i>On-site</i> – limited to the Project site.   |
|                |  | <i>Local</i> – affect locally important environmental resources or are restricted to a single (local) administrative area e.g., Chirundu District or a single community (Mwiinga Village).  |
|                |  | <i>Regional</i> – Impacts that affect regionally important environmental resources or are experienced at a regional scale e.g., North-western Province.   |
|                |  | <i>National</i> – Impacts extending outside regional/provincial boundaries or impacts that affect nationally important environmental resources; affect an area that is nationally important/protected; or have macro-economic consequences.                                 |
|                |  | <i>International</i> – transboundary impacts or impacts that affect internationally important resources such as areas protected by International Conventions.   |

|            |  |   |
|------------|--|---|
| Likelihood | Probability/certainty associated with a potential impact | <i>High</i> – the impact will certainly manifest itself. It will occur at normal operating conditions (i.e., it is essentially inevitable). |
|            |  | <i>Moderate</i> - the impact might occur, without any certainty. It is likely to occur at some time during normal operating conditions.     |
|            |  | <i>Low</i> – the impact is unlikely/ rare and could occur only in the event of an accident.   |

The determination of overall impact magnitude rating was on the basis of professional judgement and Good International Industry Practice (GIIP), considering all four parameters collectively, where relevant. This is further detailed in Table 15.

*Table 15: Impact Magnitude Definitions*

| <b>Magnitude</b> | <b>Definition</b>   |
|------------------|---|
| High             | Fundamental change to the specific conditions assessed resulting in long term or permanent change, typically widespread in nature, and requiring significant intervention to return to baseline; exceeds accepted standards and limits. |
| Moderate         | Detectable change to the specific conditions assessed resulting in non-fundamental temporary or permanent change; within accepted standards and limits.   |
| Low              | Detectable but minor change to the specific condition assessed; well within accepted standards and limits.  |
| Negligible       | No perceptible change to the specific condition assessed.   |

### 6.2.3 Criteria for Determining Sensitivity

Receiving parameter sensitivity refers to the importance, significance or value or vulnerability of the social or environmental component under examination. Receptor sensitivity is the degree to which a particular receptor is more or less susceptible to a given impact. Receptor sensitivity takes into consideration receptor resilience and value.

Receptor value takes into consideration its quality and its importance as represented, for example, by its conservation status, its cultural importance and/or its economic value. It recognizes that, for a given magnitude impact, different receptors (either directly or indirectly) may be deemed to be of greater importance and as such the significance of the impact is greater than the impact magnitude alone.

Where the receptor is physical, the assessment considers the quality, sensitivity to change and importance of the receptor. For a human receptor, the sensitivity of the household, community or wider societal group is considered along with their ability to adapt to and manage the effects of the impact.

Similar to the approach adopted for impact magnitude, a structured description of receptor sensitivity employed a qualitative category scale of negligible, low, moderate, and high, as detailed in Table 16.

Table 16: Receptor Sensitivity Definitions

| Sensitivity | Definition   |
|-------------|--|
| High        | Individual receptor has very limited or no capacity to accommodate, adapt or recover from the anticipated impact. The impact is likely to leave it in an altered state from which recovery would be difficult or impossible. |
| Moderate    | Individual receptor has limited capacity to accommodate, adapt or recover from the anticipated impact, there may be some residual modification as a result.  |
| Low         | Individual receptor has some tolerance to accommodate, adapt or recover from the anticipated impact, and/or has some opportunities for mitigation.   |
| Negligible  | Individual receptor is generally tolerant to and can accommodate or recover from the anticipated impact, and/or has excellent opportunities for mitigation.  |

### 6.2.4 Evaluation of Significance

Following the assessment of impact magnitude and determining the sensitivity of the receiving environment or potential receptor, the significance of each potential impact was established using the impact significance matrix shown in Table 17.

Table 17: Determination of Impact Significance

|                  |  | Receptor Sensitivity (Vulnerability and Value) |                 |                 |                       |
|------------------|--|--|-----------------|-----------------|-----------------------|
|                  |  | Negligible                                     | Low             | Moderate        | High                  |
| Impact Magnitude | Negligible   | Not significant                                | Not significant | Not significant | Not significant – Low |
|                  | Low  | Not significant                                | Low             | Low – Moderate  | Moderate              |
|                  | Moderate   | Not significant                                | Low – Moderate  | Moderate        | Moderate – High       |
|                  | High   | Low  | Moderate        | High            | High                  |
| High             | <i>Significant.</i> Impacts with a “High” significance are likely to disrupt the function and value of the resource/receptor, and may have broader systemic consequences (e.g. ecosystem or social well-being). These impacts are a priority for mitigation in order to avoid or reduce the significance of the impact.  |  |                 |                 |                       |
| Moderate         | <i>Significant.</i> Impacts with a “Moderate” significance are likely to be noticeable and result in lasting changes to baseline conditions, which may cause hardship to or degradation of the resource/receptor, although the overall function and value of the resource/receptor is not disrupted. These impacts are a priority for mitigation in order to avoid or reduce the significance of the impact. |  |                 |                 |                       |
| Low              | <i>Detectable but not significant.</i> Impacts with a “Low” significance are expected to be noticeable changes to baseline conditions, beyond natural variation, but are not expected to cause hardship, degradation, or impair the function and value of the resource/receptor. However, these impacts warrant the attention of decision-makers, and should be avoided or mitigated where practicable.      |  |                 |                 |                       |

|            |   |
|------------|---|
| Negligible | <i>Not Significant.</i> Any impacts that are expected to be indistinguishable from the baseline or within the natural level of variation. These impacts do not require mitigation and are not a concern of the decision-making process. |
|------------|---|

## 6.3 Bio-Physical Environmental Impacts

### 6.3.1 Visual Intrusion and Change in Landscape

#### 6.3.1.1 Impact Description

##### ***Construction***

Infrastructure that is not harmonious with the landscape or negatively impacts its existing features can affect the aesthetics of an area. The Project will occupy approximately 355 hectares of land (250ha solar plant and 70 ha transmission line), most of which will be cleared, potentially altering the existing forest and agricultural landscape. Facilities such as temporary workspaces, access roads, solar PV modules arrays, substations, and a 14.2km transmission line will be introduced. During construction, heavy machinery, including excavators, bulldozers, and transport vehicles, will be present, further altering the visual character of the area.

The visual character of the area will change due to short-term activities such as land clearing, trench digging, and the presence of construction vehicles and machinery. However, the installation of solar PV modules, substations, and the 14.2km transmission line, along with associated waste generation, will cause permanent aesthetic impacts.

##### ***Operation***

The operational phase will introduce solar PV arrays and transmission line structures, which may create aesthetic impacts. The overall aesthetic effect is likely to be perceived negatively by most, though some may not find the structures objectionable.

#### 6.3.1.2 Receptor(s)

Visual impacts may affect communities living and or farming near the project area.

#### 6.3.1.3 Rating of impacts related to visual intrusion and change in landscape – (Pre-mitigation)

| Type of Impact: Direct |             |  |
|------------------------|-------------|--|
| Parameter              | Designation | Summary of Reasoning   |
| Extent                 | On-site     | Restricted to the Project site.  |
| Duration               | Long Term   | Impacts will occur for the duration of the construction period and throughout the operation period |

|  |            |  |
|--|------------|--|
| Frequency  | Continuous | The Project infrastructure will exist for the duration of the Project.   |
| Likelihood   | High       | Impact will certainly occur because clearing, excavations and Solar module installation and tower erection are unavoidable activities associated with the Project. |
| <b>Magnitude: High</b>   |            |  |
| The project involves large-scale land use changes, introduces industrial infrastructure, and alters the visual character of the area from its current natural or rural setting.  |            |  |
| <b>Sensitivity of Receptor: Moderate</b>   |            |  |
| The proposed line will largely traverse areas that have already been disturbed by human activities. Farmers using the land may have moderate sensitivity to visual changes, as their primary concern is productivity rather than aesthetics. |            |  |
| <b>High Significance Rating Pre-Mitigation</b>   |            |  |

#### 6.3.1.4 Mitigation Measures

Minimization and mitigation measures will include:

- Use of existing access roads as much as possible;
- Crossing rivers and streams using the shortest distance possible (i.e., perpendicular to the waterbody);
- Using construction methods that minimize damage to vegetation near the transmission line;
- Utilisation of solar modules with non-reflective coating to minimize glare, which can be visually disruptive;
  - Installation and/or maintenance of visual barriers (trees and shrubs), where possible, to reduce the visibility so that there is still greenery present; and
  - Appropriate management of construction waste at the site.

#### 6.3.1.5 Residual Impact (Post-mitigation)

The residual impact is considered “**Moderate**”. While the Project would still alter the landscape, the residual impact would be significantly reduced, making it more acceptable to most stakeholders.

### 6.3.2 Air Pollution

#### 6.3.2.1 Impact Description

##### ***Construction***

Activities likely to impact air quality include transportation and construction activities such as clearance of vegetation, excavation, foundation works. Potential impacts on air quality will include increased particulate matter from; fugitive dust emissions caused by increased traffic and exposure of bare soil from wayleave clearance.

The amount of dust or gaseous emissions generated each day during the construction phase will depend on the magnitude and nature of construction activities and the atmospheric and weather conditions prevailing on that particular day.

### **Operation**

The impacts during operation of the solar plant are expected to be negligible, as solar energy generation is a clean process that does not involve combustion or the release of pollutants.

Similarly, the operation of the transmission line will not contribute to any atmospheric emissions directly since the transmission lines will be fitted with SCADA system for communication, monitoring and controls as well as other operational activities, which minimizes travelling.

In summary, the net impact of the Project on air quality will be short term as it will be limited to the construction period.

#### **6.3.2.2 Receptor (s)**

Air pollution may affect communities living in the Project area i.e community members, construction workers and animals.

#### **6.3.2.3 Rating of impacts related to air quality deterioration – (Pre-mitigation)**

| <b>Type of Impact: Direct</b>  |                    |   |
|--|--------------------|---|
| <b>Parameter</b>   | <b>Designation</b> | <b>Summary of Reasoning</b>   |
| Extent   | Local              | Particulate matter is likely to be generated along the local road network, access roads, wayleave and plant site.       |
| Duration   | Short Term         | Air quality deterioration will mainly be restricted to the construction phase.  |
| Frequency  | Intermittent       | It will be expected only during certain activities.   |
| Likelihood   | High               | Impact will certainly occur because emissions of particulate matter are commonly associated to construction activities. |
| <b>Magnitude: Low</b>  |                    |   |
| The overall magnitude of air quality impact is low to moderate during construction and negligible during operation and maintenance. The impact is short-term and localized, with no long-term or significant effects on air quality. |                    |   |
| <b>Sensitivity of Receptor: Moderate</b>   |                    |   |
| Human activities in the project area are primarily agricultural. There are no settlements, schools or health centres in the area of direct impact.   |                    |   |
| <b>Moderate Significance Rating Pre-Mitigation</b>   |                    |   |

#### **6.3.2.4 Mitigation Measures**

The following mitigation measures are recommended:

- A robust maintenance and operation regime for of all vehicles and equipment engines will be developed, in accordance with manufacturers recommendations;
- Prohibition of idling of vehicles on-site; shut down generators and machinery when not in use;
- Covering of loose materials and keeping top layers moist;
- Observing set speed limits on unhardened roads and surfaces;
- Use water for dust suppression on stockpiles, exposed soils, roads and prior to excavation works;
- Use of covered trucks for the transportation of materials that release dust emissions; and
- Use of appropriate PPE by workers on site e.g., dust masks.

#### **6.3.2.5 Residual Impact (Post-mitigation)**

With the implementation of the above measures the residual significance of impacts on air quality can be expected to be "**Low**".

### **6.3.3 Noise and Vibration**

#### **6.3.3.1 Impact Description**

##### ***Construction***

Noise is generally defined as unwanted sound. Psychological effects of noise include annoyance and disruption of concentration. Physical effects include loss of hearing, pain, nausea, and interference with communication when the exposure is severe.

The occurrence of noise at this stage is inevitable, but it is good that the construction phase lasts briefly and equipment used is usually not intensely noisy. The noise generated by construction activities tends to decrease with distance due to factors such as sound absorption, atmospheric conditions, and obstacles in the environment. Noise impacts are expected to be more predominant within 200-500m of the activity areas.

Activities likely to be a source of noise and vibration include; site clearing, transportation activities and construction activities such as grading, blasting, drilling, tower erection, conductor stringing and human interactions. They will involve different movements of trucks, cranes and other construction machinery and equipment and handling of building materials.

**Operation**

During the operation phase, maintenance activities conducted near solar plants, substation, transmission line, or wayleave could lead to an increase in noise levels which may disturb nearby communities and local fauna. This impact is expected to be negligible as only few workers are expected on site with minimal or no heavy equipment/machinery.

After construction, noise levels compared to the current situation will be negligible. The net impact of the Project will be short term as it will be limited to the construction period.

**6.3.3.2 Receptors(s)**

The primary noise receptors are communities living in the Project area i.e community members, construction workers and animals.

**6.3.3.3 Rating of impacts related to noise and vibration – (Pre-mitigation)**

| <b>Type of Impact: Direct</b>  |                    |  |
|--|--------------------|--|
| <b>Parameter</b>   | <b>Designation</b> | <b>Summary of Reasoning</b>  |
| Extent   | On-site            | Noise will be predominant within 200- 500m of the project site.  |
| Duration   | Short Term         | Noise is expected throughout the construction but negligible during the operation phase, though levels may vary  |
| Frequency  | Intermittent       | Noise will not be continuous, it will be expected only during certain activities.  |
| Likelihood   | High               | Impact will certainly occur because noise is commonly associated to construction activities such as blasting, concrete mixing, and vehicular movement for transportation of materials. |
| <b>Magnitude: Moderate</b>   |                    |  |
| The impact is short-term, localized, and unlikely to cause significant or long-term disturbance.   |                    |  |
| <b>Sensitivity of Receptor: Moderate</b>   |                    |  |
| Human activities in the project area are primarily agricultural. There are no settlements, schools or health centres in the area of direct impact. |                    |  |
| <b>Moderate Significance Rating Pre-Mitigation</b>   |                    |  |

**6.3.3.4 Mitigation Measures**

The following recommendations for mitigation measures are outlined below:

- Use of temporary noise barriers for equipment (e.g., sound proofing walls around stationary power generating sources);
- Avoid dropping materials from height, where practicable;
- Maintain and operate all vehicles and equipment in accordance with manufacturers recommendations;
- Noisy activities (activities that can be heard in nearby communities) restricted to daytime working hours;

- Inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration;
- Establishment of a grievance redress mechanism to provide means for residents to make noise complaints;
- Provision of hearing protective devices for workers, such as ear plugs and ear muffs;
- Development of a blasting schedule to be communicated to the public and appropriate warning shall be given; and
- Control of ground vibrations, for example through the use of non-electric shock tubes and emulsion explosives.

### **6.3.3.5 Residual Impact (Post-mitigation)**

With the implementation of the above measures the residual impact significance of noise and vibration can be expected to be **"Low"**.

### **6.3.4 Soil Erosion and Contamination**

#### **6.3.4.1 Impact Description**

##### ***Construction***

Site clearance and preparation will require the removal of vegetation, leading to the exposure of bare soil. Soil erosion may result from the loosening of soil material through the operation and movement of heavy-duty vehicles and machinery as well as from pitting, trenching and excavation of the soil for the placement of support structures such as towers and solar mounting systems/racks. This effect will be more pronounced on steep slopes.

Although existing roads and tracks will be used to access the solar plant site and wayleave as far as possible, some access roads in harder to access areas may be created. Vehicular movement around the project area can lead to soil compaction in those areas especially highly saturated areas such as those close to water bodies.

The excavation of soil for the construction of support structures will disrupt the soil cohesion and also may result in surplus soil due to the use of concrete for the foundation. If not properly restored or managed, this soil may erode and wash into nearby surface water bodies.

