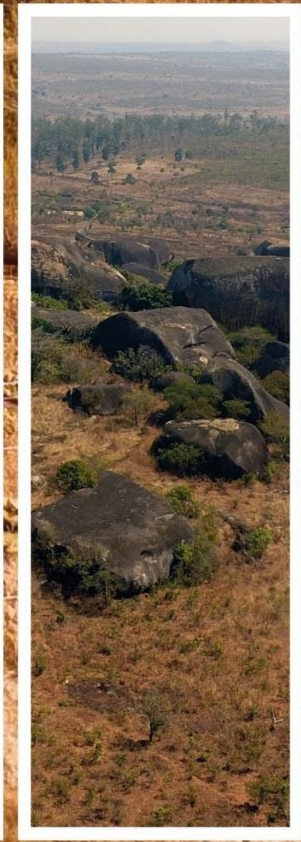
Environmental and Social Impact Assessment of the 220kV Transmission Line Project between Belém do Dango and Longonjo, Huambo Province

OZANGO MINERAIS S.A


JUNE 2022

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Environmental and Social Impact Assessment of the 220kV Transmission Line Project between Belém do Dango and Longonjo, Huambo Province.

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CONTE

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Abbreviations

ADA	Directly Affected Area
AID	Area of Direct Influence
AII	Indirect Area of Influence
ANR	National Waste Agency
AT	High Voltage
BT	Low voltage
CCB	Benguela Current Convention
CEM	Electromagnetic Fields
DNPAIA	National Directorate for the Prevention and Assessment of Environmental Impacts
STD	Sexually Transmitted Diseases
EIAS	Environmental and Social Impact Assessment
ENDE	National Electricity Distribution Company
EPAND	National Biodiversity Strategy and Action Plan
PPE	Personal Protective Equipment
IBA	Important Bird and Biodiversity Area
ICNIRP	International Commission on Non-Ionising Radiation Protection (ICNIRP) on Non-Ionizing Radiation Protection
IFC	International Finance Corporation
INBC	National Institute for Biodiversity and Conservation
INGA	National Institute for Environmental Management
INE	National Institute of Statistics
LiDAR	Light Detection And Ranging
LT	Transmission Line
MCTA	Ministry of Culture, Tourism and Environment
MINAGRIP	Ministry of Agriculture and Fisheries
MINEA	Ministry of Energy and Water
MT	Medium voltage
NdPr	Neodymium - Praseodymium
PANA	National Action Plan for Adaptation to Climate Change
PGAS	Environmental and Social Management Plan
PGC	Construction Management Plan
PGR	Waste Management Plan
WFP	Environmental Monitoring Programme
UNDP	United Nations Development Programme
PPRE	Emergency Preparedness and Response Plan

PRODEL	Empresa Pública de Produção de Electricidade - E.P.
RNT	National Transport Network - E.P.
ROW	*Right-of-Way (*Safety Corridor)
SIA	Integrated Environmental System
ToR	Terms of Reference
HIV	Human Immunodeficiency Virus
UNCBN	United Nations Convention on Biological Diversity
UNFCCC	United Nations Framework Convention on Climate Change

CHAPTER 1

INTRODUCTION

1 INTRODUCTION

In the Angola 2025 strategy for the energy sector, several priorities are defined within the scope of the national electrification policy. These priorities include: a) increasing the overall rate of national electrification and reducing access asymmetries throughout the country; b) progressively replacing public investment in electricity production with long-term private financing, with public financing reserved for structural investments; and c) make it possible to expand access to electricity in various municipalities scattered throughout the territory, by establishing partnerships between Municipal Administrations or with the National Public Electricity Distribution Company (ENDE) and the private sector to manage dispersed and isolated communities or using renewable energy leasing or commercialisation solutions.

Access to electricity has a wide range of social and economic benefits. For example, access to electricity can increase quality of life as well as stimulate economic development. However, there are still a number of places where access to energy is very limited, with recurrent unplanned interruptions that significantly limit socio-economic development.

The country's current electricity production capacity, including the projects already underway (especially the construction of the Caculo-Cabaça Hydroelectric Dam in Kwanza Norte province, with an estimated production of 2172 Megawatts (MW)), requires additional investment in electricity transmission line projects. These projects will play an extremely important role in consolidating and optimising the electricity sector, supplying energy to consumers far from the production sites.

The Environmental and Social Impact Assessment (ESIA) report was prepared in response to the requirements of Angolan legislation in force, namely Presidential Decree no. 117/20 of 22 April on the General Regulations for Environmental Impact Assessment and the Environmental Licensing Procedure, respecting the guidelines of multilateral environmental agreements and complying with good international practice in the energy sector and its transport. The EIAS was carried out on the basis of the Terms of Reference (ToR) developed in accordance with Article 13 of Presidential Decree 117/20 and other current legislation.

1.1 Justification for the EIAS

The EIAS for the 220kV Transmission Line between Belém do Dango and Longonjo, in Huambo Province, is the result of the categorisation of projects in accordance with Presidential Decree no. 117/20 of 22 April on the General Regulations for Environmental Impact Assessment and the Environmental Licensing Procedure.

The General Regulations for Environmental Impact Assessment and the Environmental Licensing Procedure (Presidential Decree no. 117/20 of 22 April) categorise projects into five (5) types (A, B, C, D and E), and the proposed Project falls under the category A activity presented in Annex I in point 1 of the aforementioned decree. This Presidential Decree states that projects should be categorised according to their specifications and the nature of the project.

This ESIA follows a systematic process to characterise the project and assess any potential negative and positive impacts it may have on aspects of the physical, biological and socio-economic environment. Subsequently, given the applicable legislation, the implementation of a project of this nature must be preceded by an ESIA report which must address, but not be limited to, the following points:

- Description of the 220 kV transmission line project between the Belém do Dango substation and the future Longonjo mine substation;
- Technological project alternatives *versus the* hypothesis of not carrying out the project;
- Identification and systematic assessment of the potential environmental and social impacts generated by the activities of the installation and operation phases of the 220 kV transmission line, including details on specific aspects of the operation of the technologies adopted;
- Definition of the geographical limits of the areas directly or indirectly affected by the project's impacts, known as Areas of Influence (AoI), considering, in all cases, the human populations and other living beings within these areas; and
- Other elements considered relevant due to their particularities and characteristics, including their importance for national economic development.

1.2 Objectives of the EIAS

The objectives of the EIAS report involve identifying, predicting and evaluating the potential environmental, social and health impacts on the communities potentially affected by the project, and outlining the mitigation measures proposed for the potential residual impacts, and the measures to reinforce the potential positive impacts that the project must implement.

The main objectives of the EIAS are as follows:

- Describe the project and analyse the environmental and social benefits inherent in the development phases of the 220 kV transmission line;
- Provide information on the alternatives for avoiding, mitigating or reducing potential impacts within sensitive areas, as well as measuring the effectiveness of each option and presenting the reasons to support the selection of the preferred options;
- Identify and assess the potential adverse environmental and social impacts associated with the proposed project;
- Identify and describe the population, natural elements and existing infrastructure that may be affected by the project's activities and the potential cause of adverse environmental, socio-economic and cultural impacts;
- Have evaluation techniques and methodologies that can be presented to decision-makers in relation to the adverse effects of the project on the natural and social environment that are difficult to quantify or evaluate;
- Propose mitigation measures to reduce and/or avoid pollution, environmental disturbances and other potential negative impacts caused during the construction activities and operation phase of the 220 kV TL project;
- Provide a record of the comments and responses received from interested and affected parties during the EIAS process; and
- Define an environmental monitoring system for the 220 kV TL project and propose an appropriate environmental monitoring plan.

1.3 Project Promoter and Consultancy Company

Founded in 2012, Ozango Minerais S.A. is a limited company based in Luanda, Angola. The organisation is owned by Pensana (based in England), which owns 84% of Ozango, which in turn proposes the development of the project. Ferrangol (the state company that manages iron ore production in Angola) owns 10 per cent of Ozango's shares and the minority partners the remaining 6 per cent. The organisation operates in the General Mining sector. **Table 1-1** shows the project proponent's contact details.

Table 1-1: Contact details of the Project Proponent.

Company	
Company Name	Ozango Minerais, S.A.
NIF	5417174149
Address	Talatona neighbourhood, Rua C, Sector B, block 06 número 72, Talatona, Luanda
Contact	(+244) 923936791
Legal Representative	
Name	Edson Paulo Carreiro Nunes
Position	Country Manager
Telephone	(+244) 923936791
Email	paulo@ozangominerais.com

The Proponent contracted the company Holísticos - Serviços, Estudos & Consultoria, Lda. to develop this EIAS report. Holísticos is an environmental consultancy company based in Luanda and registered with the Ministry of Culture, Tourism and Environment. It is made up of a team of dynamic, multidisciplinary specialists with extensive experience of working on environmental and social issues. **Table 1-2** below shows the contact information for Holísticos.

Table 1-2: Holísticos contacts.

Company	
Company Name	Holísticos - Services, Studies and Consultancy, Lda.
Commercial Registry Number at the Luanda Commercial Registry	299-06
NIF	5401156421
Registration number with the Ministry of Culture, Tourism and Environment (MCTA) - Environmental Consultant	12159922221
Address	Urbanisation Harmony, Street 60, House 559, Lar do Patriota, Luanda

Telephone	(+244) 927 442 844 / 915 034 779 / 226 434 549
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Telephone	(+244) 923 41 01 86
PO Box	2426 Apartado IV
Email	holisticos@holisticos.co.ao

1.4 Team Involved in Preparing the ESIA

The team of specialists involved in developing this EIAS is listed and described in **Table 1-3**. This team has extensive experience in providing environmental consultancy services for projects in the energy sector and has carried out several similar studies in various parts of Angola, both for energy production and transport/distribution projects.

Table 1-3: List of experts involved in the EIAS.

Name	Academic Training	Role in EIAS	Electronic Signature
Vladimir Russo	Master in Environmental Education	Project Director and Project Leader	
Miguel Morais	Biologist, Master in Marine Sciences and Coastal Zones	Environmental Specialist: Environmental Characterisation (fauna component)	
Pedro Sá	Marine Biologist, Master in Aquaculture	Project Coordinator: Environmental Specialist, Project Description and Identification of Environmental and Social Impacts	
Elayne Miranda	Natural Resources and Environment Engineer	Environmental Specialist: Environmental and Social Characterisation and Identification of Impacts Environmental and Social	
Eduardo Ferdinand	Natural Resources and Environment Engineer, Master in Management and Environmental audits	Environmental Specialist: Analysis of Social Characterisation and Description of the Consultation Process and Public Consultation	

Name	Academic Training	Role in EIAS	Electronic Signature
Suzana Bandeira	Degree in Biology Master's in Biological Sciences	Environmental Specialist: Environmental and Social Characterisation	
Pedro Vaz Pinto	Forest Engineer and PhD in Conservation Biology	Environmental Specialist: Environmental Characterisation (fauna component)	
Amândio Gomes	Degree in Biology PhD in Conservation Biology	Environmental Specialist: Environmental Characterisation (flora component)	
Teresa Ferreira	Environmental Engineer	Waste Management Plan and Non-Technical Summary	
Luís Veríssimo	Degree in Geography; Master's in Applied Ecology	Geographic Information System	

1.5 Overview of the Environmental Impact Assessment Process in Angola

The Republic of Angola has a well-established process for Environmental Impact Assessments (EIA), the aim of which is to analyse how a particular proposed project may change the environment and what potential impacts this change may bring. In addition to anticipating possible negative impacts, this process leads the Proponent to adopt alternatives to avoid, reduce, mitigate or compensate for potential adverse negative impacts and maximise the benefits of the activities associated with the project.

Under Presidential Decree No. 117/20 of 22 April on the General Regulations for Environmental Impact Assessment and the Environmental Licensing Procedure, the ESIA is one of the most important tools in the EIA process for planning and decision-making, binding the Proponent to environmental protection legislation and aligning these requirements with the Proponent's Environmental Policy.

The Ministry of Culture, Tourism and the Environment (MCTA) is responsible for assessing EPDAs and EIASs for projects likely to cause potential environmental and socio-economic impacts in a given locality or region. In the meantime, following the submission of this EIAS (electronically on the Integrated Environmental System (SIA) portal in accordance with Article 6), the MCTA must issue an opinion on it, including the action plans/programmes, which will have to be drawn up in order to guarantee the sustainability of the project. Meanwhile, during the process, copies of the final EIAS report will be printed and then submitted to the Ministry of Energy and Water (MINEA - the ministry responsible for the sector) for an opinion on the report's findings.

Figure 1-1 is a general representation of the Environmental Impact Assessment (EIA) process and the Environmental Licensing Procedure in accordance with environmental legislation and all other laws in force in the Republic of Angola.

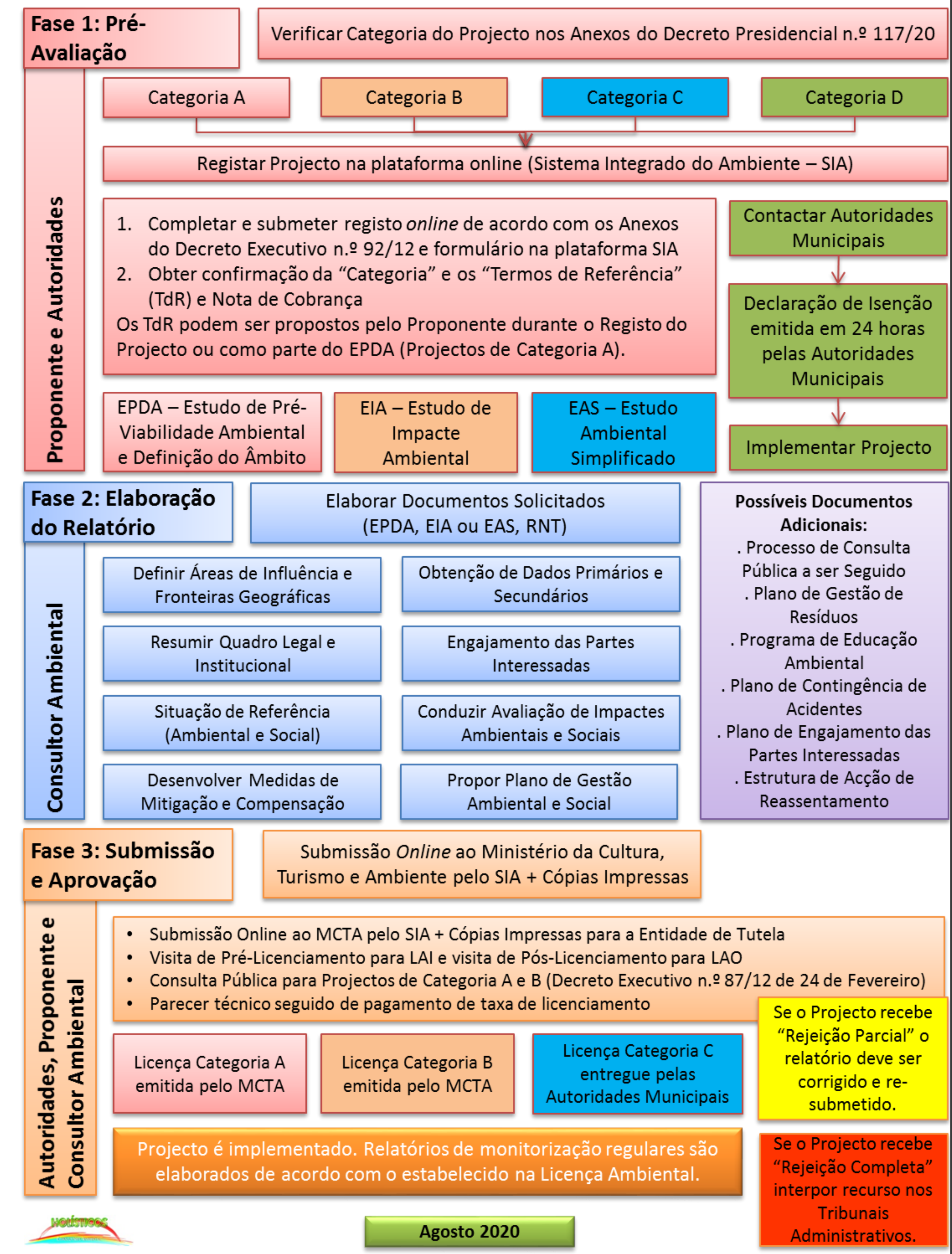

Figure 1-1: Key stages of the EIA process in Angola.

1.6 Project registration

The project was registered on the digital platform of the Integrated Environmental System (SIA) of the Ministry of Culture, Tourism and Environment (MCTA) by Holísticos in accordance with the Terms of Reference (ToR) for Environmental Impact Studies (Executive Decree no. 92/12 of 1 March). In response, the MCTA through the National Directorate for the Prevention and Assessment of Environmental Impacts (DNPAIA) issued instructions for the development of the EIA (Protocol Number: 5968434218) recommending the need to comply with the standard ToR for waste treatment projects.

According to the registration in the Integrated Environmental System, this project was classified as Category A. The documentation shown in **Table 1-4** was also requested. This table also includes the MCTA's recommendations and Ozango Minerais' comments.

Table 1-4: MCTA's Recommendations and Responses to the Project Register.

#	MCTA recommendations	Comments
1	Proof of delivery of the Waste Management Plan to the National Waste Agency.	The Waste Management Plan was drawn up in accordance with Presidential Decree 190/12 of 24 August by the company Holísticos. It was submitted to the National Waste Agency for an opinion and certificate. Proof of submission to the ANR is shown in Annex 1.
2	Environmental Impact Assessment (EIA)	This document.
3	Binding opinion of the Ministry responsible for overseeing the activity	The EIA will be submitted to the Ministry of Energy and Water as the line ministry responsible for issuing the opinion.
4	Training Plan for Environment, Safety e Labour Hygiene	This plan is presented in Annex 2.
5	Burden Distribution Proposal and Social Benefits	This proposal is presented in Annex 3.
6	Non-Technical Summary	The Non-Technical Summary is an integral part of this EIAS report. It has been submitted together with this report in the EIS for consideration by the MCTA. It is the document that will be shared with stakeholders during the public consultation.

1.7 Reliability and General Limitations

This EIAS report has been prepared by Holísticos using all the technical knowledge, secondary information available and data obtained during bibliographic consultations, as well as the professional experience of its technicians in similar work. The contents of this report are for the exclusive use of Ozango Minerals and may not be disclosed, published or amended without the prior written authorisation of both parties. It is intended for the purposes of issuing a technical opinion on the activities associated with the project, which is being analysed by the Ministry of Energy and Water (MINEA) and the Ministry of Culture, Tourism and the Environment (MCTA).

Holísticos reserves the right to rely on all Project information, documents or data provided by or for the Proponent (Ozango Minerais S.A.) including LiDAR survey data, without the need for independent investigation or verification. All information provided by municipal administrations was also considered valid and, where possible, was triangulated with other sources of information. Holísticos accepts no responsibility for relying on incomplete or inaccurate information, documentation or data provided. Holísticos assumes no liability to the Proposer and other third parties in relation to any issues outside the scope of this work.

1.8 Technical and Information Gaps

During the preparation of this Environmental and Social Impact Assessment for the 220kV Transmission Line Project between Belém do Dango and Longonjo, there were no gaps in information that could jeopardise the preparation of this EIAS report.

Relevant and available bibliographic sources were consulted, information contained in other reports for projects located in Huambo province was used, different specialists carried out three field visits, one preliminary to recognise the site and the route and two technical visits (one in the rainy season and the other *in* dry weather) to gather information *in situ and take* measurements at different points along the transmission line route. For the socio-economic information surveys, in addition to the available bibliography, the following were used several informal and formal meetings were held with local communities and municipal administrations along the transmission line route.

The primary data obtained and the secondary data consulted are sufficient to allow a description of the reference situation, both from an environmental and social point of view, in the region, making it possible to identify the sensitivity of the region's environment. This information has made it possible to identify and assess the potential positive and negative impacts as a result of the project's implementation and, consequently, to identify and list different mitigation measures for the potential negative impacts and actions to enhance the potential positive impacts. These mitigation measures and other actions were compiled in the Environmental and Social Management Plan (PGAS - Chapter 6), which is to be implemented during the project's execution.

1.9 Report structure

The EIAS report is structured as follows:

- ✓ **Chapter 1 - Introduction:** presents the importance of the energy sector, the objectives, justification for the EIAS report, the team responsible for preparing the EIAS, contact details for the applicant and the environmental consultancy company, an overview of the Environmental Impact Assessment process in Angola, general reliability and limitations and the structure of the report.
- ✓ **Chapter 2 - Project Description:** describes in detail the characteristics of the project and the activities to be carried out in both the construction and operation phases, the essential support infrastructure and other activities to enable the prior identification of potential environmental and socio-economic impacts related to the activity to be carried out under the project.
- ✓ **Chapter 3 - Institutional and Legal Framework:** identifies the Angolan legislation in force and applicable to the environmental and energy sector, including international guidance documents for the energy sector relevant to the EIAS and the activity to be carried out under the project, and describes the relevant governmental and international institutions.
- ✓ **Chapter 4 - Environmental and Social Characterisation:** describes in detail the reference conditions of the environment in the region where the project is located, with emphasis on environmental (physical and biophysical environment) and socio-economic conditions

(demographics, people's way of life, etc.), education and health, historical and cultural heritage, key ecosystem services and subsistence economic activities, etc.).

- ✓ **Chapter 5 - Assessment of Potential Impacts:** describes the methods and results of the assessment of potential impacts for all project components (including planned activities and unplanned events), including a characterisation of the impacts and their reversibility, cumulative and synergy properties and the distribution of social burdens and benefits.
- ✓ **Chapter 6 - Environmental and Social Management Plan:** This presents a plan with the appropriate mitigation and attenuation measures to achieve the objective of complying with national legislation, institutional responsibilities and other relevant commitments in the environmental area, including compensation measures where necessary.
- ✓ **Chapter 7 - Final Considerations:** includes the main conclusions of the ESIA report and a balance of the main aspects to be considered and implemented during the realisation of the activities associated with the project.
- ✓ **Chapter 8 - Bibliography:** presents the bibliography used to prepare the EIAS.

CHAPTER 2

PROJECT DESCRIPTION

2 PROJECT DESCRIPTION

This section provides a description of the 220 kV Transmission Line Project between the Belém do Dango Substation (existing) and the Longonjo Substation (to be built).

2.1 Project Location

The project area is located in Huambo province. The project runs along a 45 metre wide corridor, covering the following municipalities in Huambo province: Huambo, Caála and Longonjo. The exact location of the line and tower supports will only be defined after more detailed studies have been carried out, including topographical surveys that will make it possible to better gauge the potential impact of the line and its towers on physical elements, namely infrastructures and economic activities (e.g. agriculture).

The transmission line (from the Belém do Dango substation to the future Longonjo substation) will have a total length of approximately 50 kilometres (see **Table 2-1**), with a transit capacity of 239 MVA, at the thermal limit of the conductor cables, and will connect the Belém do Huambo substation (already existing) to the Longonjo substation (to be built). The new Longonjo 220/60 kV substation will be built around 3.5 kilometres south-west of the town of Longonjo, on land slightly away from urban or peri-urban areas. The Belém do Dango substation receives power from the Laúca hydroelectric scheme.

Two alternative routes were considered when designing the line, and the current configuration was chosen because it has less impact on the population (see **Figure 2-1**). On the other hand, it is important to note that the current process of selecting the proposed route was preceded by an analysis of the environmental and social constraints in which an attempt was made to identify a route where the environmental and socio-economic impacts would be minimised, while also considering a route that would be as direct as possible. This process included, in the first phase, identifying and evaluating the possible existence of major constraints that could limit/make unviable the installation of the line, as well as defining technically and economically viable corridors with greater environmental advantages.

Subsequently, the proposed line route was optimised using the LiDAR tool. This survey was carried out along the initially proposed route, in a 1 km corridor, and including the line's exit from the Belém do Dango substation, the substation area of the future Longonjo mine and adjacent areas. After this survey, the information collected was processed using mapping *software* (GIS) and an analysis was carried out taking into account the different environmental and socio-economic components of the region.

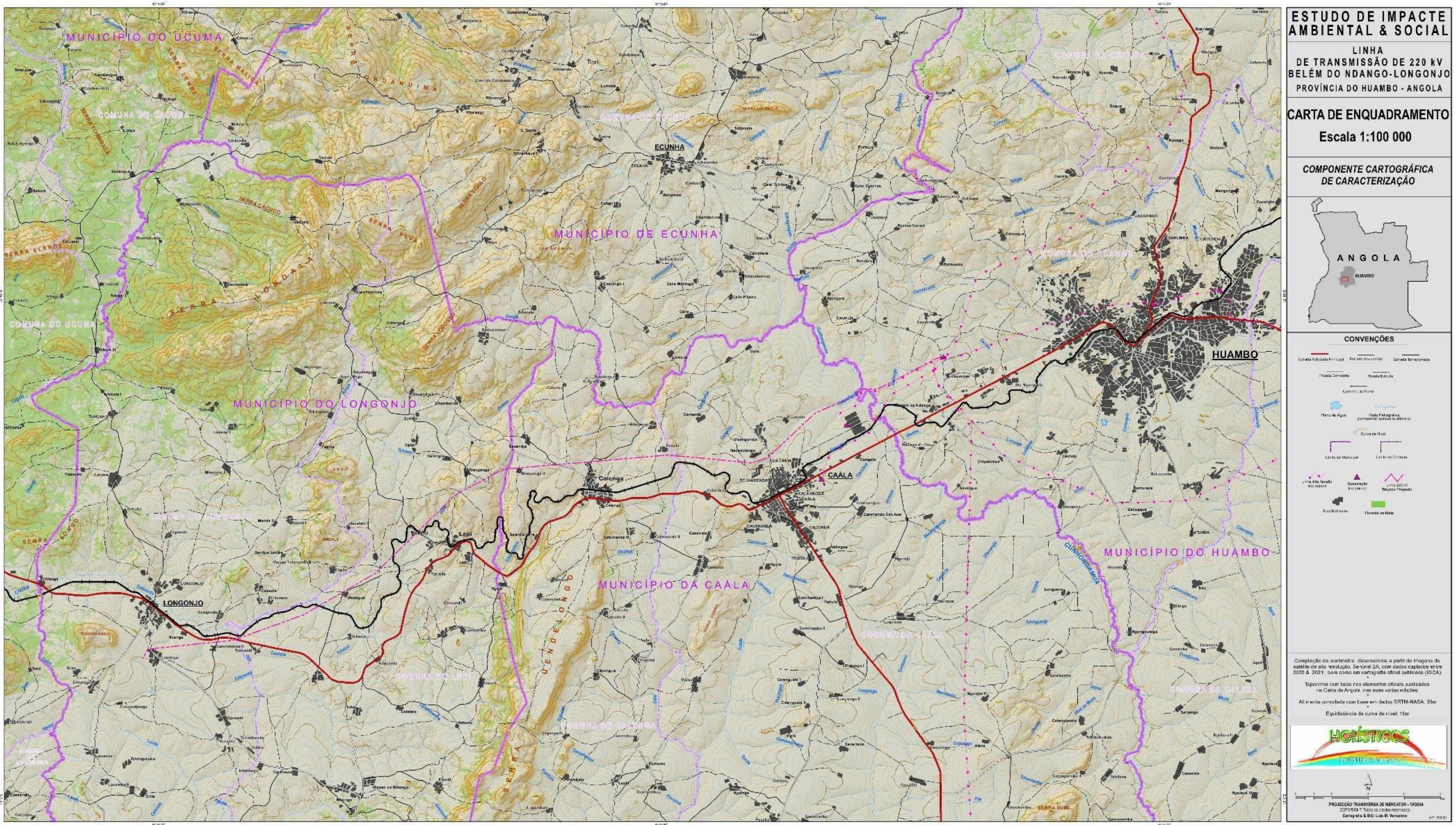

Figure 2-1: Proposed route of the 220 kV transmission line between the Belém do Dango substation and the Longonjo substation.

Cartographic elements were also produced to analyse the natural, social and landscape values of the area crossed by the transmission line, and this analysis resulted in important adjustments to the transmission line. However, the final route proposed for the transmission lines and the locations where the towers will be built may undergo minor readjustments in order to avoid sensitive areas occupied by human infrastructures, whether buildings or agricultural fields.

2.2 Analysing Alternatives

No alternative locations are presented for the project since the solution presented has already been optimised to reduce potential environmental and social impacts. This process included, in the first phase, identifying and assessing the possible existence of major constraints that could condition the installation of the Transmission Line, as well as defining technically and economically viable corridors that have greater environmental advantages, using LiDAR surveying for this purpose.

After the LiDAR survey was carried out and the data collected was analysed, an exercise was carried out to readjust the route of the transmission line with the aim of reducing its impact and making it less impactful from both an environmental and social point of view. As a result, the transmission line route was adjusted in some segments and the maps presented reflect the changes made to the route initially proposed by the bidder.

Based on the LiDAR data, it was possible to identify seven permanently built structures that could potentially be affected by the project, as shown in **Figure 2-2**. However, these structures can be easily avoided with the final tower positioning work. From the point of view of the ploughing operations that will be affected by the project's safety corridor (45 metres, 22.5 metres on each side), the following values were identified:

- Active ploughlands: 84.9 hectares (see **Figure 2-3**);
- Fallow land: 37.5 hectares (see **Figure 2-4**);
- Abandoned farmland: 4.1 hectares (see **Figure 2-5**).

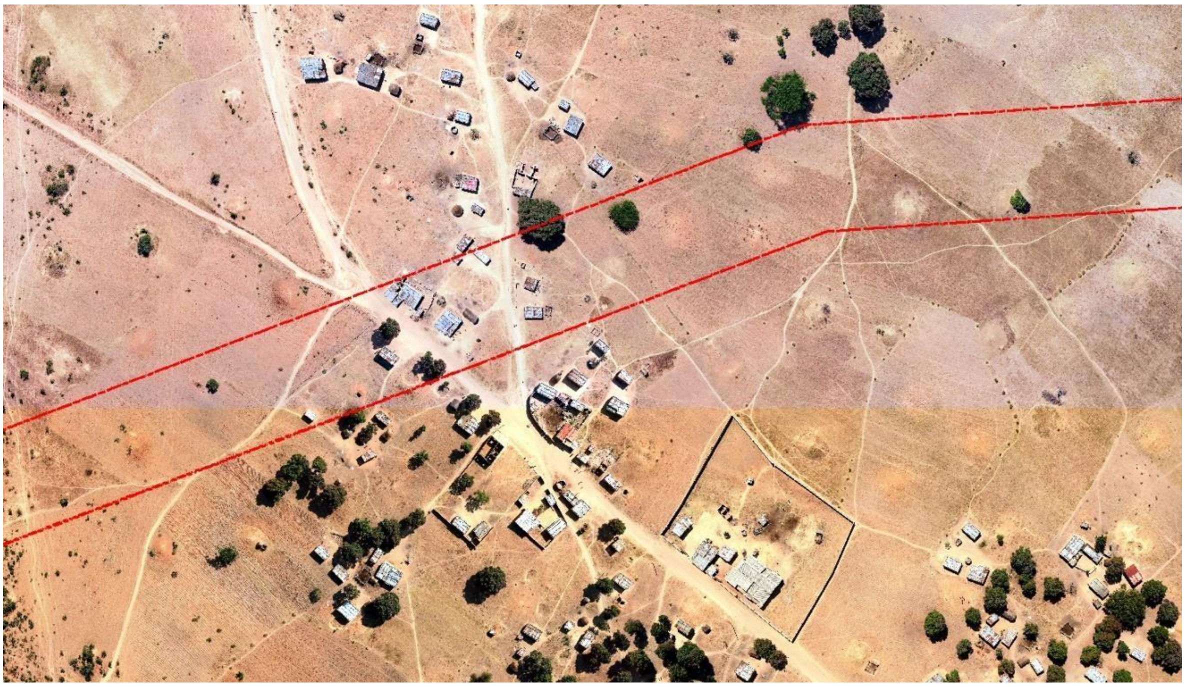

Figure 2-2: Structures identified during LiDAR within the corridor.

45 metre easement.

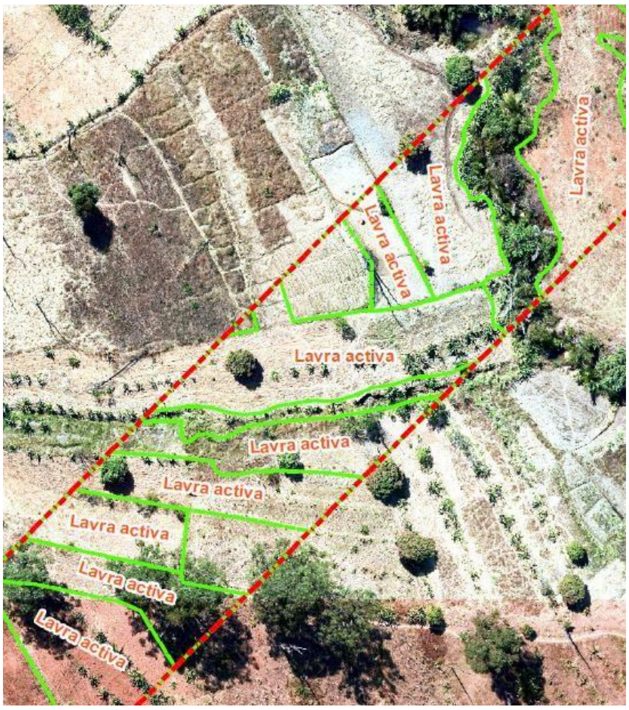

Figure 2-3: Example of active ploughing within the 45-metre corridor.

Figure 2-4: Example of fallow land within the 45-metre corridor.

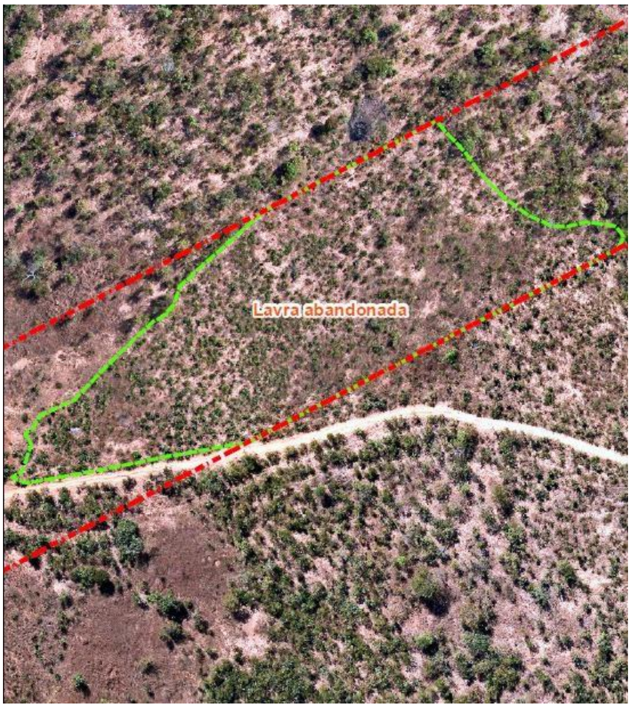

Figure 2-5: Example of abandoned mines within the 45-metre corridor.

As an example, **Figure 2-6** shows a map of a segment that has been altered to reflect the aspects mentioned above. In this particular case, the change made was to move the line away from a water tank/reservoir, while maintaining the safety distance required by law (see **Annex 5** for a summary of the relevant legislation) and with the aim of minimising the socio-economic impacts of the proposed transmission line.

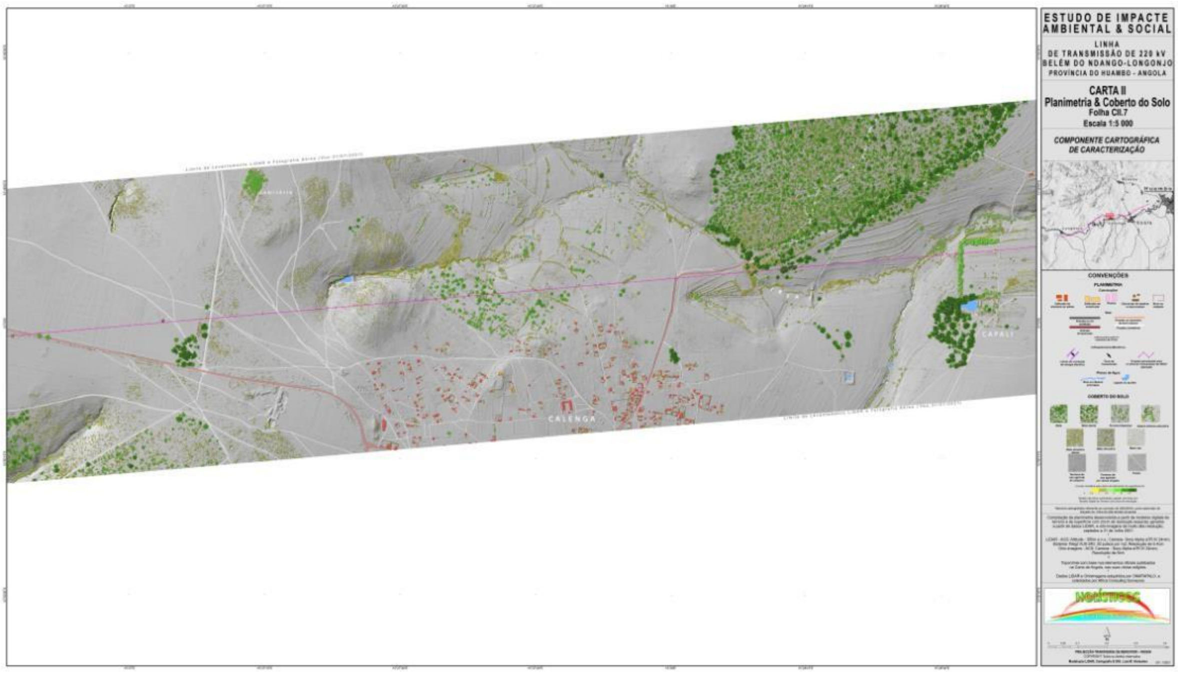

Figure 2-6: Example of an altered transmission line segment.

No alternatives were analysed for the existing Belém do Dango substation, as this is the most viable option for supplying clean energy to the mine, and the transmission line output options were analysed. Initially, the output from the 60/30kV substation in Caála was analysed, but due to the power needed to supply the mine, as well as the distance, the 220kV connection was chosen. The Belém do Dango substation is therefore the most logical option as it has the power available and is the nearest transport substation. Different sites were analysed for the Longonjo substation to be built, and the current one was chosen within the area designated for the mine, close to the mine's border, in order to facilitate external access.

On the other hand, for the substation at the future Longonjo Mine, following the field surveys carried out and meetings held with the Longonjo Municipal Administration and local authorities in the region (see more details in **Section 4.4. Consultation Meetings** and **Annex 4**), the substation's location was readjusted. This change was due to the fact that there are several informal cemeteries in the vicinity of the initially proposed location for the Mina do Longonjo substation. The location proposed for the construction of the substation at the future Longonjo Mine was the area identified with the least social impact and with the consensus of the Longonjo Municipal Administration, the traditional authorities and the respective local populations.