Soil contamination is likely to occur as a result of the mismanagement of chemicals, waste and accidental spills.

##### ***Operation***

No significant soil erosion is expected. Soil contamination may result from unplanned events such as oil leaks resulting from equipment breakdown and/or accidental spills

from machinery used for maintenance purposes at the solar plant, along the transmission line and at the substations.

#### 6.3.4.2 Receptor(s)

Potential receptors include; soils, local farmers and fauna.

#### 6.3.4.3 Rating of impacts related to soil erosion and contamination during construction – (Pre-mitigation)

| Type of Impact: Direct   |                        |  |
|--|------------------------|--|
| Parameter  | Designation            | Summary of Reasoning   |
| Extent   | On-site                | The impact on soil quality and soil structure will be limited to the plant site, wayleave (more so at tower locations), access roads, camp site and service and storage areas. |
| Duration   | Short Term             | Soil erosion, compaction, organic layer losses, and contamination are largely restricted to the construction phase.  |
| Frequency  | Intermittent (erosion) | Soil disturbance will not be continuous, it will be expected only during certain activities.   |
|  | Rare (contamination)   | Soil contamination is expected largely due to accidental spills and leakages   |
| Likelihood   | High (erosion)         | Impact will certainly occur because soil disturbance is commonly associated to construction activities such as blasting, vehicular movement for transportation of materials.   |
|  | Low (contamination)    | Soil contamination is expected largely due to accidental spills and leakages.  |
| <b>Magnitude:</b> Moderate   |                        |  |
| Risk of contamination from mismanagement of chemicals, waste, or accidental spills is present but can be minimized with proper handling and spill response plans |                        |  |
| <b>Sensitivity of Receptor:</b> Moderate   |                        |  |
| The soils are a moderately sensitive receptor given its agricultural use   |                        |  |
| <b>Moderate Significance</b> Rating Pre-Mitigation   |                        |  |

#### 6.3.4.4 Mitigation Measures

The following mitigation measures to reduce impacts on soil structure from compaction and erosion are recommended:

- Construction of foundations to be undertaken mostly in the dry season;
- Protect excavated soil materials from erosion;
- Reduction of the construction of new access roads, where possible. Promoting the use of existing access roads for machinery and vehicle movement, increasing their width as necessary;

- Ensure that the land is physically restored (include revegetation where possible) and before the next rainy season; and
- Rehabilitation of any areas which will be exposed for any reason as soon as possible to prevent possible soil erosion. Rehabilitation will be by replanting disturbed areas, or returning the top soil so that grass is able to naturally grow.

The following mitigation measures to reduce potential for soil contamination are recommended:

- Training of relevant staff in safe storage and handling practices, and rapid spill response and clean-up techniques;
- Regular checking and maintenance of all vehicles and equipment to minimize the risk of fuel or lubricant leakages;
- Store hazardous materials in a manner that includes secondary containment and prevents interaction with other materials, the environment, and accidental tampering in addition to bunding of areas where hazardous substances are stored (e.g., fuel, waste areas);
- Provision of well labelled receptacles or bins that allow for segregation of waste materials according to waste streams;
- Use of mobile toilets at construction sites, and soak-a-way pits at camp sites;
- Development and implementation of a Waste Management Plan (Construction ESMP) to ensure that waste is disposed of correctly. Use of appropriate waste disposal methods including:
  - Composting of biodegradables;
  - Selling metal, wood, and plastic scraps;
  - Reuse of materials e.g., packages, concrete, etc.; and
  - Dumping of remaining wastes at approved sites.

#### 6.3.4.5 Residual Impact (Post-mitigation)

With the implementation of the above measures the residual impact significance can be expected to be “**Low**”.

#### 6.3.4.6 Rating of impacts related to soil erosion and contamination during operation – (Pre-mitigation)

| Type of Impact: Direct |             |   |
|------------------------|-------------|---|
| Parameter              | Designation | Summary of Reasoning  |
| Extent                 | On-site     | The impact will be limited to wayleave, substations, refueling areas.                 |
| Duration               | Short Term  | In the event of an accidental spill, it will be contained and cleaned-up immediately. |
| Frequency              | Rare        | Only expected during an unplanned event or accident.                                  |

|  |     |  |
|--|-----|--|
| Likelihood   | Low | Only expected during an unplanned event or accident. |
| <b>Magnitude: Low</b>  |     |  |
| <b>Sensitivity of Receptor: Moderate</b>   |     |  |
| Due to the subtropical location of the Project, there is high probability that cleared areas will revegetate naturally thereby limiting the potential for erosion. Additionally, there will not be contamination unless an unplanned event or accident occurs. |     |  |
| <b>Low Significance Rating Pre-Mitigation</b>  |     |  |

Mitigation measures as recommended during the construction phase will apply during operation.

#### **6.3.4.7 Residual Impact (Post-mitigation)**

The residual impact can be expected to be “**Negligible**”.

### **6.3.5 Change in Quality of Water Resources**

#### **6.3.5.1 Impact Description**

##### ***Construction***

Activities likely to affect surface water quality include; construction activities such as site clearance, excavation, foundation works and waste management. Project activities will interact with water resources in the following ways:

- There will be direct interaction during clearing and construction activities close to or in surface water bodies;
- There will be indirect interaction in the case of erosion of soils into water bodies;
- There will be direct interaction from the abstraction of water from surface water bodies for foundation works and dust control; and
- There will be direct interaction from the discharge of domestic and construction wastewater to surface water bodies.

Clearing of vegetation for the wayleave may increase suspended solids in the water due to increased surface run-off. The Nantumba and Namwazi streams flow through the plant site, Musaya River flows southward of the site and the Kafue River is about 2km away. Vegetation removal in riparian areas can increase soil erosion in erosion prone areas, causing sediment to be deposited into the waterbodies, especially during rain events.

Similarly, groundwater could be contaminated during digging of foundation pits for the towers or mounting systems for solar modules. Proper management of excavation work will allow avoiding these potential impacts.

Leakage of fuel and oil from equipment and vehicles and other waste that is generated in these activities has the potential to contaminate surface water and affect aquatic ecology. Ground water impacts from the Project are negligible.

While the water demand for the Project is minimal, it could be satisfied in one of two ways namely:

- Use of water bowsers and storage of water in tanks; and
- Sinking new boreholes in accordance with the WARMA requirements.

Water requirements will likely be limited to domestic usage as well as for casting of foundations therefore its impact is likely to be insignificant.

**Operation**

In the same way, during the operation phase, oil spills could result from equipment breaking down at the site, leading to ground and surface water contamination in proportion to the magnitude of these accidental events.

Additionally, water will be required for cleaning of the solar modules periodically. Water for cleaning will be sourced at the boreholes onsite. The total maximum daily water consumption for living, greening and road watering will be approximately 1.55m<sup>3</sup>/day. The total annual water consumption for the Project is estimated at 566.24m<sup>3</sup>/yr.

Generally, the impact on the surface water and hydrogeology of the area during operation and maintenance shall be negligible and will not be assessed further.

**6.3.5.2 Receptor(s)**

The primary receptors of the impact on water pollution and quantity reduction are surface water bodies around the Project site as listed in Section 5.1.5 (*Hydrology and Drainage*), local ground water wells and boreholes.

**6.3.5.3 Rating of Impacts Related to Change in Quality of Water Resources – (Pre-mitigation)**

| Type of Impact: Negative |             |   |
|--------------------------|-------------|---|
| Parameter                | Designation | Summary of Reasoning  |
| Extent                   | Local       | Due to the nature of water, contaminants are likely to flow beyond the project site into downstream water bodies. However, the impact is expected to be at a local level only. Chemicals and fuels will not be stored in sufficient quantities to result in a spill of regional importance. |
| Duration                 | Short Term  | Largely occurs during construction. The impact is short-term as construction works are expected to continue for a period of approximately 10 months.  |

|  |              |  |
|--|--------------|--|
| Frequency  | Intermittent | Water quality impacts will not occur continuously but rather, during specific construction activities, after rainfall events (potential sediment runoff) and during accidental spills (if they occur). |
| Likelihood   | Moderate     | Impact may occur due to the nature of construction activities such as vehicular movement and wayleave clearance.   |
| <b>Magnitude: Low</b>  |              |  |
| <b>Impacts will be limited in scale</b>  |              |  |
| Siltation and contamination events will be sporadic and temporary. Also, Project water use (566 m <sup>3</sup> /year) is negligible.       |              |  |
| <b>Receptor Sensitivity: Moderate</b>  |              |  |
| Impacts on waterbodies will indirectly affect communities around the project area, the majority of whom do not have access to piped water. |              |  |
| <b>Moderate Significance</b> Rating Pre-Mitigation   |              |  |

### 6.3.5.4 Mitigation Measures

The following management measures are recommended to manage the impacts on water resources:

- Conducting of activities as far as possible from water bodies i.e., > 100m away, except where crossings are required;
- As much as possible, conserve all the vegetation (trees, shrubs, herbaceous plants, and crops) present at the edge of watercourses and in erosion prone areas, that do not represent a risk for infrastructure;
- Working in rainy season especially close to waterbodies to be avoided in order to reduce disturbances to local drainage patterns caused by working on water saturated soils and sediment transport into rivers and streams in proximity to work areas and affect water and habitat quality;
- Sensitization on proper water usage and management. Encourage water reuse/recycling where possible;
- Regularly monitor ground water quality;
- Adopt less water consuming solar module cleaning methods;
- Storage of hazardous materials in a manner that includes secondary containment and prevents interaction with other materials, the environment, and accidental tampering. In addition to, bunding of areas where hazardous substances are stored (e.g., fuel, waste areas);
- All machinery and equipment to be kept in good working condition to prevent accidental oil spillages from machinery and any other chemicals;
- Provision of well labelled receptacles or bins that allow for segregation of waste materials according to waste streams;
- Use of mobile toilets at construction sites, and soak-a-way pits at camp sites;
- Avoiding the disposing of waste in sensitive areas such as water courses;

- Development and implementation of a Waste Management Plan (site ESMP) to ensure that waste is disposed of correctly and the use of appropriate waste disposal methods including:
  - Composting of biodegradables;
  - Selling metal, wood, and plastic scraps;
  - Reuse of materials e.g., packages, concrete, etc.; and
  - Dumping of hazardous wastes at approved sites.

#### **6.3.1.5.6 Residual Impact (Post-mitigation)**

With the implementation of the above measures the residual impact significance can be expected to be "**Minor**".

### **6.3.6 Loss of Vegetation**

#### **6.3.6.1 Impact Description**

##### ***Construction***

Activities likely to result in loss of vegetation include; wayleave and site clearance, creation of access roads, transportation and movement of vehicles and machinery. The construction of the power line will involve minimum clearance of vegetation to create a wayleave of 50m (25m on either side) width leading to loss and destruction of flora species, some of which have medicinal and/or scientific value. Nevertheless, the Project has an embedded mitigation measure. In accordance with the Forestry Act No. 4 of 2015, Part VI Section 53 (1)(h), Regulation of Forest Produce, the Forestry Department has been engaged to conduct a Forest Resource Assessment (FRA), in order to grant a permit for the trees to be felled and pave way for project implementation.

##### ***Operation***

During the operational phase, the primary environmental impact will be limited to vegetation control through periodic bush clearing to maintain the wayleave and area on installation of the solar modules.

#### **6.3.6.2 Receptor(s)**

Potential receptors include; flora along the line route and Solar site, fauna that depend on the cleared vegetation for habitat, shelter, and food sources. Especially protected, endangered, or migratory species.

#### **6.3.6.3 Rating of Impacts Related to Loss of Vegetation – (Pre-mitigation)**

| Type of Impact: Direct  |              |   |
|---|--------------|---|
| Parameter   | Designation  | Summary of Reasoning  |
| Extent  | Local        | The proposed line route will not traverse any nationally protected Forest areas. Only trees within the project site will be cut down. |
| Duration  | Long Term    | The vegetation will need to be cut and maintained at a given height for the entire project life.                                      |
| Frequency   | Once-off     | Vegetation including all scrubs and trees will only be removed once during construction.  |
|   | Intermittent | Clearance will be maintained during annual bush clearing.   |
| Likelihood  | High         | Vegetation will have to be removed in order to implement and operate the Project.   |
| <b>Magnitude:</b> Moderate  |              |   |
| While vegetation removal is necessary, it is localized, managed, and does not affect protected or highly sensitive areas. |              |   |
| <b>Sensitivity of Receptor:</b> Moderate  |              |   |
| <b>High Significance</b> Rating Pre-Mitigation  |              |   |

#### 6.3.6.4 Mitigation Measures

The following mitigation measures are recommended to manage the loss of vegetation:

- Restriction of clearance to the wayleave. The boundaries shall be clearly identified and marked to avoid accidental clearing;
- Cleared woody vegetation from the wayleave and access road to be made available to local communities, to reduce the incremental disturbance to surrounding natural resources;
- Revegetation of temporal work areas and access roads with appropriate native species;
- Restriction of the creation of access roads by using existing roads and paths as far as possible; and
- Use of manual vegetation removal instead of chemical removal i.e., herbicides.

#### 6.3.6.5 Residual Impact (Post-mitigation)

With the implementation of the above measures the residual impact significance can be expected to be **"Moderate"**.

## 6.3.7 Habitat Fragmentation and Edge Effects

### 6.3.7.1 Impact Description

Habitat fragmentation refers to plant communities that have become divided or isolated. This could affect large and small mammals, birds, reptiles, amphibians, insects and other invertebrates.

Solar plants can act as physical barriers, preventing species from accessing resources, breeding sites, or migration routes. Similarly, linear clearings (wayleaves) that cut through habitats, can disrupt natural wildlife corridors, which are essential for species migration and dispersal.

The vulnerability of a particular species to habitat change is directly related to its ability to adapt. Relatively few animals find the wayleave to be a barrier. Some may simply move away to other areas, but some could be damaged or killed during the clearing process.

It is envisaged that no specific unique wildlife habitats will be affected by the Project.

### 6.3.7.2 Receptor(s)

Potential receptors include; flora and fauna within and around the Project area.

### 6.3.7.3 Rating of impacts related to habitat fragmentation and edge effects– (Pre-mitigation)

| <b>Type of Impact: Indirect</b>   |                    |  |
|---|--------------------|--|
| <b>Parameter</b>  | <b>Designation</b> | <b>Summary of Reasoning</b>  |
| Extent  | Local              | The Project site does not affect any nationally or internationally protected areas, therefore impact will be largely restricted to the project site. |
| Duration  | Long Term          | The vegetation will need to be cut and maintained at a given height for the entire project life.   |
| Frequency   | Once-off           | Vegetation including all shrubs and trees will be removed during construction but this removal will be maintained throughout the project life.       |
| Likelihood  | High               | Vegetation will have to be removed in order to implement and operate the Project.  |
| <b>Magnitude: Moderate</b>  |                    |  |
| Some species may adapt or relocate, but others could be negatively affected, particularly those with limited mobility or specific habitat needs (e.g., small mammals, reptiles, or ground-nesting birds). |                    |  |
| <b>Sensitivity of Receptor: Moderate</b>  |                    |  |
| The area supports local biodiversity, but it is not highly unique or ecologically sensitive.  |                    |  |
| <b>Moderate Significance Rating Pre-Mitigation</b>  |                    |  |

### 6.3.7.4 Mitigation Measure

Mitigation measures such as wildlife corridors, replanting native vegetation, and minimizing cleared areas are recommended. These steps can help maintain ecological connectivity and reduce the long-term effects of habitat fragmentation and edge effects. Further management of the impacts on local habitat is prescribed in 6.3.6 (*Loss of Vegetation*).

### 6.3.7.5 Residual Impact (Post-mitigation)

With the implementation of the above measures the residual impact significance can be expected to be “**Low**”.

### 6.3.8 Introduction of Alien Invasive Species

#### 6.3.8.1 Impact Description

##### ***Construction***

The means of introduction of invasive species in an area is not easy to determine. However, the continual movement of heavy vehicles into the project area will pose a continual risk of introduction of seeds of invasive alien plants through mud in tire grooves. Parts of plants, seeds, and root stocks can contaminate construction equipment and essentially “seed” invasive species wherever the vehicle travels. The diseases, predators, and parasites that kept their populations in check in their native range may not be present in the Project area. Over time, non-native, invasive species can overwhelm and eliminate native species, reducing biodiversity and negatively affecting both ecological communities and wildlife habitats.

##### ***Operation***

Infestation of invasive species can also occur during annual wayleave maintenance activities.

#### 6.3.8.2 Receptor(s)

Flora and fauna within and around the Project area.

#### 6.3.8.3 Rating of impacts related to invasion of alien invasive species – (Pre-mitigation)

| Type of Impact: Indirect |             |  |
|--------------------------|-------------|--|
| Parameter                | Designation | Summary of Reasoning   |
| Extent                   | Local       | In an event that invasive species are introduced to the site, it is most likely that they will not spread beyond the Project area. |

|  |              |  |
|--|--------------|--|
| Duration   | Long Term    | Invasive species may integrate themselves with the native species and may be extremely difficult to get rid of.  |
| Frequency  | Intermittent | Movement of heavy vehicles into the Project Area during construction may pose a risk of introduction of invasive alien species.<br><br>Infestation of invasive species may also occur during annual wayleave maintenance activities. |
| Likelihood   | Medium       | Clearance of vegetation at the plant site and in the wayleave may create a conducive environment for invasive species.   |
| <b>Magnitude: Moderate</b>   |              |  |
| In an event that invasive species are introduced to the site, it is most likely that they will not spread beyond the project area. |              |  |
| <b>Sensitivity of Receptor: Moderate</b>   |              |  |
| Invasive species are likely to thrive in cleared wayleave due to their shrubby nature.   |              |  |
| <b>Moderate Significance</b> Rating Pre-Mitigation   |              |  |

#### 6.3.8.4 Mitigation Measures

The following mitigation measures are recommended to manage the proliferation of invasive alien species:

- Vehicles and machinery should be inspected and cleaned to remove any plant residue of invasive alien flora species, before equipment is used in a new work area. This will avoid the spread of invasive species from one area to another and prevent potential introduction into the wayleave and adjacent habitats; and
- Because preventive measures during construction may not be completely effective in controlling the introduction and spread of invasive species, post-construction measures are required. Sensitive areas such as riverbanks/riparian zones should be surveyed to identify invasive species following construction and site re-vegetation. If new infestations are discovered, measures shall be taken to control the infestation. The Forestry Department shall be consulted to determine the best methods for control of encountered invasive species.

#### 6.3.8.5 Residual Impact (Post-mitigation)

With the implementation of the above measures the residual impact significance can be expected to be "**Low**".

#### 6.3.9 Mortality of Avifaunal Species

##### 6.3.9.1 Impact Description

### **Construction**

Clearing of vegetation for the line will disturb the habitat for some birds and some of them may lose their nests which may cause mortality of avifauna. Also, disturbance and displacement may occur due to noise, light and/or vibration as a result of construction activities such as excavation, drilling, blasting, operation of camps, equipment and vehicle movement. Further, there may be an increased likelihood for poaching due to the presence of workers.

### **Operation**

Birds may collide with solar modules, especially if the modules are highly reflective (acting like mirrors) and birds mistake them for open sky or water. This is particularly a risk for species during migration.

Additionally, power transmission and the presence of transmission structures poses a risk to avifauna. Some birds are likely to interact with transmission line and related infrastructure due to their behavioural or physical characteristics. The line can pose potentially fatal risks to birds and bats through collisions and electrocutions.

Birds may be at risk of electrocution if they come into contact with energized components of the transmission line infrastructure, such as conductors, insulators, or supporting structures. Birds of large wing span are most likely to be affected by the electrocution while small ones could easily perch on a live wire without much problem.

Collisions occur when birds or large mammals make contact with line hardware inadvertently. In general, birds usually collide with the shield wire rather than with the conductors, which are thicker or bundled and therefore easier to see.

#### **6.3.9.2 Receptor(s)**

Avifauna within and around the Project area.

#### **6.3.9.3 Rating of impacts related to mortality of avifaunal species during construction – (Pre-mitigation)**

| <b>Type of Impact: Direct</b> |                    |  |
|-------------------------------|--------------------|--|
| <b>Parameter</b>              | <b>Designation</b> | <b>Summary of Reasoning</b>  |
| Extent                        | Local              | Vegetation clearing may impact bird habitats within the wayleave while the risk of collisions, electrocution and poaching may occur in the wider area. |
| Duration                      | Long Term          | Habitats will be permanently modified due to clearance of the wayleave.  |
| Frequency                     | Once-off           | For nesting sites, vegetation including all shrubs and trees will only be removed once during construction.  |

|  |      |   |
|--|------|---|
| Likelihood   | High | Vegetation will have to be removed in order to implement and operate the Project. |
| <b>Magnitude: Moderate</b>   |      |   |
| Generally, the area is largely characterised by degraded forest and agricultural fields. This entails that potential for habitat loss will be limited. Further, while avifaunal mortality is likely to occur long term (both construction and operation phases), much higher risk is posed by construction activities. |      |   |
| <b>Sensitivity of Receptor: Moderate</b>   |      |   |
| No species of conservation concern have been identified in the Project area. Migratory birds may be considered to be more sensitive as losses may impact broad geographies.  |      |   |
| <b>Moderate Significance Rating Pre-Mitigation</b>   |      |   |

#### 6.3.9.4 Mitigation Measures

The following mitigation measures are recommended to manage the mortality of avifaunal species:

- towards the subject area and away from habitat areas where possible. Enforcement of speed limits and installation of bird diverters/markers to limit avifaunal collisions;
- Sensitization of workers against bird hunting, with strict penalties including dismissal of those found wanting (this measure shall be a part of the workers code of conduct); and
- Restriction of construction activities to day light hours. Lights to be used only where necessary and to be directed

#### 6.3.9.5 Residual Impact (Post-mitigation)

With the implementation of the above measures the residual impact significance can be expected to be “**Low**”.

#### 6.3.9.6 Rating of Impacts Related to Mortality of Avifaunal Species during Operation – (Pre-mitigation)

| Type of Impact: Direct |              |  |
|------------------------|--------------|--|
| Parameter              | Designation  | Summary of Reasoning   |
| Extent                 | On-site      | Risk of collisions with solar modules and transmission line as well as electrocutions due to transmission line interactions. |
| Duration               | Long Term    | Risk of bird fatalities will occur as long as the line and solar plant are in operation.                                     |
| Frequency              | Intermittent | Collisions during construction as well as electrocutions/collisions during line operation may occur sporadically.            |
| Likelihood             | Low          | However, there is no formal record of large scale bird electrocutions in the Country.  |
| <b>Magnitude: Low</b>  |              |  |

Bird mortality from collisions or electrocution is biologically significant when it results in a measurable change, for example in population decline (Manitoba Hydro, 2010). There has been no documented evidence of large bird kills from the existing lines in the Country. Also, impacts on species of conservation concern are uncertain. Further, while avifaunal mortality is likely to occur long term (both construction and operation phases), much higher risk is posed by construction activities.

**Sensitivity of Receptor: Moderate**

No species of conservation concern have been identified in the Project area. Migratory birds may be considered to be more sensitive as losses may impact broad geographies.

**Low Significance** Rating Pre-Mitigation

**6.3.9.7 Mitigation Measures**

The following mitigation measures are recommended to manage the mortality of avifaunal species during line operation:

- Use non-reflective or low-reflectivity solar modules to reduce the risk of collisions.
- Implementation of site specific and tailored management strategies once biologically significant bird interactions have been reported, including:
  - Reinstall modules at angles and heights that minimize collision risks;
  - Bird detractors e.g. scarecrow to prevent birds from venturing close to the solar modules;
  - Use of markers and bird diverters to make the lines more visible;
  - Illuminating conductors and earth wires to improve their visibility to night-flying birds;
  - Supplemental perches to lure birds from parts of the tower where phase to phase electrocutions are likely; and
  - Changing or reviewing the placement and routing of affected sections of the line (if warranted).

**6.3.9.8 Residual Impact (Post-mitigation)**

With the implementation of the above measures the residual impact significance can be expected to be “**Negligible**”.

**6.3.10 Mortality of Terrestrial Fauna**

**6.3.10.1 Impact Description**

***Construction***

The presence of workers during construction may result in increased levels of noise as well as poaching. Also, small mammals are at risk of colliding with moving project vehicles especially at night.

Clearing of vegetation will disturb the habitat for some reptiles and small mammals. Normally the herptiles crawl and they are prone to road kills by vehicles. Species normally affected are snakes, lizards and geckos. During bush clearing and when digging foundations for towers, some animals such as rodents, lizards and snakes may be killed indiscriminately. Snakes may also be a danger to the construction workers as they risk being bitten.

**Operation**

Annual line maintenance activities will be infrequent and are only likely to temporarily disturb or displace wildlife, if at all. Disturbances can be related to noise from equipment or from maintenance worker’s activities. When it does occur, unfamiliar noise may keep animals temporarily (e.g birds and snakes) away from the immediate area.

**6.3.10.2 Receptor(s)**

Terrestrial Fauna within and around the Project area. Species in critical life stages, such as breeding, nesting, or migration, may be highly sensitive. Disturbances during these periods can lead to reduced reproductive success, affecting population viability.

**6.3.10.3 Rating of Impacts Related to Mortality of Terrestrial Fauna during Construction & Operation (Pre-mitigation)**

| Type of Impact: Direct  |              |  |
|---|--------------|--|
| Parameter   | Designation  | Summary of Reasoning   |
| Extent  | Local        | The risk of collisions and poaching may occur in the wider project area.   |
| Duration  | Long Term    | Likely to occur throughout construction as well as annual bush clearing.   |
| Frequency   | Intermittent | Collisions, poaching and conflict may occur during construction and line operation sporadically.                           |
| Likelihood  | Moderate     | Interactions between construction workers and Fauna is likely to occur more during construction and less during operation. |
| Magnitude: Moderate   |              |  |
| The proposed line route will follow existing lines and a considerable portion of the affected area is used for agriculture and settlements. This entails that potential for habitat loss will be limited. Further, while faunal mortality is likely to occur long term (both construction and operation phases), much higher risk is posed by construction activities.                        |              |  |
| Sensitivity of Receptor: High   |              |  |
| Most interactions between humans and terrestrial fauna often result in fatalities for the animals. This is particularly concerning for species classified as endangered or threatened, as they are inherently more vulnerable to disturbances and habitat changes. In the project area, there have been reported sightings of elephants, which are listed as vulnerable on the IUCN Red List. |              |  |
| Moderate – High Significance Rating Pre-Mitigation  |              |  |

#### **6.3.10.4 Mitigation Measures**

The following mitigation measures are recommended to manage the mortality of terrestrial species:

- Sensitization of workers against hunting/ poaching, with strict penalties including dismissal of those found wanting (this measure should be a part of the workers code of conduct);
- All construction materials, particularly those used to reinforce structures e.g., steel wires, should be safeguarded and cleared from worksites, to avoid their use as wire snares. Wire snares are widely used in illegal harvesting of large animals;
- Enforcement of speed limits to limit terrestrial fauna collisions; and
- Restriction of construction activities to day light hours. Lights to be used only where necessary and to be directed toward the subject area and away from habitat areas where possible.

#### **6.3.10.5 Residual Impact (Post-mitigation)**

With the implementation of the above measures the residual impact significance can be expected to be "**Low**".

#### **6.3.11 Disturbance to Aquatic Habitats and Mortality of Aquatic Species**

##### **6.3.11.1 Impact Description**

###### ***Construction***

Construction activities can influence water quality or modify flooding patterns and surface water flow over a certain period of time. This can cause an increase in suspended solids in wetlands and aquatic environments, which could result in siltation of feeding sites and breeding grounds of some species, particularly for fish species. Furthermore, an increase of organic matter in aquatic environments could lead to an increase in biochemical oxygen demand (BOD) and a decrease in dissolved oxygen that could be locally harmful for aquatic fauna species.

Additionally, the presence of the construction workers in the Project area may induce illegal fishing and put a strain on the already depleting resource.

Further, waste such as oil and fuel from vehicles may find its way into water bodies, causing negative impacts on aquatic species.

No significant impacts are expected during operation of the Project.

### 6.3.11.2 Receptor(s)

Aquatic Species within the water bodies traversed by, or near the project area.

### 6.3.11.3 Rating of Impacts Related to Aquatic Ecosystems during Construction (Pre-mitigation)

| Type of Impact: Direct   |              |  |
|--|--------------|--|
| Parameter  | Designation  | Summary of Reasoning   |
| Extent   | Local        | Due to the nature of water, contaminants are likely to flow beyond the project site into wider areas of the water body i.e from Nantumba and Namwazi stream into the Kafue River |
| Duration   | Short Term   | Will be limited to activities occurring in the construction phase.   |
| Frequency  | Intermittent | Disturbance will only occur when construction activities are being conducted on sections that are crossing or nearby water courses.  |
| Likelihood   | High         | Crossing of perennial wetlands and watercourses cannot be avoided.   |
| Magnitude: Moderate  |              |  |
| Illegal fishing activities and siltation and contamination of waterbodies are most likely to occur during construction and less so during operation. |              |  |
| Sensitivity of Receptor: Moderate  |              |  |
| Aquatic organisms in the seasonal streams in the project area are highly dependent on the limited and temporary availability of water.               |              |  |
| Moderate Significance Rating Pre-Mitigation  |              |  |

### 6.3.11.4 Mitigation Measures

In addition to the measures in 6.3.1.5 (*Change in Quality of Water Resources*), the following recommendations are made:

- Work, storage and movement of equipment and vehicles, should be avoided as much as possible within the riverine, floodplain, and wetland areas, such as dambos. If unavoidable, the access to these sites should be reduced to a minimum;
- When stream crossings are unavoidable, construction of suitable culverts to ensure sufficient water supply and minimize impact on fish habitat should be done; and
- Sensitization of workers against illegal fishing, with strict penalties including dismissal of those found wanting (this measure should be a part of the workers code of conduct).

### **6.3.11.5 Residual Impact (Post-mitigation)**

With the implementation of the above measures the residual impact significance can be expected to be “**Negligible**”.

## **6.4 Socio-economic and Cultural Impacts**

### **6.4.1 National and Local Economic Benefits**

#### **6.4.1.1 Impact Description**

##### ***Operation***

The Project is designed to strengthen Zambia’s energy resilience by addressing climate-related risks to hydropower generation and diversifying the energy mix. National economic benefits will accrue predominantly during the operational phase of the Project. Infrastructure development costs will be incurred during the construction phase of the Project. Trickle down economic benefits likely to be provided by the Project include:

- Generating profits as a result of electricity trade;
- Enabling business development and household benefits that result directly from the provision of reliable power; and
- Increased employment opportunities as a result of spin-off economic benefits.

Additionally, to benefit the local community, JIGSCO and the Sikoongo Royal Establishment will enter into a Corporate Social Responsibility (CSR) Memorandum of Understanding (MoU). Once established, JIGSCO will fund a CSR programme, allocating a portion of its annual profits to interventions focused on the following proposed thematic areas, to ensure meaningful benefits for the community:

- Education;
- Health;
- Electrification;
- Social welfare;
- Environmental management;
- Climate change;
- Water and sanitation;
- Agriculture;
- Skills development and entrepreneurship;
- Cultural heritage;
- Sports development; and
- Women’s enterprise development.

### 6.4.1.2 Receptor(s)

Local communities in the project area. All Zambian citizens will benefit from a stable and reliable power grid.