In terms of the main constraints, the ecological aspects, land-use planning and the socio-economic profile of the municipalities crossed by the transmission line, as well as the biophysical and urban constraints were highlighted. Whenever possible, municipal development or master plans were also used to help define the project's activities.

On the other hand, it should be emphasised that the installation of a transmission line to power the Longonjo mine was considered the most viable alternative in terms of both costs (if a hybrid photovoltaic and battery system were to be implemented) and ecological footprint (if the mine were to run on diesel generators).

2.3 Hypothesis of Non-Realisation

Failure to realise this project will result in the energy demand required for the Longonjo Neodymium - Praseodymium (NdPr) Mining Project not being met. The absence of this transmission line could jeopardise the start-up and operation of this project, which is of vital importance to the development of the region. This project aims to be one of the main suppliers of NdPr raw materials for the ongoing electrification of modern society, which will generate a greener energy future and reduce greenhouse gas (GHG) emissions. It is intended that this objective will be achieved by creating wealth for its shareholders, opportunities for its workers and benefits for the Government of Angola and the community in which it operates.

2.4 Areas of Influence

Defining the areas of influence of a project allows for the establishment of geographical boundaries of areas that may be subject to positive or negative, direct or indirect, permanent or temporary changes, providing guidelines for the assessment of potential environmental and social impacts. The topographical, physiographical, climatic and biological aspects, possible changes to the socio-economic framework and the quality of life of the populations located in directly and indirectly affected areas were taken into account in order to define the areas of influence of this project. Given the characteristics of the project, its location and size, and with the aim of elucidating the degree of the project's potential negative impacts on environmental and social issues, three areas of influence of the project were methodologically defined[1] , namely:

- **Directly Affected Area**

The Directly Affected Area (ADA) for the 220 kV Transmission Line corresponds to the areas that may suffer direct permanent impacts, often referred to as the project footprint, as a result of the construction/implementation phases of the project, which may be positive or negative, including the implementation of the physical structures and infrastructures of the transmission line in a proportion of 22.5 metres on each side. This area will be used during construction works, for the passage of cables and the circulation of vehicles, and for maintenance work during operation. In accordance with the Land Law, an easement corridor (*RoW*) of 22.5 metres must be established on each side of the line (a total of 45 metres).

In total, around 136 towers will be erected with around 360 metres between towers, although in some areas the distances will be shorter. Each tower will have four concrete foundations, permanently occupying an area of 7 x 7 metres (approximately 0.67 hectares), requiring a temporary area of around 30 x 30 metres (approximately 12.24 hectares) during construction work. Wherever possible, existing accesses will be used to access the tower sites, however there may be a need to open new accesses during the construction phase.

[1] These areas of influence are in line with the recommendations of Executive Decree 92/12 of 1 March approving the Terms of Reference for Environmental Impact Studies.

Various auxiliary construction infrastructures will be needed, including structures to accommodate construction work and temporary storage sites for equipment and materials. Considering the length of the transmission line, there will be a construction site at the proposed location for the future Longonjo substation and the installation of a new line at the Belém do Dango substation. ENERLINE's existing construction site in Huambo will also be used to support the project. An appropriate Environmental and Social Management Plan (an integral part of the ESIA) and mitigation measures have been developed in order to reduce or avoid potential environmental and socio-economic impacts. For the substation, the ADA considered for this project is the area for the future Longonjo substation, which will occupy an area of approximately 16,900 metres^2 (130 x 130 metres).

Appropriate environmental and social mitigation measures with an associated monitoring programme will be developed for this category in order to minimise and mitigate potential negative environmental and socio-economic impacts and optimise positive ones (part of the Environmental and Social Management Plan).

- **Area of Direct Influence**

The Area of Direct Influence (AID) for the Transmission Line was considered to be the entire surroundings of the various areas with direct impacts resulting from the transmission lines, namely 250 metres on either side of the central axis of the power transmission and distribution line (see **Figure 2-1**). This corridor meets the definitions established by the MINEA document, *Technical Specification ET-N-022-Ed.2*. Direct impacts can occur here as a result of the construction (namely vegetation removal, access creation, demining and transmission line installation) and operation phases of the transmission lines (including line maintenance activities). This category will include all definitive and/or temporary routes that will provide direct access to the Project implementation sites and other sites in the vicinity that may undergo temporary improvements to facilitate construction activities. The IDA also includes non-intrusive demining works that may be necessary before the construction and implementation phase of the transmission line. Thus, this AID will be represented by a corridor along the line, 60 metres wide on each side of the line in question, which will be the area of intervention of the demining teams.

The Area of Direct Influence (AID) for the future Longonjo Substation will be the entire surroundings of the various areas where the new equipment will be installed, namely in a radius of 250 metres, including the access roads that will be used by employees and for transporting materials and equipment (see **Figure 2-2**). The AID includes the immediate accesses to the substation and other sites that may be improved in order to make the project functional and viable. Appropriate mitigation measures will be developed for this area and integrated into the project's Environmental and Social Management Plan. The project's IDA boundary was considered only in the area around the border of the Belém do Dango substation within a radius of 250 metres (see **Figure 2-3**).

- **Indirect Area of Influence**

For the Transmission Line, the Area of Indirect Influence (AII) was considered to be the area that will be subject to the indirect impacts of the project, namely the sites where raw materials are obtained for its construction and operationalisation, i.e. 500 m on either side of the transmission line axis (see **Figure 2-1**). Where possible and when potential indirect impacts are measurable, appropriate mitigation measures will be proposed. This area also includes the socio-economic boost resulting from labour requirements for the construction and operation phases of the project and the purchase of goods, materials and construction equipment and various tertiary services (food, telecommunications, transport, security, etc.). Due to the characteristics of the project and its great regional importance, the municipalities of Longonjo, Caála and Huambo were considered within the LIA.

The areas subject to the indirect impacts of the project for the SE of Belém do Dango (see **Figure 2-7**) and for the SE of Longonjo (see **Figure 2-8)** were considered as the Area of Indirect Influence (AII) those areas that will be subject to the indirect impacts of the project, appropriate mitigation measures will be proposed when and where the potential indirect impacts are measurable. This area also includes the socio-economic dynamism resulting from the need for labour for the construction phase of the project and tertiary services (food, telecommunications, transport, security, etc.). The geographical area considered includes the city of Huambo.

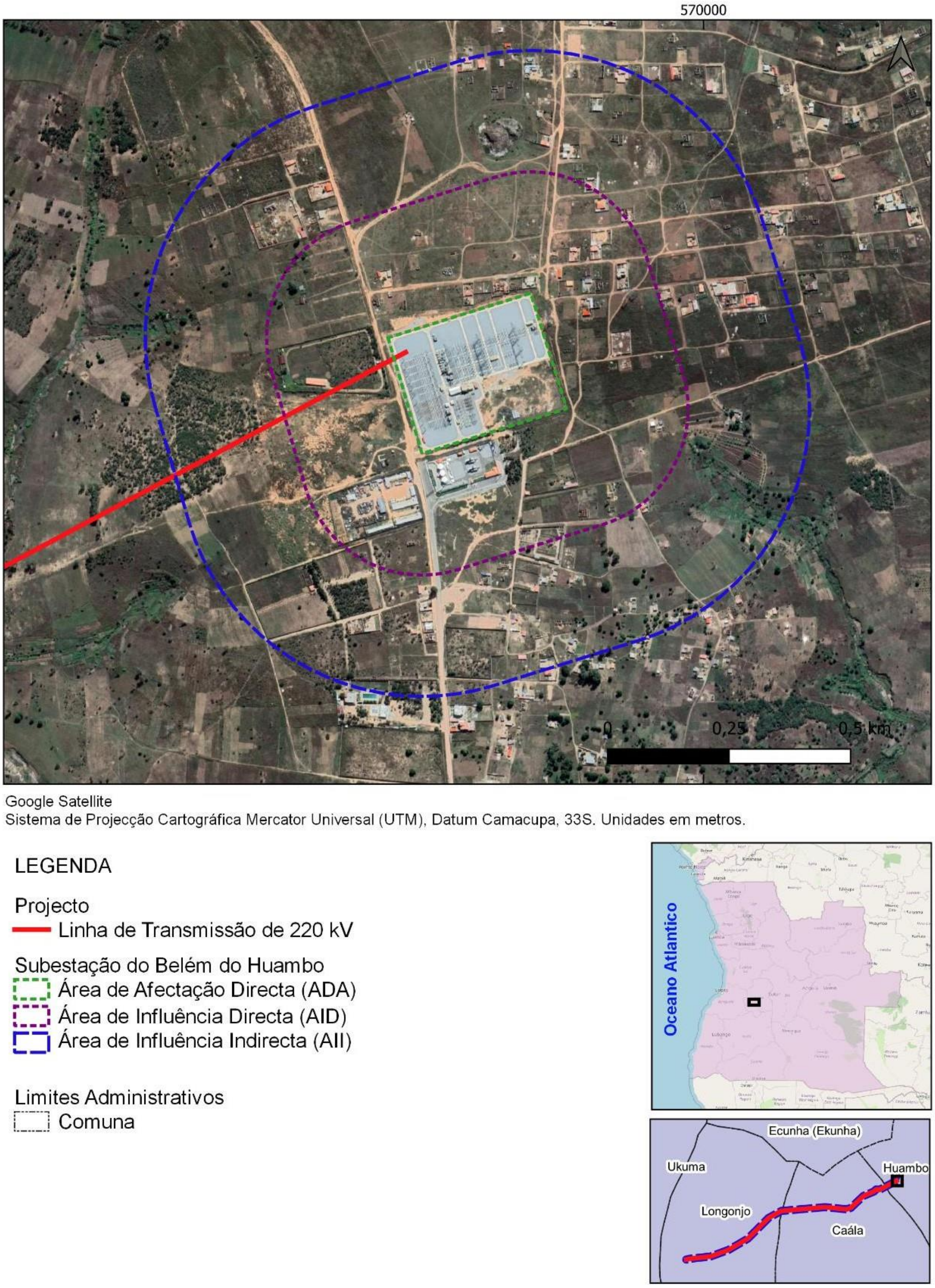

Figure 2-7: Areas of Influence of the Belém do Dango Substation.

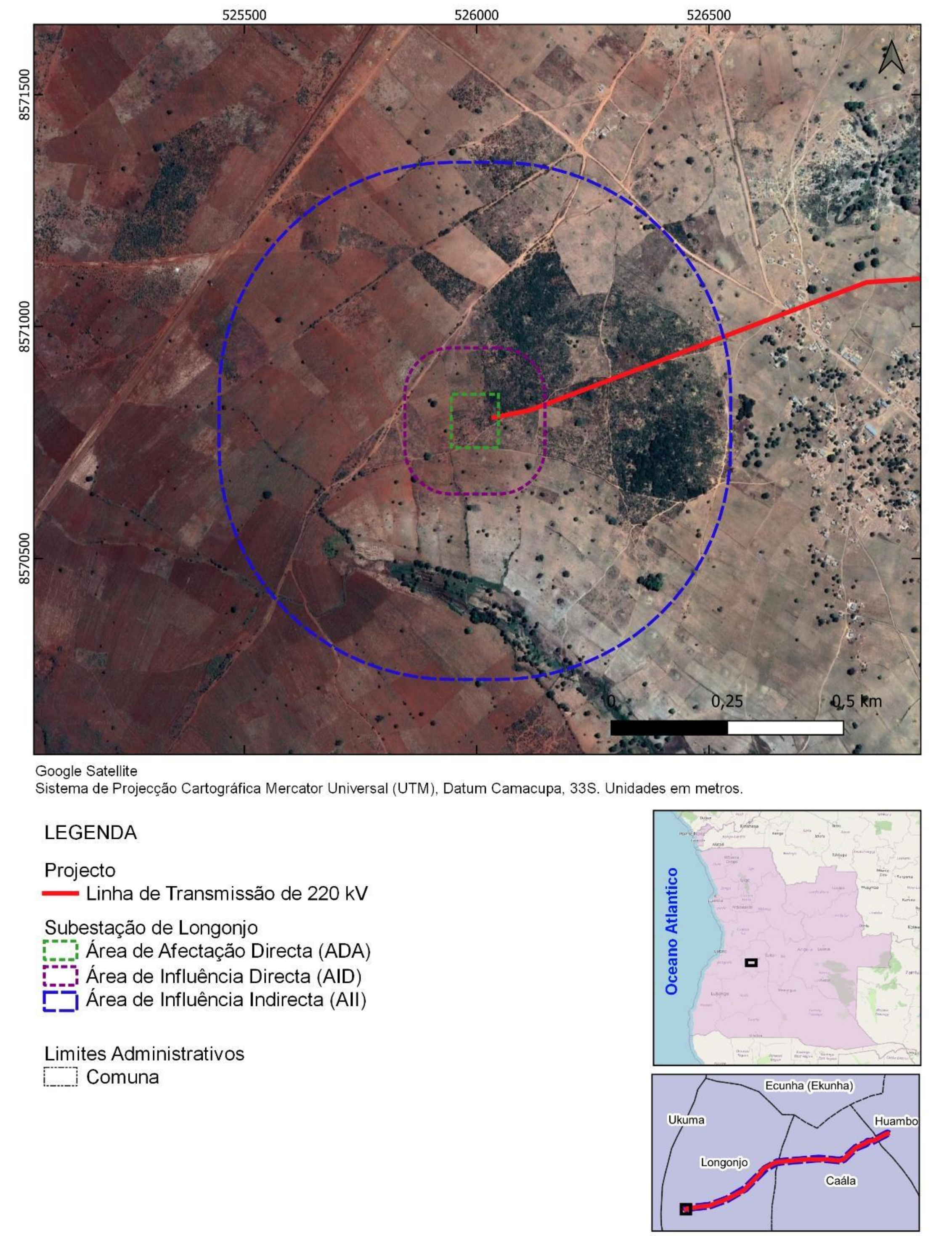

Figure 2-8: Areas of Influence of the Longonjo Substation.

2.5 General Features

From a technical point of view, this transmission line project consists of the following structural elements:

- Single line with aluminium-steel conductors with 408.5 mm^2 nominal cross-section.
- The power to be transported will be 100 MVA, in the form of three-phase alternating current, with a frequency of 50 Hz and a voltage of 220 kV.

The route of the transmission line will avoid crossing:

- Aeronautical or radio servitudes.
- Urban or urban expansion areas and rural residential areas.
- Areas with oil and gas pipelines.
- Ecologically sensitive areas.
- Cultural heritage sites.

For the equipment and materials used to carry out the project, the general technical specifications of the Ministry of Energy and Water for lines at this voltage level will be complied with, where applicable. **Table 2-1** shows some of the manufacturing/assembly specifications for the main materials used, as well as the definitions of the project parameters.

Table 2-1: Specifications of the main elements for Very High Voltage (VHV) overhead lines.

Specification Ref.	Description
ET-E-113 (31 Jul 2014)	Bare cables for EHV overhead lines.
ET-E-117 (31 Jul 2014)	Fibre optic cables and accessories for EHV installations
ET-E-115 (31 Jul 2014)	Bare copper cables for earth loops in substations and EHV lines
ET-E-107 (31 Jul 2014)	Insulators for EHV overhead lines, substations and switching stations.
ET-E-104 (31 Jul 2014)	Busbars, bare conductors and connectors for substations.
ET-E-118 (31 Jul 2014)	EHV overhead line erection, substations and switching stations
ET-E-111 (31 Jul 2014)	Accessories for fixing insulator chains and cables.
ET-E-116 (31 Jul 2014)	Devices for day and night aerial beaconing of EHV lines.
ET-E-120 (31 Jul 2014)	Environmental Impact Assessment for Power Lines
ET-E-102 (31 Jul 2014)	Insulation Coordination System.
ET-E-112 (31 Jul 2014)	Earth mesh of EHV overhead line supports.
ET-E-119 (31 Jul 2014)	EHV overhead line projects.

2.6 Site Preparation Activities

The transmission line management company (RNT) will establish a number of procedures to safely construct and install the proposed transmission line. The construction phase will involve a number of activities that will be carried out sequentially. During this preliminary phase, within a 60 metre corridor, vertices and singular points of the route, identification and marking of the terrain and demining will be carried out. The site preparation phase will consist of activities such as initial grubbing and sanitation work including deforestation and tree felling (if necessary).

Initial start

The team will position the intermediate towers based on the approved profile. If necessary, a basic access path will be created for the position of each structure, moving obstacles such as rocks, levelling high points and filling in holes. The work will be carried out in such a way as to minimise the impact on the environment in the surrounding area. Existing paths will be used wherever possible and new accesses will be created to reach the pole positions if the existing accesses are impassable.

Demining

The National Mine Action Agency (ANAM) created by Presidential Decree no. 172/21 of 7 July) aims to regulate, monitor, supervise and oversee all those involved in the demining activity sector. ANAM replaced the National Intersectoral Commission for Demining and Humanitarian Assistance (CNIDAH) and is responsible for verifying the external quality assurance and quality control of mine action activities, including quality control of all tasks completed before the land is handed over to the beneficiaries. This means that it is mandatory for the safety corridor allocated to the transmission line (45 m wide along the proposed route) to be certified as defined by a company or entity authorised by ANAM.

In terms of process, all the land allocated to the project needs to be certified as cleared before construction work can begin. Based on the information database of the CNIDAH and the Armed Forces, as well as local surveying, the land to be cleared is classified as low, medium or high risk, and by the type of potential explosive contamination identified.

This will give permission to plan and mobilise teams of demining specialists and the technical equipment needed for the activity. All areas are considered for demining, even low-risk areas have to be cleared unless they have a prior demining certificate, as is the case with roads, villages and residential areas. All areas in the 45 metre wide corridor of the route will be considered safe after the demining works, as they will be certified by the accredited operator.

No area is considered safe until mine clearance certification has been issued. It may be that some areas, fields or residential areas have previously been certified as cleared, even if they are within the 45 metre corridor of the transmission line.

The technology and methodologies to be used in the demining process will be explicitly detailed in the Demining Plan. This plan must be drawn up in a manner consistent with the survey and analysis of information. In Angola, the focus will be on anti-personnel mines. Consequently, manual demining should take place using metal detectors operated by trained technicians and with appropriate protection. In the event that specific areas are identified as containing anti-tank mines, the Plan will take into account these special circumstances and the necessary technology and methodologies.

Deforestation

When tree felling is necessary, all activities will be supervised by suitably qualified staff. The undergrowth and slow-growing trees will be removed using a front-end forklift. All bushes and trees will be cut into pieces of wood before leaving the site, and the wood will then be placed on the roadside, available for neighbouring communities to use as firewood or for construction. Deforestation will be kept to a minimum and will only take place if necessary. The transmission line structures will be placed on the land defined for each tower, in an area of 30 x 30 metres. The tower structure will be assembled and erected on the land indicated for it. The total area of land cleared to accommodate the tower (area for permanent positioning of the tower) is 7 x 7 metres.

In total, approximately 136 towers will be erected, spaced about 360 metres apart. **Table 2-2** summarises the areas to be cleared for all 136 towers.

Table 2-2: Areas needed for the towers.

Activity	Number of Torres	Area Occupied by Each Tower (m)^2	Total area of Deployment (ha)
Preparation of the ground for the towers (construction phase - temporary)	136	30 x 30 m = 900 m²	12,24
Physical implementation of the towers (phase of construction - permanent)	136	7 x 7 m = 49 m²	0,66

During the operation phase, a 45 m protection corridor (22.5 m on each side of the transmission line) will be maintained along the approximately 49 km of the line, which will result in a permanent occupation of approximately 220.5 ha. This area will be subject to a number of restrictions as defined in **Table 2-3**.

Table 2-3: Minimum safety distances between conductors and obstacles.

Nominal voltage (220 kV)	Distance (m)
Soil	12
Trees	5
Watercourses	7,1
Buildings	6
National or municipal roads	12
Electrified railways	11,50
Non-electrified railways	8
Airlines (e.g. telecoms)	3

According to the RNT procedure, a protection corridor (*RoW*) needs to be maintained to guarantee the safety of the TL. The minimum crossing widths required for distribution lines are given in **Table 2-3** and **Figure 2-9**.

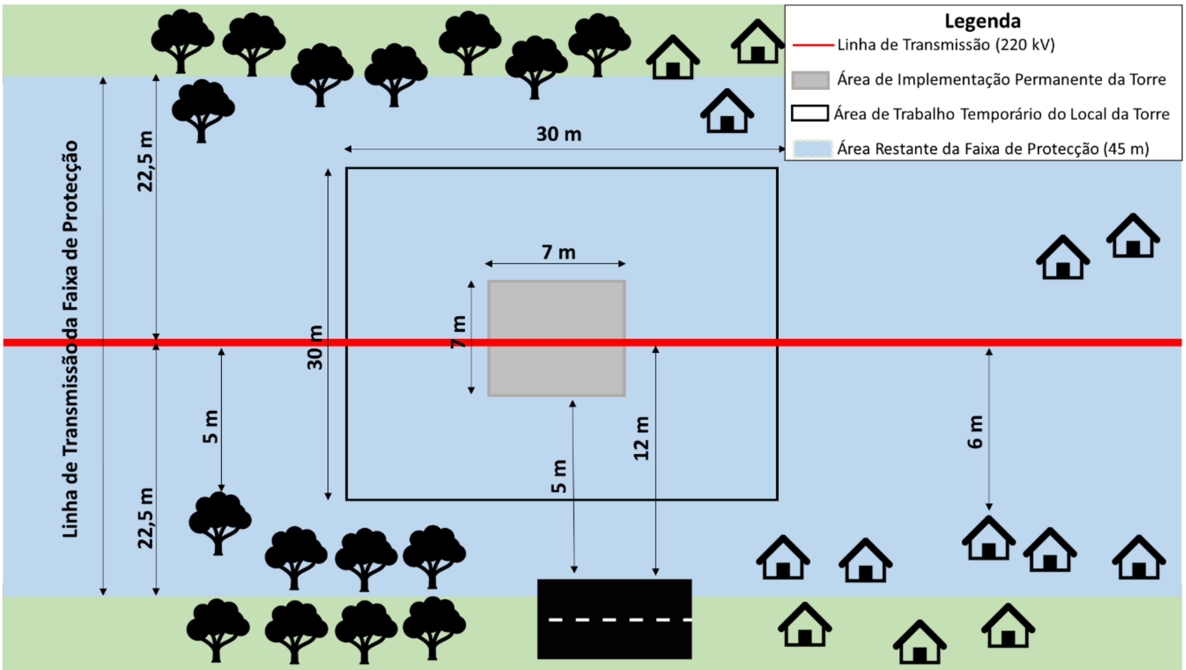

Figure 2-9: Restrictions required for the 220 kV transmission line.

The protection corridor will therefore impose restrictions on land use within the transmission line route. A 30 metre (15 metres on each side) wide corridor will be cleared of trees and obstacles within the easement and 7 x 7 m for the towers, see **Figure 2-10**. Access roads will be required for construction purposes and will remain in place for the operational lifetime of the infrastructure, as they will continue to be used for maintenance. Local and existing access roads should be used wherever possible, with other access and inspection roads created in the protection corridor along the transmission line where necessary.

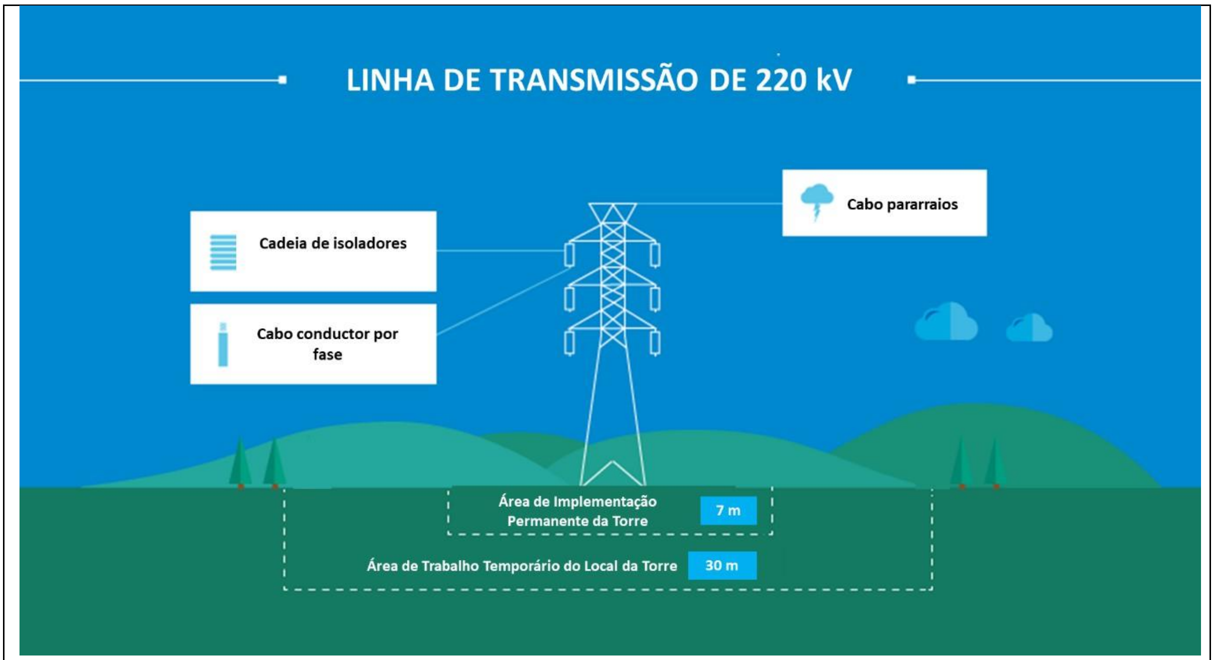

Figure 2-10: Restrictions on land use along the transmission line route.

Construction Phase Activities

Construction activities for transmission lines include excavation of the site, construction of the concrete base to support the towers that will accommodate the transmission lines, including the implementation of spikes, transport of tower components and other raw materials, assembly and erection of the towers, laying of the transmission lines and on-site rehabilitation.

The dimensions of the foundations depend on the soil conditions and the type and height of the tower. Drills will be used to excavate the foundations and install the tower anchors. In the end, the foundations will be filled with concrete. The concrete will be obtained from lorries that will come to the site or it can be prepared *in situ*. The footprint caused by the tower foundations varies according to the size/power of the line. Typical vehicles used on site for all transmission lines include lorries with material and tools, team vans, drilling machines, backhoes and light vehicles. The composition of the teams differs depending on the activity being carried out, for example for foundations, erecting the towers or laying the cables.

2.7 Transmission Line

The single-circuit overhead line will consist of three conductors arranged in a horizontal track and two guard cables, one of which is OPGW.

Support

The supports will be metallic from the "FSD" family for High Voltage Overhead Lines from the company FISOLA- Fábrica de Isoladores Elétricos Lda. The type to be used and the main dimensions of the planned supports are shown in **Table 2-4**.

Table 2-4: Specifications of the main elements for Very High Voltage (VHV) overhead lines.

Post Type	Minimum usable height soil (m)	Maximum usable height to the ground (m)	Maximum height support (m)	Width (m)
FSD-S-H	17,4	32,1	36,6	15,8
FSD-A-H	17,4	32,1	38,8	16,3
FSD-T-H	17,4	32,1	38,8	16,3

The values resulting from the mechanical calculation of the supports will always be within the limits set by the manufacturer. The following figures show the schematics of the metal poles that will be used in this project.

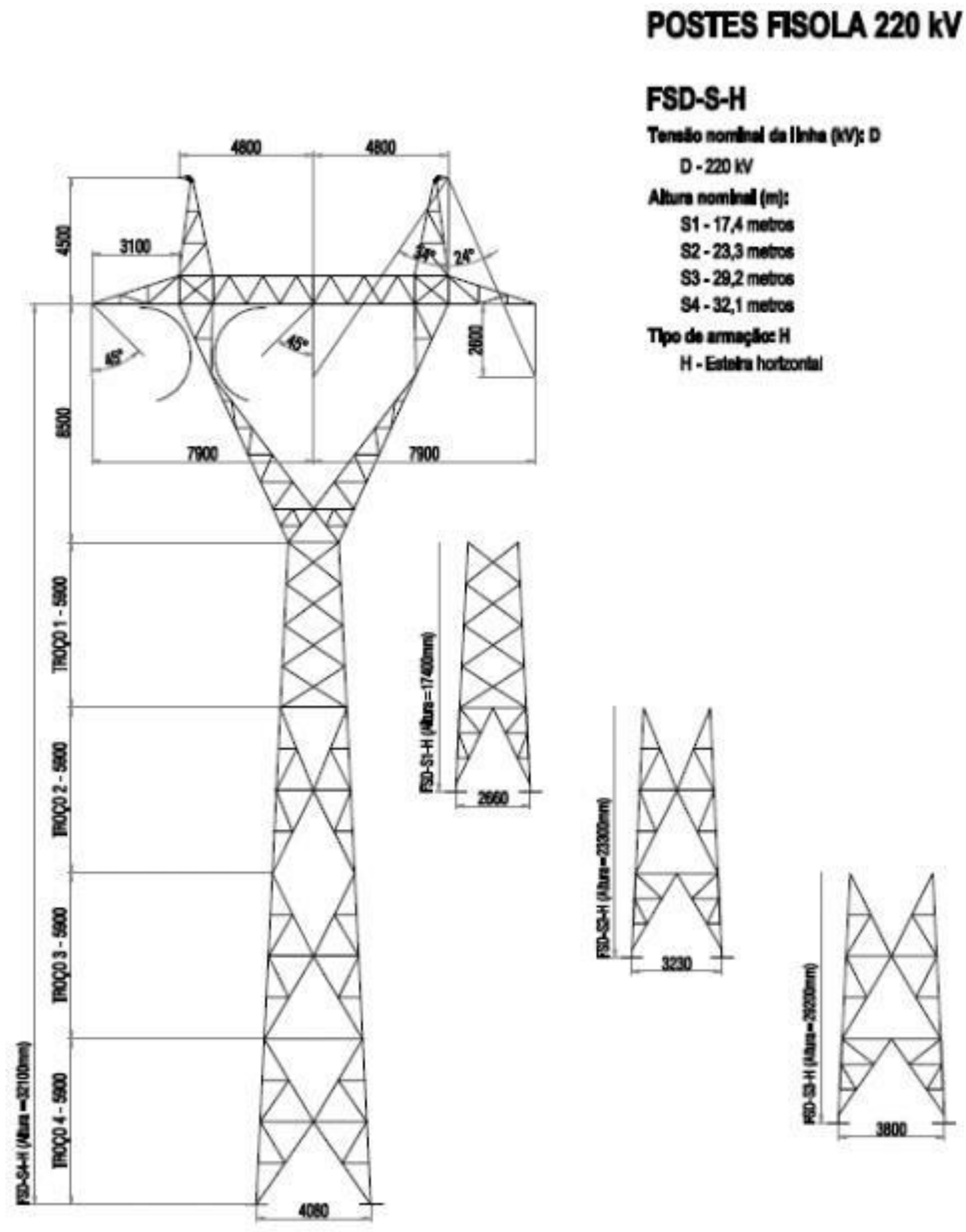

	Figure 2-11: Schematic of the FSD-S-H metal pole.

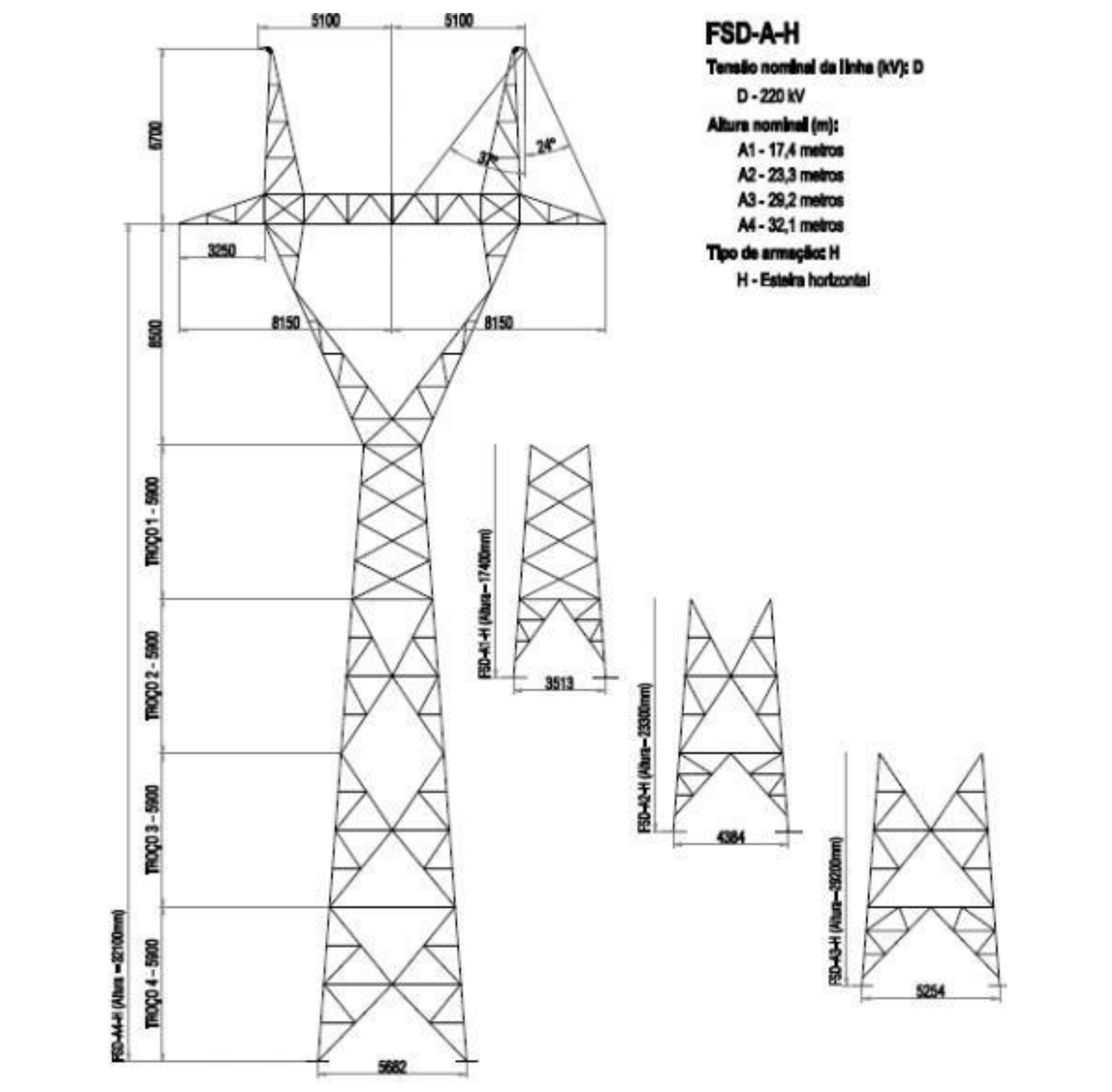

Figure 2-12: Schematic of the FSD-A-H metal pole.

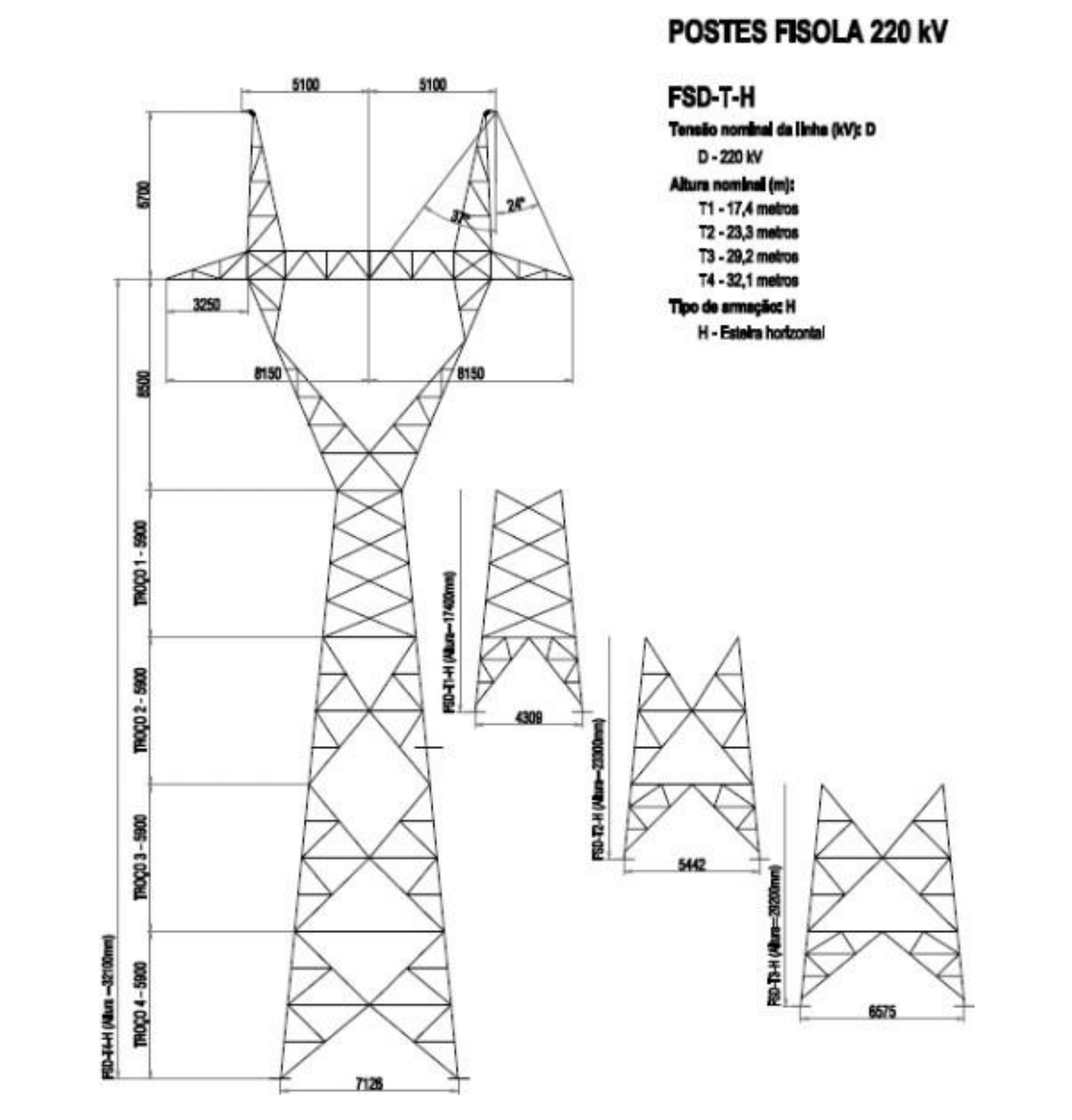

Figure 2-13: Schematic of the FSD-T-H metal pole.

Foundations

In terms of foundations, and as recommended by the manufacturer FISOLA, the foundations are made up of four separate concrete blocks, the stability of which is based mainly on the vertical reactions of the ground. Each of these blocks is sized to resist pull-out and distribute compression in the ground. Safety coefficients of 1.5 and 1.25, respectively for non-accidental loads, are taken into account when checking these foundations. They are designed to soils consisting of lightly compacted, unsaturated sands with β angles of 20°, 25° and 30° and yield strength of 250 kPa.