### 6.4.1.3 Rating of Impacts Related to National and Local Economic Benefits (Pre-enhancement)

| Type of Impact: Direct Positive Impact   |             |   |
|--|-------------|---|
| Parameter  | Designation | Summary of Reasoning  |
| Extent   | National    | Zambian citizens will benefit from a stable and reliable power grid.                      |
|  | Local       | Locals will directly benefit from the CSR programme.                                      |
| Duration   | Long Term   | This impact will occur for the life span of the Project                                   |
| Frequency  | Continuous  | Benefits will be experienced throughout the operation of the Project on an ongoing basis. |
| Likelihood   | High        | These benefits will be experienced should the Project proceed.                            |
| Magnitude of the Impact: High  |             |   |
| The Project will provide national-level benefits that are long-term and continuous, ensuring sustained economic and social improvements.   |             |   |
| Sensitivity of the Resource/Receptor: High   |             |   |
| Given the current shortage of electricity supply due to loadshedding, Zambian citizens are likely to be highly sensitive to improvements to the current status. Similarly, local communities are highly sensitive to improvements in economic opportunities and other socioeconomic indicators such as education, health, and skills development, which are essential for improving livelihoods. |             |   |
| High Significance Pre-enhancement  |             |   |

### 6.3.2.1.5 Enhancement/ Management Measures

No further enhancement measures for this impact are currently envisaged.

## 6.4.2 Local Employment Opportunities

### 6.4.2.1 Impact Description

#### **Construction**

There will be a number of direct employment opportunities created by the Project through contractors during the construction phase. Indirect employment opportunities will be created through the procurement of goods and services to support construction and will therefore include jobs created in the Project supply chain and their suppliers or sub-contractors/service providers.

Similarly, short term employment opportunities will be created through contractors during annual bush clearing and maintenance activities.

Induced employment (i.e., jobs created through spending in the local economy by direct and indirect employees on the Project) may also occur.

The percentage breakdown of the distribution of employment opportunities in terms of skilled, semi-skilled and unskilled positions is not currently known nor, where the workforce will be recruited from. However, it will be advised that the workforce will be a mix of locals as well as outsiders with preference given to locals for unskilled positions. Expatriates will be recruited where the national population do not possess the specialised skills and experience required.

Employment opportunities will result in improved income generation in the local community and in some cases security of this in the long term. This will help to improve living conditions, as more disposable income will be available for food, education and health care. Those that secure employment are likely to benefit from enhanced work experience and skills enhancement received through on-the-job and more formal training courses. Such skills enhancement will improve the potential of these people to secure future employment once their contract with the Project ends.

#### 6.4.2.2 Receptor(s)

Local communities within and around the wider Project area. This may also include in-migrants in search for job opportunities.

#### 6.4.2.3 Rating of impacts related to local employment opportunities (Pre-enhancement)

| <b>Type of Impact: Direct, Indirect and Induced Positive Impact</b>  |                    |  |
|--|--------------------|--|
| <b>Parameter</b>   | <b>Designation</b> | <b>Summary of Reasoning</b>  |
| Extent   | National           | The Project will attract skilled workers from outside the Project area i.e from the wider District and Country at large.                         |
| Duration   | Long Term          | The impact will be experienced throughout the life of the Project as annual bush clearing activities will also present employment opportunities. |
| Frequency  | Intermittent       | This impact will occur in line with recruitment needs.   |
| Likelihood   | High               | Employment opportunities will definitely be created by the Project.  |
| <b>Magnitude: Moderate</b>   |                    |  |
| Only a relatively limited number of jobs will be created as a result of the Project however, for those that are able to secure jobs, quality of life will be vastly improved if this allows for access to a secure income. |                    |  |
| <b>Sensitivity of the Receptor: Moderate</b>   |                    |  |
| The development of employment opportunities will be very welcome by local communities. Local expectations are high that they will benefit from job opportunities.  |                    |  |
| <b>High Significance Pre-enhancement</b>   |                    |  |

The likelihood that the local population will be able to take up the unskilled employment opportunities provided is relatively high. However, due to an absence of skills and experience in the area it is unlikely that they will be able to capitalise on many of the semi-skilled or skilled positions. The training received as part of the proposed Project will improve chances to seek employment opportunities in other developments.

#### **6.3.2.2.5 Enhancement Measures**

In order to ensure that the positive impact is harnessed optimally, the following enhancement measures are proposed:

- Setting of targets to maximise the number of local, female, disabled, unskilled, and skilled employees from the project area;
- Publicly advertise employment opportunities in appropriate newspapers, public libraries, the District Offices and in all relevant languages; and
- No requirement for applicants to make payments for applying, or securing, employment on the proposed Project.

#### **6.3.2.2.6 Residual Impact (Post-mitigation)**

The designations will not change and the impact significance will remain a '**High Positive**'.

### **6.4.3 Local Procurement of Goods and Services**

#### **6.4.3.1 Impact Description**

##### **Construction**

Goods and services will be procured during the construction and operation phases of the project from a diverse range of suppliers. The extent of this procurement and source thereof will largely be at the discretion of the contractor. It is anticipated that at a minimum, basic goods and services such as cement and aggregate will be sourced from the Project area. More specialised equipment will need to be sourced internationally.

The following equipment and materials may be required but not limited to; front end loaders, bulldozers, concrete plant, trucks, excavators, crusher, cranes, small vehicles, fire equipment, concrete, piping, aggregate, steel, pavement, fencing, fuel, wiring and electrical, switchyard, pumps, storage tanks, transmission pylons. In the study communities, at the time of reporting it is believed that there are only a limited number of businesses that would be able to provide the scale of goods and services required, as well as meet the stringent health and safety standards needed by the proposed Project.

There is a strong dependence on the informal sector; many local businesses are not formally registered as companies and they lack experience in providing goods and services for large scale clients. It is likely however that such businesses exist in the Capital city, Lusaka which is only 115km away.

Local procurement of goods and services by the Project could assist in building a more stable and diverse economy at the local level. This could lead to other effects such as creation of jobs by companies who secure contracts, thus enhancing living conditions for those who secure employment. This impact could be further be enhanced through in-migration to the area and increased spending power.

#### 6.4.3.2 Receptor(s)

Local companies may be advantaged by the availability of contracts or procurement of goods and services for the Project.

#### 6.4.3.3 Rating of impacts related to local procurement of goods and services (Pre-enhancement)

| <b>Type of Impact: Direct, Indirect and Induced Positive Impact</b>   |                    |   |
|---|--------------------|---|
| <b>Parameter</b>  | <b>Designation</b> | <b>Summary of Reasoning</b>   |
| Extent  | National           | While this impact looks specifically at the possibility for local businesses to benefit from procurement opportunities, suppliers from outside the affected areas are also expected to benefit. |
| Duration  | Long Term          | The impact will be experienced throughout the life of the Project.  |
| Frequency   | Intermittent       | This impact will occur in line with procurement needs.  |
| Likelihood  | High               | Procurement of goods and services are necessary for the Project to go ahead.  |
| <b>Magnitude: Moderate</b>  |                    |   |
| The impact will be constrained at the local level by the current lack of capacity.  |                    |   |
| <b>Sensitivity of the Receptor: High</b>  |                    |   |
| The development of procurement opportunities will be very welcome by stakeholders. Local expectations are high that they will benefit from contracts to supply the Project goods and/or services. |                    |   |
| <b>High Significance Pre-enhancement</b>  |                    |   |

#### 6.4.3.4 Enhancement Measures

In order to ensure that the positive impact is harnessed optimally, the following enhancement measures are proposed:

- To maximise local purchasing where possible in line with National legislation and tendering requirements, by directly working with local enterprises and by incentivising the Project's contractors to contract locally.

### 6.4.3.5 Residual Impact (Post-enhancement)

The designations will not change and the impact significance will remain a 'High'.

### 6.4.4 Physical Displacement

#### 6.4.4.1 Impact Description

##### **Construction**

Physical displacement (loss of land for residential or business purposes) shall occur as a result of the Project and will be strictly along the preferred line route as well as areas for construction/placement of the Solar Plant associated facilities.

Land will be acquired prior to the commencement of construction activities on site and therefore this impact will be felt during this phase of the Project rather than the operational phase.

Based on the studies conducted only agricultural fields are expected to be affected.

##### **Operation**

During operation, no further physical displacement is anticipated.

#### 6.4.4.2 Receptor(s)

Households farming within the Project area.

#### 6.4.4.3 Rating of impacts related to physical displacement (Pre-Mitigation)

| <b>Type of Impact: Direct</b>   |                    |   |
|---|--------------------|---|
| <b>Parameter</b>  | <b>Designation</b> | <b>Summary of Reasoning</b>   |
| Extent  | On site            | Only those in the immediate project area (solar site and transmission line wayleave) will be affected.  |
| Duration  | Permanent          | Physical displacement will be permanent particularly at the solar plant site. Those along the transmission line will be able to continue their agricultural activities. |
| Frequency   | Once-off           | The act of displacement will only occur once.   |
| Likelihood  | High               | Some displacement will occur as a result of the Project.  |
| <b>Magnitude: High</b>  |                    |   |
| Displacement will lead to a fundamental change in the way of life of people affected and will affect both those who will be physically required to move, as well as the host communities.   |                    |   |
| <b>Sensitivity of Receptor: High</b>  |                    |   |
| The area is populated with low-income households who have limited/no savings and/or access to credit facilities. Vulnerability is heightened by dependency on agricultural and other land-based activities and limited education to take advantage of other economic opportunities. |                    |   |

#### 6.4.4.4 Mitigation/Management Measures

The specific mitigation measures required are:

##### ***Pre-construction and Planning***

- Positioning of infrastructure to avoid and/or minimise resettlement. The positioning of Project infrastructure will be designed to avoid and/or minimise resettlement requirements as far as practicable, taking into account the feasibility of the location, as well as safety and legislative restrictions.
- Preparation of a Resettlement and Compensation Action Plan (RCAP). The preparation of this RCAP shall follow the requirements of National legislation and international good practice.
- Implementation of the grievance redress mechanism. Stakeholders will be made aware of the key guiding principles of the mechanism, as well as how and where they can submit any grievances, and means of resolution.

##### ***Construction Phase***

- Compensation for loss of land and other assets. This will take place prior to construction and compensation may include the provision of replacement assets and land;
- Continuous engagement with broader stakeholder groups. A proactive Stakeholder Engagement Programme will be undertaken for the resettlement process that builds on the ESIA stakeholder engagement programme. Regular communication, information and updates to communities about the Project, including the resettlement process and management of project impacts will be conducted; and
- Post-resettlement monitoring and evaluation. This will be undertaken to determine the positive or negative effects of the displacement and the effectiveness of mitigation measures used.

A carefully implemented consultation process with all affected people, the development and implementation of a RCAP which accords households improved and more secure livelihoods, assistance to vulnerable people and the introduction of livelihood restoration projects will greatly reduce the severity of the impact.

#### 6.4.4.5 Residual Impact (Post-mitigation)

Based on the implementation of the proposed mitigation measures, the significance of the impact will be a “**Low**” post mitigation.

#### 6.4.5 Economic Displacement of Land Based Livelihoods

##### 6.4.5.1 Impact Description

###### **Construction**

Similar to physical displacement, land acquisition for the construction of solar plant, transmission line towers, or other facilities, can lead to the displacement of individuals from their homes and agricultural lands, affecting their primary source of livelihood. Economic displacement is defined as the loss of income, or access to livelihood activities resulting from the acquisition of land associated with a project. The loss of access to land will take place during the construction phase of the Project and will continue to remain in effect or restricted during the operational phase.

Economic displacement with reference to land-based livelihood activities can result in the following:

- Loss of initial investment (time and resources) for establishing crops;
- Stress and ill-health as a result of disruption to livelihoods;
- Increased food insecurity and potential for nutritional diseases;
- Reduced income and economic activities within the communities; and
- Tensions between stakeholders and Project developers.

##### 6.4.5.2 Receptor(s)

Households farming in the project area.

##### 6.4.5.3 Rating of Impacts Related to Economic Displacement of Land Based Livelihoods (Pre-Mitigation)

| Type of Impact: Indirect |             |   |
|--------------------------|-------------|---|
| Parameter                | Designation | Summary of Reasoning  |
| Extent                   | On-site     | This impact will be experienced primarily by households affected by land-take for project infrastructure.   |
| Duration                 | Short term  | Economic displacement will be permanent particularly at the solar plant site. Those along the transmission line will be able to continue their agricultural activities. |

|   |          |   |
|---|----------|---|
| Frequency   | Once-off | The act of displacement will only occur once. |
| Likelihood  | High     | Displacement is inevitable.                   |
| <b>Magnitude: High</b>  |          |   |
| Households facing economic displacement will experience disruption to their livelihoods and without support are unlikely to be able to re-establish their current livelihoods.  |          |   |
| <b>Sensitivity of the Receptor: High</b>  |          |   |
| The area is populated with low-income households who have limited/no savings and/or access to credit facilities. Vulnerability is heightened by dependency on agricultural and other land-based activities and limited education to take advantage of other economic opportunities. |          |   |
| <b>High Significance</b> Pre-mitigation   |          |   |

#### **6.4.5.4 Mitigation/Management Measures**

The mitigation measures detailed above under 6.4.4 Physical Displacement (Pre-Mitigation) will be applied, as well as the following:

- Re-establish and promote access to natural resource areas where viable, post-construction; and
- Ensure communities participate in pre-construction harvesting of resources as part of clearing activities. Identify optimal methods of storing harvested materials.

#### **6.4.5.5 Residual Impact (Post-mitigation)**

Based on the implementation of the proposed mitigation measures, the significance of the economic displacement of subsistence agricultural activities will be reduced to “**Low**”. Residual impacts will require determination and continual assessment through a post-resettlement evaluation.

#### **6.4.6 Project Induced In-migration**

##### **6.4.6.1 Impact Description**

###### ***Construction***

The Project will require employment of non-local labour in terms of skilled labourers who might not be available in the Project area. There may Project Induced In-Migration (PIIM) into the area as a result of people seeking employment. Expectations regarding resettlement and compensation may also influence people to migrate to the area.

PIIM has the potential to create a range of positive and negative risks and impacts. Likely in-migrant groups include job seekers and their families, entrepreneurs/traders, opportunistic settlers looking to qualify for resettlement entitlements and commercial sex workers. Attempts to control or limit PIIM may unintentionally mitigate against

efforts to promote local development, by inhibiting the establishment of a critical mass of local producers and consumers. Additionally, attempts to control or limit in-migration and other forms of human mobility engage fundamental questions related to international human rights related to freedom of movement and the pursuit of livelihoods. It is in the interest of the Project to ensure that any efforts to control migration or human mobility remain in accordance with established legal and social norms.

PIIM may result in impacts on ecosystem services, social services and social integrity in the project area.

- *Impact on Social Services*

The influx of Project-related workers and opportunists will increase demand for social infrastructure, including healthcare, sanitation, education, and housing. While construction camps will provide essential facilities to minimize the strain on local resources, those who do not secure employment will need alternative housing. Increased pressure on healthcare and education services may reduce service quality and accessibility for local communities, while housing shortages could lead to new construction, informal rentals, or homelessness. Informal settlements may exacerbate health risks, crime, and environmental issues, further straining local infrastructure and service delivery.

- *Impact on Ecosystem services*

Similarly, in-migration of people into communities may result in an impact on ecosystem services through a reduction in availability of natural resources. Reduced access to such services may create competition and potential conflict amongst local residents and newcomers to the area.

- *Impact on Social Integrity*

The influx of in-migrants may create social tensions due to differences in cultural values and a lack of allegiance to traditional leadership structures, potentially challenging the authority of local leaders. Increased cash flow from PIIM and staff recruitment could lead to higher rates of substance abuse, commercial sex work, teenage pregnancies, and single-parent households, particularly in areas with limited recreational opportunities. Income disparities between employed and unemployed individuals may fuel crime and violence, while competition for land and resources could drive illegal poaching. Corruption risks include undue recruitment, illicit land acquisitions, and unauthorized access to project benefits. To mitigate these challenges, contractors must be contractually obligated to manage the negative impacts of labour influx, with clear accountability measures for non-compliance.

#### **6.4.6.2 Receptor(s)**

Local communities in general will be very vulnerable in the context of PIIM impact to social services as access to such services is already limited. The poorest community members are likely to be disproportionately affected.

Traditional authorities could be particularly vulnerable as it may attack their position of influence.

#### 6.4.6.3 Rating of impacts related to in-migration – (Pre-mitigation)

| <b>Type of Impact: Induced Negative Impact</b>   |                    |   |
|--|--------------------|---|
| <b>Parameter</b>   | <b>Designation</b> | <b>Summary of Reasoning</b>   |
| Extent   | Local              | Project induced in-migration is likely to occur in the project area and possibly the District.  |
| Duration   | Long Term          | Impacts of in-migration will be felt as long as the migrant population is present.  |
| Frequency  | Intermittent       | An influx of people to the area is not expected to happen suddenly, but rather continuously over the construction and operation period. |
| Likelihood   | High               | The project will definitely attract both skilled and non-skilled labour to the area.  |
| <b>Magnitude: High</b>   |                    |   |
| Insufficient ecosystem and social services to provide for increasing population numbers has the potential to affect a large number of households. The degree of change to livelihoods has the potential to be significant as quality of life and food security will be threatened. Impacts on Social Integrity may also be significant given the rural nature of the project area. |                    |   |
| <b>Sensitivity of Receptor: High</b>   |                    |   |
| High sensitivity due to the reliance of the majority of households on natural resources for their livelihoods and social services that are already strained.   |                    |   |
| <b>High Significance Pre-mitigation</b>  |                    |   |

#### 6.4.6.4 Mitigation/Management Measures

It is important to note that in-migration is difficult to manage in any circumstance, regardless of location or driver. This is especially the case since some of the measures that need to be taken rely on the capacity and collaboration of third parties including the Government, Chiefdom authorities and other institutions in the area. The specific mitigation measures required are:

- Undertake communication related to PIIM. This will include:
  - Engagement with Government authorities on issues, risks, threats, and opportunities regarding in-migration;
  - Engagement with local communities to understand their concerns, raise awareness of risks and opportunities, and identify solutions to issues relating to in-migration;

- Communication of the Project’s policy of recruiting through the Local Labour Office.
- Development and Implementation of an induction programme including a Workforce Code of Conduct that will be adhered to by all Contractors. This will increase worker-sensitivity to local norms and customs. The Workforce Code of Conduct will include:
  - Zero tolerance of illegal activities by all personnel;
  - Forbidding any gender-based violence activities;
  - Forbidding prostitution;
  - Forbidding the illegal sale or purchase of alcohol;
  - Forbidding the sale, purchase or consumption of drugs; and
  - Forbidding gambling and fighting.

#### **6.4.6.5 Residual Impact (Post-mitigation)**

Based on the implementation of the proposed mitigation measures, the significance of the impact will be “**Moderate**” post mitigation.

### **6.4.7 Health and Safety Risks**

#### **6.4.7.1 Impact Description**

##### ***Construction***

As a result of Project development, in particular during the construction phase when the workforce is likely to be greatest and when in-migration may peak, the rate of transmission of communicable diseases may increase. This will be largely due to:

- Interactions between the Project workforce and local communities;
- Potential for overcrowding as a result of increased pressure on existing housing infrastructure, water and sanitation services;
- In-migrants coming to the area bringing new communicable diseases of varying disease profiles compared to the existing community;
- Greater disposable incomes increasing a risk of engaging in high-risk sexual activities with commercial sex workers both in local communities and on transit routes to/from site, acting as a vector for possible diseases; and
- The presence of commercial sex workers with higher rates of STIs and HIV, may increase near construction sites.

If not treated in time, communicable diseases can affect the long-term health of those who contract them, leading to death in the worst-case scenario. Although stigma

surrounding HIV/AIDs has decreased in recent years due to educational and awareness raising campaigns, there is the potential that any residual prejudice against those infected with STIs may discourage people from seeking testing, treatment and care, all of which will affect health outcomes. The increased incidence of communicable diseases may impact on the availability of the Project workforce, by increasing absenteeism and staff turnover, leading to subsequent impacts on productivity and costs.

#### 6.4.7.2 Rating of impacts related to health and safety – (Pre-mitigation)

| Type of Impact: Direct and Indirect   |             |   |
|---|-------------|---|
| Parameter   | Designation | Summary of Reasoning  |
| Extent  | Regional    | The transmission of diseases has the potential to extend beyond the Project area given the presence of migrant workers.                             |
| Duration  | Long Term   | Impacts will occur for the duration of the construction period. However, some diseases such as HIV/AIDS have a lifetime impact.                     |
| Frequency   | Continuous  | The possibility of transmission may exist for the duration of the Project   |
| Likelihood  | High        | Project induced in-migration as well as the presence of the Project workforce combined with the baseline conditions mean that the impact is likely. |
| <b>Magnitude: High</b>  |             |   |
| <b>Sensitivity of Receptor: High</b>  |             |   |
| High sensitivity due to poor access to healthcare facilities and reportedly poor service of healthcare establishments (e.g., long waiting times, inadequate drug supply, etc.). |             |   |
| <b>High Significance</b> Pre-mitigation   |             |   |

#### 6.4.7.3 Receptor(s)

Local communities, healthcare facilities and healthcare providers will be susceptible to this impact. Changes in the local healthcare landscape can influence their ability to provide services or affect their working conditions. Vulnerable populations, such as the elderly, children, pregnant women, or individuals with pre-existing health conditions, may be more sensitive to changes in health services. Limited access to healthcare resources can disproportionately impact these groups.

#### 6.4.7.4 Mitigation/Management Measures

Mitigation measures will be implemented by the Project in collaboration with other agencies (i.e. NGOs or health authorities). The Project shall proactively seek and manage these partnerships to ensure that impacts are being mitigated in a timely manner and to measure and monitor outcomes based on KPIs. The interventions

- Health awareness training will be provided to all employees. This will include knowledge and awareness around how communicable diseases are transmitted, diseases to be aware of, their symptoms and the benefits of early treatment. Health awareness training shall be provided as part of workers induction with refresher courses provided regularly;
- The emergence of major pandemics will be monitored through World Health Organisation (WHO) alerts such as Covid-1. If the WHO Pandemic Alert Scale reaches level 4 the Project will develop and implement the relevant Emergency Response Plans;
- Efforts will be made to ensure that health services are available to meet the day to day needs of Project personnel without impacting access to health care for communities. Agreements can be developed with health clinics or hospitals that the Project intends to use. These agreements should include support to increase capacity (health personnel, equipment, drugs etc.);
- Operate accommodation camps in accordance with National and international good practice. This will include prevention of overcrowding, access to clean water and sanitation and enforcing high levels of food hygiene standards within the camps to minimise disease transmission;
- Development of a policy to reduce the transmission of STIs, including HIV/AIDS, that is:
  - Provide support to workers to access treatment for HIV/AIDS through existing health facilities or NGO campaigns or programmes;
  - Ensure there is access to free condoms (including female condoms) at all worker sites and accommodation (including transit routes) to promote safe sexual practices; and
  - In partnership with local health officials and relevant NGOs ensure that all Project personnel are given specific HIV and STI prevention training. This should be given on induction and refresher training provided regularly.

#### **6.4.7.5 Residual Impact (Post-mitigation)**

Based on the implementation of the proposed mitigation measures, the significance of the impact will be reduced to "**Low**" post mitigation.

Table 13 below provides a summary of impact significance and mitigation measures.

Table 13: Summary of Impact Significance and Mitigation Measures

| IMPACT                            | PRE-MITIGATION IMPACT SIGNIFICANCE | SUMMARY OF MITIGATION MEASURES   | RESIDUAL IMPACT SIGNIFICANCE |
|-----------------------------------|------------------------------------|--|------------------------------|
| <b>CONSTRUCTION PHASE</b>         |                                    |  |                              |
| <b>SOCIO-ECONOMIC ENVIRONMENT</b> |                                    |  |                              |
| Physical Displacement             | High                               | <ul style="list-style-type: none"> <li>• Positioning infrastructure to avoid and/or minimise resettlement.</li> <li>• Preparation and implementation of a Resettlement and Compensation Action Plan (RCAP).</li> <li>• Preparation and implementation of a Grievance Redress Mechanism (GRM).</li> <li>• Compensation for loss of land and other assets.</li> <li>• Proactive, continuous stakeholder engagement programme.</li> <li>• Post resettlement monitoring and evaluation.</li> </ul> | Low                          |
| Economic Displacement             | High                               | <ul style="list-style-type: none"> <li>• Re-establish and promote access to natural resource source areas.</li> <li>• Ensure communities participate in pre-construction harvesting of resources as part of clearing activities.</li> <li>• Work with Project affected communities and local authorities to assist in protecting land-based resources.</li> </ul>  | Low                          |
| In-migration                      | High                               | <ul style="list-style-type: none"> <li>• Development and implementation of an induction programme including a Workforce Code of Conduct that will be adhered to by all Contractors.</li> <li>• Engagement of Government authorities and communities to understand their concerns, raise awareness of risks and opportunities, and identify solutions to issues relating to in-migration.</li> </ul>  | Moderate                     |
| Health and Safety Risks           | High                               | <ul style="list-style-type: none"> <li>• Health awareness training will be provided to all employees.</li> <li>• Development and implementation of Pre-Employment screening measures for workers, which will cover appropriate diseases.</li> <li>• Development of Emergency Prevention, Preparedness and Response Plans</li> </ul>  | Low                          |

| IMPACT                                   | PRE-MITIGATION<br>IMPACT<br>SIGNIFICANCE | SUMMARY OF MITIGATION MEASURES  | RESIDUAL<br>IMPACT<br>SIGNIFICANCE |
|--|--|---|------------------------------------|
|  |  | <ul style="list-style-type: none"> <li>• Monitoring the emergence of major pandemics through WHO alerts such as the Covid-19.</li> <li>• Ensure sufficient health services are available to meet the day to day needs of Project personnel without impacting on access to health care for communities.</li> <li>• Operation of accommodation camps in accordance with National and international good practice.</li> <li>• Provision for awareness, counselling and testing for all Project personnel, including voluntary testing for STIs and HIV/AIDS as part of any health screening program.</li> </ul>  |                                    |
| <b>BIOPHYSICAL ENVIRONMENT</b>           |  |   |                                    |
| Visual Intrusion and Change in Landscape | High                                     | <ul style="list-style-type: none"> <li>• Use of existing access roads as much as possible</li> <li>• Crossing rivers and streams using the shortest distance possible (i.e., perpendicular to the waterbody).</li> <li>• Using construction methods that minimize damage to vegetation near the Solar Plant site and transmission line</li> <li>• Utilisation of solar modules with non-reflective coating to minimize glare, which can be visually disruptive;</li> <li>• Installation and/or maintenance of visual barriers (trees and shrubs), where possible, to reduce the visibility so that there is still greenery present; and</li> <li>• Appropriate management of construction waste at the site.</li> </ul> | Moderate                           |
| Air Quality Deterioration                | Moderate                                 | <ul style="list-style-type: none"> <li>• Maintenance and operation of all vehicles and equipment engines in accordance with manufacturers recommendations</li> <li>• Prohibition of idling of vehicles on-site; shut down generators and machinery when not in use.</li> <li>• Covering of loose materials and keep top layers moist.</li> <li>• Observing set speed limits on unhardened roads and surfaces.</li> <li>• Use water for dust suppression on stockpiles, exposed soils, roads and prior to excavation works.</li> </ul>   | Low                                |

| IMPACT              | PRE-MITIGATION IMPACT SIGNIFICANCE | SUMMARY OF MITIGATION MEASURES   | RESIDUAL IMPACT SIGNIFICANCE |
|---------------------|------------------------------------|--|------------------------------|
|                     |                                    | <ul style="list-style-type: none"> <li>• Use of covered trucks for the transportation of materials that release dust emissions.</li> <li>• Use of appropriate PPE by workers on site i.e., dust masks.</li> </ul>  |                              |
| Noise and Vibration | Moderate                           | <ul style="list-style-type: none"> <li>• Use of temporary noise barriers for equipment (e.g., sound proofing walls around stationary power generating sources);</li> <li>• Avoid dropping materials from height, where practicable;</li> <li>• Maintain and operate all vehicles and equipment in accordance with manufacturers recommendations;</li> <li>• Noisy activities (activities that can be heard in nearby communities) restricted to daytime working hours.</li> <li>• Inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration.</li> <li>• Establishment of a grievance redress mechanism to provide means for residents to make noise complaints.</li> <li>• Provision of hearing protective devices such as ear plugs and earmuffs.</li> </ul>   | Low                          |
| Soil Erosion        | Moderate                           | <ul style="list-style-type: none"> <li>• Construction of foundations to be undertaken preferably in the dry season;</li> <li>• Backfilling of foundation pits by the excavated soils which will resemble the order of the original soil layers;</li> <li>• Protect excavated soil materials from erosion;</li> <li>• Reduction of the construction of new access roads, where possible. Promoting the use of existing access roads for machinery and vehicle movement, increasing their width as necessary.</li> <li>• Ensure that the land is physically restored (include revegetation where possible) before leaving to next tower location and before the next rainy season;</li> <li>• Rehabilitation of any areas which will be exposed for any reason as soon as possible to prevent possible soil erosion. Rehabilitation will be by replanting disturbed areas, or returning the top soil so that grass is able to naturally grow.</li> </ul> | Low                          |

| IMPACT                               | PRE-MITIGATION IMPACT SIGNIFICANCE | SUMMARY OF MITIGATION MEASURES   | RESIDUAL IMPACT SIGNIFICANCE |
|--------------------------------------|------------------------------------|--|------------------------------|
| Soil Contamination                   |                                    | <ul style="list-style-type: none"> <li>• Training of relevant staff in safe storage and handling practices, and rapid spill response and clean-up techniques.</li> <li>• Regular checking and maintenance of all vehicles and equipment to minimize the risk of fuel or lubricant leakages.</li> <li>• Store hazardous materials in a manner that includes secondary containment and prevents interaction with other materials, the environment, and accidental tampering. In addition to, bunding of areas where hazardous substances are stored (e.g., fuel, waste areas).</li> <li>• Development and implementation of a Waste Management Plan (as part of the site- ESMP) to ensure that waste is disposed of correctly.</li> </ul>  |                              |
| Change in Quality of Water Resources | Moderate                           | <ul style="list-style-type: none"> <li>• Activities shall be conducted as far as possible from water bodies' i.e &gt; 100 m away, except where crossings are required.</li> <li>• Selective cutting of the vegetation in dambos and riparian habitats to keep low shrubby and herbaceous species that do not represent a risk for the powerline. As much as possible, conserve all the vegetation (trees, shrubs, herbaceous plants, and crops) present at the edge of watercourses and in erosion-prone areas.</li> <li>• Working in rainy season especially close to waterbodies to be avoided in order to reduce disturbances to local drainage patterns caused by working on water saturated soils and sediment transport into rivers and streams in proximity to work areas and affect water and habitat quality.</li> <li>• Sensitization on proper water usage and management. Encourage water reuse/recycling where possible.</li> <li>• Storage of hazardous materials in a manner that includes secondary containment and prevents interaction with other materials, the environment, and accidental tampering. In addition to, bunding of areas where hazardous substances are stored (e.g., fuel, waste areas).</li> </ul> | Minor                        |