The base of each tower will occupy an area of between 16 m^2 and 49 m^2 and its foundations will have a mass of between 5 m^3 and 18.17 m^3 , depending on the type of tower. The excavation volume will vary between 21.2 m^3 and 85.8 m^3 .

Conductors and Earth Cables

The earth conductors and cables will have the characteristics shown in **Table 2-5**.

Table 2-5: Characteristics of earth conductors and cables.

Parameters	Drivers	Earth cable
Cable type	ACSR CROW Cable 408.5	ALUMOWELD 19 No9 Awg
Total Section (mm)^2	408,5	126,10
Aluminium section (mm)^2	361,62	-
Steel Section (mm)^2	46,87	-
Diameter (mm ⌀)	26,28	14,5
Composition (no. of threads x mm ⌀)	54x2.92+7x2.92	19 (ACST
Resistance (Ω/km at 20ºC)	0,0798	0,6821
Linear weight (kg/m)	1,368	0,841
Breaking load (kg)	11927	15550

The conductors and earth cable will be installed so as not to exceed the limit values defined in ET-E-119-Ed.A.

Chains and Accessories

The lashing and suspension chains will consist of 14 elements, type U160BS. All the chains have discharge rods in accordance with specification ET-E-111-Ed.A.

Crossings and intersections

The most important crossings of watercourses and road/rail infrastructure identified so far are described in **Table 2-6**. These aspects may be altered after analysing the LiDAR survey.

Table 2-6: Main crossings and intersections in the proposed route.

#	Location (between vertices)	Distance to origin (m)	Name
1	V3 - V4	995	Small Watercourse
2	V3 - V4	1908	Small Watercourse
3	V3 - V4	2280	The Way
4	V3 - V4	2720	Small Watercourse
5	V3 - V4	3673	The Way
6	V3 - V4	3890	The Way
7	V4 - V5	4573	The Way
8	V6 - V7	5188	Water course
9	V7 - V8	5862	The Way
10	V7 - V8	6762	Small Watercourse
11	V8 - V9	8159	The Way
12	V8 - V9	8535	The Way
13	V8 - V9	9855	Small Watercourse
14	V8 - V9	10549	The Way
15	V8 - V9	11040	Road
16	V10 - V11	13850	Small Watercourse
17	V11 - V12	16810	The Way
18	V11 - V12	17235	The Way
19	V11 - V12	18594	The Way
20	V11 - V12	20584	The Way
21	V11 - V12	21931	The Way
22	V11 - V12	22150	The Way
23	V11 - V12	22813	The Way
24	V11 - V12	22997	The Way
25	V12 - V13	26396	The Way
26	V12 - V13	26766	The Way
27	V12 - V13	28321	The Way
28	V13 - V14	31319	Railway
29	V13 - V14	31383	The Way
30	V13 - V14	31991	Small Watercourse
31	V13 - V14	32685	Small Watercourse
32	V13 - V14	32971	The Way
33	V14 - V15	33238	Railway
34	V14 - V15	33342	The Way
35	V14 - V15	36725	The Way
36	V14 - V15	37882	Small Watercourse
37	V14 - V15	38157	Railway
38	V15 - V16	40502	The Way
39	V15 - V16	40855	Small watercourse
40	V15 - V16	41275	The Way
41	V15 - V16	42670	The Way
42	V15 - V16	42803	The Way
43	V15 - V16	42952	Road

#	Location (between vertices)	Distance to origin (m)	Name
44	V16 - V17	43948	The Way
45	V16 - V17	44732	Small Watercourse
46	V16 - V17	45937	The Way
47	V16 - V17	46280	The Way
48	V17 - V18	47578	The Way
49	V17 - V18	47663	The Way
50	V17 - V18	47717	The Way
51	V17 - V18	48026	The Way

The vertical distance between the lower conductor of the very high voltage line and the aforementioned road and railway infrastructure will always be greater than the regulatory minimum. In the event of an intersection with medium-voltage lines, the vertical distance between the lower conductor of the high voltage line and the upper conductor of the medium voltage line is, in all cases, greater than the regulatory minimum.

At this stage, no crossings were identified with low, medium or high voltage power lines or telecommunications lines.

Signal sets

At each support there will be signs clearly visible from the ground with the following content:

- Signpost or warning plate with the text "DANGER TO DEATH" and the order number of the support on the line.
- Identification plate with the name (acronym) of the line and the telephone number of the responsible institution (RNT).

Large signalling units suitable for aerial inspection of the line are installed on the supports which are numbered in multiple tens. These same supports are labelled with the phases of the conductors.

Aerial beaconing

Aircraft signalling: In the event of line signalling, alternating red or international orange and white spheres with a minimum diameter of 0.6 metres should be installed on the guardrail cables, in accordance with ICAO recommendations.

Bird signalling and nest construction conditioning: The bird signalling devices are of the "BFD" (*Bird Flight Diverter*) type, consisting of spirals 30 cm in diameter, which are fixed to the guard cables at regular intervals, of the appropriate length for each situation.

BFD devices have a helical shape, are made of plastic, white or orange in colour, and fit onto the guard cable by winding. At one end, these devices have a larger diameter ring that protrudes from the cable profile. This ring, combined with the colour of the device, significantly increases the visibility of the cable to birds, without making it look bulky and without introducing any significant increase in the area exposed to the wind.

The ecology studies (birdlife) to be carried out as part of the executive project, as well as the Environmental Impact Study, will identify the areas to be signposted with BFDs, as well as the supports where nesting platforms will be installed.

2.8 Dango Bethlehem Substation

2.8.1 Description of Work at the Belém do Dango Substation

The Substation Extension Project includes the following components:

- Extension of the 220kV busbar to two panels;
- Relocation of existing busbar voltage transformers;
- Construction of a 220kV line panel within the substation's existing platform.

Civil works will be required, which in general include foundations, cable ducts, earthworks and so on. No works or earthworks are planned outside the perimeter of the current substation. The three parts of the project are summarised below.

Current situation

The substation currently has enough power to meet the needs of the new Longonjo Mine substation. There is currently a spare line panel (P209) equipped, which will be used to connect the new 220kV line. A new reserve (P213), which will involve relocating the existing voltage transformers and extending the existing 220kV busbars (see **Figure 2-14**).

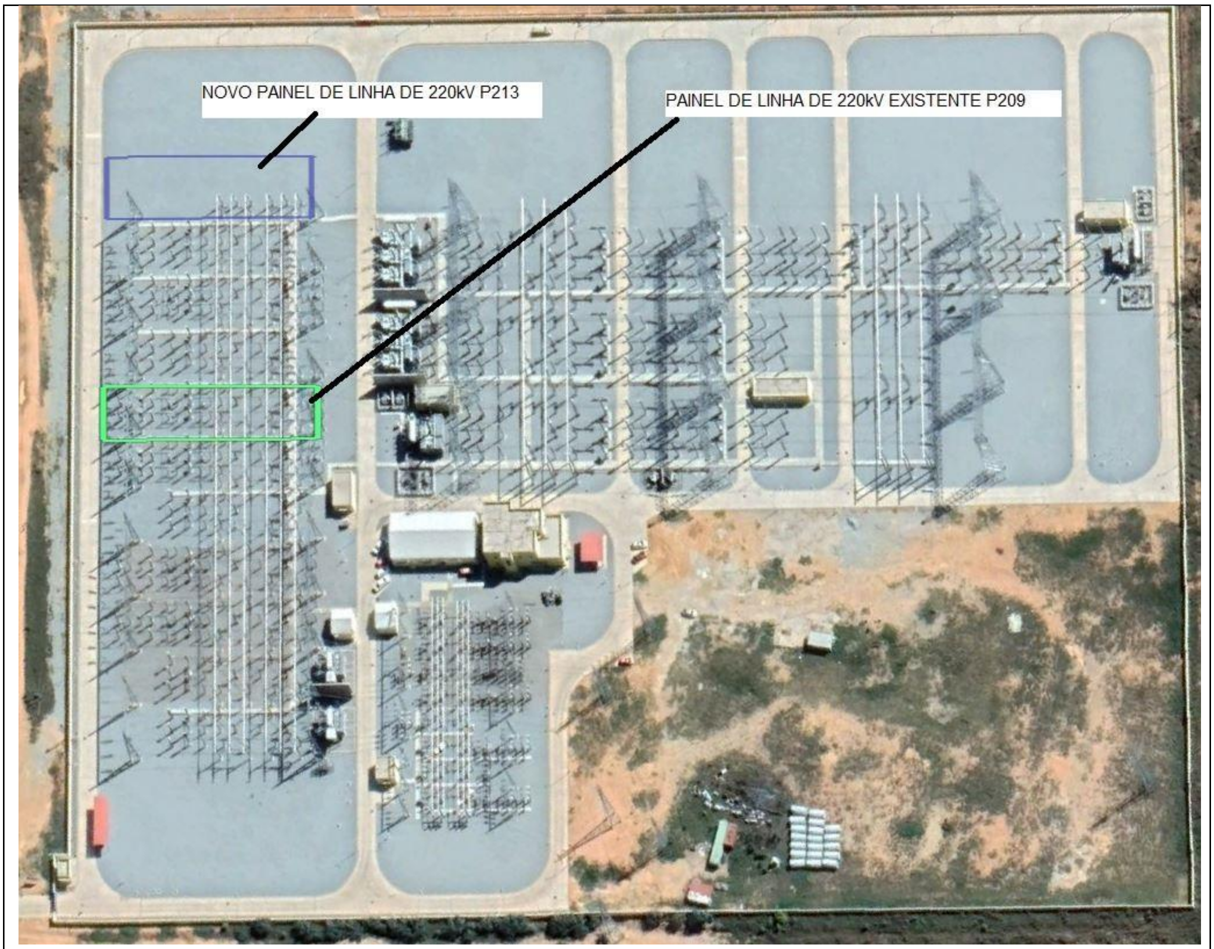

Figure 2-14: Detail of the Belém do Dango substation, Huambo.

Uninstalling the existing transformers would mean power cuts, as well as a high economic investment for the removal, transport and installation in a new location, as well as the economic investment to reuse the space currently used in the Belém do Dango substation. For these reasons, it was proposed to supply, assemble and commission a new 400/220 kV 450 MVA power transformer.

2.8.2 Description of Equipment to be Supplied

The equipment to be installed is described below.

220 kV Line Panel

The park equipment will include the following:

- Three (3) ZnO lightning conductors for 220 kV;
- Three (3) 220 kV voltage measurement transformers;
- Three (3) current measurement transformers for 220 kV;
- One (1) SF6 three-pole circuit breaker for 220 kV;
- Two (2) 220kV three-pole pantograph busbar disconnectors;
- One (1) Horizontal three-pole disconnector without 220kV circuit-breaker isolating earth blades;
- One (1) Horizontal three-pole disconnector with 220kV circuit-breaker isolation earth blades;
- One (1) Horizontal three-pole disconnector without earth blades for bypassing the 220kV circuit-breaker;
- One (1) set of supplies for electrical and mechanical assembly (control cables, connection piece, electrical conductors, small insulators, fasteners, assembly profile...).

The control and line protection cabinets will include:

- SPT1 - Differential line protection (87L);
- SPT1 - Emergency distance protection (21)
- SPT2 - Distance protection (21)
- SPT1 and SPT2 - Protection Maximum intensity (50)
- SPT1 and SPT2 - Maximum protection intensity Emergency (50)
- SPT1 and SPT2 - Directional Earth Protection (67N)
- SPT1 and SPT2 - Directional Protection (67)
- SPT1 and SPT2 - Overvoltage protection (59)
- SPT1 and SPT2 - Undervoltage protection (27)
- BCU1 - Control device for the line panel.

220 kV busbar

The park equipment will include two (2) sets of supplies for mechanical assembly (metal structures, connection parts, pipes).

Bar Voltage Panel

The park equipment will contain the following:

- Six (6) voltage measurement transformers for 220 kV (Existing);
- Six (6) Metal structures (Existing)
- Two (2) Cable Regrouping Boxes (Existing)
- Two (2) sets of supplies for mechanical assembly (low voltage cables, connection piece, electrical conductors, fasteners, assembly profile...).

The existing equipment in the busbar voltage cabinets will remain unchanged.

Auxiliary Services Network

The auxiliary services network is considered to be existing and sized for the substation's entire expansion capacity. As such, no changes or supplies are planned in this area.

2.8.3 Building work

The civil works to be carried out will be those necessary for the installation of the planned equipment. The existing platform has been regularised and work will begin on removing the existing gravel for final replacement. The main works to be carried out are as follows:

- Excavation and earth transport from the substation platform to landfill;
- Opening and closing trenches for the earthworks;
- Construction of all the massive equipment support structures;
- BT cable trays.

The following Protection and Control equipment will be installed: 1 Protection and Control panel for the 220 kV park's busbar sectioning, comprising: 2 Control and Synchronising Protection Relays (25), one for each busbar. The protection panel will be retained for the existing busbar coupling.

2.8.4 Services and Supplies

Substation services and works basically comprise the following groups of activities:

- Development of the executive project;
- Purchase of equipment;
- Construction work;
- Reinforcement of the ground network;
- Installation of the necessary structures for the equipment to be installed;
- Assembly of the equipment to be supplied;
- HV (high voltage) and LV (low voltage) connections for the equipment to be supplied;
- Preparation of the Protocol for Global Commissioning Tests;
- Commissioning tests.

2.9 Longonjo substation

2.9.1 Description of work at the Longonjo substation

The new Longonjo substation will consist of two (2) areas, namely a 200 kV area and a 30 kV area.

- 220 kV area:

The 220kV level will have a Double Main Busbar (BI and BII) and By-pass Busbar (BBP) configuration to the line panel circuit breaker. Constructively, this is a conventional outdoor installation with air insulation, whose panels have a 15 metre pitch. The installation of:

- One (1) 220kV line panel;
- Two (2) 220/30kV transformer panels including 2 power transformers with a capacity of 100MVA each;

- One (1) 220kV interbar panel;
- Three (3) 220kV busbars (two main + one by-pass).

The initial configuration, in the 220 kV zone, includes the panels needed to supply the Longonjo mine with an exclusive line supply from the Belém do Dango substation. The substation's final configuration includes the installation of a second 220 kV line panel to integrate the substation into a radial network of Angola's electricity transmission network in order to increase the substation's availability.

- 30kV area:

The 30kV level will have a single busbar configuration with sectioning (BI and BII). The MV armoured metal switchboard (QMMT) will be interior-mounted and air-insulated. The installation of:

- Two (2) 30 kV Arrival panels;
- Four (4) 30 kV line panels;
- One (1) 30 kV bar disconnection panel.

2.9.2 Description of Equipment to be Supplied

220kV Line Panels

The park equipment will include the following:

- Three (3) ZnO lightning conductors for 220 kV;
- Three (3) 220 kV voltage measurement transformers;
- Three (3) current measurement transformers for 220 kV;
- One (1) SF6 three-pole circuit breaker for 220 kV;
- Three (3) 220kV three-pole pantograph busbar disconnectors;
- One (1) three-pole horizontal isolating 220kV circuit-breaker;
- One (1) 220-kV three-pole vertical earth knife disconnector;

- One (1) set of supplies for electrical and mechanical assembly (control cables, connection piece, electrical conductors, small insulators, fasteners, assembly profile).

The control and line protection cabinets will have the following types of protection installed:

- SPT1 - Differential line protection (87L);
- SPT1 - Emergency distance protection (21)
- SPT2 - Distance protection (21)
- SPT1 and SPT2 - Protection Maximum intensity (50)
- SPT1 and SPT2 - Maximum protection intensity Emergency (50)
- SPT1 and SPT2 - Directional Earth Protection (67N)
- SPT1 and SPT2 - Directional Protection (67)
- SPT1 and SPT2 - Overvoltage protection (59)
- SPT1 and SPT2 - Undervoltage protection (27)
- BCU1 - Control device for the line panel.

220/30kV Transformer Panels (2Un)

The park equipment will include the following:

- Eight (8) ZnO lightning conductors for 220 kV;
- Six (6) current measurement transformers for 220 kV;
- Two (2) SF6 three-pole circuit breakers for 220 kV;
- Four (4) 220 kV three-pole pantograph busbar disconnectors;
- Two (2) sets of supplies for electrical and mechanical assembly (control cables, connection piece, electrical conductors, small insulators, fasteners, assembly profile).

The transformer control and protection cabinets will have the following types of protection installed:

- SPT2 - Distance protection (21)
- SPT2 - Maximum protection intensity Emergency (50)
- SPT2 - Directional Earth Protection (67N)

- SPT1 and SP2 - Differential transformer protection (87T);
- SPT1 and SP2 - Maximum intensity protection (50/51)
- SPT1 and SP2 - Maximum intensity protection Homopolar (50N)
- BCU1 - Control device for the line panel.

220kV Interbar Panels

The park equipment will include the following:

- Three (3) current measurement transformers for 220 kV;
- One (1) SF6 three-pole circuit breaker for 220 kV;
- Three (3) 220 kV three-pole pantograph busbar disconnectors;
- One (1) 220 kV three-pole pantograph busbar by-pass disconnector;
- One (1) set of supplies for electrical and mechanical assembly (control cables, connection piece, electrical conductors, small insulators, fasteners, assembly profile).

The interbar control and protection cabinets will have the following types of protection installed:

- SPT1 - Distance protection (21)
- SPT1- Protection Maximum intensity (50)
- SPT1 - Overvoltage protection (59)
- SPT1 - Undervoltage protection (27)
- BCU1 - Control device for the line panel.

2.9.3 30 kV equipment

30 kV metal switchgear

The metal frame equipment includes:

- Two (2) 30kV input cells;
- Two (2) TT 30kV Metering Cells
- Four (4) 30kV output cells;
- One (1) 30kV busbar disconnection cell

- One (1) set of supplies for electrical and mechanical assembly (control cables, connection piece, electrical conductors, small insulators, fasteners, assembly profile...).
- Two (2) sets of MV cables between the output of the power transformers and the 30kV Input cells, including terminals, heat shrink sleeves and fixings;

MT cell control and protection cabinets include:

- SPT/BCU1 - Protection Maximum intensity (50)
- SPT/BCU1 - Maximum protection intensity Homopolar (50N)
- SPT/BCU1 - Directional Ground Protection (67N)
- SPT/BCU1 - Protection Broken conductor detection (50 BF)
- SPT/BCU1 - Overvoltage protection (59)
- SPT/BCU1 - Undervoltage protection (27)
- SPT/BCU1 - Control device for the panel.

Neutral Reactance with Auxiliary Services Transformer

Equipment includes:

- Two (2) Neutral reactors with auxiliary services transformer;
- Two (2) sets of MV cables between the output of the power transformers and the reactors, including terminals, heat shrink sleeves and fixings;

Auxiliary Services Network

The network of auxiliary services is distributed throughout the facility and its architecture is basically as follows:

- There will be two power supplies, consisting of the two 0.4 kV medium-voltage auxiliary services transformers, which supply the 400/230 V alternating current auxiliary services switchboard, to be installed in an auxiliary services cabinet located in the Command building.

- The SSAAs will be powered by a direct current source consisting of a 110 Vdc rectifier/acid battery combination. The battery will power the DC Auxiliary Services Board.

The equipment that forms part of the auxiliary services network is basically as follows:

- Two (2) SSAA transformers, 400V, 50 Hz, 4% Vac, ZY connection;
- One (1) AC auxiliary services board;
- One (1) rectifier, battery charger and batteries;
- One (1) DC auxiliary services board;
- One (1) emergency generator set for auxiliary services.

Building work

The civil construction work required for the installation of the new substation includes the entire area destined for the substation as well as its surroundings. The main works are as follows:

- Earthworks to level the substation platform (101 m x 115 m);
- Deforestation of the substation area;
- Excavation and earth transport from the substation platform to landfill;
- Backfill of the platform to raise the level of the substation platform;
- Regularisation of the platform, providing for the storm sewer network;
- Construction of the substation fence;
- Opening and closing trenches for the earthworks;
- Spreading a layer of gravel over the entire substation platform area;
- Construction of all massifs and equipment support structures;
- Two 220/30 kV transformer laying bases;
- Construction of an underground oil collection tank connected to the transformer foundations, designed to prevent oil leaks to the outside;
- MV and LV cable ducts;
- Command building.

Building

The substation control building will be a one-storey technical building with divisions in accordance with drawing AO.20.4.2.6-101. The building will be compartmentalised as follows:

- One (1) SSAA control room, protection and cabinets;
- One (1) 30 kV cell room;
- One (1) Telecommunications room;
- One (1) WC;
- One (1) cup;
- One (1) electrical generator room
- One (1) warehouse.

2.10 Water and Energy

During the execution of this project, the existing water and power infrastructures at the Belém do Dango substation will be used. Power from the Belém do Dango substation will be supplied via the existing transmission line fed by the Laúca dam.

For the construction of the 220 kV TL and the new SE at the Longonjo mine, autonomous generator sets will be available to supply power during construction activities, where total consumption of 181 625 litres of diesel is expected. During the operating phase, annual consumption is expected to be 2479 litres of diesel. The water needed for the construction phase will be sourced locally from a river (yet to be defined) and stored in PVC tanks for this purpose, with a total consumption of 316,576 litres of water expected. For the operation phase, annual consumption is expected to be 1,825 litres.

2.11 Waste and Effluent

During the implementation phase of the project, various types of typical construction waste will be generated, such as mixtures or separate batches of concrete and bricks, metals, wood, plastics, paper, lubricating oil, among others. For this and all other waste generated, the substation's existing waste management facilities will be used during the execution of the work and, when necessary, the following will be used

In addition, other appropriate containers were used and labelled in accordance with national legislation. A Waste Management Plan (WMP) was drawn up for the project, which includes the procedures for handling waste, whether hazardous or not, during the execution of the work. This RMP was drawn up in accordance with current legislation, specifically Presidential Decree 190/12 of 24 August.

For the project, an estimate was made (based on previous similar projects) of the quantities of some waste produced during the construction phase. The quantities expected for some of the waste are shown below:

- Wood - 500kg;
- Plastic - 150kg;
- Metals - 400kg;
- Paper/Cardboard - 200kg;
- Water (Effluent) - 16,671 litres.

2.12 Gas emissions

During the work associated with the project, polluting gases will be released into the atmosphere. These emissions will essentially be associated with the combustion of fossil fuels, mainly diesel from the machines, vehicles and generators used during the construction phase. Based on a calculation of the volume of fuel to be used during construction work, a total emission of 495 tonnes of CO_2 is expected. During the operation phase, no emissions are expected from equipment in operation, only from maintenance and repair work on the transmission line and substation. It is therefore not possible to predict/calculate these emissions at this stage.

2.13 Shipyard

ENERLINE's existing facilities in Huambo (on the national road to Caála) will be used as a construction site, which will also be used to house ENERLINE workers who are not resident in Huambo.

During the construction phase, various pieces of mechanical equipment will be used. As the site has 24-hour surveillance, the equipment used on a day-to-day basis will be stored on site whenever it is not in use.

To support the construction and installation activities of the new equipment, a yard will be established (see layout presentation in **Figure 2-15**) in the project area that will cover the substation area inside, will be about 160 x 200 metres and will also be used for storing equipment and materials. The site will be equipped with offices, toilets, storage and maintenance rooms. The workers will be housed in existing houses in Longonjo and Huambo.

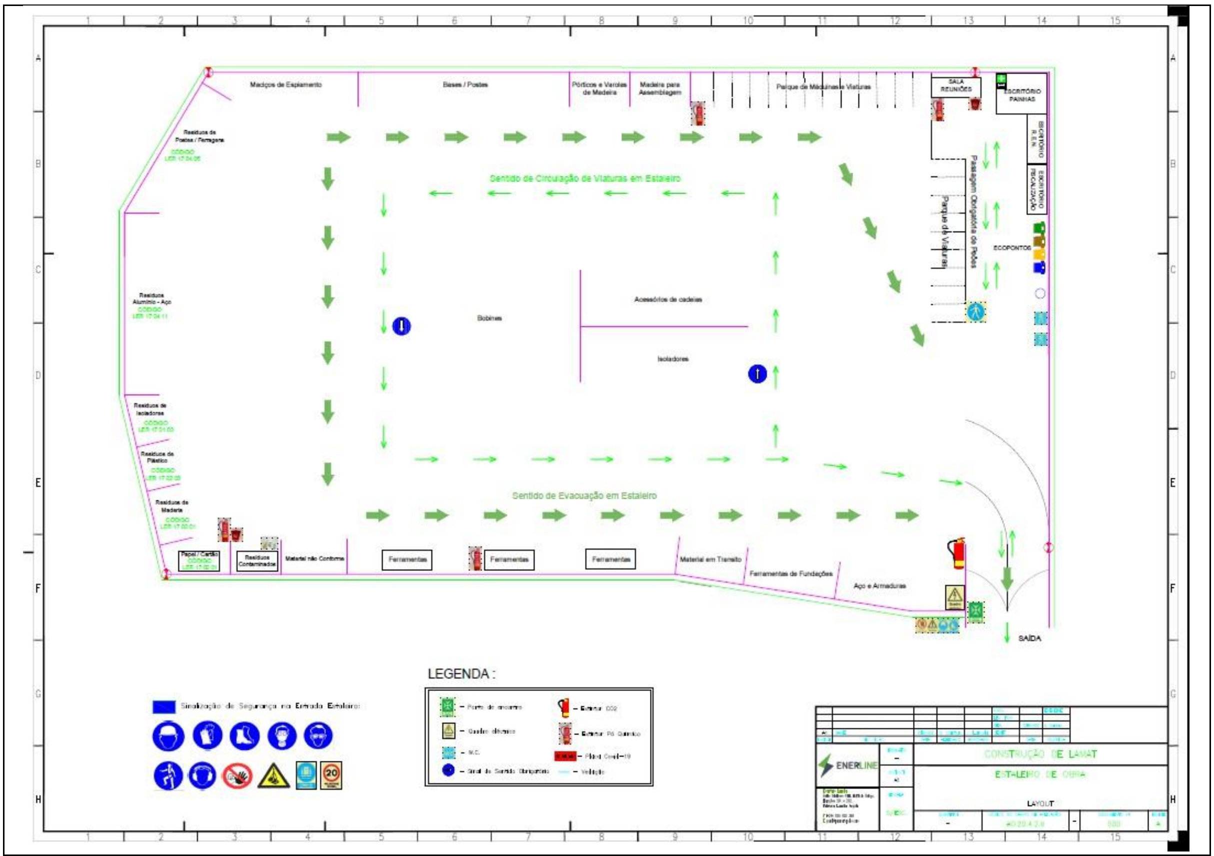

Figure 2-15: Layout of the construction site in Longonjo to support the project.

2.14 Equipment

During the construction work, various pieces of equipment and machinery will be used to carry out the project. Among all the equipment to be used, the following can be highlighted: machine lorry, crane lorry, self-propelled crane, *pickups,* tractors, winch/brake set, backhoe loader, generator, lifting platform, among others. During the operation phase, the equipment to be used will be associated with maintenance and repair work, which may include the aforementioned.

2.15 Access routes

To support the construction and installation of the towers, access roads will be established to the location of each tower, approximately 6 metres wide. Whenever possible, existing accesses, roads and paths will be used.

2.16 Raw Material Sourcing Zones

The construction and installation of the towers will require the use of a number of raw materials that will be obtained locally, namely around 410 tonnes of cement, 642 tonnes of sand and 1270 tonnes of burgau. The concrete plant and quarry are located on EN 120 Huambo-Caála, Belém neighbourhood in Huambo.

2.17 Timetable

Work, characterised by demining activities along the transmission line route and at the site of the future Longonjo Mine ES, is scheduled to begin in February 2022. Construction work is scheduled to begin in March 2022, starting with the extension of the Belém do Dango power station and the construction of the future Longonjo Mine power station.

Construction work on the project will take twelve (12) months from the date on which the contract with a contractor enters into force. The hiring of the contractor, as well as the start of the activities depends on the approval of funding for this project. The operation phase will last 40 years.

2.18 Labour force

A workforce of around 70 people will be needed, 60% of whom will be hired locally. The number of accommodation places for the workers will depend on the number of contractors involved, which has not yet been defined.

2.19 Global Investment

The estimated budget for the 220 kV transmission line project between Belém do Dango and Longonjo is in the region of USD 35,000,000.

CHAPTER 3

INSTITUTIONAL AND LEGAL FRAMEWORK

3 INSTITUTIONAL AND LEGAL

This chapter focuses on Angola's legislative framework and highlights the specific environmental legislation applicable to any project in the energy sector, specifically the 220kV Transmission Line between Belém do Dango and Longonjo. It also includes international organisations and standards, multilateral environmental agreements to which the Republic of Angola is a signatory.

3.1 Institutional Framework

The planning of projects whose activities could contribute negatively to the quality of the environment and the social harmony of the population must be regulated by the Angolan Executive through the various government institutions that make up its organisational structure, as well as relevant sectoral legislation. It is also the role of the Angolan Executive to foster and encourage public and private initiatives that bring social, economic and environmental benefits to the country. Taking into account the nature of the region, the above responsibilities and those set out in the environmental legislation in force fall to the Ministry of Energy and Water (MINEA), the Ministry of Culture, Tourism and Environment (MCTA), the Ministry of Agriculture and Fisheries (MINAGRIP) and the Government of Huambo Province.

3.1.1 Ministry of Energy and Water

This Ministry was created by Presidential Decree 223/20 of 28 August. It is responsible for executing and controlling the Executive's policy in the fields of energy and water. These duties are carried out by its central executive services, namely the National Directorate of Electricity; Local and Rural Electrification; and Renewable Energy and Water. The National Directorate of Electricity is the direct executive service of the Ministry of Energy and Water (MINEA), which aims to plan, study, design and monitor the implementation of the policy on the production, transport, distribution and use of electric energy. The national companies responsible for the electricity sector are: Public Electricity Production Company (PRODEL), National Transmission Network (RNT) and National Electricity Distribution Company (ENDE).

3.1.2 Ministry of Culture, Tourism and Environment

The Ministry of Culture, Tourism and the Environment, abbreviated to MCTA, restructured under Presidential Decree no. 162/20 of 8 June, is the body responsible for formulating, conducting, overseeing, evaluating and executing the Executive's policies in the field of culture, tourism and the environment, and conducting strategies for programmes and projects to promote culture, tourism development and environmental management. In the environmental field, the MCTA has the following duties, among others:

- ✓ Promote the public dissemination of information on the state of the country's environment;
- ✓ Ensuring the protection and preservation of environmental components, as well as the maintenance and improvement of ecosystems of recognised ecological and socio-economic value;
- ✓ Promoting environmental training and education, dialogue and citizen participation in order to gain a better understanding of environmental balance phenomena;
- ✓ Coordinate national actions in response to global environmental problems, by implementing the recommendations of international conventions and agreements;
- ✓ Carrying out environmental audits and environmental licensing of activities likely to cause potential significant environmental and socio-economic impacts and setting up environmental monitoring systems;
- ✓ Promote the management of conservation areas, including national parks, nature and biosphere reserves and landscape protection and preservation.

These duties are carried out by direct executive bodies and services, namely: the National Directorate for the Environment and Climate Action, the National Directorate for the Prevention and Assessment of Environmental Impacts (DNPAIA) and the National Institute for Environmental Management (INGA). The DNPAIA is responsible for implementing Presidential Decree 117/20 of 22 April on the General Regulations for Environmental Impact Assessment and the Environmental Licensing Procedure. This decree introduces the obligation to register projects in the Integrated Environmental System (SIA) - an electronic platform created by the MCTA (in accordance with Article 6); the categorisation of projects to be licensed (Article 7), which are listed in Annexes I, II, II, IV and V; the distribution of competences to the central body (ministerial department) and local government services (provincial governments) over the assessment of projects and the issuing of the respective licences (Article 8), the pre-assessment of projects for their subsequent categorisation (Article 9) and the inclusion of the

The EPDA is only required for Category A projects (Article 12). **Figure 1-1** in **Chapter 1** presents the general process of registration and environmental impact assessment.

3.1.3 Ministry of Agriculture and Fisheries

The Ministry of Agriculture and Fisheries (MINAGRIP), restructured under Presidential Decree no.177/20 of 23 June, is the body responsible for formulating, conducting, executing, controlling and supervising the Executive's policies in the areas of agriculture, livestock, forestry, food and food safety, management and planning of aquatic biological resources, sustainable fishing and aquaculture activities, salt production, research, experimentation and technological innovation in the area of the sea, prospecting, use, exploitation and enhancement of aquatic resources, and a sustainable sea economy from a sustainable development perspective.

The Ministry of Agriculture and Fisheries in the field of Agriculture, Livestock and Forestry has the following remit: to formulate and propose policies and strategies for national development in the fields of agriculture, livestock, forestry, food security and food, from a development perspective.

Approach to Angolan legislation on crop compensation

Compensation for economic crops and trees is based on the compensation rates established by the former Ministry of Agriculture and Forestry (now the Ministry of Agriculture and Fisheries). The latest available crop rates were established in 2018 and are presented in the table below (**Table 3-1**). It is understood that these rates are calculated on the basis of market rates with values provided in US dollars per hectare of crop. The 2015 version of the government's harvest rates provides more detailed rates, taking into account the maturity and size of the crop, as shown in **Table 3-2**.

Table 3-1: Government Compensation Rates for Crops and Trees (2018).

#	Crop/Tree	Production price (USD/ha)
1	Maize	424,4
2	Beans	296,4
3	Cassava	375,6
4	Potatoes	449,9

#	Crop/Tree	Production price (USD/ha)
5	Aubergine	388,8
6	Tomatoes	377,1
7	Pepper	387,3
8	Hose	477,3
9	Papaya	447,2
10	Banana tree	447,2
11	Orange tree	467,6
12	Limoeiro	451,9
13	Pineapple plant	436,1
14	Avocado	450,1

Table 3-2: Compensation rates for crops and trees (2015).

#	Crop/Tree	Production price (USD/ha)
1	Transplanting improved mango trees (nursery)	15 - 17
2	Medium mango tree planted in the ground	55
3	Local mango tree in production (i.e. productive tree)	120
4	Improved mango trees planted in the ground and producing	160
5	Cashew tree transplant (nursery)	8
6	Medium cashew tree planted in the ground	40
7	Medium cashew tree planted in the ground and productive	60
8	Banana tree/birch	8
9	Banana trees planted in the ground and productive	50
10	Cassava	1150/ha = 0.115 USD/m^2
11	Sweet potatoes	980/ha = 0.098 USD/m^2
12	Sugar apple tree or candy tree (i.e. *Annona squamosa*)	30
13	Soursop tree (i.e. Annona muricata)	30
14	Transplanting papaya trees (nursery)	8
15	Medium-sized papaya planted in the ground and productive	20
16	Papaya in production (i.e. productive tree)	55
17	Guava tree transplant (nursery)	8
18	Medium guava tree planted in the ground	30
19	Guava tree in production (productive tree)	60

#	Crop/Tree	Production price (USD/ha)
20	Passion fruit in production (productive tree)	30/m^2
21	Avocado tree transplant (nursery)	8
22	Medium avocado planted in the ground	60
23	Avocado in production (productive tree)	160
24	Tamarind	30
25	Lemon tree without fruit and in production	35-55
26	Lemon tree in production (i.e. productive tree)	100
27	Transplanting citrus trees (lemon, orange and grapefruit)	14-16
28	Medium orange planted in the ground	50
29	Orange tree in production (productive tree)	120
30	Coconut tree in production (productive tree)	80
31	Transplanting shade trees and ornamental plants (**)	30
32	Medium shade tree planted in the ground	30
33	Large shade tree planted in the ground	80
34	Transplanting a pineapple plant	8
35	Pineapple plant, planted in the ground and productive	60
36	Tomato plant	5
37	Pomegranate tree	30
38	Aubergine	8
39	Okra plant	8
40	Gimboa Plant (Jimboa)	5
41	Pumpkin/melon/watermelon	10
42	Palm tree in production	60
43	Apple tree (i.e. *Annona squamosal*) in production	60
44	Various plants in production	1150/ha = 0.115 USD/m^2
45	Soursop tree (i.e. *Annona muricata*) planted in the ground and productive	35-70
46	Tamarind tree planted in the ground and productive	25-40
47	Sugarcane	450/ha = 0.045 USD/m^2
48	Pulses (G r o u n d n u t s , Kidney Beans and Macunde) in production	600/ha = 0.06 USD/m^2
49	Maize planted in the ground and productive	500/ha = 0.045 USD/m^2

Source: Ministry of Agriculture (Ministério da Agricultura e Florestas), 2015.
Notes: (*) Refers to a productive tree that is not bearing fruit at the time of the asset inventory, either because the fruit may already have been harvested or because the asset inventory is carried out at a time when the tree is not bearing fruit.

(**) Shade trees refer to any tree that does not bear fruit (e.g. baobab, acacia, neem, etc.) and is not considered ornamental, such as palm trees. These trees are compensated as part of a communal compensation package which usually consists of a nursery or tree planting campaign for the community.

3.1.4 Government of Huambo Province

The Provincial Governments, as Local State Administration bodies, monitor the implementation of public and private investment programmes and economic intervention projects in their respective provinces, and draw up provincial territorial plans. In the field of the environment and in accordance with the Law on the Organisation and Functioning of State Administration Bodies (Law no. 17/10 of 29 July), the Huambo Provincial Government is given the following powers:

- ✓ Promoting measures to defend and preserve the environment;
- ✓ Promoting actions, campaigns and programmes to create green spaces;
- ✓ Promote and encourage local business development initiatives;
- ✓ Promote sanitation and the environment, as well as the construction of rural and urban equipment, and promote environmental education campaigns; and
- ✓ Promoting and guiding socio-economic development based on the principles and strategic options defined by the State, as well as ensuring the provision of public services in the respective geographical area.

According to Presidential Decree no. 281/17 of 15 November, which approves the Regulation of the State's Local Administration Law, activities related to environmental issues at provincial level are the responsibility of the Provincial Office for the Environment, Waste Management and Community Services.

3.2 National Legislative

Article 21 of the Constitution of the Republic of Angola (of 5 February 2010) states that the fundamental tasks of the Angolan state are, among others, to promote harmonious and sustained development throughout the national territory, protecting the environment, natural resources and the national historical, cultural and artistic heritage. The need for environmental preservation, protection and conservation and the requirements for achieving sustainable development are based on the he right of all citizens to live in a healthy and unpolluted environment and the duty to defend and preserve it is enshrined in Article 39/1 of the Constitution.

Table 3-3 shows a summary of the legislation directly related to the 220 kV transmission line between Belém do Dango and Longonjo, from the point of view of the environment, the energy sector and occupational health and safety. **Annex 5** summarises the legislation relevant to the project's activities.

Table 3-3: List of legislation directly related to project activities.

Diploma	Name of legislation
Environmental sector	
Law no. 5/98 of 19 June	Basic Environmental Law
Presidential Decree no. 194/11 of 7 July	Liability for Environmental Damage
Executive Decree 87/12 of 24 February	Regulation on Public Consultations
Executive Decree no. 92/12 of 1 March	Terms of Reference for the preparation of EIAs
Presidential Decree no. 117/20 of 22 April	General Regulations for Environmental Impact Assessment and the Environmental Licensing Procedure
Presidential Decree no. 83/22 of 12 April	Table of Fees to be Charged for Issuing and Renewing Environmental Licences for Impact Assessment Environmental
Territorial Planning Sector	
Law no. 3/04 of 25 June	Town and Country Planning Law
Law no. 9/04 of 9 November	Land Law
Decree no. 58/07 of 13 July	General Land Concession Regulations
Biodiversity sector	
Resolution no. 1/10 of 14 January	National Policy on Forests, Wildlife and Areas Conservation
Executive Decree no. 252/18 of 13 July	Red List of Threatened Species
Presidential Decree no. 26/20 of 6 February	National Strategy and Action Plan for Biodiversity
Energy sector	
Decree no. 42895 of 31 March 1960	Substation Safety Regulations
Decree 46.847 of 1966	High Speed Transmission Protection Regulation Voltage
Law no. 14-A/96 of 31 May	General Electricity Law
Decree no. 41/04 of 2 July	Licensing Regulations for Energy Production, Transport and Distribution
Water sector	
Law no. 6/02 of 21 June	Water Law
Presidential Decree no. 261/11 of 6 October	Water Quality Regulation

Diploma	Name of legislation
Presidential Decree no. 82/14 of 21 April	Regulations for the General Use of Water Resources
Health and Safety Sector	
Executive Decree no. 6/96 of 2 February	General Regulations for Safety and Hygiene Services at work in companies
Executive Decree 128/04 of 23 November	General Regulations on Health and Safety Signs at work
Law no. 7/15 of 15 June	General Labour Law
Culture Sector	
Law no. 14/05 of 7 October	Cultural Heritage Law
General	
Presidential Decree no. 117/16 of 30 May	Relocation Regulations
Law no. 1/21 of 7 January	Public Expropriation Law

3.3 International Guidelines

For the development of projects in the energy transport sector, regional and international financial organisations have developed a set of guidelines relevant to the project in question, which are presented below.

3.3.1 International Commission on Non-Ionising Radiation Protection

As an independent organisation, the International Commission on Non-Ionizing Radiation Protection (ICNIRP) provides recommendations and scientific guidance on the effects of Non-Ionizing Radiation (NI) on the environment and health to protect populations and the environment from dangerous exposure to NI.

ICNRIP has prepared guidelines limiting exposure to electric, magnetic and electromagnetic fields of varying frequencies (up to 300 GHz). The ICNRIP guidelines, which include safety margins, are based on careful analysis of research results on the health effects of exposure to Extremely Low Frequency (ELF) fields. The guidelines were first proposed in 1990 and were reconfirmed in 1993 and 1998 after more recent research results were analysed.
ICNIRP concluded from the results of its research that the most obvious effects were those caused by currents induced in the body by ELF electric and magnetic fields. In very strong fields,

these induced currents can interfere with the body's nervous system and should therefore be limited to levels where such effects do not occur; ICNIRP also wanted to limit the possibility of suffering minor shocks in strong electric fields. While acknowledging the outcome of the studies that identified a small association between ELF magnetic fields and the risk of childhood leukaemia, ICNIRP considered that the results were not sufficiently robust and concluded that they need further confirmation from other sources in order to form the basis of exposure guidelines. Other recent reviews, including a 2007 WHO review, have come to the same conclusion, stating that the data currently available does not warrant the establishment of strict exposure limits.

The 2007 WHO review supports the use of the ICNIRP guidelines. The ICNIRP guidelines established a basic restriction on the density of the electric current induced in the body by the ELF. As the density of induced currents is difficult to measure in the body, the guidelines also prescribe reference levels in terms of field strengths more easily.

The ICNIRP guidelines for exposure to electric and magnetic fields have been incorporated into this Addendum as a reference for planning supervision and monitoring impacts. A more detailed description of issues pertinent to the basic restrictions provided in the guideline annex can be accessed using the following links:

- https://www.icnirp.org/cms/upload/consultation_upload/ICNIRP_RF_Guidelines_PCD_Appendix_A_2018_07_11.pdf
- https://www.icnirp.org/cms/upload/consultation_upload/ICNIRP_RF_Guidelines_PCD_Appendix_B_2018_07_11.pdf.

3.3.2 ADB Guidelines for Electricity Transmission and Distribution Lines

The African Development Bank (AfDB) has developed specific guidelines for the power transmission lines and interconnection systems sector. The aim of these guidelines is to identify typical project components, sources of impacts, commonly applied assessment, methods and options for managing potential impacts. The ADB guidelines are organised according to the following aspects: a) Project components and activities; b) Impact sources and receptors/resources; c) Mitigation and management options.

The phases of transmission line projects considered are: a) Design and planning, including route and site selection; b) Construction; c) Operation and maintenance; and d) Decommissioning (where appropriate).

3.3.3 IFC's Environmental, Health and Safety Guidelines for Transmission Lines and Electricity Distribution

The IFC Guidelines apply to the transmission of energy between the power generation facility and substations located within the electricity grid as well as the distribution of energy from the substations to consumers. Industry-specific impacts and management measures are included in the Guidelines, including information on construction impacts such as:

- Generation of waste at the construction site;
- Soil erosion and sediment control in site preparation activities;
- Dust and other emissions;
- Noise from heavy equipment and lorry traffic; and
- Potential for hazardous materials and oil spills associated with the operation of heavy equipment and fuelling.

The IFC's Environment, Safety and Health (EHS) standards (IFC, 2007a) are technical reference documents, with examples of good international practice, both general and specific to certain market sectors or types of enterprise. When one or more members of the World Bank Group are involved in a project, these HSA standards are applied as required by their respective policies and regulations. The SSA standards prescribe minimum performance levels and measures that are generally considered feasible in new facilities, using existing technology at reasonable costs. The guidelines cover issues relating to the environment, occupational health and safety, community health and safety, construction and project decommissioning.

IFC's Performance Standards (PS) provide the framework for managing the environmental and social risks of projects. They define clients' responsibilities for managing their environmental and social risks, are considered an international benchmark and have been adopted by many organisations as a key component of their environmental and social risk management (IFC, 2012). These Performance Standards also provide guidance on how to identify risks and impacts and have been developed to avoid, mitigate and manage the risks and impacts associated with projects, as a way of developing economic activities in a sustainable manner. The Performance Standards are presented below:

- PD1: Assessment and Management of Environmental and Social Risks and Impacts;
- PD2: Employment and Working Conditions;
- PD3: Resource Efficiency and Pollution Control;
- PD4: Community Hygiene and Safety;
- PD5: Land Acquisition and Involuntary Resettlement;
- PD6: Biodiversity Conservation and Sustainable Management of Living Natural Resources;
- PD7: Indigenous Peoples;
- PD8: Cultural Heritage.

3.4 Multilateral Environmental

According to Article 13 of the Angolan Constitution of 5 February 2010, international treaties and agreements that have been duly approved or ratified are in force in the Angolan legal system after their official publication and entry into force in the international legal system and for as long as they are internationally binding on the state. The same law states that everyone has the right to live in a healthy and unpolluted environment, as well as the duty to defend and preserve it. To this end, the State shall adopt the necessary measures to i) protect the environment and species of flora and fauna throughout the national territory,

ii) the maintenance of ecological balance, iii) the correct location of economic activities and iv) the rational exploitation and use of all natural resources, within the framework of sustainable development and respect for the rights of future generations and the preservation of different species.

Angola is a signatory to several multilateral environmental agreements that are relevant to aspects related to activities associated with the energy sector. These agreements are listed and briefly described in **Annex 6**.

3.5 International Organisations

Within the scope of the project's activities, a number of international organisations and their guidelines are also relevant to its implementation. **Annex 7** shows some of the relevant organisations and their descriptions, with emphasis on the International Finance Corporation, which has developed a set of environmental and social performance standards to guarantee the sustainability of projects.

3.6 Proponent's Environmental Policy

The project proponent's Environmental Policy is presented in full in **Annex 8**.

CHAPTER 4

ENVIRONMENTAL AND SOCIAL CHARACTERISATION

4 ENVIRONMENTAL AND SOCIAL CHARACTERISATION

In order to characterise the baseline situation of Huambo province, in particular the area of influence of the project, the municipalities of Huambo, Caála and Longonjo, an analysis of different descriptors was carried out. A methodology of bibliographic consultation, collection and analysis of satellite images of the region, field surveys along the proposed route of the transmission line and collection of information from environmental and social study reports from previous studies carried out in the region and reports previously drawn up by Holísticos were used to describe them.

This chapter presents sections characterising the physical, biotic and socio-economic aspects of the region, with particular emphasis on the municipalities mentioned above and along the proposed transmission line route of approximately 48 km.

4.1 PHYSICAL ENVIRONMENT

4.1.1 Climate and Climate Change

With the exception of other plateau areas in adjacent provinces, Huambo's climate is quite different from that found in much of the country. Its high rainfall and low temperatures come directly from the higher altitudes in the province.

The average temperature fluctuates between 18°C and 23°C throughout the year, although the average daily maximum temperatures are between 25°C and 27°C and the average minimum temperatures are between 11°C and 13°C. The higher and more southerly regions are a little cooler than the other areas of the province. September and October are the hottest months and June and July are the coolest. Frost occasionally occurs in July and August in the lower valleys and depressions (See **Figure 4-1**).

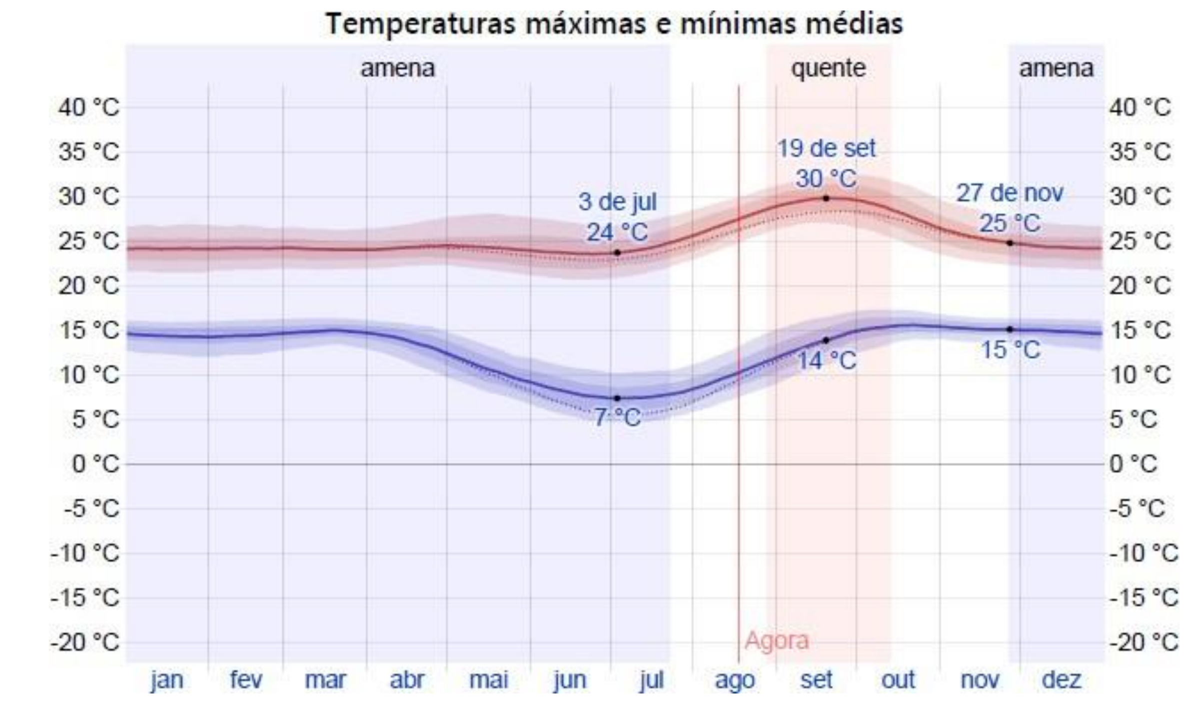

Figure 4-1: Average maximum (red line) and minimum (blue line) temperatures, with corridors from the 25th to the 75th and from the 10th to the 90th percentiles.
Source: https://pt.weatherspark.com

On average, relative humidity varies between 60 and 70 per cent throughout the year. January is the wettest month of the year, when levels range from 70 to 80 per cent, while August is the driest, with average relative humidity levels of 35 to 40 per cent.

The greatest rainfall occurs during the hottest summer months, particularly between October and April. Around 95 per cent of a season's rain falls between these months. Rainfall peaks in December and March. This is because the Intertropical Convergence Zone (ITCZ) moves south in the first half of summer and then north at the end of the season. Thus, the greatest rainfall occurs when the ITCZ is located more or less over Huambo in December and again in March. During each of these very rainy months, between 230 and 240 millimetres (mm) of rain fall. **Figure 4-2** shows the main temperature variations in the dry and rainy periods in Huambo.

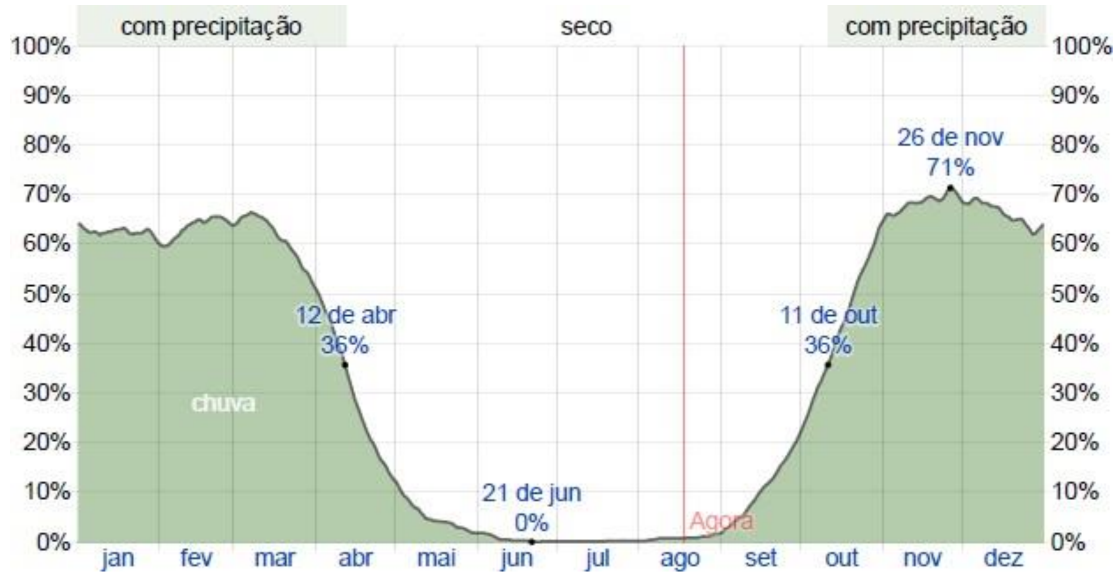

Figure 4-2: Huambo's characteristic climate during the year.
Source: https://pt.weatherspark.com/

Although Huambo receives much more rain on average than most other areas of Angola, rainfall is often very variable. Occasionally, there are long periods of drought when little rain falls for prolonged periods or, on the other hand, there are occasionally prolonged periods when rain falls almost every day, which can also limit plant growth.

Winds

The average hourly wind speed in Huambo undergoes small seasonal variations throughout the year. The windiest time of the year lasts six months, from 28 March to 28 September, with average wind speeds of over 10 kilometres per hour. The windiest days of the year are in July, with an average hourly wind speed of 12 kilometres per hour. The calmest time of the year lasts 6 months, from 28 September to 28 March. The calmest days of the year are in November, with an average hourly wind speed of 8 kilometres per hour.

The predominant wind direction for the Huambo region is east (see **Figure 4-3**), varying between east-northeast and east-southeast, the latter being the predominant one. Maximum wind speeds are always less than 38 km/h.

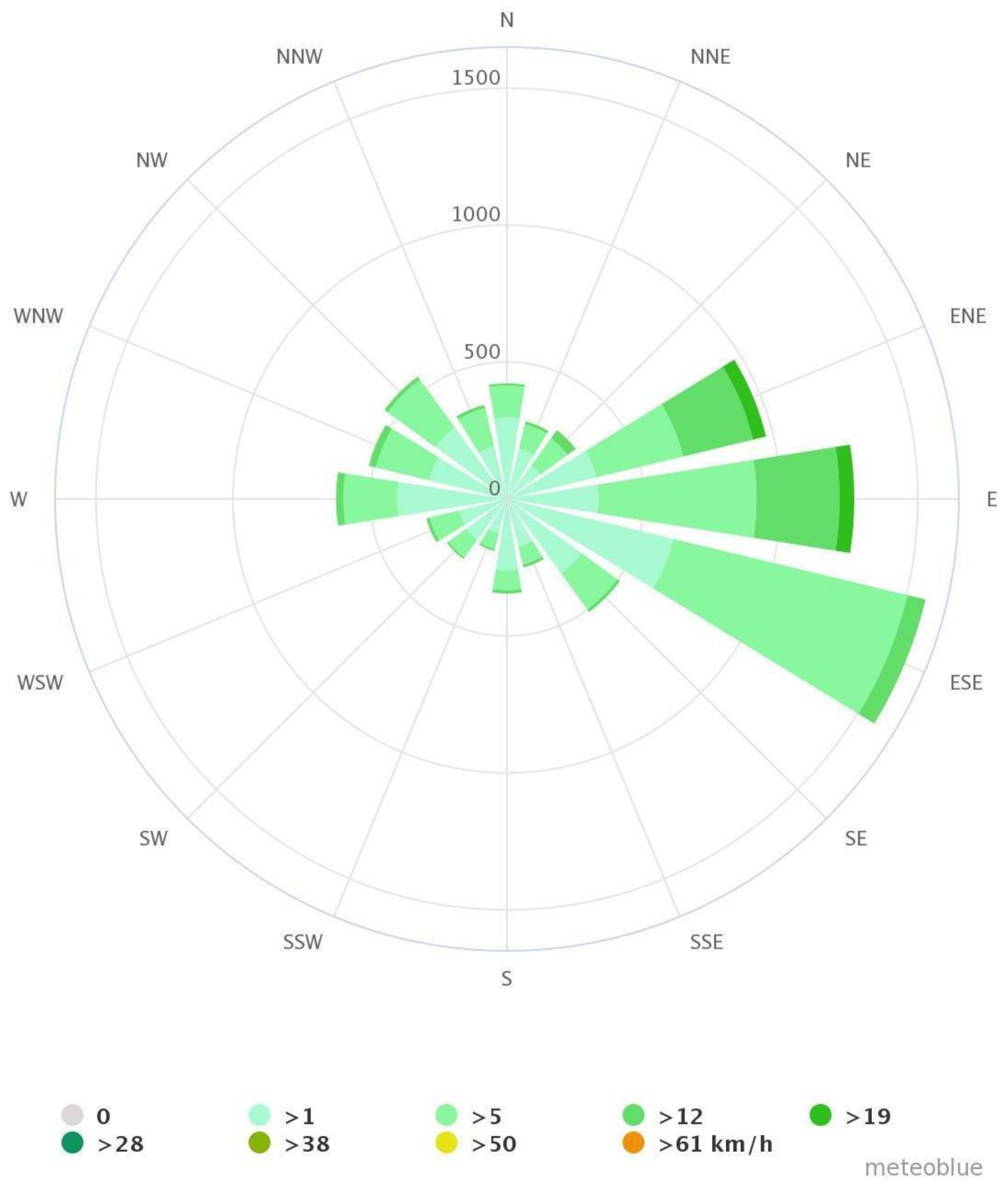

Figure 4-3: Prevailing wind in Huambo during the year.
Source: https://www.meteoblue.com/

Climate change and its effects are not a recent issue, however, in recent years the southern African region has felt its effects more severely. This region has seen prolonged periods of drought, with episodes of severe drought. Specifically in Angola, the centre and south are the regions that have felt its effects most acutely. The *El Niño* and *La Niña* phenomena, which alter the planet's meteorological patterns, lead to the occurrence of periods of drought, more so in the central and southern regions.

Severe and long periods of rain, contrasted with periods of torrential rain, can have serious consequences in some areas of the country.

Along the proposed route of the 220 kV transmission line, there are several areas where the effects of periods of drought are felt more acutely. Many of these areas are used for agriculture, mostly subsistence, where the effect of the lack of precipitation is visible, aggravated by the fact that there are no water retention structures, the existing watercourses have very low flows and several are currently dry.

The areas identified as being most sensitive to the effects of flooding are the lower areas and banks of watercourses, as well as the banks of courses that are currently dry. These areas are particularly sensitive because there is almost no vegetation capable of fixing the soil when floods occur, resulting in the removal of large quantities of sediment. The removal of this sediment could not only destroy areas of cultivation, mostly subsistence agriculture, but also jeopardise the integrity of some of the dwellings that exist in these areas.

As a way of combating the severe effects of climate change, the Government of Angola, through the Sustainable Development Goals report (INE, 2018), has established national goals/priorities and respective indicators. In view of climate change and its impacts, the following priorities were established: (i) adapt the national territory to the impacts of climate change; (ii) draw up strategies and implement actions within the scope of Climate Change Adaptation and Mitigation, with emphasis on measures to combat drought and desertification;
(iii) implement nature and biodiversity conservation actions and strengthen sectoral policies related to the protection of wild flora and fauna; (iv) strengthen waste collection and sorting actions, promote environmental awareness and education actions and environmental monitoring; (v) prevent natural hazards and protect populations in vulnerable areas; and (vi) promote the transition to a low-carbon economy.

On the other hand, and according to the National Climate Change Strategy - ENAC 2018-2030 (MINAMB, 2017), Angola's vulnerability and exposure to the effects of climate change have been felt over time, with frequent episodes of extreme weather phenomena such as droughts, floods or the marked variability of temperature in some areas of the country.

affect the Angolan economy and the well-being of the population. High temperatures are conducive to prolonging the seasonality of diseases such as malaria. The report predicts that the future will be hotter and wetter, and even in areas above 1500 metres, where the risk of contracting the disease is lower, the incidence of malaria will be more frequent. One of the solutions proposed by ENAC is to promote the transition to a low carbon economy, adapting the national territory to the impacts of climate change, namely a) promoting the use of efficient biomass cookers, b) promoting sustainable and low carbon agricultural practices; c) developing community and school gardens and d) Replicating the project "Promoting sustainable charcoal in Angola through a Value Chain Approach".

4.1.2 Geology and Geomorphology

The study area is located on Angola's Central Plateau, one of the provinces with the highest altitudes, with some regions reaching over 1,800 metres. The eastern part of the province is predominantly covered by continental sediments belonging to the Calaári Group (Tertiary) and recent Quaternary deposits. The Calaári Group is represented by different deposits of psammitic composition, while the recent sediments are predominantly made up of alluvial deposits. In reality, the occurrence of these Tertiary deposits of the Calaári Group would be expected, since Huambo Province is located at the western end of the extensive Calaári Basin. However, occasional occurrences of igneous-metamorphic rock outcrops have been identified in this eastern part of the province, scattered among the Calaári Group sediments (Araújo *et al.*, 1992) (see **Figure 4-4)**.

The western part of the province is predominantly characterised by intrusions of Proterozoic age, although it is still possible to identify some recent Quaternary deposits. The igneous-metamorphic rocks (early Proterozoic) identified in this area are dominated by the Oendolongo Group (Proterozoic), which is represented by conglomerates, argillites, quartzitic sandstones or arkoses, grauvaques, sandstones, quartzites, siltstones and the Central Volcanic Complex, which is made up of granitoid porphyries, as well as porphyroblastic biotite granites and leucocratic granites (extremely rich in silica) (Araújo *et al.*, 1992). Some magmatic occurrences of Cretaceous age are also identified in the northern part of the province, which are made up of ultrabasic alkaline and carbonatitic rocks, as well as alkaline rocks of basic composition (Araújo *et al.*, 1992).

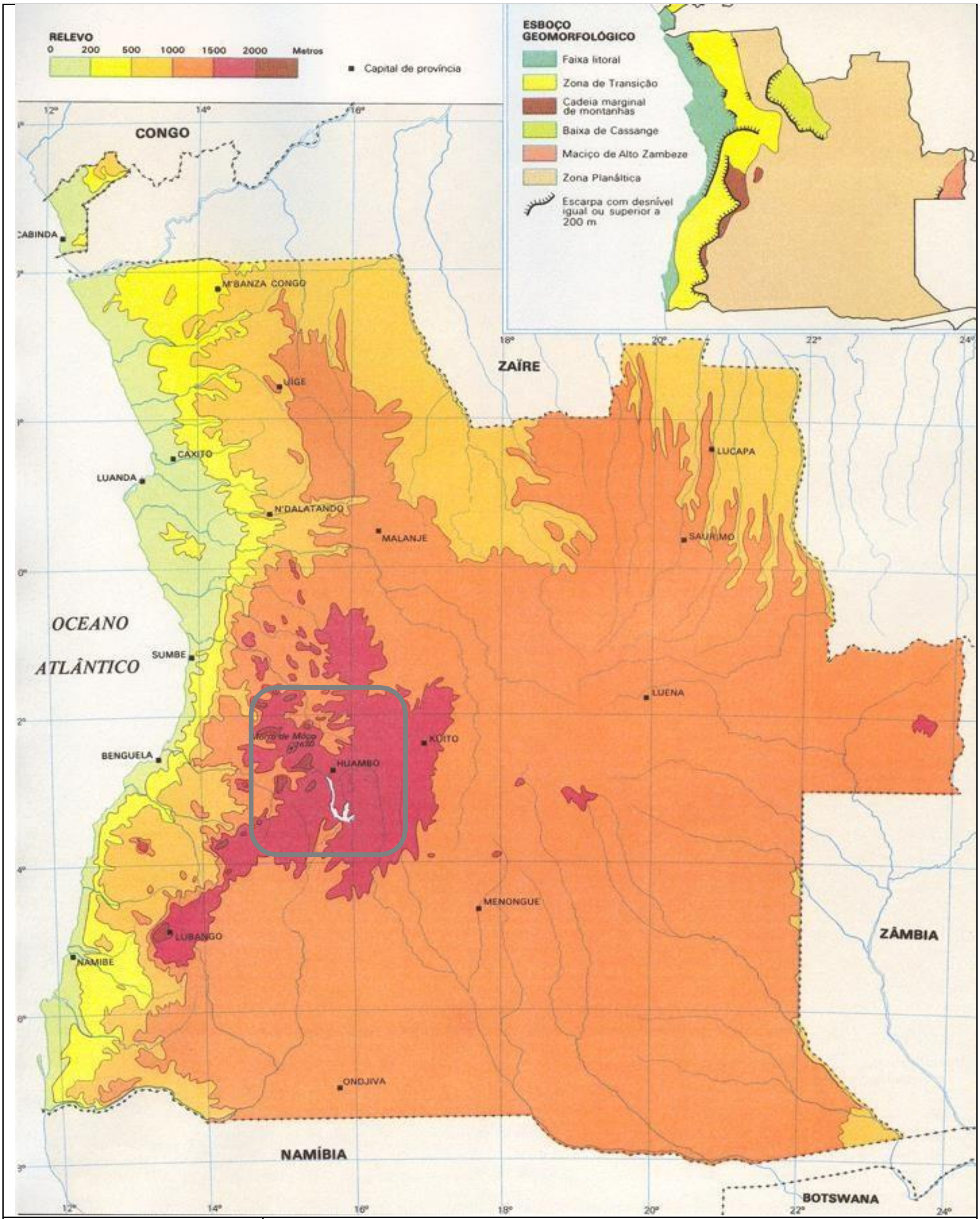

Figure 4-4: Relief and geomorphological map (top right) of Angola with an indication of Huambo province (grey).
Source: Cabral & Costa 2013, modified.

In general, the area of influence of the project crosses two geological zones as shown in **Figure 4-5,** namely unconsolidated Quaternary sediments and pre-Cambrian crystalline substrate.

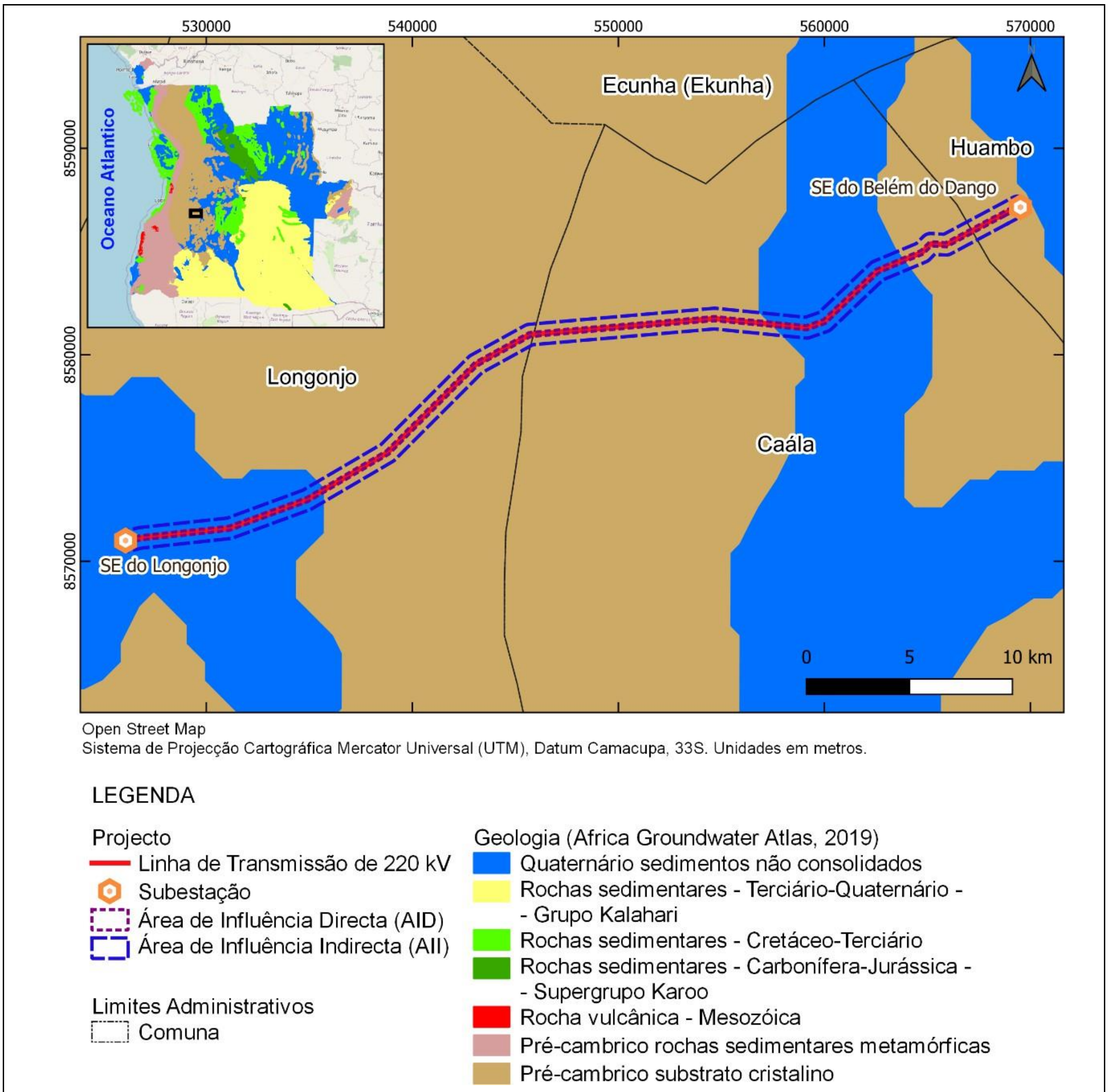

Figure 4-5: Geological map of the project's area of influence.
Source: Africa Groundwater Atlas, 2019.

The rocks that characterise the study area also have significant mica content, of which biotite is the dominant one. However, bearing in mind that Huambo province has rainfall conditions where intense rainfall is one of the dominant characteristics, the action of various rock alteration processes is to be expected. Thus, the rocks that

Rocks with high concentrations of minerals that formed at high temperatures, such as biotite, are less stable to atmospheric conditions such as those identified in Huambo province, easily transforming into iron and aluminium oxides. However, rocks with high concentrations of minerals formed at lower temperatures, such as quartz, are clearly more stable (Pedro *et al.*, 2015).

In terms of geomorphology, Huambo province covers most of the "Central Plateau". The "Central Plateau" slopes steeply towards the coastal plateau to the west, while to the north, east and south, the slope is gradual and gentle. In hypsometric terms, Huambo province is dominated by altitudes between 1500 and 2000 metres, on a vast plateau. The highest values are located along the marginal mountain range to the west, where they rise well above 2000 metres (see **Figure 4-6**). The lowest altitudes (below 1300 m) are only found in the north-west of the province along the surfaces carved out by the Queve basin.

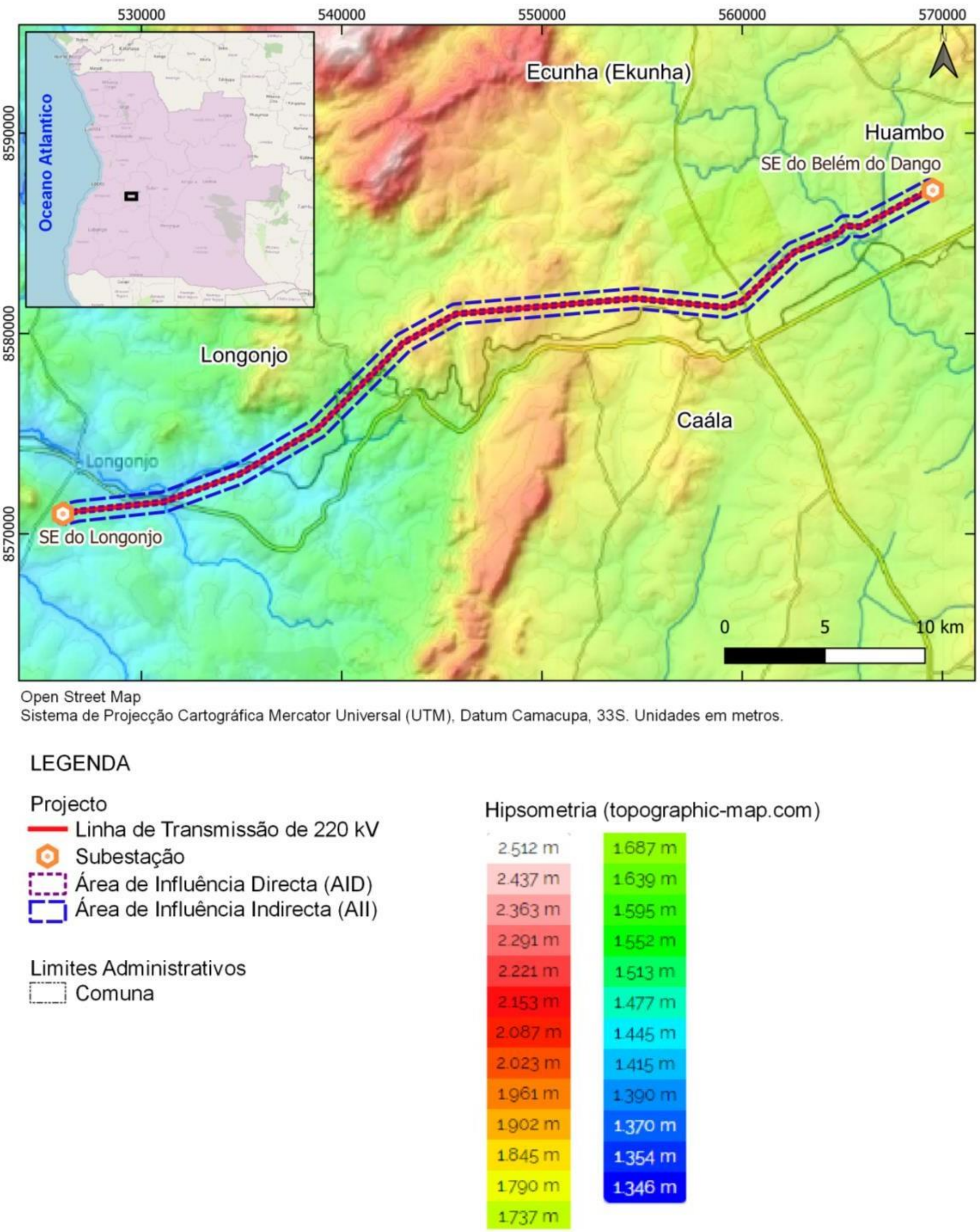

Figure 4-6: Hypsometric chart of the project's area of influence.
Source: topographic-map.com.

4.1.3 Soils

In tropical areas such as Angola, the climate is undoubtedly the most important factor. In fact, humidity, rainfall and thermal variations, which are typical in in tropical areas, favour rapid chemical alterations of minerals and promote the leaching of soluble alteration products out of the soil profile. In this context and according to the FAO/UNESCO classification, there are several types of soil identified in Angola (see **Figure 4-7**).

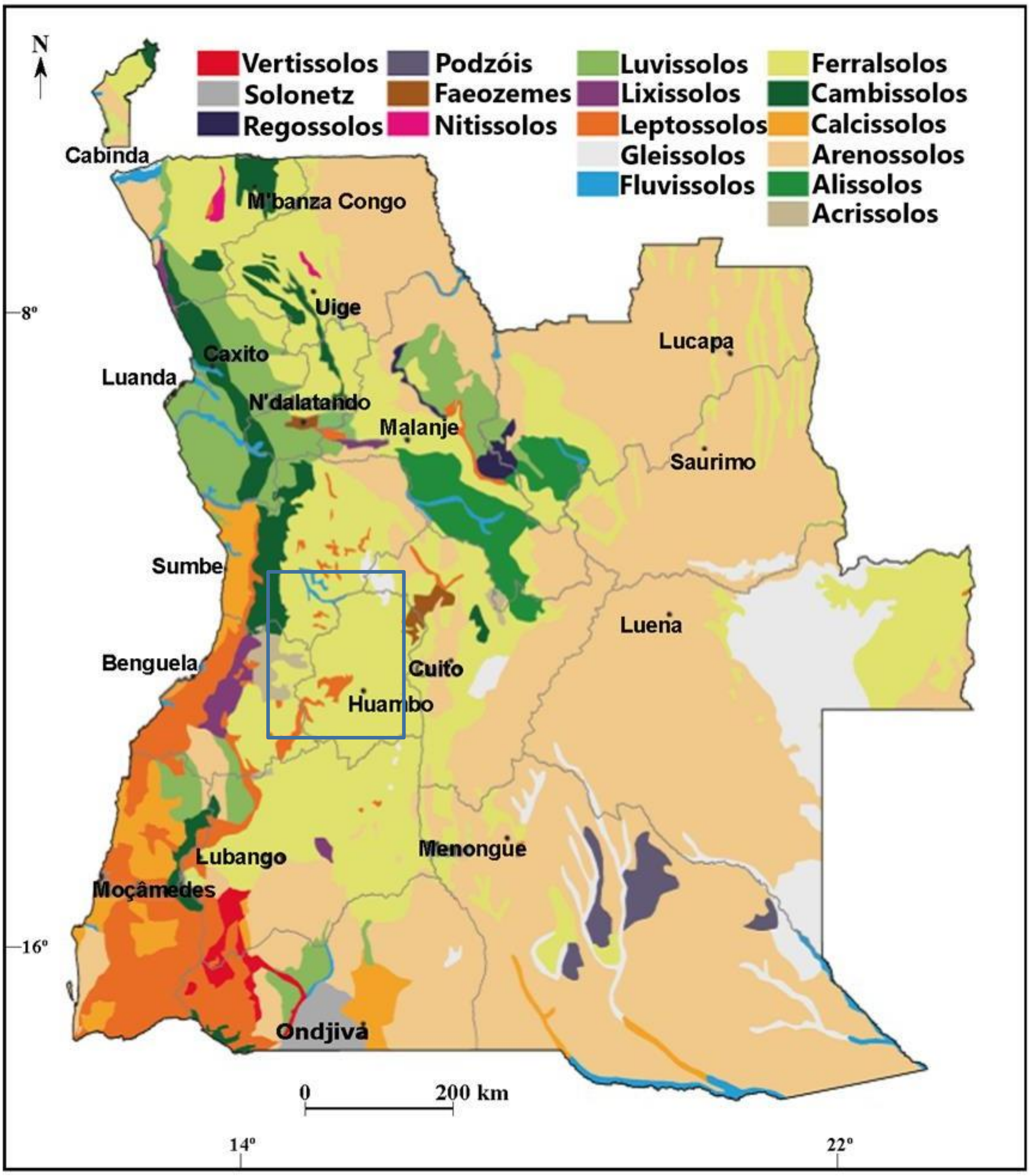

Figure 4-7: Main soil types in Angola.
Source: Huntley *et al.*, 2019, modified.