| IMPACT                                 | PRE-MITIGATION<br>IMPACT<br>SIGNIFICANCE | SUMMARY OF MITIGATION MEASURES  | RESIDUAL<br>IMPACT<br>SIGNIFICANCE |
|--|--|---|------------------------------------|
|  |  | <ul style="list-style-type: none"> <li>• All machinery and equipment to be kept in good working condition to prevent accidental oil spillages from machinery and any other chemicals.</li> <li>• Avoiding the disposing of waste in sensitive areas such as water courses. Development and implementation of a Waste Management Plan (site- ESMP) to ensure that waste is disposed of correctly.</li> </ul>   |                                    |
| Loss of Vegetation                     | High                                     | <ul style="list-style-type: none"> <li>• Cleared woody vegetation from the wayleave and access road to be made available to local communities, to reduce the incremental disturbance to surrounding natural resources.</li> <li>• Revegetation of temporal work areas and access roads with appropriate native species.</li> <li>• Restriction of clearance to the wayleave. The boundaries shall be clearly identified and marked to avoid accidental clearing</li> <li>• Restriction of the creation of access roads by using existing roads and paths as far as possible.</li> <li>• Use of mechanical vegetation removal instead of chemical removal i.e herbicides.</li> </ul>   | Moderate                           |
| Habitat Fragmentation and Edge Effects | Moderate                                 | <ul style="list-style-type: none"> <li>• Cleared woody vegetation from the wayleave and access road to be made available to local communities, to reduce the incremental disturbance to surrounding natural resources.</li> <li>• Revegetation of temporal work areas and access roads with appropriate native species.</li> <li>• Restriction of clearance to the wayleave. The boundaries shall be clearly identified and marked to avoid accidental clearing</li> <li>• Restriction of the creation of access roads by using existing roads and paths as far as possible.</li> <li>• Use of mechanical vegetation removal instead of chemical removal i.e., herbicides.</li> </ul> | Low                                |
| Introduction of Invasive Species       | Moderate                                 | <ul style="list-style-type: none"> <li>• Inspection and cleaning of vehicles and equipment/machinery before they come onto site.</li> </ul>   | Low                                |

| IMPACT  | PRE-MITIGATION IMPACT SIGNIFICANCE | SUMMARY OF MITIGATION MEASURES  | RESIDUAL IMPACT SIGNIFICANCE |
|---|------------------------------------|---|------------------------------|
|   |                                    | <ul style="list-style-type: none"> <li>• Post construction survey for invasive species in sensitive areas such as wetlands and high quality forests.</li> </ul>   |                              |
| Mortality of Avifaunal Species                        | Low                                | <ul style="list-style-type: none"> <li>• Enforcement of speed limits, installation of bird diverters/markers on transmission towers to limit avifaunal collisions.</li> <li>• Sensitization of workers against bird hunting, with strict penalties including dismissal of those found wanting (this measure should be a part of worker codes of conduct).</li> <li>• Restriction of construction activities to daylight hours. Lights to be used only where necessary and to be directed toward the subject area and away from habitat areas where possible.</li> </ul>   | Negligible                   |
| Mortality of Terrestrial Fauna                        | Moderate                           | <ul style="list-style-type: none"> <li>• Sensitization of workers against hunting/ poaching, with strict penalties including dismissal of those found wanting (this measure should be a part of worker codes of conduct).</li> <li>• All construction materials, particularly those use to reinforce structures i.e., steel wires, should be safeguarded and cleared from worksites, to avoid their use as wire snares. Wire snares are widely used in illegal harvesting of large animals.</li> <li>• Enforcement of speed limits to limit avifaunal collisions</li> <li>• Restriction of construction activities to day light hours. Lights to be used only where necessary and to be directed toward the subject area and away from habitat areas where possible.</li> </ul> | Low                          |
| Disturbance to Aquatic Habitats and Species Mortality | Low                                | <ul style="list-style-type: none"> <li>• Measures as recommended for "Change in Quality of Water Resources" above.</li> <li>• Work, storage and movement of equipment and vehicles, should be avoided as much as possible within river, floodplain, and wetland areas, such as dambos. If unavoidable, the access to these sites should be reduced to a minimum.</li> </ul>   | Negligible                   |

| IMPACT                         | PRE-MITIGATION IMPACT SIGNIFICANCE | SUMMARY OF MITIGATION MEASURES   | RESIDUAL IMPACT SIGNIFICANCE |
|--------------------------------|------------------------------------|--|------------------------------|
|                                |                                    | <ul style="list-style-type: none"> <li>• When stream crossings are unavoidable, construction of suitable culverts to ensure sufficient water supply and minimize impact on fish habitat.</li> <li>• Sensitization of workers against illegal fishing, with strict penalties including dismissal of those found wanting (this measure should be a part of worker codes of conduct).</li> </ul>  |                              |
| <b>OPERATION PHASE</b>         |                                    |  |                              |
| Soil Erosion and Contamination | Low                                | <ul style="list-style-type: none"> <li>• As recommended during construction</li> </ul>   | Negligible                   |
| Mortality of Avifaunal Species | Moderate                           | <ul style="list-style-type: none"> <li>▪ Use non-reflective or low-reflectivity solar modules to reduce the risk of collisions.</li> <li>▪ Implementation of site specific and tailored management strategies once biologically significant bird interactions have been reported, including:               <ul style="list-style-type: none"> <li>• Reinstall modules at angles and heights that minimize collision risks;</li> <li>• Use of markers and bird diverters to make the lines more visible;</li> <li>• Illuminating conductors and earth wires to improve their visibility to night-flying birds;</li> <li>• Supplemental perches to lure birds from parts of the tower where phase to phase electrocutions are likely; and</li> <li>• Changing or reviewing the placement and routing of affected sections of the line (if warranted).</li> </ul> </li> </ul> | Negligible                   |

## **7.0 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN**

The Environmental and Social Management Plan (ESMP) will facilitate the operationalization of the mitigation measures. The ESMP shall details its purpose and management and monitoring programmes shall also be outlined.

### **7.1 Objectives of the ESMP**

The objectives of this ESMP are to:

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

Monitoring is necessary to avoid negative effects during construction and operation of the proposed Project and to achieve sustained environmental compliance. Details of the proposed Environmental Social Monitoring Plan (ESMP) which provides mitigation/enhancement measures, and timing for the relevant actions are presented for construction and operational phases, respectively.

## **7.2 Management Arrangements**

### **7.2.1 Roles and Responsibilities**

#### **7.2.1.1 JIGSCO Energy Corporation Limited**

This section describes the organizational structure and responsibilities for implementation of the ESMP. The general responsibilities of JIGSCO will include, but not limited, to the following:

- Supervising its contractors with the implementation of the ESMP during construction;
- Monitoring and evaluating the implementation of the ESMP during the operational phase;
- Monitoring key indicators of the Project's environmental impacts and performance;
- Reviewing plans, designs and strategies in relation to environmental, social and health considerations;
- Maintaining appropriate management systems and documentation;
- Preparing and submitting environmental and social documentation to Government agencies and financiers as required;
- Following-up non-conformance situations to ensure they have been successfully addressed; and
- Adapting management policies and strategies through lessons learnt.

Environmental and social safeguards team will be responsible for:

- Management, implementation, monitoring of compliance to the ESMP and any approval conditions, including construction supervision and performance of all Project staff, contractors and subcontractors;
- Review of ESMP performance and implementation of corrective actions, or stop work procedures, in the event of breaches of ESMP conditions, that may lead to serious impacts on local communities, or affect the reputation of the Project;
- Ensure effective communication and dissemination of the content and requirements of the ESMP to contractors and subcontractors;
- Assisting the contractor with implementation of ESMP sub-plans;
- Monitoring of ESMP and EIS performance;
- Ensuring compliance to all Project social commitments, including implementation of the social management and Resettlement and Compensation Action Plans;
- Report environmental performance of the project directly to JIGSCO Management;
- Report on environmental performance to ZEMA and other Government regulators as required;
- Prepare environmental reports summarizing Project activities, as required;
- Representing the Project at community meetings; and
- Ensuring effective community liaison and fulfilling commitments to facilitate public consultation throughout the Project cycle.

### **7.2.1.2 The Contractor**

The Contractor is required to appoint an officer(s) who will be responsible for the management of environmental and social issues on site, that is, the Safeguards Officer (SO). As a contractual requirement, the contractors will be required to demonstrate compliance of their activities against their approved Contractors ESMP (C-ESMP). This includes providing resources to ensure compliance of next tier contractors and a process for emergency stop-work orders in response to monitoring triggers. The SO will liaise regularly with the construction crews to ensure all environmental and social commitments are incorporated into the construction activities and work processes. Contractors will be responsible for performing all work:

- In compliance with relevant National legislation and international standards and regulations, ZESCO policies and with other requirements to which the Project subscribes;
- In conformance with the Project ESMP, and related management plans for specific aspects; and
- In accordance with contractual technical and quality specifications.

The Project's ESMP and related documentation will be the main contractual documentation to which the contractor(s) will be bound. However, contractors will be required to develop their own site management plans (C-ESMP) including worker camp management plan, which show how they will comply with these environmental and social requirements. In this way, the ESMP will be implemented and controlled using both ZESCO and contractor management systems.

Contractors will be required to self-monitor against their plan and compliance with the plan will be routinely monitored by JIGSCO directly or by third parties as required. Contractors will be required to submit regular reports of monitoring activities and the Project will review these on a regular basis.

Hierarchy for the implementation of the ESMP is as depicted in Figure 14.



Figure 14: Organisational Structure for ESMP Implementation

### 7.2.1.3 External Institutions/Organisations

JIGSCO carries the ultimate responsibility for ensuring that the Project and all supporting infrastructure are designed, constructed and operated in conformance to Zambian legislative requirements and industry best practice. A monitoring programme will be implemented in collaboration with appropriate stakeholders and Government Departments operating in the Project area.

Listed below are some of the institutions and Government agencies that may be contacted whenever necessary to ensure successful implementation of the ESMP:

- a. **Ministry of Green Economy and Environment**
  - Zambia Environmental Management Agency (ZEMA)
  - Provincial Forestry Department
  - Chirundu District Forestry Department
- b. **Ministry of Water Development and Sanitation**
  - Department of Water Affairs
  - WARMA
- c. **Ministry of Tourism**
  - Department of National Parks and Wildlife
  - National Heritage Conservation Commission
- d. **Ministry of Lands and Natural Resources**
  - Lands Department

- e. Ministry of Agriculture**
  - Chirundu District Agriculture Coordinators Office
- f. Ministry of Health**
  - Provincial Health Office i.e Southern Province
  - Chirundu District Health Office
  - Local Rural Health Centres
- g. Ministry of Local Government and Rural Development**
  - Chirundu Town Council
  - Chirundu District Commissioner
  - Area Members of Parliament; and
  - Area Councillors
- h. Ministry of Labour and Social Security**
  - Department of Occupational Health and Safety
  - Department of Labour

### **7.3 Environmental Awareness and Training**

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

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

#### **7.3.1 Project Environmental Awareness Induction**

An environmental awareness induction (training) will be developed by the Contractors SO. An environmental training register will be kept, maintained and used to verify that all personnel working onsite have completed the environmental induction. The content of the induction is to include, but not be limited to:

- i) An overview of the Project environmental policy;
- ii) Relevant details of the ESMP including potential significant impacts;
- iii) Identification of relevant Project stakeholders;
- iv) Conditions of any environmental licenses, permits and approvals;
- v) Roles and responsibilities of all personnel in achieving environmental conformance;

- vi) Identification of any environmentally sensitive areas;
- vii) Definition and management of environmental incidents and operation of pollution / spill control equipment;
- viii) Definition and management of waste and an explanation of the waste minimisation and recycling strategy;
- ix) Processes for refuelling and the management and use of hazardous substances; and
- x) Appropriate responses to environmental incidents.

### **7.3.2 Environmental Toolbox Talks**

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

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

## **7.4 Monitoring, Auditing and Reporting**

### **7.4.1 Monitoring**

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

### **7.4.2 Auditing**

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

### **7.4.3 Reporting**

The SO will prepare periodic i.e monthly reports summarising monitoring, auditing and inspection outcomes as well as details of any environmental non-compliances. Other details to be reported on include:

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

Regulatory and funding agencies may also require the preparation of reporting as part of approval conditions.

### **7.4.4 Inspections**

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

### **7.4.5 Project Records**

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

- i) Induction register;
- ii) Environmental incidents, non-conformances and complaints;
- iii) Inspection reports, checklists, diary entries;
- iv) Environmental monitoring results;
- v) Meeting minutes;
- vi) Formal letters and correspondence;

- vii) Waste measurement and tracking records;
- viii) Calibration records; and
- ix) Activity specific environmental risk assessments.

## **7.5 Preventative & Corrective Action**

### **7.5.1 Preventative Action**

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

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

### **7.5.2 Corrective Action**

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

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

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

### **7.5.3 Maintenance Observations**

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

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

## **7.6 Review and Update of the ESMP**

JIGSCO Limited shall review the ESMP to assess its effectiveness and relevance as follows:

- A full review shall be undertaken as conditions prevail;
- Following a reportable incident, or a significant non-compliance; and
- Following an addition, up-date or change order to the ESMP, or a sub-plan.

The review of the ESMP should consider the following:

- Adequacy of data collection, analysis and review;
- Reporting;
- Non-compliance; and
- Corrective actions implemented.

The ESMP shall also be reviewed periodically to evaluate environmental controls and procedures to ensure that they are still applicable to the works being carried out. Reviews shall be undertaken by the Environmental team as follows:

- The full ESMP shall be reviewed periodically;
- Relevant parts of the ESMP shall be reviewed following a reportable incident;
- Relevant parts of the ESMP shall be reviewed following the receipt of an updated sub-plan; and
- At the request of stakeholders, including the Contractor, Supervising Engineer, ZEMA and other regulatory authorities, financiers and the communities.

## **7.7 Environmental and Social Monitoring Plan**

The responsibility of implementation of the regular environmental and social monitoring (Implementation-Level) during construction primarily lies with the Contractor and is embedded in the contract. During construction JIGSCO Limited Project Implementation Unit (PIU) will be responsible for periodic monitoring & audit (Oversight-Level) as detailed in Table 18.

Table 18: Environmental and Social Monitoring Plan

| Aspect   | Potential Impact  | Proposed Mitigation/ enhancement Measures  | Frequency Monitoring | Time Frame  | Performance Indicator   | Responsible Personnel               | Cost (USD)               |
|--|---|--|----------------------|---|---|-------------------------------------|--------------------------|
| Clearing of vegetation in the wayleave, solar plant site access roads. | <ul style="list-style-type: none"> <li>• Loss of vegetation</li> <li>• Change in the micro-climate of the project area due to loss of carbon sinks.</li> <li>• Loss of habitat for wildlife resulting from bush clearing</li> </ul> | <ul style="list-style-type: none"> <li>▪ Preservation of green space around the project site as a natural barrier.</li> <li>▪ Conservation of vegetation in the surrounding areas.</li> <li>▪ Stumping of trees in the wayleave shall be applied</li> <li>▪ Implementation of Re-vegetation Management Plan</li> </ul>   | Quarterly            | During the Construction and operation phase (if trees are cleared). | <ul style="list-style-type: none"> <li>▪ Tree felling restricted to wayleave</li> <li>▪ Proportion of non-built surfaces visibly retaining natural vegetation</li> <li>▪ Trees stumped in the wayleave</li> </ul> | Contractors Safeguards Officer (SO) | Embedded in project cost |
|  | Change in landscape   | <ul style="list-style-type: none"> <li>▪ Use of existing access roads as much as possible</li> <li>▪ Crossing rivers and streams using the shortest distance possible (i.e., perpendicular to the waterbody).</li> <li>▪ Using construction methods that minimize damage to vegetation near the transmission line</li> <li>▪ Placing structures to take advantage of existing natural screening to reduce the view of the line from nearby roadways.</li> <li>▪ Appropriate management of construction waste at the site.</li> </ul> |                      | Construction phase  | <ul style="list-style-type: none"> <li>▪ Minimal new access roads constructed</li> <li>▪ Vegetation clearing restricted to construction site</li> </ul>   | Contractors Safeguards Officer (SO) | Embedded in project cost |