However, the main soil group in Angola is represented by sandstones, accounting for 53 per cent of the land cover throughout the country. These soils are predominantly identified in the dunes of the Namib Desert, in the "red sands of musseque" along the coastal corridor from Sumbe and in the Calaári Basin. The second group of soils, accounting for 23 per cent of Angola's land cover, is represented by ferral soils, which are formed from the degradation of bedrock, mainly represented by the gneisses and granites of the Precambrian Basement Complex and the schists, limestones and quartzites of the Western Congo System (Huntley *et al.*, 2019).

The province of Huambo is predominantly characterised by soils of the ferralsols group, commonly known as ferralitic soils, which make up a large part of the soils in the area of influence of the project, as well as a part covered by leptosols (see **Figure 4-8,** next page).

The area around the project under analysis is characterised by this type of soil. These soils are commonly identified in areas with high hypsometric values, yellowish or reddish in colour, highly weathered and rich in aluminium hydroxides and iron oxides.

The ferral soils along the route are predominant, accounting for around 85 per cent of the IDA of the TL route and the future Longonjo SE. These have poor potential in terms of agricultural production, since they are permeable and consequently have a low water retention capacity. In addition, this permeability, combined with the long periods of rainfall common in the study area, promotes the rapid leaching of mineral nutrients and organic matter. However, these soils can achieve moderate agricultural potential when fertilisers (natural or artificial) are used to increase the soil's organic and mineral content. In Huambo province it is also possible to identify other types of soil, although to a lesser extent, namely leptosols, phaeozems, gleissols and fluvissols.

Leptosols are the second most abundant type along the route of the TL, representing approximately 15 per cent of the soils present there. These are thin soil horizons rich in carbonate materials, usually made up of rock fragments. Phaeozems are dark in colour, rich in humus or decomposed organic matter, and are usually are formed from basaltic material. Gleissols develop in areas clearly influenced by the water table and consequently have reduced horizons. Fluvissols are recent alluvial soils formed in areas characterised by river deposits. As such, these soils are periodically subject to flooding under normal conditions.

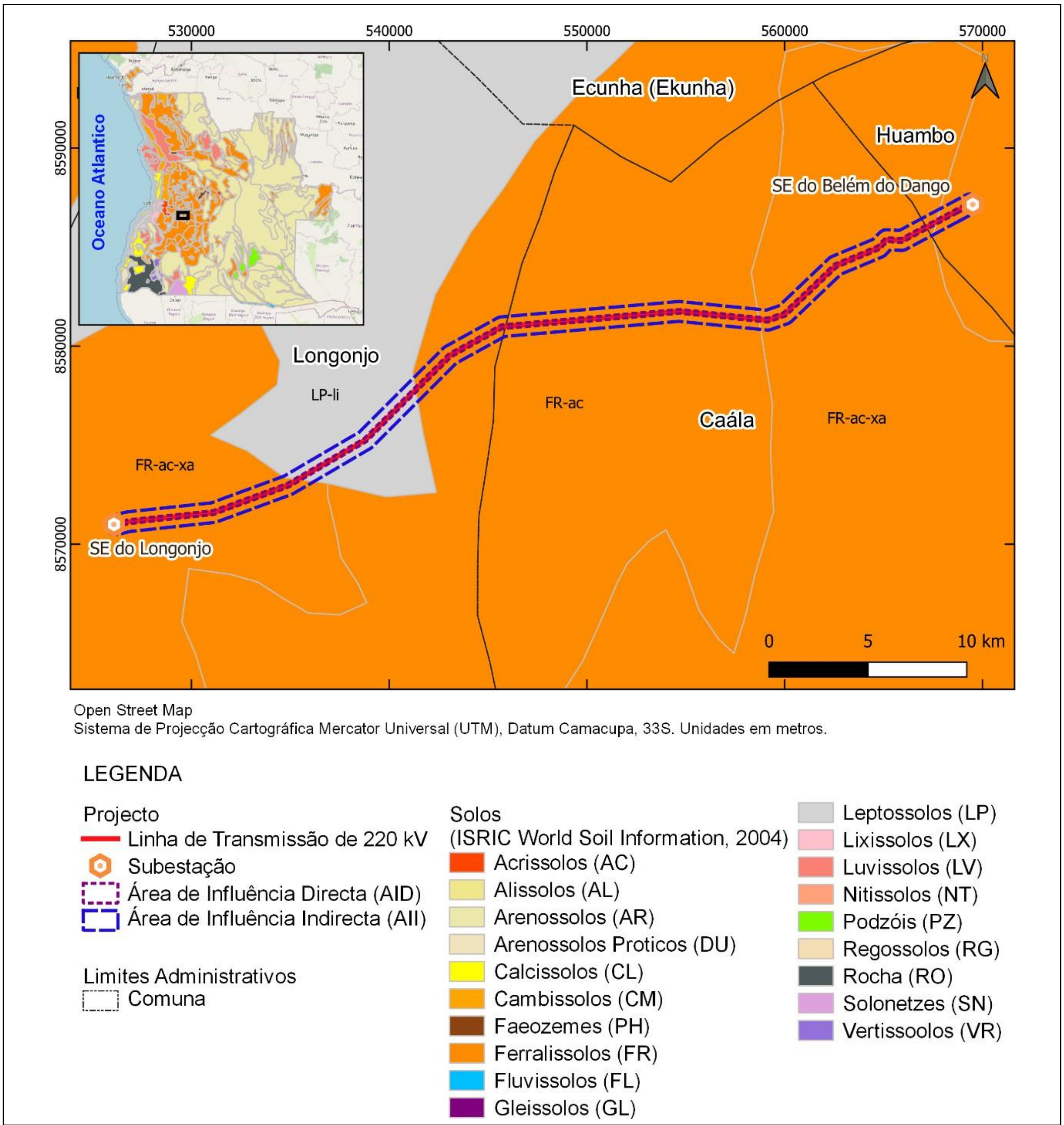

Figure 4-8: Main soil types in the project area.
Source: ISRIC World Soil Information, 2004.

Land use is shown in **Figure 4-9,** where it is clear that there is a great deal of agricultural activity. **Table 4-1** shows a selection of land use classes within the corridor. This highlights family farming activity with around 58.1 %, with active ploughing accounting for 85.2 ha (39.1 %). Given the proximity of the line to areas that have been significantly altered by human activity, natural vegetation occupies only 2.2 per cent.

Table 4-1: Main land uses in the project corridor.

Class	Total area (ha)	Percentage (%)
Open forest - Native Miombo woodland	4,6	2,1
Exotic tree cover (Eucalyptus)	1,4	0,6
Arboreal Gallery	0,2	0,1
Scattered Trees	5,5	2,5
Dense shrubland	14,6	6,7
Shrubbery	26,6	12,2
Mato Ralo	18,5	8,5
Palustrine vegetation	0,23	0,1
Water Plan/Course	0,34	0,2
Active Lavras	85,2	39,1
Fallow land	38,2	17,5
Abandoned Lavras	4,2	1,9
Social Area	0,37	0,2
Power Station	0,17	0,1
Railway line	0,07	0,0
Other Classes (Bare soil, grass cover, asphalted and earthen surfaces, roads, etc.)	17,6	8,1

The other unmapped classes include bare ground, roads, paths, sparse scrub, dense low scrub, secondary savannah, water bed.

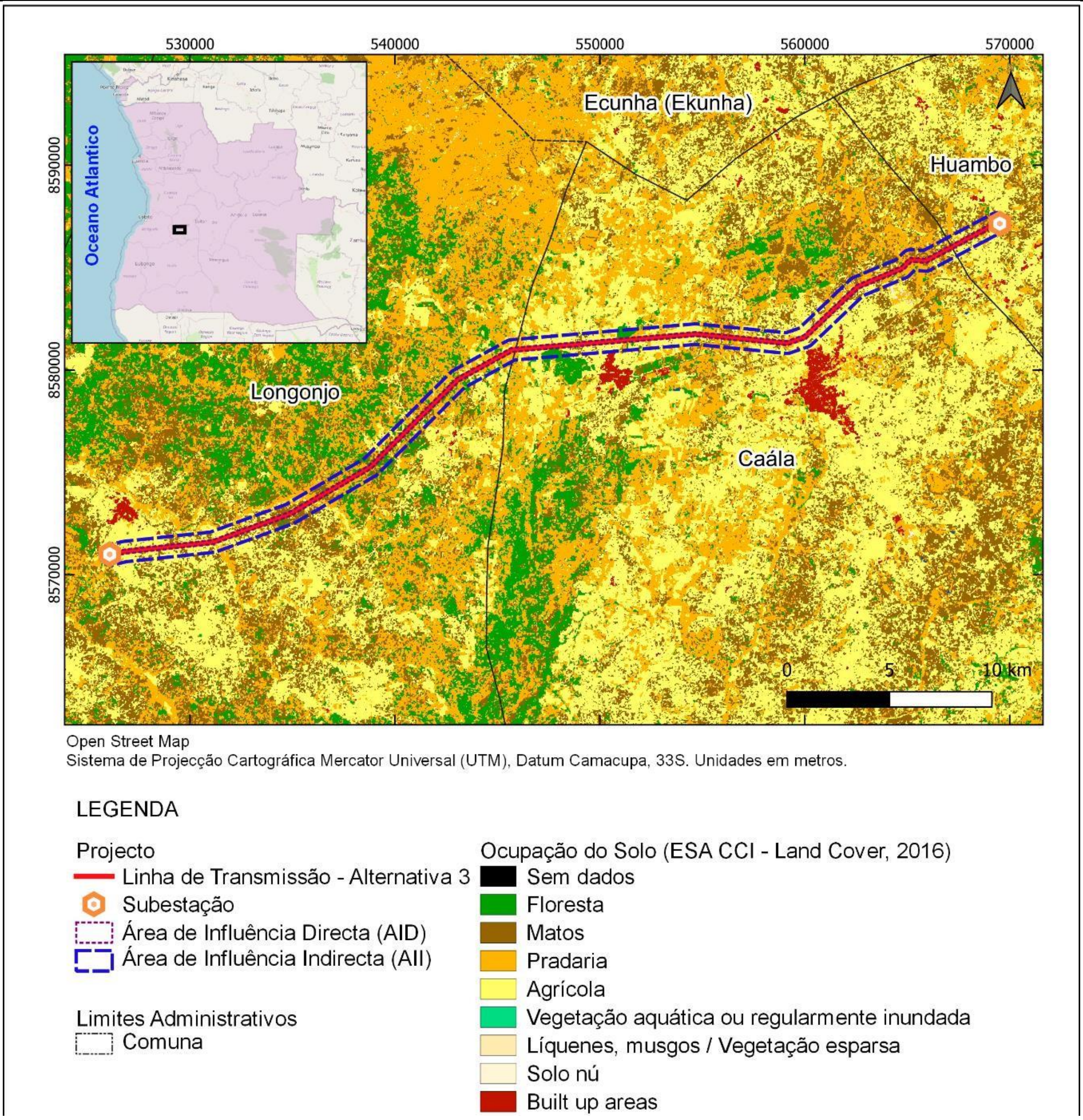

Figure 4-9: Main types of land use in the Project area.

4.1.4 Water Resources

According to a report published on groundwater resources (GMI, 2018), Huambo province is one of the provinces with an important groundwater network. In terms of Huambo province's hydrography, the Kwanza River is undoubtedly the most notable, being responsible for a huge erosive landscape located in the eastern part of Huambo province. The geomorphological characteristics, with hypsometric values in the order of 1000 m identified at

In addition, the seasonal variations in rainfall, which are high upstream and fall slowly downstream, are a major contributor to the erosive nature of the river. In addition, the seasonal variations in rainfall, which are high upstream and slowly decrease downstream, are a strong contributor to the erosive character of the Kwanza River.

The Cubango and Cunene rivers have slow and usually meandering flow regimes. These characteristics identified in the Cubango River are strongly driven by the rainfall cycles, which decrease smoothly towards the south, in line with the climatic change from humid in the north to semi-arid in the far south (see **Figure 4-10**). For its part, the Cunene River is characterised by high rainfall in the initial stretch (Matala to the north and Ruacaná to the north-west), which gradually decreases towards the south and west of the catchment. However, the Cunene river basin is mostly covered by sediments from the Calaári and is therefore characterised by a great shortage of permanent surface water, except for the water that accumulates in some depressions (natural and artificial) during the rainy season. It is the Cunene basin that feeds the province's main dam (Gove), which has an installed capacity of 60 MW.

It should be noted that the project is influenced by the Hydrographic Units of Queve (with an area of 22 813 km^2) and Alto Cunene (with an area of 27 983 km^2). The Queve Hydrographic Unit has an average annual runoff of 286.7 mm, while the Alto Cunene has 205 mm (COBA, 2014).

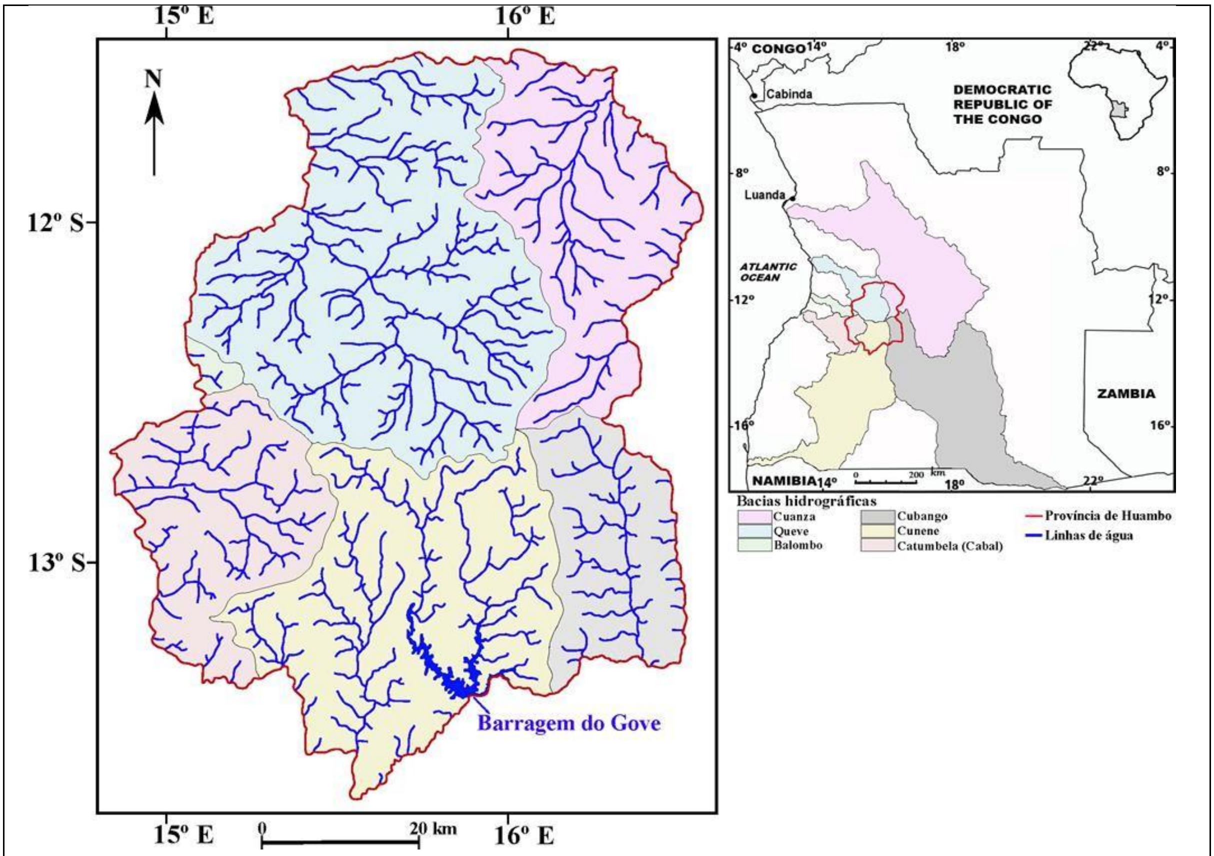

Figure 4-10: River basins in Huambo province.

The Catumbela, Balombo and Queve rivers are characterised by flows that are more aggressive and erosive than those of the Cubango and Cunene rivers, but smaller than those of the Kwanza river, as these flows are strongly driven by steep geomorphological features and are, as in the case of the Kwanza river, strongly influenced by seasonal periods of precipitation. In the Project's region of influence, the main river includes the Cunhongamua (see **Figure 4-11**). The Cunhongamua River runs between the Serra da Veva and the Gove Dam reservoir and is 130 kilometres long, making it an important water supply for the city of Huambo. There is also a watercourse close to the Longonjo substation area.

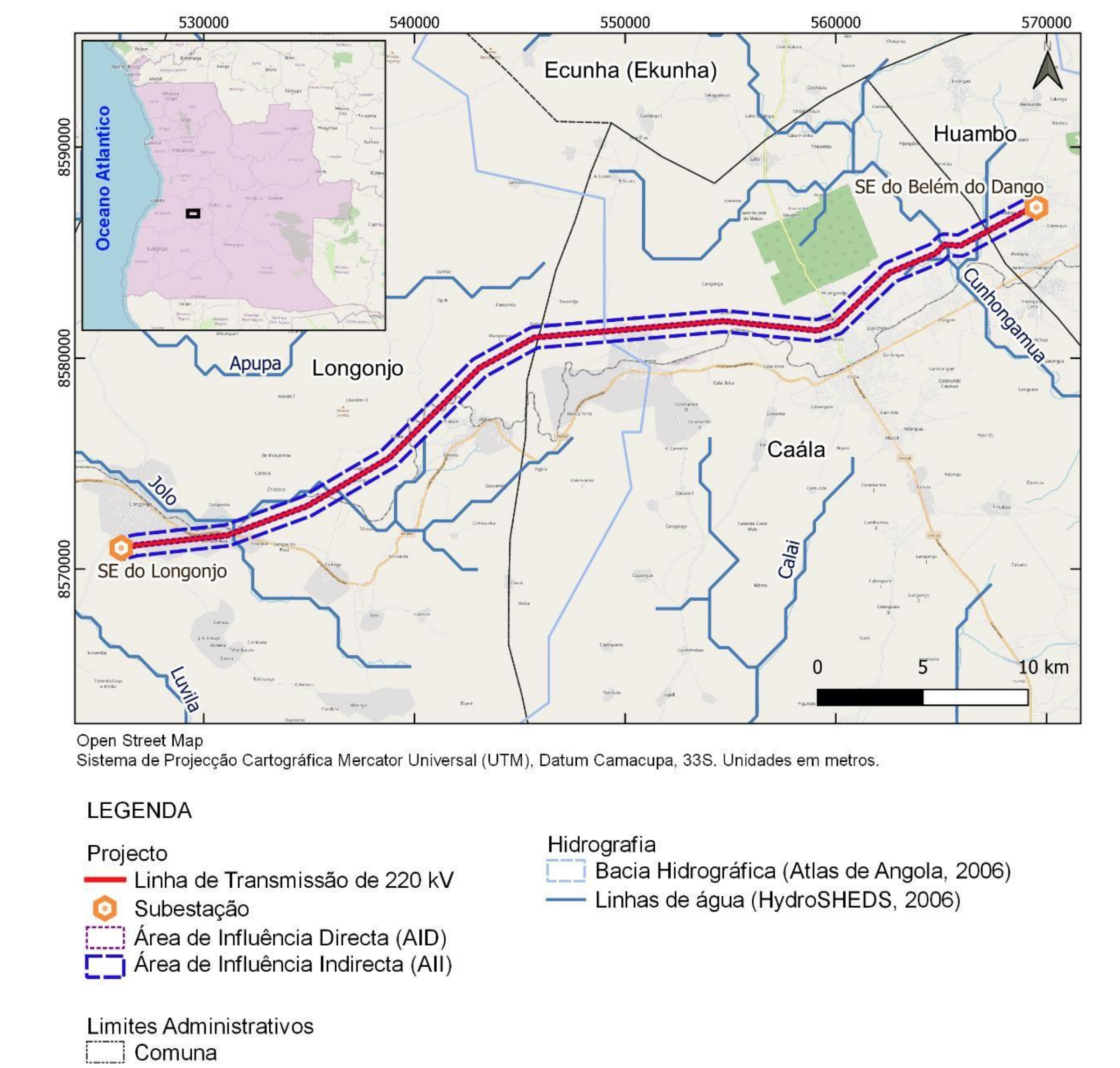

Figure 4-11: Main water bodies in the region of influence of the Project.
Source: Angola Atlas, 2000; HydroSheds, 2006.

Around 0.34 ha within the 45 metre corridor are occupied by watercourses, which corresponds to 0.2% of the corridor area. **Figure 4-12** shows some photographs of some of the main permanent watercourses within the project's LIA which, in some places, are crossed, or their tributaries and effluents, by the proposed route of the TL, namely:

- Cunhongamua River (12°49'7.47"S 15°36'57.03"E);
- River located near the Francisco Muteka neighbourhood (12°49'14.56"S 15°35'47.18"E);
- Chandenda River (12°49'52.16"S 15°33'13.36"E);

- Chicanda River (12°55'12.18"S 15°21'55.54"E); and
- River located at Longonjo (12°55'14.83"S 15°17'20.04"E).

Figure 4-12: Photographs of some of the main permanent watercourses located along the route of the transmission line.

4.1.5 Landscape

The landscape is characterised by different components: topography, land use and potentially sensitive areas in relation to the landscape (e.g. cultural heritage sites) and for the case of this transmission line it has been categorised according to the presence of common elements. These include factors such as:

- Topography;
- Land use;
- Built forms; and
- Evidence of human modifications.

During the field survey, photographs were taken of the site and the surrounding landscape from predetermined viewpoints always within the area of influence of the transmission line. The project's landscape study area was identified as a 1000 m corridor along the transmission line (500 m on each side) where it is assumed that most of the potential impacts will occur.

Angola's physical terrain is mainly made up of broad plateaus above 1000 metres in altitude; a high plateau in the central and southern regions reaches up to 2400 metres. The predominantly flat coastal plain stretches inland for 50 km to 150 km in a belt of hills and a series of scattered mountains. Angola's high plateau rises from 1200 m to 1800 m, lies to the east of the mountains and dominates Angola's terrain. The highest point in the country is the 2620 metre Morro de Moco peak, located in Huambo province. The terrain along the transmission line varies from approximately 1400 (at the future Longonjo substation) to 1800 metres above sea level at the Belém do Dango substation. The landscape in the central area of the line is characterised by areas with elevations of 1950 m. The relief of the region is quite variable, sometimes quite rugged, and there are several rocky outcrops, some of them quite prominent.

The distribution of vegetation along the length of the transmission line is very variable. To the north-east (NE) in the area surrounding the Belém do Dango substation, the landscape is surrounded by exposed soil with some vegetation and low vegetation. As the transmission line crosses the municipality of Caála, the vegetation is less abundant and there is a higher percentage of exposed soil. When it crosses the municipality of Calenga, the situation becomes different, as low and medium-sized vegetation becomes abundant and the presence of exposed soil decreases considerably. The same landscape can be seen in the commune of Lépi. When you reach the municipality of Longonjo, in the area surrounding the substation, the amount of exposed soil increases considerably and the presence of vegetation decreases.

It is important to note that the anthropised landscape elements that interfere with the natural landscape include a large number of agricultural fields, mostly for subsistence farming, the presence of parts of the railway line and a number of non-definitely built houses (made of adobe and zinc sheet roofs). Other landscape features in the area, but slightly removed from the directly affected area, are the Francisco Muteka Centre (Caála) and some scattered non-infrastructure settlements.

It is important to emphasise that near these settlements there is evidence of cultivation sites, including abandoned and fallow fields.

As indicated above, the existing landscape along the project's area of influence is quite diverse, with patches of agricultural fields (some fallow) interspersed with low-growing grasses and isolated patches of trees. Along the line, landscapes can be identified that are typically wooded areas of closed miombo (see **Photo 4-1**) or open miombo woodlands showing some degradation (see **Photo 4-2**).

Photo 4-1: Landscape largely made up of miombo woodland.

Photo 4-2: Landscape made up of open miombo woodland with signs of degradation.

A small area of eucalyptus trees can be found along the route (see **Photo 4-3**), as well as the presence of extensive agricultural areas interspersed with areas occupied by grass and undergrowth (see **Photo 4-4**).

Photo 4-3: Eucalyptus grove next to the railway line.

Photo 4-4: Predominantly herbaceous vegetation with active ploughing.

Next to the Belém do Dango substation, the landscape is characterised by the absence of vegetation and the presence of power towers (see **Photo 4-5**).

Photo 4-5: Landscape next to the Dango Belem Substation devoid of vegetation.

It is important to emphasise that in some cases the proposed route is close to the road linking Belém do Dango to Longonjo, passing through Cáala, Lépi and the town of Lumingo. Part of the

The route crosses the tarmac road linking Benguela to Huambo (see **Photo 4-6**). There is also an area where the proposed line will cross the current railway line (see **Photo 4-7**).

Photo 4-6: Detail of the road linking Benguela to Huambo.

Photo 4-7: Landscape next to the Dango Belem Substation devoid of vegetation.

A large part of the route is made up of dirt roads, which in some cases do not have good driving conditions, especially during the rainy season. Some of these roads will be used as access roads to the tower sites (see **Photos 4-8 and 4-9**).

Photo 4-8: Dominant landscape from the dirt track in the direction of Lépi.

Photo 4-9: Dominant landscape of the dirt road in the area of influence of the project.

4.1.6 Air Quality

With regard to air quality, measurements were taken along the proposed route of the 220 kV transmission line between Belém do Dango and Longonjo, including in the vicinity of the Belém do Dango power station and the proposed location of the future Longonjo Mine power station (see **Figure 4-13**).

In general, along the proposed route and location of the future SE, the levels of particulate matter emissions are low and mainly made up of dust. The mobile sources of emissions are mostly associated with land movement as a result of subsistence farming practised by local communities, and to a lesser extent from road traffic (quite small and mostly made up of mopeds) and passers-by.

The collection of air quality data serves to define the baseline for a given area, and this data is subsequently used for air quality monitoring actions. Characterising the baseline air quality situation is the first step in assessing and identifying possibly polluted or degraded areas. The assessment of air quality (solid particles in the atmosphere) is a basic condition for the implementation of mitigation, control, compensation and/or continuous improvement measures and, consequently, for the quality of life of project employees and the surrounding population.

Knowing the air quality data makes it possible to determine the degree of control and the technological, human and financial resources needed to mitigate the potential impacts of air pollution on the environment and human health. The aim of this sampling is to provide primary data on air quality (particulate matter - $PM_{2.5}$) within the Project's area of influence.

Point measurements of air quality were carried out between 25 and 26 October 2021 and 24 and 27 January 2022, where measurements were taken for one (1) hour at four (4) different points, including along the proposed route of the TL and in the vicinity of the SE associated with the project, as illustrated in **Figure 4-13**. The sampling points were selected on the basis of the existence of sensitive receptors in the vicinity of the proposed transmission line route.

The measurements were taken using a Haz-Dust (particulate matter monitor) model EPAM-5000 duly calibrated together with a *Hold Peak* HP-866B Pro *Anemometer,* where it was possible to obtain the minimum and maximum wind speed and local temperature.

The Haz-Dust monitor is a device designed to measure the trace level of ambient air pollution. Its unique sampling *design* makes it possible to collect data in real time and carry out a gravimetric analysis of the filter using the 47mm FRM located directly behind the optical sensor.

The sampling sites selected were based on the location of the main sensitive receptors identified along the proposed route of the TL. The main sensitive receptors identified, mostly dwellings, are located around the Belém do Dango SE, Francisco Muteka Centrality (Caála), peri-urban areas of the city of Caála and some communities in the vicinity of the proposed location of the future Longonjo SE. In other areas along the proposed route of the TL, during the field surveys, no sensitive receptors were identified at a distance of less than 1 kilometre from the route, and no significant impacts on receptors at greater distances are anticipated.

Only $PM_{2.5}$ measurements were taken, taking into account the characteristics of the terrain, soil and activities along the route that could contribute to the spread of particles into the atmosphere. No measurements were taken at night for safety reasons for the technical staff and equipment used.

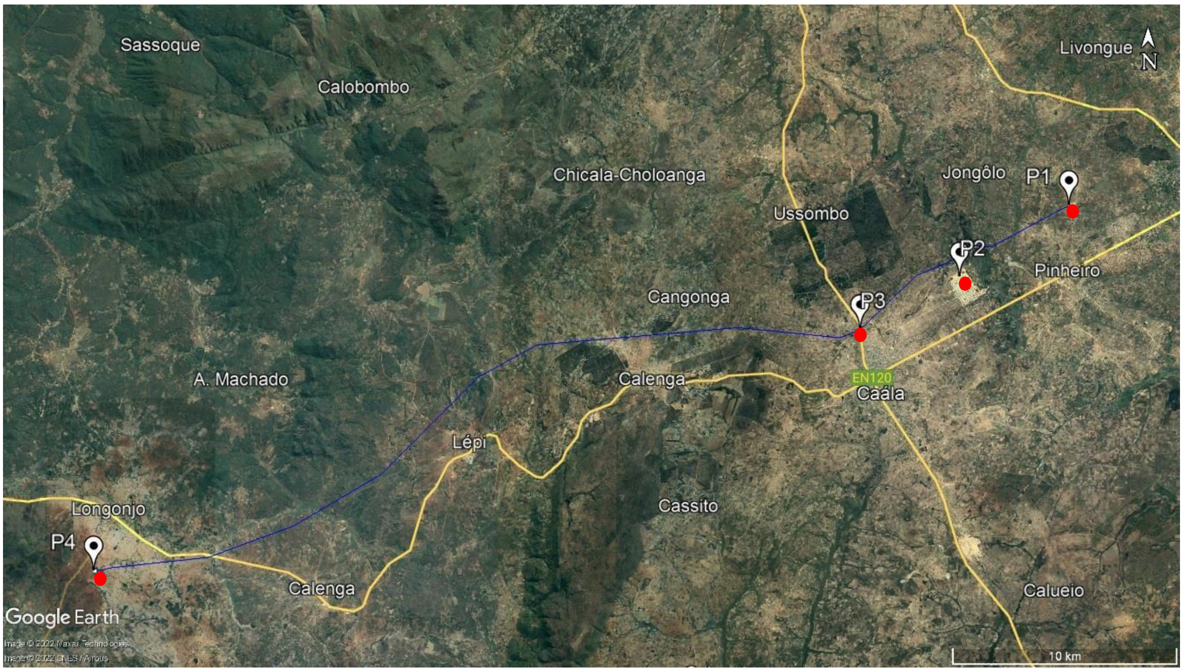

Figure 4-13: Sampling points for particulate matter and noise in the Project's area of influence. Red dots mark the main sensitive receptors.

Table 4-2 shows the two air quality and wind measurement points (for the Project site), their geographical coordinates and the duration of the measurements.

Table 4-2: Particulate matter sampling points along the project's areas of influence.

Reference	Measurement Location	Geographical coordinates	Date	Time of measurement	
				Home	End
1	Near the SE of Belém do Dango	12°46'45.22'' S 15°38'20.10'' E	25/10/21	08h57	09h58
			24/01/22	15H52	16H54
2	Centralisation of Caála	12°48'28.65'' S 15°35'38.97'' E	26/10/21	12h44	13h47
			25/01/22	14H07	15H09
3	Locality of Calenga, Municipality of Caála	12°49'44.53'' S 15°33'12.51'' E	25/10/21	16h13	17h15
			25/01/22	15H32	16H34
4	Immediate vicinity of the future SE of Mina do Longonjo	12°55'33.81'' S 15°14'22.97'' E	25/10/21	09h04	10h06
			27/01/22	12H05	13H007

When analysing the results obtained, a number of sources of particulate matter emissions were found, such as traffic and vehicles, agricultural and construction activities, etc. There are also emissions from diffuse and natural sources, including unpaved roads.

Table 4-3 shows the results of point measurements of $PM2_{.5}$ particulate matter and wind in the areas defined for the project site.

Table 4-3: Particulate matter and wind sampling results for the project.

Reference	Temperature (º C)	Management wind	Wind (Km/h) *		Parameters (mg/m³)			
			Maximum	Minimum	Maximum	Minimum	TWA	STEL
1	30,9	S	6,4	3,9	0,134	0,002	0,009	0,017
	26,6	SE	6,8	0,7	0,073	0,002	0,008	0,012
2	22,3	E	4,6	3,63	0,127	0,002	0,020	0,035
	28,7	O	10,9	8,3	0,058	0,002	0,005	0,009
3	32,4	E	5,3	2,8	0,150	0,002	0,017	0,025
	26,5	O	11,0	5,3	0,123	0,002	0,039	0,029
4	32,9	NE	9,7	5,6	0,101	0,002	0,008	0,015
	28,1	N	11,1	5,4	0,089	0,002	0,006	0,010

***Note:** Duration of wind measurement - 5 minutes. TWA=time-weighted average; STEL=short term exposure limit

There is no specific legislation on air quality in Angola. In this context, the guidelines and good practices of the *International Finance Corporation* (IFC) applicable to the Project were used. For ambient air quality standards, the general *Environmental, Health and Safety* guidelines of the *International Finance Corporation* (IFC, 2007)[2] require that:

> "Emissions of solid dust particles do not result in concentrations of pollutants that reach or exceed established limits and relevant environmental quality standards, applying legislated standards, or in their absence, the current Air Quality Guideline".

[2] *International Finance Corporation (April 30, 2007) Environmental, Health and Safety Guidelines: General EHS Guidelines: Environmental Air Emissions and Ambient Air Quality*.

Air Organisation or other World Organisation Organisation Health Organisation (WHO)[3], recognisedsources internationally."

The IFC air quality guidelines (emission of solid dust particles) relevant to this study are shown in **Table 4-4**.

Table 4-4: IFC air quality guidelines.

Pollutant	Average period	Air quality standard (µg/m)[3]
PM2.5	Annual average	35
	24 Hours	75

Based on the time of the samples taken, an extrapolation from sixty (60) minutes to 24 hours was made by comparing the $PM2_{.5}$ TWA values in **Table 4-3** with the standard set by the IFC for 24 hours (see **Table 4-4**). No values above the air quality standard were recorded during the measurements. There was no record of the limit value being approached, nor did it exceed the $PM2_{.5}$ air quality standard (see **Table 4-2**).

Of all the measurements made for $PM2_{.5}$, the highest particulate matter emission values were measured in **reference** area **3,** in the dry season the highest value, near a village and a national road with regular road traffic, mostly mopeds and light passenger and goods vehicles. In general, at all the points sampled, there were no constant or significant sources that could significantly affect/degrade air quality through particle emissions. In this way, and according to established international standards (**Table 4-4**), the air quality in the project's areas of influence can be judged to be good.

4.1.7 Sound

To obtain detailed information on the noise environment, four (4) measurements were taken at the same locations (shown in **Figure 4-13**) and at the same time as the particulate matter measurements (see **Table 4-1**). The selection criteria used for the particulate matter measurements were

[3] *World Health Organisation (WHO). Air Quality Guidelines Global Update, 2005. PM 24-hour value is the 99th percentile.*

also applied to the noise environment. The measurements were carried out using noise measuring equipment (see **Photo 4-10**), consisting of a Brüel & Kjær model 2245 precision sound leveller.

Photo 4-10: Noise measurement carried out at reference site 1 (SE of Belém do Dango).

The following parameters were used to interpret the results:

- **LAeq:** equivalent continuous noise level. This is calculated using a formula based on the principle of energy equality (calculated by the device). It is a level used to define the continuous energy equivalent noise value at the measurement site;
- **LAFmax:** is the highest level of environmental noise occurring during the measurement time. This represents the noise that occurred above 0.1 per cent of the measurement time;
- **LAFmin:** is the lowest environmental noise level that occurred during 0.1 per cent of the measurement time;
- LApeak**:** this is the maximum noise level (peak) during the measurement.

For each series of measurements, an *on-site* check was carried out before the measurements were taken.

Sound is a normal and desirable part of human life, however, when noise is imposed on people it can lead to disturbances, discomfort and other inconvenient effects on human and animal health. Noise is measured and quantified in decibels (dB). The definition of the logarithmic decibel scale means that noise levels do not change or add according to simple linear arithmetic. **Table 4-5** shows the noise sources and corresponding levels and typical tolerance.

Table 4-5: The noise levels and subjective intensity of common noise sources.

Causes	Noise level, dB (A)	Tolerance
Space launch (rocket) at 100 metres, firing a gun fire	140	Intolerable
Machines in a ship's workshop, rock concert	120	Intolerable
Factory factory factory, roomroom press press presses in operation	100	Very noisy
Motorway, shouting	80	Noisy
Warehouse, restaurant, discourse	60	Noisy
Quiet residential neighbourhood (level environment)	40	Calm
Studio recording studio (level environment)	20	Very calm
Hearing limit for young people normal	0	Very calm

The measurements took place only during the daytime and lasted twenty (20) minutes. The recorded values are shown in **Table 4-6** and **Figure 4-13 (**previous section) shows the noise measurement points.

Table 4-6: Results of noise measurements in the project's area of influence.

Reference	Time	Measured noise levels / Results (dB)				Noise sources
		LAeq	LApico	LAFmax	LAFmin	
1	09h20	56,9	98,6	86,7	38,8	Passers-by on the road and talking, mopeds in the vicinity and noise from the SE transmission lines in operation.
	16H00	50,5	80,1	66,7	43,9	
2	08h40	47,0	87,1	75,6	28,2	Passers-by travelling on the road and talking, domestic activities of rooms and background music.