| Aspect  | Potential Impact  | Proposed Mitigation/ enhancement Measures  | Frequency Monitoring | Time Frame  | Performance Indicator   | Responsible Personnel               | Cost (USD)               |
|---|---|--|----------------------|---|---|-------------------------------------|--------------------------|
|   | <ul style="list-style-type: none"> <li>Loss of habitat and disturbance to breeding sites.</li> <li>Mortality of avifauna species</li> <li>Mortality of terrestrial fauna</li> </ul> | <ul style="list-style-type: none"> <li>Ensure that only work areas are cleared of vegetation.</li> <li>In the wayleaves stumping as opposed to uprooting of the vegetation cover</li> <li>Mapping of sensitive breeding sites and periods</li> <li>All disturbed habitat areas must be rehabilitated as soon as possible to ensure that floral ecology is re-instated.</li> </ul>  | Monthly              | Construction phase  | <ul style="list-style-type: none"> <li>Records of affected sites</li> <li>Clearance of prescribed work areas.</li> <li>Vegetation clearance done as per guideline. Uprooting only when absolutely necessary.</li> <li>Records of affected sites.</li> </ul> | Contractors Safeguards Officer (SO) | Embedded in project cost |
| Increased traffic from motor vehicles and movement of construction equipment. | Air pollution by volatile organic compounds, dust and emissions from machinery on site.   | <ul style="list-style-type: none"> <li>Ensure machinery is regularly serviced and watertight on any leakage of fuels.</li> <li>Dust suppression methods such as water spraying to be used to reduce dust.</li> <li>Covering of loose materials and keeping top layers moist.</li> <li>Use of covered trucks for the transportation of materials that release dust; and</li> <li>Use of appropriate PPE by workers on site e.g., dust masks.</li> </ul> | Weekly               | During construction phase and part of the operation phase | <ul style="list-style-type: none"> <li>No visible leakage or spillage of fuel on site.</li> <li>No strong pungent smell of fuel as a result of leakage.</li> <li>Service record of vehicles and machinery.</li> <li>Workers in appropriate PPE</li> </ul>   | Contractors Safeguards Officer (SO) | Embedded in project cost |

| Aspect   | Potential Impact  | Proposed Mitigation/ enhancement Measures  | Frequency Monitoring | Time Frame                   | Performance Indicator  | Responsible Personnel               | Cost (USD)               |
|--|---|--|----------------------|------------------------------|--|-------------------------------------|--------------------------|
|  | Risk of road accidents  | <ul style="list-style-type: none"> <li>Awareness and inductions on traffic management.</li> <li>Implement traffic safety procedures to coordinate safe transport of workers to and from the workers' camp.</li> <li>Construct and maintain roads, particularly emphasizing major slopes, to ensure slope stability and the safety of heavy vehicle operation.</li> </ul> | Weekly               | Throughout the Project cycle | Zero accidents on site throughout the project. Where accidents occur, they should be minor and nor more than three incidences in a year.   | Contractors Safeguards Officer (SO) | Embedded in project cost |
| Blasting, drilling and machinery operations on site. | Noise pollution and vibration effect on local communities, wildlife and avifauna. | <ul style="list-style-type: none"> <li>Machinery is regularly serviced.</li> <li>Appropriate noise abatement technologies shall be employed.</li> <li>Controlled and timed blasting to ensure minimal disturbances to the surrounding will be employed.</li> </ul>   | Weekly               | Construction phase           | <p>Noise levels maintained below 85 db.</p> <p>Vibration amplitude and frequency of vibration to a level of below 15Hz per second.</p> <p>No record of complaints from community members regarding noise</p> | Contractors Safeguards Officer (SO) | Embedded in project cost |
| Excavations and ground                               | Soil erosion  | <ul style="list-style-type: none"> <li>Construction of foundations to be</li> </ul>  | Monthly              | Construction phase           | <ul style="list-style-type: none"> <li>All burrow pits are buried and</li> </ul>   | Contractors Safeguards              | Embedded in project      |

| Aspect    | Potential Impact | Proposed Mitigation/<br>enhancement Measures   | Frequency<br>Monitoring | Time Frame | Performance<br>Indicator   | Responsible<br>Personnel | Cost<br>(USD) |
|-----------|------------------|--|-------------------------|------------|--|--------------------------|---------------|
| levelling |                  | <p>undertaken in the dry season;</p> <ul style="list-style-type: none"> <li>▪ Backfilling of foundation pits by the excavated soils which will resemble the order of the original soil layers;</li> <li>▪ Protect excavated soil materials from erosion;</li> <li>▪ Reduction of the construction of new access roads, where possible. Promoting the use of existing access roads for machinery and vehicle movement, increasing their width as necessary;</li> <li>▪ Ensure that the land is physically restored (include revegetation where possible) before leaving to next tower location and before the next rainy season; and</li> <li>▪ Rehabilitation of any areas which will be exposed for any reason as soon as possible to prevent possible soil erosion.</li> </ul> |                         |            | <p>revegetated</p> <ul style="list-style-type: none"> <li>• Grass planted or facilitated to grow naturally</li> <li>• Minimal signs of soil erosion</li> </ul> | Officer (SO)             | cost          |

| Aspect           | Potential Impact  | Proposed Mitigation/ enhancement Measures   | Frequency Monitoring   | Time Frame                   | Performance Indicator   | Responsible Personnel   | Cost (USD)  |
|------------------|---|---|--|------------------------------|---|---|---|
|                  |   | Rehabilitation will be by replanting disturbed areas, or returning the top soil so that grass is able to naturally grow.  |  |                              |   |   |   |
|                  | Emission of dust which will result in air deterioration and visual impacts        | <ul style="list-style-type: none"> <li>▪ Use water for dust suppression on stockpiles, exposed soils, roads and prior to excavation works</li> <li>▪ On the areas that are cleared, dust prevention measures need to be implemented during construction to reduce visual impacts associated with dust</li> </ul>  | Weekly   | Construction phase           | <ul style="list-style-type: none"> <li>• Dust suppression methods applied</li> <li>• No record of complaints from community members regarding dust</li> </ul>   | Contractors Safeguards Officer (SO)   | Part of the project cost  |
| Waste generation | Contamination of surface and ground water with sewage and other generated wastes. | <ul style="list-style-type: none"> <li>▪ Complex building will be built with water borne toilet facilities. The company will also develop their own sewerage treatment plant with capacity of 2.5 factor higher than the estimated population on site.</li> <li>▪ All sewage will be treated and ensure compliance with the recommended concentration before disposal.</li> </ul> | <p>Quarterly during construction</p> <p>Annually for the first three years and then biennial (every two years) unless conditions require adjustments</p> | Throughout the project cycle | <ul style="list-style-type: none"> <li>▪ The faecal coliforms are maintained at less than 5000/100ml of water sample.</li> <li>▪ The Total Coliforms are maintained at 25000/100ml of waste water.</li> </ul> | <p>Contractors Safeguards Officer (SO) during construction</p> <p>JIGSCO ECO during operation</p> | <p>Embedded in project cost during construction</p> <p>1,000.00 per sampling during operation</p> |

| Aspect | Potential Impact   | Proposed Mitigation/<br>enhancement Measures   | Frequency<br>Monitoring  | Time Frame                   | Performance<br>Indicator   | Responsible<br>Personnel  | Cost<br>(USD)   |
|--------|--|--|--|------------------------------|--|---|---|
|        | Deterioration of water quality; surface and ground water. This may result in disturbance to aquatic ecosystems | <ul style="list-style-type: none"> <li>▪ Ensure that machinery is serviced regularly throughout the project implementation.</li> <li>▪ Ensure that soil sampling and analysis for hydrocarbons is done at regular intervals and where contamination is found, bioremediation done.</li> <li>▪ All fuel/oil storage facilities are bunded for containment.</li> </ul> | <p>Quarterly during construction</p> <p>Annually for the first three years and then biennial (every two years) unless conditions require adjustments</p> | Throughout the Project Cycle | Zero or insignificant contamination that is kept at Total Petroleum Hydrocarbon (TPH) of less than 10 mg/L of the water    | <p>Contractors Safeguards Officer (SO) during construction</p> <p>JIGSCO ECO during operation</p> | <p>Embedded in project cost during construction</p> <p>1,000.00 per sampling during operation</p> |
|        | Contamination of soils with hydrocarbons.  |  | <p>Quarterly during construction</p> <p>Annually for the first three years and then biennial (every two years) unless conditions require adjustments</p> | Throughout the Project Cycle | Zero or insignificant contamination that is kept at Total Petroleum Hydrocarbon (TPH) of less than 2000mg/kg of the soils. | <p>Contractors Safeguards Officer (SO) during construction</p> <p>JIGSCO ECO during operation</p> | <p>Embedded in project cost during construction</p> <p>2,000.00 per sampling during operation</p> |

| Aspect                               | Potential Impact  | Proposed Mitigation/ enhancement Measures   | Frequency Monitoring  | Time Frame                                       | Performance Indicator  | Responsible Personnel   | Cost (USD)   |
|--------------------------------------|---|---|---|--|--|---|--|
|                                      | Public health challenges and ecological impacts from indiscriminate disposal of solid and liquid waste (oils, lubricants, faecal matter).   | <ul style="list-style-type: none"> <li>▪ Ensure that waste is segregated at source and disposed of at designated sites.</li> <li>▪ All project activities shall be handled according to the ZESCO Waste Procedure. The procedure prescribes reduction, re-use and recycling to promote sustainable waste management and prevent pollution to the environment</li> <li>▪ Waste containing hazardous substances are to be collected and disposed using approved means.</li> </ul> | <p>Daily during construction</p> <p>Annually during operation</p> | Construction phase Throughout the project cycle. | <ul style="list-style-type: none"> <li>▪ All wastes sorted, labelled and isolated on site prior to disposal</li> <li>▪ All solid waste disposed of in designated areas away from human settlements.</li> <li>▪ No record of sickness as a result of exposure to disease causing vectors.</li> <li>▪ Well banded hazardous waste containers.</li> </ul> | <p>Contractors Safeguards Officer (SO) during construction</p> <p>JIGSCO ECO during Operation</p> | <p>Embedded in project cost during construction</p> <p>1000.00 per year during operation</p> |
| Creation of wayleave and solar plant | <ul style="list-style-type: none"> <li>• Change of land tenure</li> <li>• Change in land use</li> <li>• Involuntary resettlement</li> </ul> | The project affected people (PAP) shall be fairly and fully compensated. Compensation shall be done prior to commencement of the project. Resettlement and compensation shall be carried as per the RCAP.   | Monthly   | Throughout construction phase                    | <ul style="list-style-type: none"> <li>▪ Compensation being paid to all PAPs.</li> <li>▪ No grievances from PAPs concerning compensation.</li> </ul>   | JIGSCO ECO, Contractors Safeguards Officer (SO)   | 30,000.00  |
|                                      | Restricted agricultural activities  | <ul style="list-style-type: none"> <li>▪ Animal grazing in the wayleave will be allowed</li> <li>▪ Farming of low laying crops will be allowed in the</li> </ul>  | Annually  | Operation phase                                  | Animal grazing and farming of low laying crops allowed in the wayleave   | JIGSCO ECO  | N/A  |

| Aspect  | Potential Impact  | Proposed Mitigation/ enhancement Measures   | Frequency Monitoring | Time Frame         | Performance Indicator   | Responsible Personnel               | Cost (USD)               |
|---|---|---|----------------------|--------------------|---|-------------------------------------|--------------------------|
|   |   | wayleave  |                      |                    |   |                                     |                          |
| Erection of towers and stringing of conductors. | <ul style="list-style-type: none"> <li>▪ Bird collision with and electrocution</li> <li>▪ Visual intrusion</li> </ul>   | <ul style="list-style-type: none"> <li>▪ Bird diverters to be installed in bird migration corridors.</li> </ul>   | Annually             | Post construction  | Bird diverters installed on conductors.   | JIGSCO ECO                          | 5,000.00                 |
| Installation of solar modules                   | <ul style="list-style-type: none"> <li>▪ Visual impacts; glint and glare</li> </ul>   | <ul style="list-style-type: none"> <li>▪ Appropriate facing of solar modules to minimize glint and glare impacts on resident and sensitive habitats.</li> <li>▪ Preservation of green space around the project site as a natural barrier.</li> </ul>  | Annually             | Construction Phase | <ul style="list-style-type: none"> <li>• No grievances from community members</li> <li>• Natural barriers installed or maintained</li> <li>• No ecological impacts of significant scale e.g. mortality of birds from collisions with modules</li> </ul> | Contractors Safeguards Officer (SO) | Embedded in project cost |
| General construction works of the project       | <ul style="list-style-type: none"> <li>▪ Influx of people from outside the project area.</li> <li>▪ Increased crime</li> <li>▪ Increased incidence of communicable diseases</li> <li>• strain on local resources/amenities</li> </ul> | <ul style="list-style-type: none"> <li>▪ Prioritisation of locals for unskilled labour</li> <li>▪ Health education on the dangers and prevention of communicable diseases shall be given to the construction workers and the local community.</li> <li>▪ Distribution of condoms</li> <li>Partner with the District Medical Office for</li> </ul> | Weekly               | Construction phase | <ul style="list-style-type: none"> <li>▪ Attendance lists and minutes for health awareness</li> <li>▪ Local employment ratio</li> <li>▪ Cases of communicable diseases recorded</li> <li>▪ Reports of criminal activities</li> </ul>                    | Contractors Safeguards Officer (SO) | Embedded in project cost |

| Aspect | Potential Impact                                    | Proposed Mitigation/ enhancement Measures  | Frequency Monitoring | Time Frame                   | Performance Indicator  | Responsible Personnel                            | Cost (USD)               |
|--------|---|--|----------------------|------------------------------|--|--|--------------------------|
|        |   | appropriate interventions  |                      |                              |  |  |                          |
|        | Improved energy access                              | Ensure that the project is implemented.  | Annually             | Operation phase              | Power plant operating  | JIGSCO Management                                | NA                       |
|        | Water and sanitation risks                          | Water and toilets for workers will be provided at site   | Monthly              | Construction phase           | Toilets and water available at site  | Contractors Safeguards Officer (SO)/ HSE Officer | Embedded in project cost |
|        | Human animal conflict                               | <ul style="list-style-type: none"> <li>Poaching will be prohibited</li> <li>Conservation awareness campaigns will be conducted to construction workers</li> </ul>  | Quarterly            | Construction phase           | Records of conservation awareness held   | Contractors Safeguards Officer (SO)              | Embedded in project cost |
|        | Improved local economy                              | <ul style="list-style-type: none"> <li>Local people shall be prioritised for employment</li> <li>Some building materials such as sand and crushed stones shall be bought locally.</li> </ul>                                   | Monthly              | Construction phase           | <ul style="list-style-type: none"> <li>Local employment ratio</li> </ul>   | Contractors Safeguards Officer (SO)              | NA                       |
|        |   | <ul style="list-style-type: none"> <li>Implementation of the CSR MoU</li> </ul>  | Annually             | Operation Phase              | <ul style="list-style-type: none"> <li>Proportion of agreed funds disbursed</li> </ul>   | JIGSCO Management                                | 50,000 annually          |
|        | Risks of occupational health and safety of workers. | <ul style="list-style-type: none"> <li>Site Safety and health procedures/guidelines shall be developed and enforced.</li> <li>PPE shall be provided to workers.</li> <li>Safety and health inductions and awareness</li> </ul> | Weekly               | Throughout the Project cycle | <ul style="list-style-type: none"> <li>Zero Accidents on site throughout the project. Where accidents occur, they should be minor and not more than three</li> </ul> | Contractors Safeguards Officer (SO)/ HSE Officer | Embedded in project cost |

| Aspect | Potential Impact | Proposed Mitigation/ enhancement Measures   | Frequency Monitoring | Time Frame                   | Performance Indicator  | Responsible Personnel   | Cost (USD)   |
|--------|------------------|---|----------------------|------------------------------|--|---|--|
|        |                  | <p>campaigns shall be conducted periodically.</p> <ul style="list-style-type: none"> <li>▪ Appropriate signage shall be placed on the construction site and the communities within the project area.</li> <li>▪ Availability of emergency equipment e.g fire extinguishers, first aid kits</li> </ul> |                      |                              | <p>incidences in a year.</p> <ul style="list-style-type: none"> <li>▪ Availability and proper placement of signage</li> <li>▪ Availability and proper placement of emergency equipment</li> <li>▪ Emergency Preparedness and Response Procedure prepared</li> </ul>  |   |  |
|        | Fire risks       | <ul style="list-style-type: none"> <li>▪ Fire safety training to be provided for the employees.</li> <li>▪ Ensure that fire extinguishers are in place.</li> <li>▪ Appropriate symbols and procedures of fire safety to be established on sites.</li> </ul>   | Monthly              | Throughout the project cycle | <ul style="list-style-type: none"> <li>▪ Zero record of fire throughout the project. Where a record is made, then only once in three years</li> <li>▪ Emergency Preparedness and Response Procedure prepared</li> <li>▪ Record of safety drills conducted</li> </ul> | <p>Contractors Safeguards Officer (SO)/ HSE Officer during construction</p> <p>JIGSCO SHEQ Officer during Operation</p> | <p>Embedded in project cost</p> <p>5,000.00 annually</p> |

## **7.7 Environmental and Social Management and Monitoring Costs**

Table 19 outlines the estimated costs associated with environmental and social management and monitoring activities, throughout the various phases of the KGL SPP. The monitoring framework ensures compliance with regulatory requirements, mitigates potential environmental and social impacts, and promotes sustainable project implementation.

The JIGSCO PIU will perform critical supervisory functions including validation of contractor monitoring data and targeted environmental and social sampling to verify mitigation effectiveness. These oversight activities will be funded separately from construction contracts. The total monitoring budget is estimated to be **USD885,500.00** (Eight Hundred Eighty-Five Thousand Five Hundred United States Dollars).

Table 19: Environmental Monitoring Activities and Cost

| Project Phase/Activity        | Activities  | Person Responsible   | Schedule/Frequency  | Cost Element                 | Estimated Cost (USD) |
|-------------------------------|---|--|---|------------------------------|----------------------|
| Preparatory Phase             | Environmental Impact Statement  | PIU  | Once - off  | Review fees                  | 45,000.00            |
|                               | Obtaining Tree felling permit from Forestry Department  | PIU- ECO   | Once - off  | Forestry resource assessment | 20,000.00            |
|                               |   |  |   | Compensation cost            | 50,000.00            |
| Pre-Mobilization/Construction | <ul style="list-style-type: none"> <li>• Compensation payments</li> </ul>   | <ul style="list-style-type: none"> <li>• PIU – Social Specialist</li> </ul>  | <ul style="list-style-type: none"> <li>• Compensation- Before project implementation</li> </ul>   | Valuation services           | 10,000.00            |
|                               |   |  |   | Compensation cost            | 300,000.00           |
|                               |   |  |   | Transport                    | 15,000.00            |
|                               |   |  |   | Staff allowances             | 20,000.00            |
| Mobilization                  | <ul style="list-style-type: none"> <li>• Local labour recruitment</li> <li>• Awareness meetings for workers: health, safety, security and environmental conservation</li> </ul> | <ul style="list-style-type: none"> <li>• PIU, Contractor &amp; community leadership</li> <li>• ECO with Local Health Team</li> <li>• ECO with safety officers</li> <li>• ECO with security officer</li> <li>• ECO with officers from DNPW</li> </ul> | <ul style="list-style-type: none"> <li>• Recruitment – once prior to project execution</li> <li>• Health – twice during project implementation</li> <li>• Safety – twice during project implementation</li> <li>• Security – before project commencement</li> <li>• Environmental conservation – before project commencement</li> </ul> | Transport & other logistics  | 10,000.00            |
|                               |   |  |   | Staff allowances             | 4,500.00             |

| Project Phase/Activity | Activities  | Person Responsible  | Schedule/Frequency   | Cost Element   | Estimated Cost (USD)                             |
|------------------------|---|---|--|--|--|
|                        | Locals people in project area<br>Health, safety, security and environmental conservation awareness  | ECO with Local Health Team<br>ECO with safety officer<br>ECO with security team<br>ECO with local conservation team | <ul style="list-style-type: none"> <li>Health – soon after mobilization</li> <li>Safety – soon after mobilization</li> <li>Security – soon after mobilization</li> <li>Conservation – soon after mobilization</li> </ul> | <ul style="list-style-type: none"> <li>Staff allowances</li> <li>Venue and other logistics</li> </ul>              | 116,300.00<br>5,000.00                           |
| Construction           | <ul style="list-style-type: none"> <li>Health awareness and monitoring for both Local people and construction workers</li> <li>Safety &amp; security awareness and monitoring for both Local people and construction workers</li> </ul> | ECO with Health Team<br><br>ECO, Safety & Security Officers & Contractor  | Health – once off<br><br>Safety & security – periodic during project implementation  | Staff allowances<br><br>Transport and other logistics<br><br>Staff allowances<br><br>Transport and other logistics | 4,500. 00<br>10,000.00<br>4,500. 00<br>10,000.00 |
|                        | Noise & dust mitigation   | ECO, Safety and Health officer, Site Engineer   | Periodic throughout project execution  | Air quality measurements<br><br><ul style="list-style-type: none"> <li>Transport and other logistics</li> </ul>    | 25,000.00<br>5,000.00                            |
|                        | Water pollution   | ECO, Safety, Security, Civil Engineering & contractor   | Periodic in selected locations   | Transport and other logistics<br><br>Water sampling & analysis   | 5,000=00<br>25,00.00                             |
|                        | Conservation monitoring   | ECO with Forestry Department and DNPW   | Conservation - once  | <ul style="list-style-type: none"> <li>Allowances for officers</li> </ul>  | 20,000.00  |

| Project Phase/Activity | Activities   | Person Responsible  | Schedule/Frequency   | Cost Element  | Estimated Cost (USD)   |
|------------------------|--|---|--|---|--|
|                        |  |   |  | Transport   | 5,000.00   |
|                        | General Monitoring of compliance to outlined environmental mitigation measures | <ul style="list-style-type: none"> <li>PIU (Site Engineer &amp; ECO)</li> <li>ZEMA</li> </ul> | <ul style="list-style-type: none"> <li>Throughout project execution</li> <li>Once or twice during project execution</li> </ul> | <ul style="list-style-type: none"> <li>Staff allowances</li> <li>Transport &amp; Other Logistics</li> <li>Allowances for officers</li> <li>Transport and other logistics</li> </ul> | <ul style="list-style-type: none"> <li>40,000.00</li> <li>15,000.00</li> <li>20,000.00</li> <li>10,000.00</li> </ul> |
| Pre-commissioning      | Environmental Auditing   | ECO with the ESD Auditing Team  | Prior to project commissioning   | <ul style="list-style-type: none"> <li>Staff allowances</li> <li>Transport (operation)</li> <li>Audit report production</li> </ul>  | <ul style="list-style-type: none"> <li>30,000.00</li> <li>15,000.00</li> <li>5,500.00</li> </ul>                     |
| Operational            | Environmental Auditing   | ECO with the ESD Auditing Team  | One year after project commissioning   | <ul style="list-style-type: none"> <li>Staff allowances</li> <li>Transport (operation)</li> <li>Audit report production</li> </ul>  | <ul style="list-style-type: none"> <li>30,000.00</li> <li>15,000.00</li> <li>5,500.00</li> </ul>                     |
| <b>TOTAL</b>           |  |   |  |   | <b>885,000.00</b>  |

## **8.0 DECOMMISSION AND REHABILITATION**

Decommissioning is defined as the close down of operations, the removal of process equipment, buildings and structures and carryout site cleanup and remediation if required. The expected lifetime of the project ranges between 25 to 30 years that will be renewable as long as the appropriate predictive maintenance measures are taken, and all the necessary revamps and upgrades are done.

The proposed Project will have a life expectancy after which the performance of the project scales down to diminishing returns or the Project is no longer viable. At this point, the Project will be decommissioned in consultation with ZEMA and other stakeholders and in line with prevailing national legislative standards and good international practice at that time.

Decommissioning typically includes the removal of infrastructure. Removed parts will be re-used, recycled or disposed of. After removal of the line, the wayleave is restored to as close as possible to its natural setting.

### **8.1 Decommissioning Activities**

The following are major activities during decommissioning:

#### **8.1.1 Pre-Decommissioning Activities**

- Stakeholders Consultation for Decommissioning

As the Project approaches the end of its economic viability, the developer will consult various stakeholders including host communities, nearby facility owners, ZEMA and experts. This will allow for a carefully planned redeployment and, where necessary, disengagement of personnel as appropriate. Activities associated with decommissioning are captured in Table 20.

- Preparation of Decommissioning Plan

Prior to engaging in decommissioning works, a decommissioning plan will be developed in accordance with regulatory requirements at the time of decommissioning. This will include a detailed Environmental and Social Management Plan (ESMP), which as a minimum will capture aspects as outlined in Table 21.

## 8.1.2 Decommissioning Activities

Table 20: Decommissioning Activities

| ACTIVITY   | DESCRIPTION  |
|--|--|
| <b>Pre-Decommissioning Phase</b>                                     |  |
| Site Preparation   | <ul style="list-style-type: none"> <li>Site preparation activities similar to those undertaken in the construction phase will be required during decommissioning phase. This will include confirming the integrity of the site, access to the site in order to accommodate the required equipment (e.g lay down areas and decommissioning camp) and the mobilization of decommissioning equipment.</li> </ul>  |
| <b>Decommissioning</b>   |  |
| Disassemble and remove existing components for the solar plant       | <ul style="list-style-type: none"> <li>The components including modules, tracking systems, inverters, and associated infrastructure would be disassembled, and reused and recycled (where possible), or disposed of in accordance with regulatory requirements.</li> </ul>   |
| Disassemble and remove existing components for the transmission line | <ul style="list-style-type: none"> <li>Complete discharging of oil from the transformers;</li> <li>Removal of all electrical systems and accessories;</li> <li>Demolition of substation walls and slab foundation;</li> <li>Excavation and demolition of tower foundations;</li> <li>Filling of tower spots with gravel, clean fill and top soil; and</li> <li>Site restoration including revegetation and reseeding using of plants endemic to the site.</li> </ul> |
| Disposal and handling  | <ul style="list-style-type: none"> <li>Ensure proper handling and disposal of hazardous materials, if any, in accordance with environmental regulations</li> <li>Salvage and resell components with resale value, such as solar modules, to secondary market</li> </ul>  |
| <b>Site Restoration</b>  |  |
| Land Reclamation   | <ul style="list-style-type: none"> <li>Restore the land to its original condition, including the removal of any remaining infrastructure, restoration of vegetation, and land reclamation</li> <li>Implement erosion control measures and ensure compliance with local land use regulations</li> </ul>   |
| <b>Post-Decommissioning</b>  |  |
| Monitoring and Maintenance   | <ul style="list-style-type: none"> <li>Monitor the site post-decommissioning to ensure compliance with environmental and safety standards.</li> <li>Establish a long-term maintenance plan for any remaining infrastructure or ongoing land reclamation efforts</li> </ul>   |

Table 21: Environmental and Social Management during Decommissioning

| Aspect   | Impact                               | Pre-Mitigation Significance | Mitigation Measures                               | Residual Impact Significance |
|--|--------------------------------------|-----------------------------|---|------------------------------|
| Site clearance<br>Creation of access roads<br>Excavation and backfilling of foundation towers<br>Transportation of equipment and materials<br>Accidental spills and leakages<br>Waste management         | Soil Erosion and Contamination       | Moderate                    | Mitigation Measures as described for construction | Low                          |
| Excavation and backfilling of foundation towers<br>Creation of access roads<br>Transportation of equipment and materials especially over wet areas<br>Accidental spills and leakages<br>Waste management | Change in Quality of Water Resources | Low                         |   | Negligible                   |
| Excavation and backfilling of foundation towers<br>Transportation of equipment and materials<br>Emissions from operation of equipment and vehicles   | Air Quality Deterioration            | Moderate                    |   | Low                          |

|   |                                       |          |  |            |
|---|---------------------------------------|----------|--|------------|
| Labour influx<br><br>Decommissioning activities e.g., demolishing of concrete   | Noise and Vibration                   | Moderate |  | Low        |
| Transportation and traffic<br><br>Decommissioning activities<br><br>Site restoration (risk from use of non-native species to revegetate)  | Introduction of Invasive Species      | Low      |  | Negligible |
| Site clearance<br><br>Decommissioning activities<br><br>Transportation of equipment and materials (potentially leading to collisions)<br><br>Labour influx (potentially leading to illegal hunting) | Mortality of Avifaunal Species        | Low      |  | Negligible |
| Site clearance<br><br>Decommissioning activities<br><br>Transportation of equipment and materials (potentially leading to collisions)<br><br>Labour influx (potentially leading to illegal hunting) | Mortality of Terrestrial Fauna        | Low      |  | Negligible |
| Excavation and backfilling of foundation towers   | Disturbance to Aquatic Ecosystems and | Low      |  | Negligible |

|  |                                     |  |  |  |
|--|-------------------------------------|--|--|--|
| <p>Creation of access roads</p> <p>Transportation of equipment and materials especially over wet areas</p> <p>Accidental spills and leakages</p> <p>Waste management</p> <p>Labour influx (potentially leading to illegal fishing)</p> | <p>Mortality of Aquatic Species</p> |  |  |  |
|--|-------------------------------------|--|--|--|

## **9.0 DECLARATION OF AUTHENTICITY**

The environmental and social impact assessment team comprises of highly qualified and specialized individual experts in socio-economic assessment, environmental assessment and engineering development, and to the best knowledge of the experts involved, the information contained in this document is original and correct. Where secondary sources have been used, it is clearly indicated and acknowledged appropriately. All facts have been presented to the best knowledge of the developer. No part of this document shall be reproduced for any reason other than what it is intended for supporting decision making process for the competent authorities.

For correct discernment and interpretation of this document however, non-professionals or lay readers should seek clarification where necessary from either the Project developer (JIGSCO) or ZEMA for correct interpretation of the information contained herein.

### **AUTHORISED SIGNATURE OF PROJECT PROPONENT**

Name: Bonje M. Muyunda

Designation: Head – Environment, ZESCO Limited

Sign: \_\_\_\_\_

Date: \_\_\_\_\_

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## **11.0 APPENDICES**

Appendix 1: Chance Finds Procedure

Appendix 2: Air Quality and Noise Baseline Assessment Report

Appendix 3: ZESCO Waste Management Procedure

Appendix 4: Resettlement and Compensation Action Plan (RCAP)

Appendix 5: Letter of Approval for TOR and Scoping Report

Appendix 6: Approved Terms of Reference (TORs)

Appendix 7: Approved Scoping Report (SR)

Appendix 8: Grievance Redress Mechanism (GRM)

Appendix 9: Stakeholder Engagement Plan (SEP)

## **Appendix 1: Chance Finds Procedure**

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

- i) Stop the construction activities in the area of the chance find;
- ii) Delineate the discovered site or area;
- iii) Secure the site to prevent any damage or loss of removable objects. In cases of removable antiquities or sensitive remains, a night guard shall be present until the responsible local authorities and the NHCC take over;
- iv) Notify the supervisory Engineer who in turn will notify the responsible local authorities and the NHCC;
- v) The NHCC would be in charge of protecting and preserving the site before deciding on subsequent appropriate procedures. This would require a preliminary evaluation of the findings to be performed by the archaeologists of the NHCC. The significance and importance of the findings should be assessed according to the various criteria relevant to cultural heritage; those include the aesthetic, historic, scientific or research, social and economic values;
- vi) Decisions on how to handle the finding shall be taken by the NHCC. This could include changes in the layout (such as when finding an irremovable remain of cultural or archaeological importance) conservation, preservation, restoration and salvage;
- vii) Implementation for the authority decision concerning the management of the finding shall be communicated in writing by the NHCC; and
- viii) Construction work could resume only after permission is given from the responsible local authorities and the NHCC concerning safeguard of the heritage;
- ix) These procedures must be referred to as standard provisions in construction contracts, when applicable. During project supervision, the Site Engineer shall monitor the above regulations relating to the treatment of any chance find encountered are observed; and
- x) Construction work will resume only after authorization is given by the responsible local authorities and the National Museum concerning the safeguard of the heritage.