Reference	Time	Measured noise levels / Results (dB)				Noise sources
		LAeq	LApico	LAFmax	LAFmin	
	14H15	41,7	79,4	67,6	33,0	Passers-by travelling on the road, background noise coming from houses, music and street vending.
3	16h30	57,6	92,6	80,1	38,3	Passers-by on the road and chatting, frequent road traffic with mopeds, light and heavy vehicles.
	15H37	56,7	87,3	74,5	39,5	
4	13h00	31,0	70,3	49,2	24,5	People chatting in the neighbourhood and noise of birds in the area.
	12H26	40,9	74,6	58,3	31,3	People passing by chatting, background noise from agricultural activities and birds existing in the area.

❖ National Guidelines and Standards

In Angola there are no guidelines for noise levels during the installation/construction, operation or decommissioning phase of a project. However, the *International Finance Corporation* (IFC, 2007) guidelines on Environment, Health and Safety (EHS) provide criteria and guidelines that have been adopted and are described below.

❖ IFC Guidelines on Noise

The IFC guidelines on SSA provide criteria for noise levels that have been adopted for this report. The criteria state the following:

> *"The noise impact must not exceed the levels shown in Table 1.7.1, or result in a maximum increase in background levels of 3 dB at the nearest off-site receptors."*

Table 1.7.1 of the IFC guidelines on SSA is shown in **Table 4-7**, taken directly from the IFC document.

Table 4-7: Noise levels according to IFC guidelines on SSA.

Receiver	Established Noise Levels - 1 hour $_{LAeq}$, dB(A)	
	Daytime (07:00 - 22:00)	**Night (22:00 - 07:00)**
Residential, industrial and educational zones	55	45
Industrial, commercial	70	70

Although the occupational hazards of noise are not included in this report, it is important to note that there are some good practices on noise at project implementation sites that will be adopted in this report, and these include the following:

- The noise exposure limit for workers of 85 dB(A) over an 8-hour average is the acceptable exposure. This noise exposure limit is consistent with current worker noise exposure standards from the US Occupational *Safety and Health* Administration (OSHA) and international regulations.
- In addition, no unprotected ear should be exposed to a peak (instantaneous) sound pressure level of more than 140 dB(C) or an average sound pressure level of 110 dB(A).

In general, the values recorded confirm that the areas along the proposed route for the TL have a fairly quiet noise environment, with values below 70 dB ($_{LAeq}$). The Belém do Dango SE (reference point 1), which is in operation and surrounded by a few houses, and the town of Calenga (reference point 3), with constant traffic on the main road, have higher noise levels compared to the other reference points (2 - the town centre and 4 - the future Longonjo mine SE).

4.2 Biotic

4.2.1 Areas of Environmental

Using the data obtained from the LiDAR survey carried out along the proposed route of the transmission line, it was possible to carry out an exercise to assess existing conditions. Through this exercise it was possible to identify some areas of environmental sensitivity, particularly watercourses and areas with more developed vegetation. As such, some adjustments were made to the route in some sections of the line so that it would have fewer potential impacts and improve its environmental performance. It was also the aim of this exercise to identify areas/locations with steeper slopes and, consequently, more prone to ongoing erosion processes. These erosion processes have the potential, in the future, to influence the integrity of the towers to be installed and jeopardise energy transport.

4.2.2 Flora and vegetation

The flora and vegetation surveys on the ground were carried out on two occasions, between 25 and 26 October and 2 and 3 November 2021, and between 24 and 27 January 2022. The general land cover chart (see **Figure 4-14**) indicates that there is a mosaic of forest and grassland areas (covered by miombo) in the area, interspersed with areas of intense agricultural activity and sparse vegetation.

Bibliographic data on the phytogeography of Huambo province was previously consulted in order to obtain an overview of the natural vegetation cover in the area in question. With the aid of line maps and previously obtained satellite images, the representative areas of the main vegetation units were defined for the surveys. This was followed by a reality check and a detailed description of the vegetation cover. These areas were classified according to their natural value and landscape sensitivity (see **Table 4-8**).

Table 4-8: Quantification of the area of influence according to natural value and landscape sensitivity.

Class	Total area (ha)	Percentage (%)
High Nature Value (A)	0,15	0,07
Medium-High Value (B)	3,25	1,49
Average Natural Value (C)	2,44	1,12
Steep Slopes with Erosive Vulnerability (D.1)	1,46	0,67
Steep Slopes with Erosive Vulnerability Reduced (D.2)	1,86	0,85
45 metre corridor	217,75	100

It should be emphasised that of the main vegetation units identified (see **Table 4-9**) around 57.5 % are represented by scrubland (including dense scrubland totalling 41.2 ha), 6.4% by native miombo woodland and less than 2% by exotic tree cover, namely a eucalyptus grove of approximately 1.4 ha.

Table 4-9: Quantification of the area of influence according to vegetation type.

Class	Total area (ha)	Percentage (%)
Open forest - Native Miombo woodland	4,6	2,1
Exotic tree cover (Eucalyptus)	1,4	0,6
Arboreal Gallery	0,2	0,1
Scattered Trees	5,5	2,5
Dense bushland	14,6	6,7
Shrubbery	26,6	12,2
Mato Ralo	18,5	8,5
Palustrine vegetation	0,23	0,1

Considering the linear extension of the area to be affected and the few variations in vegetation cover along it, we tried to walk as close as possible to the line corridor in order to see the situation *in situ* and describe the structure and composition of the predominant plant communities. The DAFOR scale was used to estimate abundance (see **Table 9-1** in **Appendix 9**).

According to Barbosa (2009), the area under study is entirely within the miombo domain, characterised by the occurrence of the genera *Brachystegia, Julbernardia* and *Isoberlinia,* and is considered to be a medium or high miombo (from 7 to 15 metres), submontane, on ferralitic or similar soils, associated with plots of "Anharas de Ongote", dominated by suffrutice vegetation. The floristic composition varies little along the route, while the structure is quite variable, depending on the relief, the soil and climatic conditions of the location and the level of anthropogenic intervention, being more intense in the vicinity of the towns.

The main species identified in the miombo were: *Brachystegia spiciformis, Brachystegia tamarindoides, Brachystegia floribunda, Brachystegia puberula, Julbernardia paniculata, Faurea rochetiana, Protea sp., Syzygium guineense, Cussonia angolensis, Ochna schweinfurthiana, Parinari* *curatelifolia*, among others, and can form part of the tree and/or shrub strata. The miombo is often interrupted by open areas called "Anharas de Ongote", or "Anharas do alto", formations of rhizomatous and *cespitose* suffrutices, with a predominance of *Brachystegia russelliae, Cryptosepalum maraviense, Cryptosepalum exfoliatum,* among other species (see **Table 9-1** in **Appendix 9**).

Dinis (2006) categorises the area in question as agricultural zone no. 24, corresponding to the extensive plateau area, whose dominant vegetation is generally open forest, panda or miombo woodland, dominated by the genera *Brachystegia*, *Julbernardia* and *Isoberlinia,* alternating with plots of savannah (shrubby or rarely arboreal) and high and valley anharas, depending on the relief.

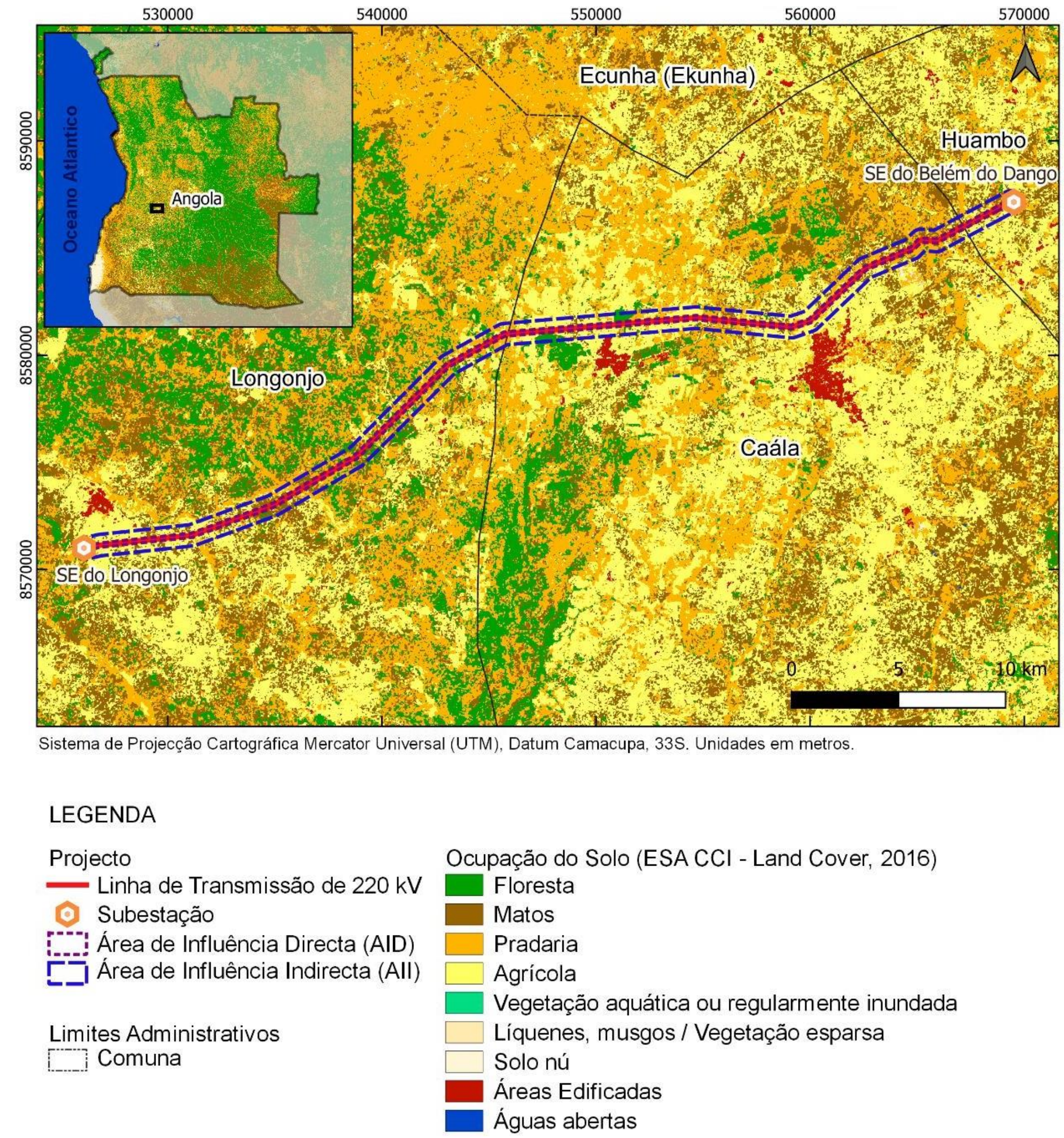

Figure 4-14: General map of land cover in the area of influence of the project. **Source:** ESA CCI - Land Cover, 2016.

As you can see, both authors refer to the two main vegetation formations and mention little variation in the specific composition and structure, which shows a certain constancy along the entire route.

According to the bibliographic data, the area where the line will run is completely covered in miombo, the main plant formation of the central plateau. The above description characterises the state of the area's natural vegetation cover at a time when there was little or no intervention on the natural landscape. As a result of the growing human influence on the natural environment, the vegetation is now quite devastated, especially near the localities where the constant search for natural resources for survival has contributed to the current situation (see **Photo 4-11**).

Photo 4-11: Aspect of miombo vegetation in the initial part of the power transmission line route, near the Belém do Dango substation.

Some species-rich residual patches can be found sporadically, mainly in correspondence with private properties or venerated sites such as cemeteries. Some tall trees that were deliberately left and appear isolated in the degraded landscapes bear witness to the structure and composition of the dense miombo that characterised the natural landscape. The level of degradation varies according to proximity to the localities and access conditions, and the growing trend is evident.

Charcoal production and itinerant agriculture are two of the main human activities that have contributed greatly to the current situation, which has considerably reduced and continues to reduce the local flora and consequently the fauna that depends on it. Despite this, since the miombo is a very resilient formation, even in very degraded areas several species can be seen regenerating, although they suffer the effects of constant burning year after year, especially during the dry season. In many places the degradation of the miombo has been so profound that the process of savannisation is very evident at various points along the line and adjacent areas.

The two main predominant vegetation formations (habitats) along the line are miombo and "anharas de ongote" (see **Photo 4-12**). Some of the main constituent species have been identified in each of these formations

Photo 4-12: Aspect of the two main predominant habitat types along of the line. On the left, miombo and on the right, "Anhara de Ongote".

For miombo, some of the main species identified along the route were: *Brachystegia spiciformis, Brachystegia puberula, Brachystegia tamarindoides, Julbernardia paniculata, Isoberlinia angolensis, Bobgunia madagascariensis, Combretum collinum, Erytrina abyssinica, Erytrophleum africanum, Hymenocardia acida, Parinari curatelifolia, Ekebergia benguelensis, Syzygium guineense, Pericopsis angolensis, Psorospermum febrifugum,* among others, and can form part of the tree and shrub strata simultaneously. The herbaceous stratum, which is generally grassy, is also quite degraded due to overgrazing, a very frequent activity practised by the people along the line. It should be emphasised that there is also the spread of some large trees of anthropogenic origin such as eucalyptus and/or pine trees, often forming dense clusters, and also fruit trees (mangoes, avocados, among others), especially along water courses (rivers) and close to localities.

The "anharas de ongote" are a characteristic formation within the miombo, which occur throughout the area. It generally appears as an open area, alternating with the miombo, or occupying the small clearings between the trees and shrubs, with a great diversity of geoxylic suffrutices. The main species identified were: *Brachystegia russelliae* (ongote), *Cryptosepalum exfoliatum* subspecies *suffruticans*, *Eugenia malangensis, Psorospermum mechowi, Fadogia fusioides, Combretum platypetalum, Lannea edulis,* among others.

The degradation of the vegetation is also evident in the watercourses along the line (see **Photo 4-13**), as they are generally used for agriculture in times of drought when rainfall is scarce. In addition to various vegetables, maize and bananas are grown on the banks of the watercourses. Several species of other plants were identified near the water line, including *Phragmites mauritianus, Penisetum purpureum* (used as fodder for cattle) and the invasive *Tithonia diversifolia*.

Invasive species are species introduced accidentally or on purpose into a given environment (exotic) that proliferate uncontrollably, jeopardising the balance of the ecosystem and native species.

Photo 4-13: Photograph of a watercourse with degraded vegetation replaced by ploughs.

During the field surveys, some species considered invasive in Angola were identified and recorded (see **Figure 4-15**), of which *Tithonia diversifolia* and *Opuntia ficus indica stand* out. The most common of these is *Tithonia diversifolia,* which is already widespread at various points along the route, especially close to localities and watercourses.

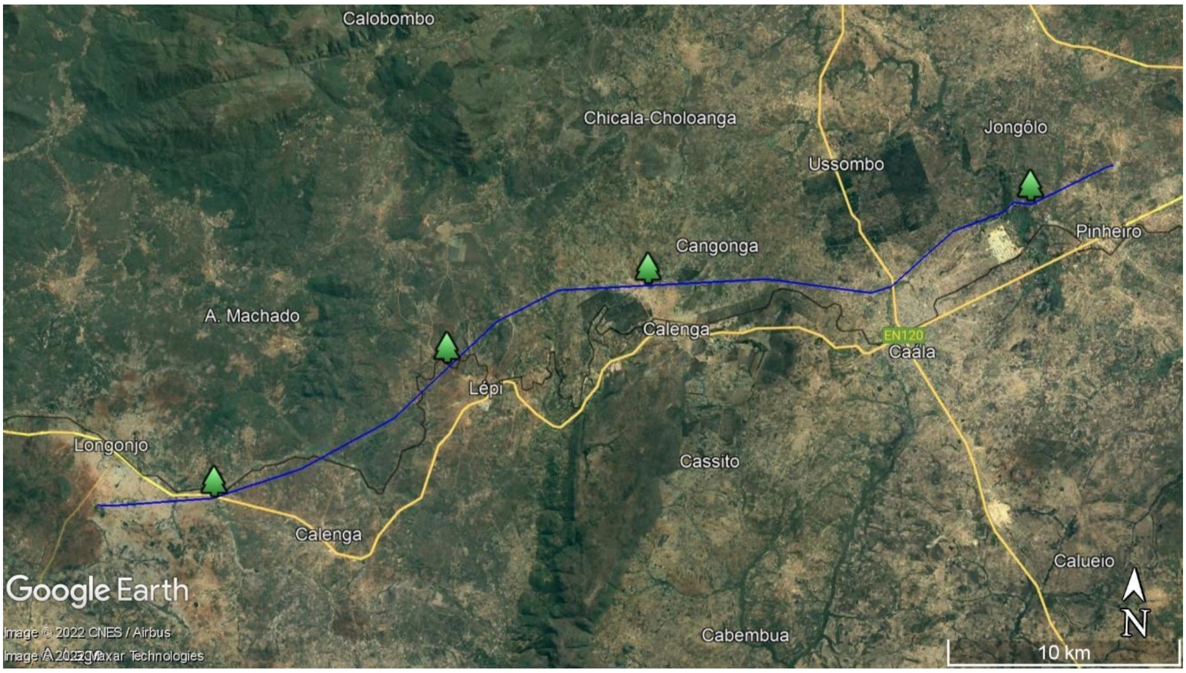

Figure 4-15: Map showing locations where some invasive species have been observed in Angola.

4.2.3 Fauna

In this chapter we discuss the data on the faunal elements present in the study area, mainly resulting from bibliographical research and field visits. The main focus in this report is on Birds, with more brief reference to Mammals, Reptiles and Amphibians. As a whole, these constitute the faunal groups that are generally best known, most easily discussed in an appropriate context and thus considered most suitable for the desired environmental characterisation, with birds remaining the most important given the local conditions, and especially considering the scope of the proposed project.

The ornithological, mammal, reptile and amphibian field surveys (see **Figure 4-16**) were carried out in three visits during the dry and rainy seasons, namely between October 2021 and January 2022.

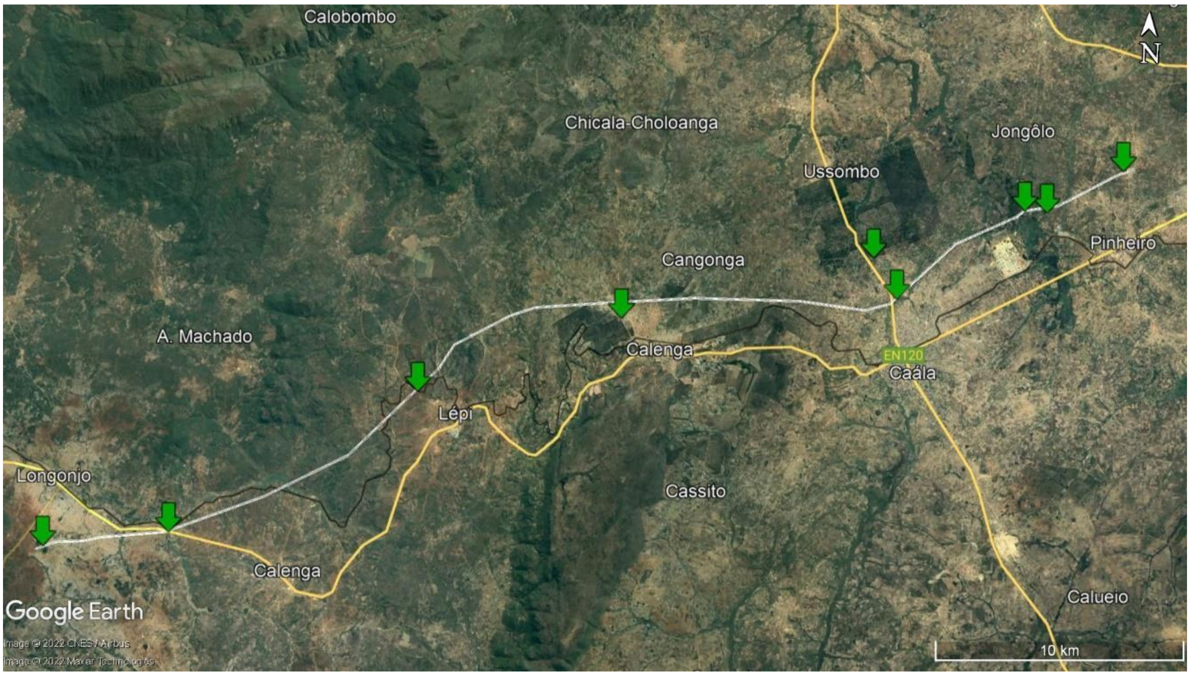

Figure 4-16: Map showing some of the locations where fauna surveys were carried out.

Birdlife

Birds are often the most important faunal group to characterise in faunal surveys, firstly because of their high diversity, and because they are relatively common with many species that are easy to record, and secondly because birds are suitable for quantification and future monitoring. Birds are above all sensitive environmental indicators of biological richness, fulfilling several important ecological roles in the places where they occur. In addition, published knowledge on birds tends to be much more detailed, up-to-date and accessible than that corresponding to other faunal groups, and therefore more easily comparable, and generally includes data on threatened, migratory, rare and endemic taxa.

On the other hand, birds are also the most vulnerable group and most likely to be directly affected by power lines, especially as a result of direct injuries and fatalities following flight collisions or electrocution. Although no studies have been carried out in Angola investigating the risks that transmission lines pose to birds, there is extensive literature on the subject carried out more globally, but particularly in South Africa, which can be applied to this study (e.g. Jenkins et al. 2010; Smallie 2011). These risks, however, are not evenly distributed between taxonomic groups of birds.

birds, but tend to have a high incidence for some, while remaining of little relevance for other groups (Smallie 2011). Specifically, large, dense-bodied species that inhabit open fields are the most vulnerable (Jenkins et al. 2010).

This paper presents the result of an effort to produce as comprehensive a list of birds as possible, although some of it was based partly on desk work, considering some time constraints for fieldwork. As a starting point, we produced, based on available literature (e.g. Rosa Pinto 1983; Dean 2000), but also from unpublished records and some online resources (essentially from IUCN, CITES, GBIF, among others), a list that aggregates all the bird species that have been recorded or are expected to occur in Huambo Province. This list was later condensed to include only those species confirmed on site or considered likely to occur in the actual project area. We also took into account the species mentioned in an unpublished report to which we had access, referring to an exhaustive survey carried out at the Mina do Longonjo site, and since it is close to the end of the planned line route.

The surveys were carried out opportunistically and not on the basis of a systematic methodology. The reason for discarding methodologies such as transects or point counts was because the area of the line route was relatively large for a systematic survey, and also because of the need to spend relatively little time at the various sites. Observations were conducted by one observer, including at fixed points and on foot, mainly in the early morning and late afternoon along the proposed route. Due to some human disturbance of the site, most of the work was done using the existing roads, which were preferably travelled slowly to allow the birds to be recorded, often requiring the vehicle to stop to properly identify the birds.

A pair of Swarovski SLC 10X42 binoculars was used for birdwatching, and when necessary we also used a Swarovski 80mm ATS HD telescope mounted on a Manfrotto tripod, which is useful for spotting birds perched far away. Whenever possible, the birds were photographed with a Canon Eos 7D camera and a Canon EF 400mm f5.6L USM telephoto lens.

To help identify the birds, we used the few published field guides that include Angola (Sinclair and Ryan 2003), and several published articles that dealt with the local bird fauna (e.g. Rosa Pinto 1983; Mills 2007, 2010; Mills *et al., 2010;* Dean et *al.,* 2019).

In order to compile as comprehensive a list of birds as possible and to compensate for the limitations of field surveys, we refer here not only to the bird species recorded in the field, which are marked as "CR" (confirmed record), but also to those that are expected to occur in the project area, as they have been previously confirmed in the region. These have been referred to here as "PR" (probable occurrence) or "PO" (possible occurrence). However, it is still difficult to assess the likelihood of recording many species at the project site, and it is possible that species not considered may be recorded in later surveys (See **Table 9-2** in **Annex 9**).

As a starting point, a total list of 463 bird species for Huambo province was produced from bibliographic data, but subsequently a shorter list was considered with 292 species that were considered possible from the outset and with some subjective probability of occurring at the site. Finally, as a result of the fieldwork, it was possible to record and confirm the presence of a total of sixty-four (64) bird species, twelve (18) of which were photographed.

In the general list that includes all the species expected to occur (see **Table 9-2** in **Annex 9**), the birds are relatively well distributed among the respective families, and it is quite rich in terms of diversity, which is not surprising given that it covers a relatively extensive region. This list of species should, however, be considered merely indicative, as only around 22 per cent of these birds were subsequently confirmed as being present during the field surveys (64/292). On the other hand, the list of birds confirmed in the field is generally balanced, since 42% (27/64) of the species belong to an order other than passerines, a proportion that is approximately within expectations, since a result close to 50% or slightly below is considered normal, consistent with global proportions (for the province's global list this ratio is 52%, and in the list of species that were considered possible or expected this proportion is 48%). This result probably reflects a relatively high local ornithological diversity if we take into account the high level of environmental disturbance.

Based exclusively on the birds that were recorded and reported as confirmed, in terms of bird families and within the non-passerine orders, we recorded a total of 13 families belonging to 12 orders, indicating a very balanced distribution of the families present. Among these, the most representative families were herons (family Ardeidae) with five representatives, followed by raptors (family Accipitridae) with four, and ducks and the like (family Anatidae) with three representatives. Among the order of passerines, the presence of 15 bird families was confirmed. Among the latter, the most representative group was the swallows (Hirundinae family) with six representatives, followed by the group of small granivores (Estrildidae family) with five, and the nuthatches and flycatchers (Muscicapidae family), hummingbirds (Nectarinidae family) and the weavers and widows (Ploceidae family), all with four representatives, and finally the petrels and warblers (Motacilidae family) with three representatives each.

In general, the birds observed were located somewhat heterogeneously along the route, with the areas with the greatest diversity being the flooded lowlands of the Cunhongamua River, particularly near two small lagoons on its banks, and in some woodlands near Lepi and Longonjo. Several of the species observed are quite common and, in some cases, commensals of man, with a tendency to become locally dominant, such as the heron (*Bubulcus ibis*) and the common raven (*Corvus albus*). These species, being generalists, are very adaptable and tolerant of habitat disturbance and transformation.

<u>Sensitive birds and/or those potentially most affected by the project</u>

Birds of prey

Diurnal birds of prey are predatory species that occupy the highest positions in the ornithological trophic pyramid and, for this reason, are typically less abundant in number, but on the other hand more vulnerable to potential environmental impacts. In addition, they can be highly specialised, occupying very particular niches and are therefore also excellent natural indicators. Finally, the sometimes considerable size of some of these birds often makes them vulnerable to transmission lines, which is also why they should be given special consideration in studies of this nature.

The diversity of diurnal birds of prey (families Pandionidae, Accipitridae and Falconidae) throughout the project area is potentially high, which is reflected in a total of 30 species (one species of the Pandionidae family, 21 of the Accipitridae family and eight of the Falconidae family) that were initially considered likely to occur along the route of the line. During the fieldwork, the presence of only six species of birds of prey was confirmed, four of them belonging to the Accipitridae family and two to the Falconidae family. In addition to these, seven more species of birds of prey (six from the Accipitridae family and eight from the Falconidae family) have been confirmed at the mine site. Although the species reported for the mine site have not been confirmed along the power line route, it is quite likely that they could occur. Overall, this result can be considered relatively modest, and not representative of the expected diversity, but if we add up the species present at the mine, it is much more informative. We have only marked one additional species (Accipitridae family) as being very likely to occur, and which should or could be recorded in future surveys.

Focussing exclusively on the birds of prey confirmed in the study area, none of them are essentially migratory, all of them are common and widely distributed on the continent, and above all none of them is a species of special conservation concern. Some of these birds may show some sensitivity to the presence of power lines, but they will be mentioned in the corresponding chapter. Among the birds observed, the grey kestrel (*Elanus caeruleus*) is a small insectivorous raptor that was seen near Dango; the yellow-billed kite (*Milvus aegyptius*) is a medium-sized species and a generalist with great adaptability that tolerates disturbance well, having been seen on two occasions, near Longonjo and Caála; the marsh harrier (*Circus ranivorus*) was observed and photographed hunting in a low point of one of the tributaries on the left bank of the Cunhangamua river to the west of Dango; the red-tailed buzzard (*Buteo auguralis*) is a small eagle that feeds on small rodents and insects and is relatively common on the Angolan plateau. One of these birds was seen hovering over a eucalyptus grove north of Lepi; two small falcons were also confirmed, namely an African kestrel (*Falco rupicolus*) which was seen near Longonjo; and finally a Dickinson's kestrel (*Falco dickinsoni*) photographed near Caála.

Water birds

The concept of waterfowl is a very broad one that includes birds from many different families and orders, and is often difficult to define, which is why they have not been categorised in the general list. In any case, some have been highlighted here because they are of a particular nature.

among the birds confirmed in the field. In addition, many of the aquatic species are also predominantly migratory, but this aspect will be considered in more detail in a separate section. The importance of recognising the presence of waterbirds is not just because they are often at least partially migratory, or because they can include vulnerable species, but above all because of their tendency to occasionally accumulate in large concentrations around water points and wetlands. In addition, many aquatic species can actually pose significant risks of collision with transmission lines.

In the specific case of this project, a critical area stands out in particular, with the presence of permanent water and a swampy surrounding area, namely at the crossing over the Cunhangumua River. On the rest of the route of the projected line, the presence of aquatic birdlife is reduced or absent, with only two crossings over the Tchicanda River between Lépi and Longonjo worth mentioning, but where the surveys carried out, although somewhat limited here due to the difficulty of access, did not record much diversity when compared to the Cunhangamua River, and no additional species. Thus, in the Cunhangamua River and associated lagoons, the presence of bird species was confirmed, all non-passerine, essentially aquatic, and some of them were photographed. This is a significant result, and an indicator of the considerable diversity that exists in the wetlands surrounding the project at this location. All the aquatic species listed here are widely distributed and not threatened with extinction. In addition, only one of them is migratory, and five of them may be at medium or high risk of collision with transmission lines, but these components will be analysed in the corresponding section. Among the aquatic species, we have the sting-billed duck (*Plectopterus gambiensis*), the long-eared duck (*Nettapus auritus*) and the yellow-billed duck (*Anas undulata* - see **Photo 4-14**), species belonging to the Anseridae family, well adapted to all types of inland waters, and which were observed in the lagoons or flying near the Cunhangamua River. In particular, the last of these duck species proved to be very common, with several flocks observed.

	Photo 4-14: Yellow-billed duck (*Anas undulata*) photographed near the transmission line route.

Lesser grebes (*Tachybaptus ruficollis*) were seen in the lagoons, a species that is well distributed throughout the country and very common in all types of lagoons and inland reservoirs. Among the Ardeidae family, there are three species that can be considered to be almost exclusively associated with aquatic areas: the crab heron (*Ardeola ralloides*), the *purple heron* (*Ardea purpura*) and the egret (*Egretta garzetta*). All these herons are very common and well-distributed species in Angola. The African Cormorant (*Microcarbo africanus*) was also confirmed in the same area and is also a common species in all types of inland waters. Two representatives of the Rallidae family were also recorded and photographed in one of the lagoons on the Cunhangamua River, namely the common moorhen (*Gallinula chlorops*) and the crested coot (*Fulica cristata*), which were found to be locally common. Finally, specimens of two representatives of the Alcedinidae family were also seen at the same site, the pileated woodpecker (*Corythornis cristata*) and the spotted woodpecker (*Ceryle rudis*), both of which are also very common in all types of inland waters.

Migratory birds

The definition of a migratory bird is not always clear or conclusive. It generally refers to species that follow regular seasonal movements, sometimes covering long distances, between breeding and wintering grounds. However, many species make irregular, often unpredictable movements, and sometimes also concentrate in large numbers in certain places and, in this sense, may be at least partially or locally migratory. Finally, some of the migratory species present in Angola are Palaearctic migrants, while others are intra-African migrants. In this study, we only considered the Angolan species classified as migratory in the only available *checklist of* Angolan avifauna (Dean 2000).

The presence of migratory birds is usually of great concern for projects of this nature, because they can include large flocks and often rare or threatened species, which increases the risk and consequences of possible collisions. Migratory birds tend to follow pre-established routes which, when intersected by a barrier such as a power line at specific locations, can lead to major losses. In addition, they can also congregate, sometimes in large numbers, at specific sites that attract many species, such as estuaries, marine lagoons, inland reservoirs and wetlands in general. The lists of birds prepared in this work discriminate against migratory birds, even though they are made regardless of whether or not they are species vulnerable to transmission lines. It should be noted that migratory behaviour is often partial or regional, and also that certain species may have overlapping populations and behave differently in terms of seasonal movements, which can confuse the definitions adopted.

Our preliminary list recovered 58 species of migratory birds considered likely to occur with some degree of probability, which corresponds to approximately 20 per cent (58/292) of the total possible birds considered. However, only 10 migratory species were confirmed during our visits, namely the aforementioned crested coot (*Fulica cristata*) and Dickinson's kestrel (*Falco dickinsoni*), as well as the golden bee-eater (*Merops pusillus*), the yellow-winged warbler (*Motacilla flava*), the common black swallow (*Psalidoprocne pristoptera*), the grey swallow (*Pseudohirundo griseopyga*), the little striped swallow (*Cecropis abyssinica* - see **Photo 4-15**), the squirrel swallow (*Cecropis senegalensis)* and the grey flycatcher (*Muscicapa striata*).

Photo 4-15: Lesser Spotted Swallow (*Cecropis abyssinica*) photographed near the transmission line route.

However, it should be emphasised that most of these species are local and only partial migrants, which make irregular movements in southern Africa, and may even be resident in the area. On the other hand, six other migratory species were also recorded at the mine site and could probably occur, at least transiently, along the route of the line. Furthermore, if the study had been carried out in the transition from the cacimbo to the rainy season or vice versa, there would have been more chance of detecting migratory birds, given the typical seasonal patterns. In conclusion, none of the migratory species detected are of conservation concern, and only one represents a moderate risk in terms of collision, a factor that will be addressed in another section.

Birds with restricted global distribution

As species of restricted global distribution we are referring to birds that are endemic or almost endemic to a region or country, in other words, that occur exclusively in a certain circumscribed area. More specifically, here we consider bird species that may be endemic or near-endemic to Angola. The fact that they have a limited distribution corridor can make it difficult to find them.

certain species that are more sensitive to environmental disturbance, while at the same time raising the importance of their conservation.

Our preliminary list determined the possible occurrence of six species with a restricted global distribution, four of which are endemic to Angola and the other two almost endemic. All six of these species were considered possible. Subsequently, during our field surveys, only one of these species was observed, the Oustalet's hummingbird (*Cinnyris oustaleti*). This is a species that is almost endemic to Angola and whose global distribution is restricted to the highlands of the Angolan plateau and some areas of northern Zambia. This species seems to favour areas of sparse miombo savannah at altitude, and in Angola it is relatively common in the province of Huambo. It is not an endangered species, nor is it particularly vulnerable to the presence of power lines.

It should also be emphasised that the presence of one of Angola's endemic birds, the Angolan Lark-bill (*Coccopygia bocagei*) and four of the near-endemic species, has been reported for the mine area, but some of these records raise some doubts and may be erroneous. On the other hand, and also for the mine, the occurrence of a species of wagtail (*Colius striatus*) was recorded, which is certainly an error as it doesn't occur in this region of Angola, but should be an observation of the endemic species of red wagtail (*Colius castanotus*), the latter restricted in its distribution to the western half of Angola, but quite common, adaptable and tolerant of human presence and impacted habitats, and not threatened.

Threatened or priority birds in terms of conservation

This classification refers to species categorised according to their conservation status, for which we follow the global Red Lists published by the IUCN, but we also take into account the Red List of species in Angola. In this context, species of conservation interest are those assessed and considered to be at risk of extinction, or classified as anything other than Least Concern (LC).

For this particular project, we didn't record any species of conservation concern in the field, and all 62 birds observed were considered to be birds of least conservation concern (LC). In relation to the group of birds considered to be of possible occurrence, we have only two species that are sensitive in terms of conservation, in both cases, listed on the IUCN list as near threatened (NT). One of these species, the dancer *eagle* (*Terathopius ecaudatus*), was considered highly likely to be present, although we were unable to observe it. In addition, this bird was observed at the mine site, which is a very strong indicator that it may also occur along the power line route, not least because it is a species that maintains large territories. This eagle is a species vulnerable to human disturbance and particularly to intensive agricultural practices, but in Angola it is still relatively common in the highlands. The second species considered, the vespertine falcon (*Falco vespertinus*) is a migratory bird of prey, but its presence in Angola is frequent but rather unpredictable, so it was only included on the list as a hypothetical occurrence.

Birds sensitive to transmission lines

Ornithological species were also considered in this list according to the potential risk that the existence of transmission lines could pose to them, in terms of injury or death caused by collision and/or electrocution, and in accordance with what is published in the literature. Although studies of this nature have never been carried out in Angola, there are studies carried out in South Africa (e.g. Smallie 2011), which we have applied as far as possible to our conditions. Thus, for this specific variable, the bird species were classified as high (A), medium (M) or low risk (B).

Considering the species with confirmed presence in the field, three species were detected that can be considered to be at high risk of collision. Two of these are waterfowl from the Anatidae family and have already been mentioned, namely the iron duck (*Plectopterus gambiensis*) and the eared duck (*Nettapus auritus*). The ferret duck is a large, dense-bodied anatid which, in studies carried out in South Africa, was often found to be sensitive to the risks of collision with power lines. On the other hand, the long-eared duck is much smaller, but has a high body density and a very fast, straight flight, and has been reported in South Africa as a regular victim of collisions with power lines. In any case, we didn't detect any flocks of these birds, and only one pair of ruddy ducks and one isolated individual of a stoat duck were detected. It is therefore likely that they are not abundant in the area and this could minimise the expected impact, not least because they are widely distributed species, common and tolerant of a lot of additional disturbance.

The third species at high risk of collision is a bird of prey and has also been mentioned before, the marsh harrier (*Circus ranivorus*). This species is known to be very sensitive to collisions, due to its somewhat erratic flight at typically medium height, which is a concern to be considered, especially when power lines intersect or follow water lines and low-lying areas, which are this species' favoured hunting grounds. In any case, the aforementioned presence of the golden eagle (*Terathopius ecaudatus*) in the mine area must also be emphasised here, as it is a species classified as being at high risk of collision. The soaring eagle can be the victim of accidental collisions with high-voltage power lines during its gliding flights, while the palm vulture could be affected in areas close to water lines.

In addition, we also identified 11 bird species that we classified as medium risk (M), with all the rest being low risk (B). Among these species classified as medium risk are eight that have already been mentioned, namely five water birds - the yellow-billed duck (*Anas undulata*), the African cormorant (*Microcarbo africanus), the purple* heron (*Ardea purpurea)*, the common moorhen (*Gallinula chlorops*) and the crested coot (*Fulica cristata)*; and two birds of prey - the yellow-billed kite (*Milvus aegyptius*) and the red-capped buzzard (*Buteo auguralis*). In addition to these, there are two galliformes from the Phasianidae family, the stone partridge (*Peliperdix coqui*) and the red-collared partridge (*Pternistis afer*), two species of bird that are very common in Angola, adaptable and tolerant of human presence, and for this reason of little concern; finally, we also recorded the black-headed egret (*Ardea melanocephala*) and the red-eyed turtle-dove (*Streptopelia semitorquata*), quite different species in terms of habits and adaptations, but in both cases very common and well distributed in Angola, and equally tolerant of human presence. Four more medium risk (M) species were recorded in the mine area, three of them medium-sized birds of prey.

On the other hand, and in relation to birds with some probability of occurring in the study area but not confirmed either in the survey carried out in the area of the route or at the mine site, two additional species were identified as being of potentially high risk of collision. These were considered only possible but not necessarily probable, namely the Abdim's stork (*Ciconia abdimii*) and the palm vulture (*Gypohierax angolensis*). In the case of the former, being a stork, it is part of a group of large birds that are vulnerable to collisions with electrocution, especially when they accumulate in large areas.

In this case, however, its presence was not identified. As for the aforementioned vulture, which is a resident bird, it could also be the victim of collisions, especially near agricultural areas along water lines, where it favours establishing its territories. However, it should be emphasised that the presence of any of these species has not been confirmed.

Due to the confirmed presence of two high-risk species on the line route and a third in the mine, as well as 11 moderate-risk birds on the route and a further four in the mine, plus the unconfirmed possibility that up to two other high-risk species may occur, the presence and dynamics of the respective populations of these species should be monitored in the future.

Protected or specially designated areas

There is no formally designated conservation area crossed by the proposed route of this transmission line. It is only worth considering the existence of an IBA (*Important Bird and Biodiversity Area*) in Morro do Moco (Dean 2001), but this is around 50 kilometres north of the transmission line route (see **Figure 4-17**). Morro do Moco, as well as being an IBA, is also recognised for its importance in terms of endemism and biodiversity and is proposed as one of Angola's priority conservation sites, with a proposal to create a reserve on the site currently being evaluated, but not yet formalised. However, the considerable distance of Morro do Moco from the line project means that there is no interference to consider. In other words, the project under study is not expected to have any impact, even of a low order, on the bird communities in the Morro do Moco IBA.

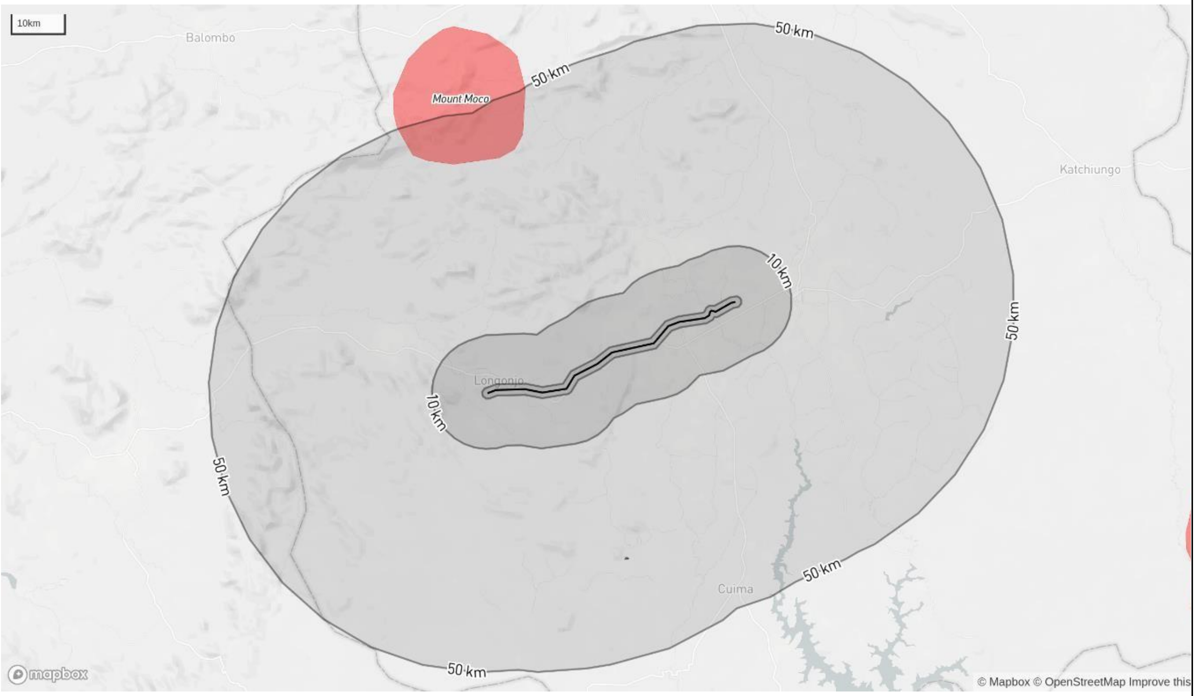

Figure 4-17: Location of the IBA in Morro do Moco in relation to the transmission line route.

Mammals

Mammals are generally one of the most important faunal groups to compile in biological inventories, given their high diversity, adaptation to a wide variety of habitats and the complex, often conflicting relationships they establish with human populations. The fact that many mammals are routinely captured and killed, and suffer from environmental destruction, makes some of these species highly vulnerable to disturbances of anthropogenic origin.

In general, most mammal families are better known and studied than some other vertebrate groups, such as amphibians and reptiles, but this may not be the case for some taxonomic subgroups that have cryptic diversity, such as rodents and bats. In Angola and throughout the country, around 300 species of mammals have been listed, but many areas of the country are poorly studied, which greatly limits the knowledge available and there are no exhaustive lists for the region where this project is located.

Several restrictions affected the compilation carried out on mammals. Firstly, the fieldwork had time constraints and was only carried out in a short seasonal window. Another limitation

The obvious reason for this is the nocturnal habits of many species or the shy nature of most diurnal mammals, making most species very difficult to observe and record in the wild. In addition, some taxonomic groups are notoriously difficult, not only to observe, but even to infer their presence from indirect evidence, including for example all bats and small rodents. Finally, and in a similar way to the case of amphibians and reptiles, we could not use mammal capture techniques, as this type of capture would take many days of effort in a given location and would be beyond the scope of this work.

The proposed power line is not expected to have a significant negative effect on local mammal populations. At the very least, terrestrial mammals should not be directly impacted, although an exception can be made in relation to some Chiroptera (bats) which may be affected in various ways, and particularly the larger frugivore species (family Pteropodidae), as it is well documented that these can occasionally collide with power lines.

The list of species (see **Table 9-3** in **Appendix 9**) of mammals produced here presents some results of records obtained during the field survey, but in order to try to present as comprehensive a list as possible, it was based mainly on office work. In addition to these, the species mentioned in an unpublished report to which we had access, referring to an exhaustive survey carried out at the Mina do Longonjo site, were taken into account, since it is located near the end of the planned line route. Overall, most of the entries on the list are thus based on available literature (e.g. Hill & Carter 1944; Crawford-Cabral & Veríssimo 2005; Kingdon et al. 2013; Beja et al. 2019) and some unpublished records, resulting in a final list that aggregates all the mammal species that have been recorded or are expected to occur in both Huambo and Huíla provinces together.

In addition to the species confirmed by observation or indirect evidence at the site as "RC" (confirmed record) or "RM" (record at the mine), we also tried to identify species that can be considered as "PR" (probable) or "PO" (possible) to occur along the route, while the others were considered to have a low probability of being present. However, some mammal species should be listed as unlikely to be recorded mainly because there simply isn't enough information available, making it really difficult for them to be recorded.

difficult to assess their likelihood, or in other cases due to the low intrinsic detectability of the taxonomic group, as in the case of many chiropterans and rodents.

The surveys were carried out opportunistically and not on the basis of a systematic methodology. The reason for discarding methodologies such as transects or trapping was because the area along the line route was relatively large for a systematic survey, and also because of the need to spend relatively little time at the various sites.

A total of 100 mammal species have been included in a list produced for the whole of Huambo province, but this is nevertheless a fairly extensive list that covers all the mammals that have at least once been mentioned as occurring within the boundaries of this province, but does not reflect their current situation, nor does it focus on the specific study area. The fact that the current project is quite extensive in its limits makes it more difficult to establish a list of probable species, as many may occur, but the paucity of data makes this exercise somewhat thankless.

The preliminary list was in any case condensed according to the subjective probability of recording the various species along the project route. In this context, a total of 37 mammal species were suggested, which we considered to be of possible presence or to be expected to some extent, having been drawn up prior to the field survey. However, in this list of expected species we opted to exclude all bat species except those previously reported for the mine area, given the lack of published data for this taxonomic group. Due to the limited time and the low detectability of most mammals, fieldwork proved to be unproductive in this chapter, with only two species confirmed through direct observation. In addition to these two species, 21 other species have been reported as being present in the mine area.

Endemism, rarity and priority conservation species

All the species confirmed in the field during our visits are fairly common in Angola, with a wide distribution and no conservation concerns. The swamp mangrove (*Atilax paludinosus*) was observed in the late afternoon in a bite near a tributary of the Cunhangumua River. This small, diurnal carnivore is quite common in the centre and north of the country and its presence was reasonably expected. Finally, on one occasion we also observed a

African common hare (*Lepus victoriae*), in a plough near Longonjo. This is another fairly common species, in this case mostly nocturnal, more frequent near ploughs and even in somewhat degraded areas. It is likely to be common along the entire route projected for the line. It should also be noted that small rodents were briefly observed but could not be identified, and we also recorded several tracks that also did not allow for probable species identification.

Among the species not confirmed for the transmission line route, we should highlight those that have been reported in the mine area. These include three endemics, one endemic species, one endemic subspecies and one near-endemic species. Thomas's rock rat (*Aethomys thomasi*) is an endemic species that has been confirmed as occurring in the mine area and will probably also be present throughout the study area for this project. It is, however, a common species in the central plateau and not threatened. The endemic subspecies was the Bocage's damselfly (*Heterohyrax brucei bocagei*). This is a relatively common species in Angola, particularly on the central plateau and escarpment and always associated with rocky clusters. Finally, the presence of Bocage's mole rat (*Fukomys bocagei*) was also reported at the mine. This is a species of mole rat that is relatively common in savannah and grassland areas on the central plateau. All the species listed as confirmed or expected to occur along the project route have an IUCN conservation status of low concern (LC).

It is important to mention here the situation regarding bats (order Chiroptera), since these are generally very little known in Angola and often include populations that may be locally threatened, even if they are not necessarily recognised on red lists. Although we didn't manage to identify any species during our visits, this is offset by the records obtained by third parties in the mine area. In the latter case, some caves with active bat colonies were located in the mine, and it was possible to identify five species belonging to four families of chiropterans. It is likely that all these species occur along the route of the transmission line, but we do not have any additional data, and the conservation of these species should mainly centre on protecting their shelter areas.

Species potentially affected by the project

Although none of the few species confirmed or listed as possible to be recorded can be considered problematic in relation to the current project, a side note should be inserted here again on Chiroptera (bats). Few studies at a global level have focussed on the risks posed by power lines to bats, and in this case they have focused mainly on the effects of wind farms (Thaxter et al. 2017). In the African context, the situation is similar, but it has been suggested that especially fruit bats (family Peropodidae) are very likely to be prone to collision with power lines (MacEwan 2018). In addition to the risks of collision and electrocution, bats can be affected by roosting difficulties, loss of habitat in their home range and even electromagnetic interference (MacEwan 2018).

It should be emphasised that no species of fruit bat was detected during our visits or in the mine area, but we cannot of course exclude the possibility that various species of fruit bats may use the project area, but we lack the data to even assess the extent to which their presence is real or even likely, which greatly hampers our ability to assess the risks. However, the configurations of the route crossing fairly extensive areas but not subject to significant physical barriers, the absence of well-preserved native forest that could provide food in the form of wild fruit for fruit bats, and the fact that no Chiroptera aggregation sites were detected, all suggest that it is unlikely that any species present will be severely affected by the project.

Conservation areas

There is no formally designated conservation area that is crossed by the proposed route of this transmission line. Only Morro do Moco (Dean, 2001), around 50 kilometres north of the transmission line route (see **Figure 4-17**), deserves to be mentioned. However, the considerable distance of Morro do Moco from the line project means that there is no interference to consider.

Reptile

Another faunal group that is generally important for environmental studies are reptiles, as they occupy crucial niches in most ecosystems, with many species playing various roles in food chains, often as predators and prey simultaneously. Reptiles also tend to be relatively common in most regions, and often reflect a rich diversity, derived from the fact that small changes in habitats followed by geographical isolation often lead to the evolution of new taxa, and in this way, reptile lists can contribute a great deal of information to faunal inventories.

Although reptiles tend to be relatively well distributed and diverse in most regions, there are still some problems that can severely restrict the results expected from reptile surveys. The first and most obvious limitation is the cryptic nature of most reptile species. Recording a significant or representative series of reptile species in a given study area often requires intensive capture methodologies and sustained effort over a long period, which is beyond the scope of typical studies and surveys.

Some specific categories of reptiles, such as most snakes, legless lizards and burrowing reptiles, are rarely detected, regardless of the methodologies used. An additional and very important constraint in our case stems from the lack of reliable and up-to-date information on the distribution of reptiles in Angola. Only recently has a herpetological atlas for Angola been published (Marques *et al*., 2018), but even this work is of limited use as it is mainly based on historical records. Despite all the limitations mentioned, we have tried to compile a basic herpetological list (see **Table 9-4** in **Appendix 9**), which we believe will be useful for providing preliminary data to help characterise the study area from a faunal point of view. In any case, it should be emphasised that the proposed power line is not expected to have a significant negative effect on reptile populations, apart from occasional local habitat destruction.

We based this work largely on the information available and produced for the region where the study area is located, whether from known literature (e.g. Bocage 1895; Ceríaco *et al.,* 2016; Marques *et al.,* 2018; Branch et *al.,* 2019) or unpublished data and also online resources, and thus produced a comprehensive list aggregating all the reptile species previously known and recorded for the provinces of Huambo and Huíla, which is defined here as the preliminary base list. These include the species we confirmed in the field and others mentioned in an unpublished report to which we had access, referring to an exhaustive survey carried out at the Mina do Longonjo site, since it is near the end of the planned line route. Species observed in the field have been marked as "RC" (confirmed record) while those previously recorded in the mine area have been marked as "RM" (mine record), while species not necessarily recorded in this study, but which may occur in the project area, since they have been confirmed in the region and in similar habitats, have been included here as "PR" (probable) or "PO" (possible or minimally expected to occur).

The surveys were carried out opportunistically and not on the basis of a systematic methodology. The reason for discarding methodologies such as transects was because the area along the line's route was relatively long for a systematic survey. The use of traps, which could have greatly increased the recovery rate and potentially allowed the recording of highly cryptic species such as snakes and fossorial reptiles, was, however, discarded as a practical methodology because it would have required a much longer period of time to produce results. We therefore concentrated on several different habitats and some of the most promising sites. This survey, coinciding with the rainy season, was very concentrated in time in one particular season, which must also be taken into account.

Whenever possible, reptiles were observed, identified and photographed in the wild, or collected and photographed after handling. We looked for dead reptiles on roads and bites, as this can be an efficient source for recovering snake species, but none were recorded in this way.

Whenever possible, we tried to photograph reptiles with a Canon EOS 7D camera and a Canon EF 400mm f5.6L USM telephoto lens, and with a Canon EOS 5D equipped with a Canon EF 100mm f4 macro lens, for details of the specimens handled.

The correct nomenclature of species can be complicated in the case of reptiles due to the fact that there are relatively few research studies carried out in Angola and also due to taxonomic uncertainties. However, this was overcome by consulting the published literature (Bocage 1895, Boulenger, 1905; Branch, 1998; Alexander & Marais 2007) and most of the species collected turned out not to be problematic in terms of their correct identification. In addition, we also made use of a vast body of recently published work on Angolan herpetology, and even used some data from work in progress.

The list (see **Table 9-4** in **Annex 9**) compiled for Huambo province totalled 69 reptile species. Of these, 33 species were considered likely or possible to be present along the route of the transmission line, i.e. around half (48%) of the reptiles known for Huambo province were considered potentially present in the study area. This is a relatively modest result from the outset, but it reflects the low heterogeneity of the area and the high anthropogenic impact. However, in the field, we were able to confirm during our

This can only be considered a reasonably informative result, as it corresponds to around a third of the species expected from the outset, and even if it doesn't reflect the likely real herpetological diversity present in the area. However, 12 other species that were recorded in the Longonjo mine area can also be considered, which brings the total of confirmed species in the comprehensive region to 21 reptile species. With regard to the nine species recorded, these were compiled despite the obvious difficulties in carrying out proper herpetological surveys, which would require more time available to invest in some of the most promising sites, plus the practical impossibility of using intensive capture techniques throughout the study area. In any case, the list obtained nevertheless provides some useful, albeit basic, indications.

Obviously, much of the supposed diversity in terms of fossorial reptiles and cryptic forms has gone almost completely unnoticed, but that's not surprising. Overall, it is assumed that the proposed route is probably reasonably diverse in terms of reptiles despite the disturbance of the site, and we found that around 13 per cent (9/69) of all the species known to occur in the whole province were confirmed, which is a reasonable result taking into account the constraints already mentioned. If we consider this result in terms of the species considered to be expected or possible to occur in the area, it corresponds to 24 per cent (9/37), but if we add up all the species confirmed either along the route of the transmission line or at the Longonjo mine, then there are around 57 per cent (21/37) present, which can be considered a fairly significant result. In addition to the visual record, seven of the nine species confirmed during the field visits were also photographed on site.

All the records could be identified with relative certainty down to the specific level, although some species of lizard may be subject to ongoing taxonomic revisions, particularly those belonging to the genus *Trachylepis*. The list is also somewhat unbalanced, with all the entries within the Order Squamata (lizards and snakes), four of the nine confirmed species belonging to the family Gerrhosauridae (geckos, plate lizards and the like), two others belonging to the family Agamidae (agamas), and one representative from the families Gekkonidae (geckos), Chamaeleonidae (chameleons) and Lamprophiidae (a large family of non-venomous snakes). The latter turns out to be the only snake species confirmed, which is logically a major underestimation of the real local diversity.

Endemism, rarity and priority conservation species

All nine of the reptile species we confirmed in the field are fairly common in Angola, with one exception, and do not raise conservation concerns. The only species that can be considered uncommon or localised in some mountainous areas of the central plateau is certainly also rare in the study area. This is a very recently described species of gecko (Branch et al. 2021), the Angola gecko (*Afroedura wulfhacki* - see **Photo 4-16**). This gecko is also endemic to our country and its formal conservation status has not yet been assessed and it is not yet on the respective lists. This gecko was found in a granite agglomeration about five kilometres west of Lépi, and it is likely that it occurs in other similar agglomerations in the area. It is a cryptic species with nocturnal habits that takes refuge during the day inside narrow chips in large granite cliffs. Also noteworthy among the reptiles found is another endemic species, Schack's stone agama (*Agama schacki*). This agama is, however, very common on the Angolan plateau and often abundant in rocky regions and even in urban areas, as it is very tolerant of human presence and environmental disturbance, even benefiting from the presence of constructions and buildings where it establishes its territories. For this reason, its presence was to be expected.

Finally, the Bayão lizard (*Trachylepis bayoni*) was also identified, an almost endemic species, since its distribution extends as far as Zambia, but in our country it is relatively common in the highlands. The remaining six species have a wide global distribution. Most of the reptile species are not formally classified in terms of conservation and are therefore listed as not evaluated (NE), with the exceptions among the confirmed species, the common chameleon (*Chamaeleo dilepis quilensis*), and the ground agama (*Agama aculeata*), classified as being of low conservation concern (LC). Both of these species are also very common throughout the country and tolerant of environmental changes and anthropogenic disturbance. On the other hand, the aforementioned Bayão lizard is listed as not having sufficient information (DD).

Photo 4-16: Angolan gecko (*Afroedura wulfhacki*) photographed near the transmission line route.

On the other hand, another endemic species was recorded in the mine area, the Angolan house snake (*Boaedon angolensis*), but this is quite common in the centre and a very adaptable and tolerant species in northern Angola. In addition to these, there are two almost endemic species, the Angolan dwarf gecko (*Lygodactylus angolensis*) and the Angolan limbed lizard (*Sepsina angolensis*), both relatively common species on the plateau and generally associated with miombo woodlands and/or mountain habitats.

Among the other species observed but not yet mentioned are the Kalahari tree lizard (*Trachylepis spilogaster*), the western rock lizard (*Trachylepis sulcata*), the Wahlberg's striped lizard (*Trachylepis wahlbergi*), and the olive snake (*Psammophis mossambicus)*. As mentioned above, these are all very common and widely distributed species, at least in the centre-south plateau of Angola.

If we consider all 19 species of reptiles, which have not been confirmed but are listed as possible or probable, most are also relatively common, and there are only a few more to mention an endemic species that could possibly occur in the study area, namely the Angolan house snake (*Boaedon angolensis*). This snake is quite common in the highlands and tolerant of human presence, even in urban or heavily transformed environments. On the other hand, all these other species listed as possible or likely to occur, in terms of conservation, are classified as being of low concern (LC) or not evaluated (NE).

Species potentially affected by the project

No reptile species confirmed or listed as possible or likely to occur along the route of the transmission line can be considered as minimally problematic in terms of being directly or indirectly affected by the project.

Conservation areas

There is no formally designated conservation area that is crossed by the proposed route of this transmission line. Only Morro do Moco (Dean 2001), around 50 kilometres north of the transmission line route (see **Figure 4-17**), is worth mentioning. However, the considerable distance of Morro do Moco from the transmission line project means that there is no type of interference to consider, let alone that it could have any type of negative impact on the respective herpetological communities.

Amphibians

Among the various vertebrate groups typically compiled during faunal inventories, amphibians are also considered important to assess, especially as they are recognised as excellent bioindicators. This results from the fact that most species depend on very specific habitat requirements and have permeable skin that easily absorbs any type of toxic substance. These characteristics make amphibians very susceptible to environmental disturbances and are therefore good environmental indicators. The general health of a given frog community can be seen as an indication of the environmental state of the local biosphere.

Despite their importance as bioindicators, there are some limitations related to amphibian inventories that should be emphasised here. One of these limitations stems from the fact that the particular nature of the proposed project, power lines, should not directly affect amphibian communities. However, there may always be indirect impacts affecting some amphibian communities.

sensitive habitats, and amphibians remain important for better characterising the habitats present. Another serious limitation stems from the near absence of reliable local historical data, making it very difficult to compile a species list. Finally, the highly marked seasonality exhibited by most frog species, their typically irregular distribution, even locally, and the cryptic nature of several of the amphibian genera that must be present, greatly restricts the results of surveys concentrated on just a few days and in a few locations. As far as possible, the survey endeavoured to distribute the effort along the proposed route.

In the absence of reliable and up-to-date information on amphibians in the region where the power line is located, and in order to establish a baseline for this study, we produced an original list (see **Table 9-5** in **Appendix 9**) of species for the whole of Huambo province, incorporating both old and more recent publications (e.g. Bocage, 1895; Marques *et al.*, 2016; Conradie *et al.,* 2019) as well as unpublished records. Species observed in the field have been marked as "RC" (confirmed record), while species not necessarily detected in this study, but which may occur in the project area, since they have been confirmed in the region in the past and/or in similar habitats. In the latter case, these expected amphibian species have been listed as "PR" (probable) or "PO" (possible or at least expected).

The surveys were carried out opportunistically and not on the basis of a systematic methodology. The reason for discarding methodologies such as transects was because the area of the line route was relatively extensive for a systematic survey. These amphibian surveys were carried out mainly at night, as most species tend to be evasive and cryptic during the day.

Whenever possible, amphibians were observed, identified and photographed in the wild or, in some cases, collected and then photographed after handling. On the other hand, we were attentive to calls as several species can be identified on the basis of their characteristic songs.

In order to address taxonomic identifications, we have turned to the available literature (e.g. Bocage, 1895; Schiotz, 1999; Carruthers, 2001; Channing, 2001; Du Preez, 2011; Marques *et al*., 2018; Channing & Rodel, 2019) and so far the species listed and likely to be present are not considered problematic in terms of proper identification. In addition, we have also resorted to some recent research published on Angolan amphibians, but also some data from ongoing work.

The preliminary list compiled for Huambo and Huíla provinces as a whole totalled 26 amphibian species. Of these, 17 species were considered likely or possible to be present along the route of the transmission line, i.e. around two thirds of the amphibians known for Huambo province were considered potentially present in the study area. As expected, and because of the local conditions and the dependence of most amphibians on the presence of water, the diversity found was higher in low-lying areas and mainly wetlands, and in the specific case of the project in question, in the Cunhangamua river basin.

In any case, the results of the field survey carried out for amphibian species can be considered modest, considering that only a total of four species were confirmed, which corresponds to only a quarter of the species considered to be potentially present (4/16). Among these, one species, the Angolan red-legged frog (*Hyperolius angolensis* - see **Photo 4-17**) was recorded strictly on the basis of hearing its characteristic call, and is probably present in almost all lowlands and watercourses. Another confirmed species, the flat-backed toad (*Sclerophrys pusilla*) also frequents savannah and woodland areas far from water during the cacimbo, but in the rainy season it concentrates in great abundance in ponds and wetlands in order to breed. Another frog was also confirmed, which is a relatively common type of frog that is well adapted to life among reeds and herbaceous riparian vegetation, in this case Monard's frog (*Hyperolius cinereus*), and a common puddle frog (*Phrynobatrachus natalensis*) was also recorded, the latter being common in almost any type of ecosystem, particularly during the rainy season.

Photo 4-17: Angolan redstart (*Hyperolius angolensis*) photographed near the transmission line route.

In addition to the four species we confirmed, another four species were listed as being present in the mine area, and which are very likely to occur along the route. Not surprisingly, and given the small number of taxa recovered, the relative representation of amphibian families does not necessarily reflect taxonomic diversity, with only three families confirmed, with one representative from the Bufonidae family, two from the Hyperoliidae family, and one from the Phrynobatrachidae family. All the species we found are typically associated with mesic conditions and/or riverside vegetation. The absence of representatives of the Pipidae, Arthroleptidae, Ptychadenidae and Pyxicephalidae families should be noted, but we assume that they are present anyway.

Endemism, rarity and priority conservation species

All four amphibian species recorded during the field surveys (RC) are fairly common species on the Angolan plateau and none of them is a priority in terms of global or regional conservation, all of them being classified on the IUCN Red List as being of Low Concern (LC). All six species have a very wide distribution in Africa, with one exception, in this case, Monard's wormwood (*Hyperolius cinereus*), which is endemic to Angola. This species occurs throughout the central and southern plateau, and is particularly common in high-altitude wetlands in the provinces of Huambo, Bié and Huíla. As it is a common species, despite being endemic to Angola, it does not raise any conservation concerns.

All five species considered to be of probable occurrence (PR) but not confirmed in our study are widely distributed, common and classified as being of low conservation concern (LC). And only one of these is an endemic species, the Anchieta's tree frog (*Leptopelis anchietae*), the latter being an Angolan endemic but quite common in the savannas and mountain pastures of the central and southern plateau. Of the seven additional species considered to be of possible occurrence ("PO"), all of them, without exception, are quite common on the Angolan plateau and are not a priority in terms of global or regional conservation, all of them being classified on the IUCN Red List as being of low concern (LC), and they also do not include any endemic or near-endemic species.

Although the identifications down to species level have been obtained with as much rigour as possible, there are still some taxonomic doubts that are awaiting resolution in ongoing research.

Species potentially affected by the project

No amphibian species confirmed or listed as possible or likely to occur along the route of the transmission line can be considered as minimally problematic in terms of being directly or indirectly affected by the project.

Conservation areas

There is no formally designated conservation area that is crossed by the proposed route of this transmission line. Only Morro do Moco (Dean, 2001), about 50 kilometres north of the transmission line route (see **Figure 4-17**), deserves to be mentioned. However, the considerable distance of Morro do Moco from the transmission line project means that there is no interference of any kind to be considered, let alone that it could have any kind of negative impact on the respective amphibian communities.

4.2.4 Conservation Areas

There are no protected areas in the municipalities of Huambo and Longonjo. Outside the perimeter of the project implementation area and those mentioned above is Morro do Moco, an area of high importance from the point of view of biodiversity and landscape, which is currently being categorised as a conservation area. Morro do Moco is also one of 23 *Important Bird and Biodiversity Areas* (IBA). None of these IBAs are located in the municipalities through which the transmission line will pass or in the area where the project will be implemented.

The conservation areas established by law cover approximately 150,000 square kilometres (12% of the national territory). As **Figure 4-18** illustrates, there are nine national parks:

- Luengue-Luiana and Mavinga National Parks (Cuando Cubango);
- Maiombe Park (Cabinda);
- Bicuar National Park (Huíla);
- Mupa National Park (Cunene);
- Cangandala National Park (Malanje);
- Iona National Park (Namibe);
- Cameia National Park (Moxico);
- Quiçama National Park (Luanda).

In addition to the national parks described above, there is also a regional nature park (Chimalavera in Benguela province) and two integral nature reserves (Luando nature reserve in Malanje province and Ilhéu dos Pássaros in Luanda province) and a partial reserve (Namibe partial reserve in Namibe province).

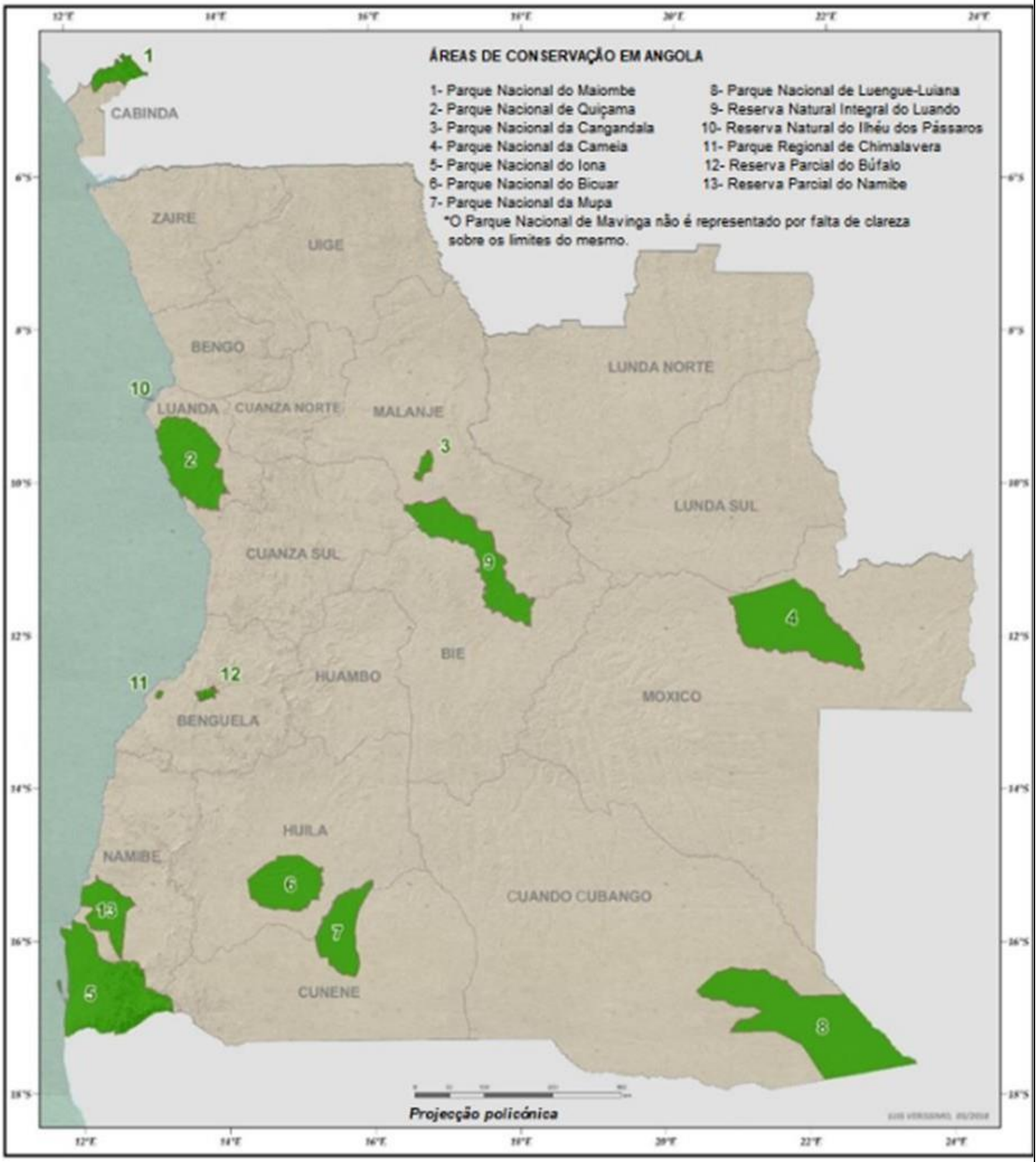

Figure 4-18: Environmental conservation areas in Angola.

4.3 Socio-economic characterisation

This section deals with aspects related to the administrative division of Huambo province, in particular the communities along the transmission line route, their population and questions about essential services for the population, namely: education, health, education and health care.

public services, drinking water, electricity, housing, basic sanitation, access and transport and the main economic activities carried out in the region.

4.3.1 Administrative Division

Huambo province is administratively divided into eleven municipalities, namely: Huambo (Capital), Caála, Bailundo, Ekunha, Mungo, Catchiungo, Londuimbale, Longonjo, Tchicala- Tcholoanga, Tchindjenje and Ucuma, 37 communes (of which Ussoque and Kandjonge are on the edge of the study area), 341 neighbourhoods in urban areas and 2886 villages (rural areas) (see **Figure 4-19**).

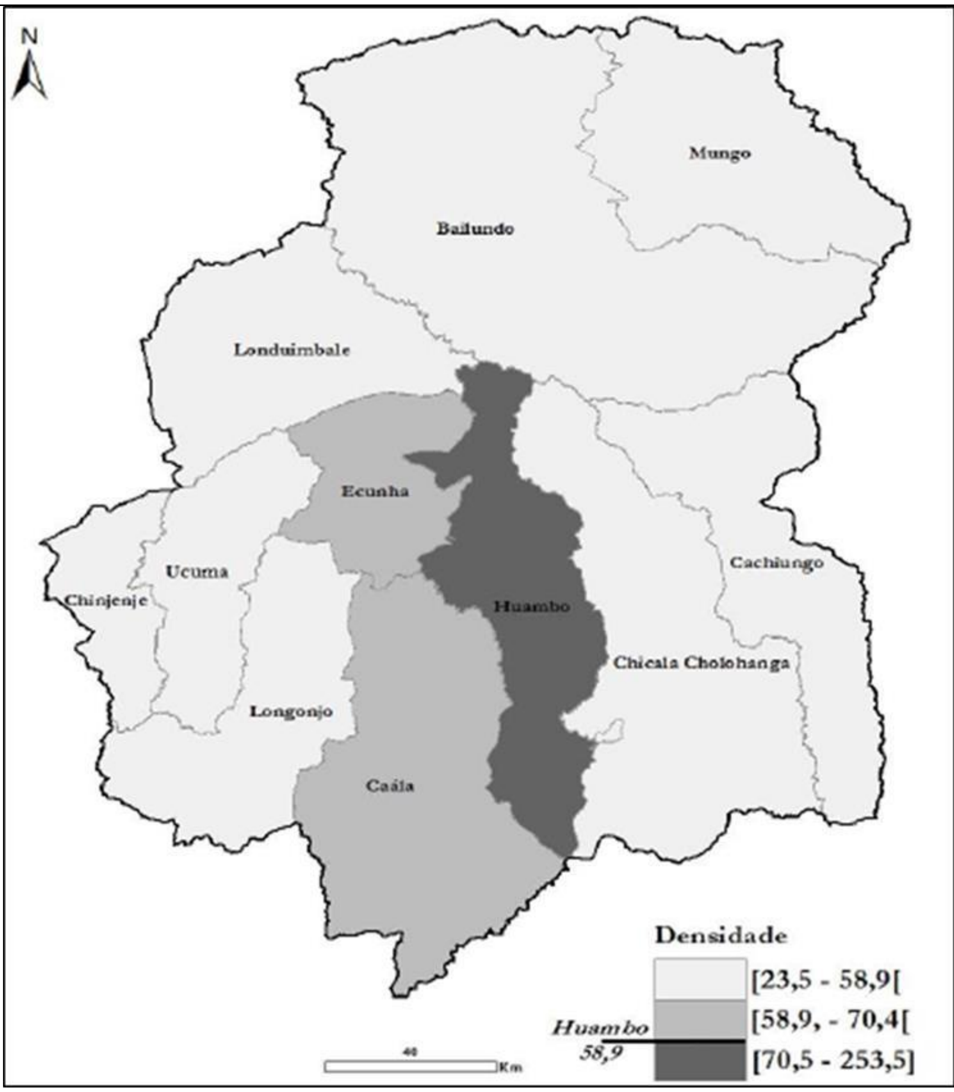

Figure 4-19: Population density of Huambo province by municipality.
Source: INE, 2016.

4.3.2 Demographics

According to data from the Population Census (2016), Huambo province is a province of Angola with a geographical area of 35,771 km^2 . The resident population of Huambo province is 2,091,555 inhabitants, with 48% living in urban areas and around 52% in rural areas (see **Table 4-10**). The population density in Huambo province is around 59 people per square kilometre. The municipality of Huambo has the highest population density in the province, with 254 inhabitants per square kilometre, around four times higher than the provincial average (INE, 2016a). The municipality of Longonjo has 2915 square kilometres and around 91,000 inhabitants.

Table 4-10: Resident population by area of residence, by major age group and sex.

Province, area of residence	Total		
	Total	Men	Women
Huambo	2 019 555	958 140	1 061 414
Urban	963 203	460 720	502 483
Countryside	1 056 352	497 420	558 931

However, the core groups in the province report that people over the age of 65 are often asked by family members (children, siblings, nephews, grandchildren, etc.) to leave the villages for the care that many of them need in terms of physical and emotional health. The higher number of men in the older age group is especially surprising given the many years of armed conflict that have plagued the region, according to traditional authorities. In terms of age structure, the age pyramid in Huambo province has a broad base, corresponding to the young population, and a narrow top that represents the older population (see **Figure 4-20**).

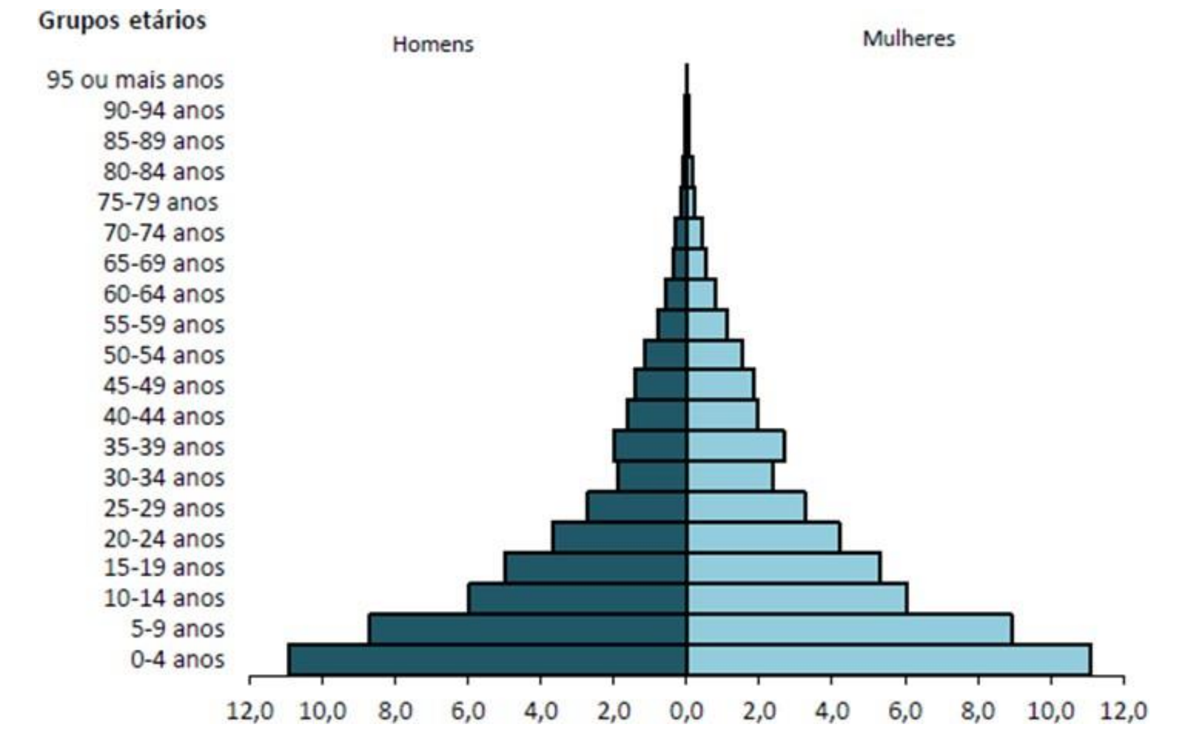

Figure 4-20: Age structure of Huambo's population.

Source: INE, 2016.

4.3.3 Household and Housing

The heads of household are mostly men (55 per cent) and 24 per cent are aged between 25-34. The average number of people per household in the province is 4.6.

Portuguese is spoken by 67% of the population, with a greater predominance in the urban area, where 83% of the population speaks the Portuguese language, compared to only 53% in the rural area (see **Figure 4-21**). Umbundu is the language most spoken by residents, at around 70 per cent, with a greater predominance in the rural area, where 82 per cent of the population speaks Umbundu, compared to 57 per cent in the urban area (INE, 2016).

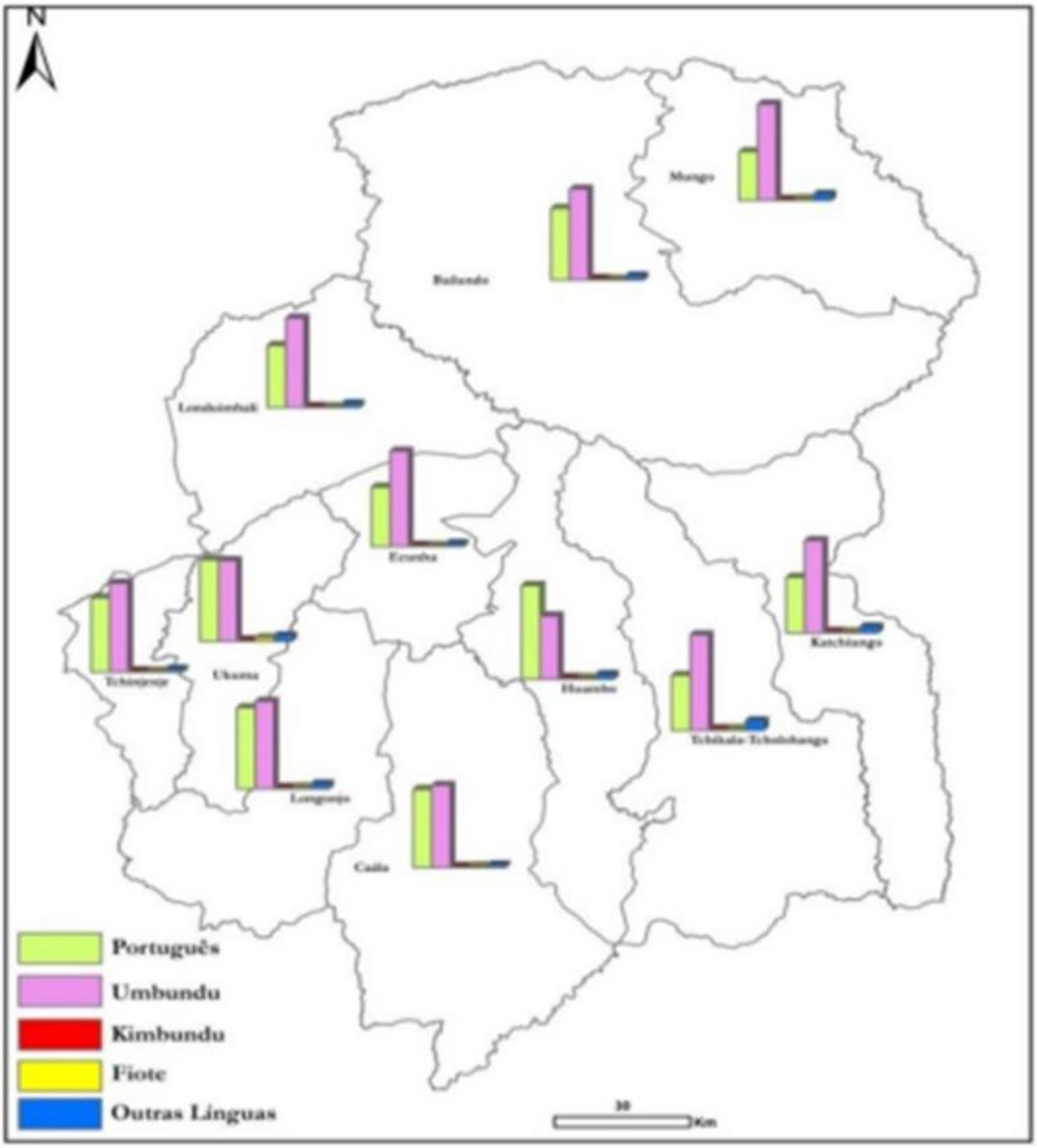

Figure 4-21: Main languages spoken by municipality.

Source: INE, 2016.

In 2014, the majority of occupied family homes were of the conventional type, covering 95 per cent of households, followed by occupied cubata houses with 4 per cent. The majority of households live in self-built housing (80%), 11% live in rented houses (private) and only 3% live in bought houses (3% fully paid for and 1% in the process of being bought). At provincial level, each dwelling has an average of 3 rooms, with the average number of sleeping rooms per dwelling being 1.5 and the average number of people per sleeping room being 3.

4.3.4 Education

The literacy rate expresses the ratio between the population aged 15 or over who can read and write and the total population aged 15 or over. The literacy rate in Huambo province is 60%, 77% in urban areas and 44% in rural areas (see **Figure 4-22**). In terms of gender, 77% of men can read and write, compared to 45% of women.

The analysis by municipality shows that in Huambo province, the lowest rate is in the municipalities of Ecunha and Londuimbale, where only around 4 out of 10 people can read and write (42 per cent).

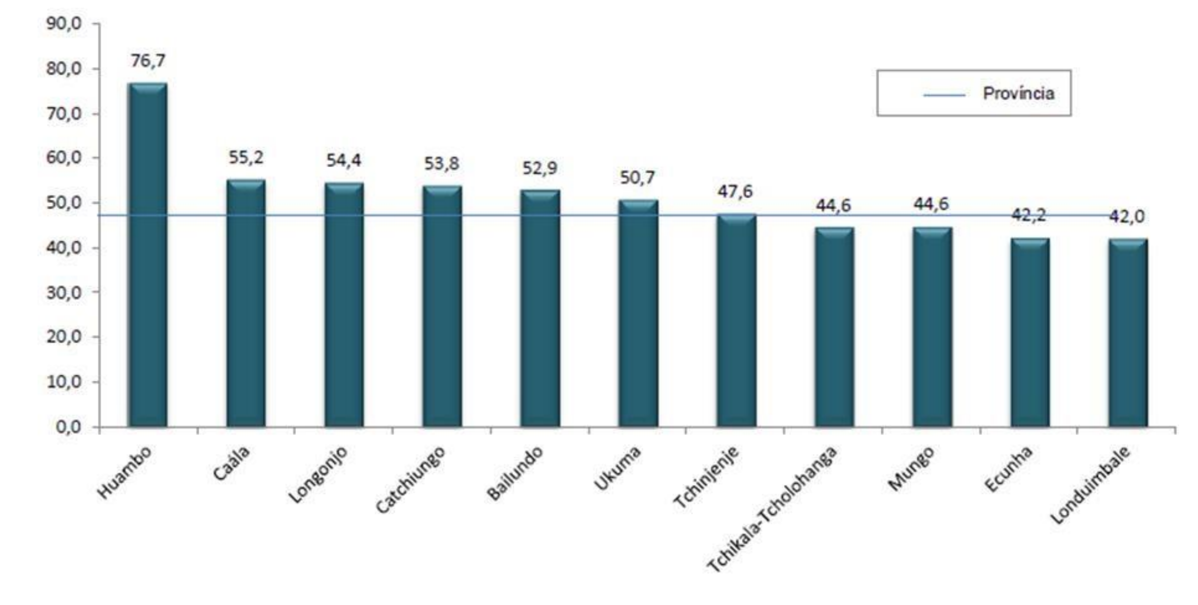

Figure 4-22: Literacy rate in Huambo province.
Source: INE, 2016.

As part of the Integrated Municipal Intervention Programme (PIIM), 174 projects are planned to build, equip and upgrade social infrastructure in Huambo province, including the municipalities of Huambo and Longonjo. In the municipality of Longonjo, two schools are being built, in the communes of Chilata and Lépi respectively. For the municipality of Huambo, the construction of two primary schools and a secondary school is underway (PIIM, 2021).

4.3.5 Health

Huambo province has several hospitals, both regional and municipal, which treat patients from the different areas of the province. The Huambo Central Hospital (see **Photo 4-18**) is one of the most popular for general services in the province's main municipality.

Photo 4-18: Huambo Central Hospital.

The most common diseases in the region are malaria, acute diarrhoeal diseases (ADD), acute respiratory diseases (ARDs), urinary tract infections, hypertension, gastritis, typhoid fever, yellow fever, sexually transmitted infections (HIV/AIDS and gonorrhoea) and malnutrition. There are also health problems caused by road accidents, mostly accidents involving motorbike taxis and large lorries. According to the Angola Multiple Indicators and Health Survey 2015-16 (IIMS), 26 per cent of children between 12 and 23 months in Huambo province have received all their basic vaccinations; 1 per cent of children between 6 and 59 months have tested positive for malaria through a rapid diagnostic test (RDT).

4.3.6 Economy

In Huambo province, men represent the largest proportion of economically active people. The activity rate in Huambo province was 57 per cent, 63 per cent for men and 53 per cent for women (INE, 2016a).

Agriculture and fishing are the most represented economic activities in the province, concentrating 60 per cent, as shown in **Figure 4-23**.

Figure 4-23: Graph of the percentage of the employed population by main sector

economic activities.

For the municipality of Huambo, the main crops are maize, beans, potatoes and horticulture (main), followed by manioc, sugar cane, massango and massambala, and to a lesser extent soya and cashew nuts.

4.3.7 Water and electricity

According to the results of the 2014 Census, half of all households have access to appropriate sources of drinking water. Between the municipality of Huambo and the others, there are significant differences in access to suitable drinking water. The municipality of Tchinjenje has the highest figure of

Figure 4-24 illustrates the main sources of water in each municipality, with only 30 per cent of households having access to water suitable for drinking (2 times lower than in Huambo). **Figure 4-24** illustrates the main sources of water by municipality, with the municipalities of Huambo and Longonjo's main sources of water being public pipes and wells.

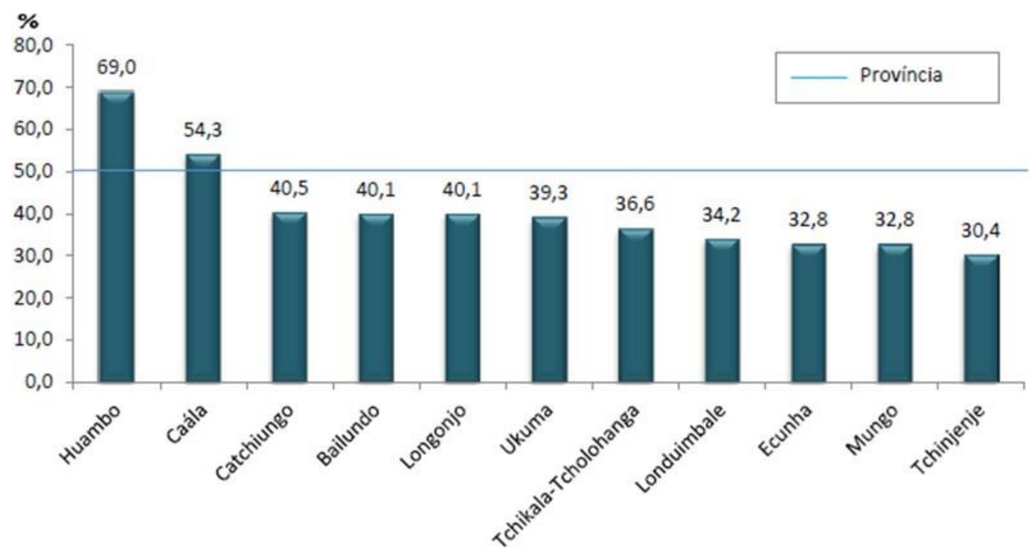

Figure 4-24: Households using appropriate sources of drinking water by municipality.
Source: INE, 2016.

In the municipality of Huambo, 497,361 people use appropriate sources of drinking water. According to INE (2016), the following are considered appropriate sources: Tap in the home connected to the public network, Tap in the building/neighbour, connected to the public network, Public fountain, Borehole with pump, Protected cistern or Protected spring. A total of 48,700 households do not treat their drinking water at all and 90,099 treat their water adequately (INE, 2016).

With regard to mains electricity, only 15 per cent of households in Huambo province have access to mains electricity. The majority use secondary sources of electricity, such as lanterns, generators, firewood, etc. **Figure 4-25** shows the population's main sources of energy in Huambo.

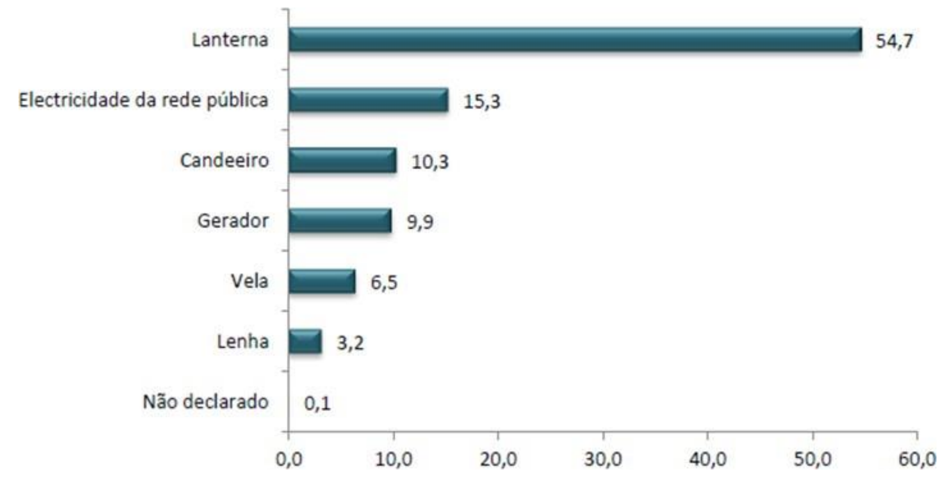

Figure 4-25: Energy sources in Huambo province.
Source: INE, 2016.

4.3.8 Basic Sanitation

At provincial level, around 77 per cent of households use an appropriate place to defecate. However, this figure is only 65 per cent in rural areas compared to 91 per cent in urban areas. There are different realities between municipalities regarding the use of appropriate sanitation facilities. The municipality of Huambo has the highest figure at 90 per cent. The municipality of Tchinjenje has the lowest figure at 31 per cent. In Huambo province, only 28 per cent of households dispose of rubbish or solid waste in appropriate places. Rubbish is deposited in the open by 66 per cent of households in Huambo province, 76 per cent among those living in rural areas, compared to 52 per cent among those living in urban areas. Only 22 per cent of households living in urban areas dispose of their rubbish in bins. In the municipalities of Huambo and Longonjo, the population chooses to throw rubbish in the open or burn household waste, usually in areas close to the villages.

4.3.9 Telecommunications and Transport

The municipalities of Huambo and Longonjo both have telecoms services provided by the two main mobile operators in the country, namely UNITEL and MOVICEL. Although Movicel is present in the province, the signal does not work efficiently in all communities. The remaining rural communities do not have telephone communication services mobile. These municipalities also have Rádio Huambo, Angola Public Television, ZAP, TV Cabo and Angola Telecom, which are the main means of public information.

4.3.10 Historical and cultural heritage

Huambo province is among the richest in the country in terms of historical and cultural heritage, with around 123 monuments and sites listed by the Directorate of Culture, including the following (see **Figure 4-26**):

- Shrine of Our Lady of the Mount in Huambo (National Shrine).
- Feti archaeological site in the Calima commune.
- António Agostinho Neto Square, in the centre of Huambo.
- The Elundi stones, which in the past were important places of worship in the Longonjo municipal area.

Figure 4-26: Location of selected historical monuments in the area of influence of the transmission line.

None of these sites are located in the area directly affected by the project.

In terms of tourism, the Granja Pôr-do-sol, the reservoirs of the Cuando and Gove rivers, which offer sport fishing, swimming and various nautical activities, the thermal waters of the Wama and Lépi, the rocks of the Kawe and Ganda in Caála are some of the attractions that the province offers its visitors.

In the hotel business, the Ilha dos Amores tourist complex in the municipality of Ecunha, as well as the "Ekuikui", "Chapesseka", "Kassueka" and "Katito" hotels are some of the highlights in the province. New hotels and restaurants are springing up all over the region with the aim of boosting tourism growth and development and, consequently, the hotel and catering sector.

However, there is a need to invest in tourism and leisure programmes for both the domestic and international markets, as well as to increase the availability of qualified human resources.

4.3.11 Land Use

Most of the land is used for agriculture, and in Huambo commune approximately 9500 households are engaged in this activity. **Table 4-11** shows the main agricultural crops in Huambo municipality, where cereal production stands out, especially in Huambo commune.

Table 4-11: Households by type of agricultural activity.

Municipality/communes	Number of households	Number of households engaged in agricultural activity	Type of activity			
			Forestry	Fruit growing	Horticulture	Cereals
Huambo	144 006	11 570	10 584	23 658	48 651	61 112
Huambo	124 017	9448	9152	19 330	34 433	45 087
Calima	12 013	1505	986	2696	8326	9362
Tchipipa	7976	617	446	1632	5892	6662

4.3.12 Religion

Catholicism is the predominant religion in Huambo province, practised by 56 per cent of the resident population, followed by Protestantism with around 40 per cent. As in most of the country, the population of the municipalities of Huambo and Longonjo is mostly Catholic, although there are also other religious denominations such as the Pentecostal, Seventh Day Adventist and Methodist churches.

The Catholic and Seventh Day Churches gather the largest number of believers and all of them have fulfilled their role of evangelising the local population, pacifying spirits, donating clothes and various food products, including basic necessities, and raising the population's awareness through education and social mobilisation. They have also given up their space to set up literacy centres for adults, marriage counselling and the creation of classrooms for beginners and primary school pupils.

4.4 Consultation meetings

A Stakeholder Engagement Plan (see **Annex 4**) has been drawn up for this project, the objectives of which include involving interested and potentially affected parties in a participatory and transparent manner, providing timely information about the project, the ESIA and the EIA process. This document is also important for obtaining information and opinions from interested and potentially affected parties on the project to be carried out. In addition, it is an important tool for helping the project proponent and its subcontractors interact with state authorities, provincial government and municipal administrations, traditional authorities (sobas, centuries, etc.) and local communities.

Three consultation meetings were held on 25, 26 and 27 January 2022, one in each municipality, Huambo, Caála and Longonjo. The main objectives of the meetings were to present the project and its proponent, describing its general characteristics and objectives, to discuss aspects related to the environmental licensing process in Angola and the activities carried out within this framework, and finally to obtain information from the audience about their concerns and expectations about the project, to clarify doubts about it and about the environmental and social surveys carried out as part of the Environmental and Social Impact Study for the transmission line project.

Generally speaking, the meetings were divided into three parts: a presentation by the project proponent and the background to the project, a presentation of the project and the work carried out as part of the EIAS report, and finally a time to share information and questions related to the project, its execution, the organisations involved and the activities associated with its implementation.

A representative of Ozango Minerais gave a short presentation in which he gave an overview of the Longonjo Mine Project, the partner organisations in the group proposing the projects (mine and transmission line), describing the uses of the minerals to be extracted at the mine, information on jobs, the socio-economic implications of operating the mine, the work in progress and the social action projects associated with it. It was emphasised that the transmission line project will be to supply electricity for the mine's operations and not for public supply, adding that Longonjo has energy from the grid and does not yet have the capacity to use all the energy it receives.

The Holísticos representative followed with a presentation introducing the transmission line project and its location. The technical part of the project and its characteristics were presented. He then summarised the Environmental Impact Assessment (EIA) process and the Environmental and Social Impact Assessment (ESIA) report underway for projects likely to cause potential impacts on the environment and the importance of the study so that potential negative impacts are reduced, minimised and mitigated. It was mentioned that the ESIA is being drawn up in accordance with current national legislation, good practice in the sector and the environmental and social guidelines of the International Finance Corporation (IFC) and the Equator Principles. Reference was made to the LiDAR survey carried out in August/September 2021 and demonstrated the importance of this survey for drawing up the maps, identifying land uses along the line route and possible adjustments to the route. The main findings of the field surveys carried out to date were presented, with emphasis on the environmental and socio-economic aspects of the Project implementation area and its municipalities.

He also stressed that the consultation process was extremely important for the materialisation of the project. He mentioned that the project is being promoted by Ozango Minerais, with ENERLINE in charge of the contract, and that the involvement of interested and potentially affected parties is fundamental for the implementation of the project and for the compensation process.

The tables below summarise the explanatory session held at each of the consultations.

Table 4-12: Summary of the briefing session at the consultation meeting in the municipality of Huambo.

Comment/Question	Answer
José A. Cunha (JC) - Director of ENDE EP Huambo Will the future substation (SE) at the Longonjo mine have a panel installed to distribute power to the south? How powerful will the future substation be?	**Carlos Queiroz -** ENERLINE The outlets to be installed at the new Longonjo substation will only be for supplying power to the mine, although the option of other outlets may be something to discuss with Ozango for inclusion in the project. The power to be installed will be 100 MVA (there will be two transformers, one of which will be in operation and the other will be a backup). **Edson Nunes** - General Manager of Ozango Minerais He added that, according to information provided by RNT E.P., there is a state project for a railway line to be installed in the city. transmission towards the Lomaum.
Helmano Inácio (HI) - Vice-governor of Huambo for the Technical Area. He asked for more information/details on the issues related to resettlement and compensation. He also asked them to share more information on aspects of social responsibility associated with the Longonjo mine and communities, as well as issues related to contamination associated with mining activities.	**Pedro Sá** - Holistic No housing or economic resettlement is expected to be necessary along the proposed route, although a resettlement and compensation plan is being drawn up to take this into account. The need for compensation is foreseen, and this process is being developed and implemented with the intervention of various organisations (project proponent, municipal administrations, traditional authorities, etc.). Initially, it will be necessary to survey the affected families and their ploughs and/or dwellings (and the LiDAR survey will help in this process), and then a compensation process will have to be carried out. This process will follow both national legislation and international best practice so that compensation is fair, clear and there is consensus between all parties involved. **Edson Nunes** - General Manager of Ozango Minerals The industrial tax for the mining sector is 25%, with 5% of the 25% reverting to the local authority and considering the expected return during the project.

Comment/Question	Answer
	This will be a significant amount of money and will certainly contribute to local development. Ozango Minerals will recruit locally for all jobs where there are local candidates who fulfil the requirements. An agricultural project will be implemented for the people/families/communities who carry out their activities within the boundaries of the mine, where they will be able to carry out agricultural activities in other areas, a co-operative will be set up, machinery, equipment and products will be provided to carry out this activity. The products will be marketed both to Ozango Minerais for mining logistics and to other people/entities, and the proceeds will go to the cooperative and its members. With regard to the issues of possible contamination as a result of mining, the mine will include tailings retention ponds and other means of containment to safeguard against such situations. The water to be used during exploitation will be reused (as much as possible), reducing dependency on and use of water. of this resource.

Table 4-13: Summary of the briefing session at the consultation meeting in the municipality of Caála.

Comment/Question	Answer
Tomás de Jesus (TJ) - Deputy Municipal Administrator of Caála for the Technical Area During the presentation, concerns were raised about the possibility of resettlement along the route, but the maps presented show that the transmission line will not cross housing estates and forested areas. During the exploitation of the Longonjo mine, what will be done about the radiation emitted by the ore extracted? How will this ore be transported?	**Edson Nunes** - General Manager of Ozango Minerals From the studies that have been carried out, it is not expected that the radiation levels will be significant, much less exceed admissible levels, and that both the workers and the population will be safe. The ore will be transported from the mine by rail to the Port of Lobito in 20-foot containers in *big bags* containing around 1m of ore.[3] **Pedro Sá** - Holistic He emphasised that the proposed route of the transmission line sought to avoid both housing and other sites that could cause some kind of constraint, such as forested areas, areas of greater erosion, water dams, etc. It is not envisaged that there will be any need for housing resettlement or along the proposed route.
Albino Damião (AD) - Soba from the village of Lénha He said that the communities were willing to help and co-operate during the projects, working together with the municipal administration, with other sobas and neighbourhood leaders in the region. He warned of the possible existence of mines	**Carlos Queiroz** - ENERLINE She thanked him for the information and reminded him that before the towers are built and erected, demining work will be carried out along the proposed route and in other places deemed necessary.

Comment/Question	Answer
near the bases of old power towers in some places close to the route proposed for this project.	
Evaristo Chevele - Regedor in the Calenga Commune He mentioned that the project would be important for the development of the region and that he would pass on information about the project within his community. He pointed out that some roads were previously used for support, including other transmission lines, were used for the population's agriculture.	**Pedro Sá** - Holistic He mentioned that for the construction of the line and the installation of the equipment, the existing accesses will be used and that the opening of new accesses will be avoided, but if necessary, the construction company will do this work. Work will be carried out to identify the mines and their respective owners/users and that compensation will be paid for the work. will be given to the people/families affected.

Table 4-14: Summary of the briefing session at the consultation meeting in the municipality of Longonjo.

Comment/Question	Reply
Salomão Camatuta (SC) - 1st Municipal Secretary of the MPLA There is already a line from Belém do Dango to Caála, why not use this line to supply the future Longonjo mine?	**Edson Nunes** - General Manager of Ozango Minerals When Ozango Minerais contacted ENDE to talk about supplying energy to the mine, they were told that the line will be used to supply Ecunha and the future industrial park in Caála, and that the line will not have the capacity to supply the mine either. to supply the energy needed to run the future mine.
Cândido Caucombe (CC) - Municipal Director for Health I'd like to know, in general terms, what the boundaries of the area are for the future Longonjo mine.	**Edson Nunes** - General Manager of Ozango Minerals Ozango Minerais has a prospecting licence for around 4000 km^2 (from Caála to Ganda) and will be able to carry out prospecting activities within this area. For the future Longonjo mine, the boundaries run from the Lulumia river to the 3 Casas area, comprising an area of around 5 km^2 , but exploration will not take place over the whole of this area, part of which will be for the installation of a mining plant. support structures and areas for materials and equipment.
Adelino - Member of the Municipal Youth Council He congratulated the projects (transmission line and mine), which will be an asset for the region. With regard to employment, what opportunities will there be for young people? In which areas will people be hired? Could Ozango Minerais contribute to training in technical courses at the Municipal Institute?	**Edson Nunes** - General Manager of Ozango Minerais When Ozango Minerais begins the implementation phase, it will need labour and will recruit locally, so there will be an opportunity to hire people who meet the requirements. During the operation/exploitation phase its employees will be continuously trained, and for the younger ones there may be the possibility of doing internships at the mine. Ozango will also be able to support the Municipal Institute, however, this social support component will be something to be discussed/agreed with the municipal authorities in accordance with the main objectives of the project. needs and will be defined in the future.
Alegria Correia (AC) - Energy and Water Director	**Edson Nunes** - General Manager of Ozango Minerals There is already a state project to supply energy in these locations, but it has yet to begin.

Comment/Question	Answer
In terms of social support, isn't there the possibility of supplying energy along the proposed route, particularly to Lépi and other surrounding communities?	planned works. ENDE/RNT said that an independent line would be needed for the mine (given the mine's needs) and that Ozango would have to start the project. **Carlos Queiroz** - ENERLINE As it is a 220kV line, it is not possible to distribute power along the route, as this would require a large structure (a substation) and not a simple transformer station to bring it down to 30 KV.
Domingos Paciência (DP) - Municipal Director for Education He said that this sharing of information was a commendable initiative that contributed to the inclusion of the population. As part of the strategy related to the new Longonjo Technical Institute, of which How can Ozango Minerals support the courses available and the inclusion of young people?	**Edson Nunes** - General Manager of Ozango Minerais One way that could be implemented to support the institute and the training of young people could be to provide internships, as well as other similar support, during the 20 years planned for the operation of the mine. These internships will contribute to the professional development of young people in the region, particularly in Longonjo.
Viviane Chicombe What precautions will be implemented at the mine to conserve and prevent contamination of the Cuíva River and affect the people who use this river and its water on a daily basis?	**Edson Nunes** - General Manager of Ozango Minerais For the mine's exploration activities, chemical products will be used, mostly acids, during the process to prepare the ore before refining. The water that will be used during exploration will be collected from the rivers/streams in the area and through boreholes, although it will be guaranteed that the population will continue to have access to existing water. During the mine's activities, no water will be discharged into the environment.
Berto Guilherme - Representative of the Catholic Church of Longonjo There has been a religious monument (former church) since 1948 near the mine area, what is Ozango's view of this monument? Exploration activities are being carried out in the Luvila River area, is this river being affected? How will the population be affected?	**Edson Nunes -** General Manager of Ozango Minerals The existing ruins will not be affected by the mine's activities because no exploration activities will be carried out in the area. What could be affected is access to the existing ruins, but if this happens a new access will be created so that the population can go to the site as normal. These ruins were identified during the EIA surveys and Ozango is willing to support the church in whatever way is necessary. The existing accesses to the mines within the mine boundaries will continue to be available to the population until the end of the RAP and compensation process. It should be borne in mind that some areas will not be used for exploration but are part of the security perimeter. Hydrological studies are underway so that people always have water available for their meals. their activities during the period of exploitation of the mine.

On 16 February 2022, a meeting was held between various representatives of the project proponent, representatives of the Longonjo Municipal Administration and traditional authorities in the region. The purpose of the meeting was to interact with local authorities about the existence, expansion and proliferation of informal cemeteries in the region, specifically around the area of the future Longonjo Mine.

During the meeting there was a brief overview of the projects, both the future mine and the transmission line, a presentation of maps showing the location of the boundaries of the mine concession area, the proposed location of the substation and the final section of the transmission line. Those present did an exercise to identify the cemeteries on the map and then visited the site to confirm the boundaries.

At the meeting it was agreed that, with the help of the Longonjo Municipal Administration and the traditional/local authorities, the cemeteries in question will not extend beyond their existing boundaries. However, as there is still no immediate alternative space for funeral ceremonies, local people will continue to use them because the existing cemeteries have space for them. On the other hand, in order to avoid constraints, and mainly because few people apart from local authorities and elders know the actual boundaries of the cemeteries, it will be necessary to physically delimit the cemeteries and signpost them, the following proposals have been put forward:

- Clear the boundary area, create a road around the cemeteries; and/or
- Place stakes with at least one line of wire around the cemetery; and/or
- Official administration sign showing the cemetery boundary

Since the solution presented has associated costs that will be covered by the project proponent, it was agreed that after the project proponent's evaluation and decision, the delimitation of the cemeteries will be carried out. In this process, the project proponent will circulate an official document (term of responsibility or agreement for validation and signature) so that all parties involved have access to/are informed and engaged in this process.

CHAPTER 5

ASSESSING POTENTIAL IMPACTS

5 ASSESSMENT OF POTENTIAL IMPACTS

This chapter presents the assessment of the potential environmental (physical and biological), social, community health and cultural impacts associated with the construction and operation of the 220 kV transmission line project between Belém do Dango and Longonjo. Unplanned events and cumulative impacts are also included. It describes the methodology used to assess the potential impacts and the mitigation measures needed to minimise, mitigate and/or reduce the potential environmental and socio-economic impacts identified.

5.1 Methodology for Evaluating Environmental and Social Impacts

This section describes the proposed method for assessing the significance of potential environmental and social impacts. Assessing the significance of potential impacts for a project is, by its nature, uncertain and a matter of judgement. To deal with the uncertainty associated with judgement and guarantee repeatable results, Holísticos' team of experts classifies potential impacts using a standardised and internationally recognised methodology, following the requirements of the International Organisation for Standardazation (ISO) 14001 and the World Bank/IFC. This methodology is in line with the General Regulations for Environmental Impact Assessment and the Environmental Licensing Procedure (Presidential Decree no. 117/20 of 22 April). It is important to emphasise that this chapter focuses on the potential environmental and social impacts for the construction and operation phases. Potential impacts considered negligible are not presented/included in the impact assessment tables. Given the long life cycle of the project and the changes that may be made to environmental legislation, the impacts of the decommissioning phase have not been considered. In the light of Presidential Decree no. 117/20 of 22 April, the Environmental Decommissioning Licence will be preceded by the relevant environmental licensing instrument, which will be defined by the authorities at a later date.

For each potential impact predicted, criteria are assigned. These include magnitude (size or degree scale), which also includes the type of impact (positive or negative), duration (time scale) and extent (spatial scale), as well as the likelihood of occurrence. The methodology is qualitative, in which professional judgement is used to identify a rating for each criterion based on a seven-point scale (see **Table 5-1**), and significance is generated automatically in a quantitative way using a matrix and applying calculations shown in **Figure 5-1**. The significance ratings are shown in **Table 5-5**.

Calculations

For each potential impact predicted, certain criteria are applied to establish its likely significance, first in the event that no mitigation is applied and then with the most effective mitigation measure(s) in place.

These criteria include **magnitude** (size or degree scale), which also includes the type of impact, whether it is a potential positive or negative impact; **duration** (time scale); and **extent** (spatial scale). These numerical classifications are used in an equation in which the **consequence of** the potential impact can be calculated. The consequence is calculated as follows:

Consequence = type x (magnitude + duration + extent).

To calculate the significance of a potential impact, the probability of that potential impact occurring is applied to the consequence.

Significance = consequence x probability

Depending on the numerical result, the potential impact would fall into a significance category such as insignificant, minor, moderate or major, and the type would be positive or negative.

Figure 5-1: Calculation of significance.

Table 5-1: Evaluation criteria for assessing potential impacts.

Criteria	Numerical Classification	Category	Description
Duration	1	Immediate	Impact will immediately self-heal.
	2	Soon	The impact won't last more than a year.
	3	Short duration	The impact will last between 1 and 5 years.
	4	Medium duration	The impact will last between 5 and 10 years.
	5	Long-lasting	The impact will last between 10 and 15 years.
	6	Continuous	The impact will last between 15 and 20 years.
	7	Permanent	The impact could be permanent or exceed 20 years.
Extension	1	Very limited	Very limited impacts, felt in isolated areas in the study area.

Criteria	Numerical Classification	Category	Description
	2	Limited	Impacts limited to particular areas in the area of study.
	3	Location	Impacts mostly felt in the study area.
	4	Municipal Area	Impacts felt outside the study area, at municipal level.
	5	Regional	Impacts felt outside the study area, at regional/provincial level.
	6	National	Impacts felt outside the study area, at a national level.
	7	International	Impacts felt outside the study area, a international level.
Magnitude	1	Negligible	Natural and/or social functions and/or processes are altered insignificantly.
	2	Very low	Natural and/or social functions and/or processes are slightly altered.
	3	Low	Natural and/or social functions and/or processes are altered in some way.
	4	Moderate	Natural and/or social functions and/or processes are moderately altered.
	5	High	Natural functions and/or processes and/or social changes significantly.
	6	Very high	Natural and/or social functions and/or processes are greatly altered.
	7	Extremely high	Natural and/or social functions and/or processes are severely altered.
Probability	1	Highly unlikely/ None	Let's hope it never happens.
	2	Rare/Improbable	Conceivable, but only in extreme circumstances, and/or may occur for this project, although this has rarely happened elsewhere.
	3	Unlikely	It hasn't happened yet, but it could happen once during the lifetime of the project, therefore, there is a possibility that the impact will occur.
	4	Likely	It happened here or elsewhere, and therefore it can happen.
	5	Possible	Impact can occur.
	6	Almost certain/Highly likely	Most likely, the impact will occur.
	7	Certain/Definitive	There are solid scientific reasons to expect that the impact will definitely occur.

When assessing potential impacts, broader considerations are also taken into account. These include the level of confidence in the assessment rating; the reversibility of the potential impact; and the irreplaceability of the resource as set out in **Table 5-2**, **Table 5-3** and **Table 5-4** respectively.

Table 5-2: Definition of confidence ratings.

Category	Description
Low	Judgement is based on intuition.
Average	Determination is based on common sense and general knowledge.
High	There is substantive supporting data to verify the assessment.

Table 5-3: Definition of reversibility classifications.

Category	Description
Low	The affected environment will not be able to recover from the impact - it will be permanently modified.
Average	The affected environment will only recover from the impact with significant intervention.
High	The affected environment will be able to recover from the impact.

Table 5-4: Definition of resource irreplaceability classifications.

Category	Description
Low	The resource is not irreparably damaged or scarce.
Average	The resource is irreparably damaged, but is represented elsewhere.
High	The resource is irreparably damaged and is not represented elsewhere.

Table 5-5: Significance ratings.

Significance	Negative	Positive
Insignificant	Insignificant - Negative	Insignificant - Positive
Minor	Minor - Negative	Minor - Positive
Moderate	Moderate - Negative	Moderate - Positive
Bigger	Higher - Negative	Bigger - Positive

5.2 Identification of the Main Project Actions that Generate Impacts on the Environment

The main potential impacts generated by the project under study occur in the construction phase, where the main interferences occur in terms of land occupation and those potentially affecting existing natural, landscape and socio-economic values.

Thus, there will be a direct impact on the area to be occupied for the construction of the supports - more extensive and temporary during the construction phase and more localised and permanent during the operation phase - as well as its surroundings, corresponding to the protection of the line's right-of-way (*RoW*) and support areas intended for the installation of the construction site and temporary access to the activities being carried out. During construction and in order to minimise potential impacts, where possible, construction will take place within the *RoW* of the existing 60 kV line, as well as on existing access roads (including EN 120). During the operation phase, the impacts of the previous phase will be maintained, in terms of permanent land occupation, landscape, interference in land use planning and the socio-economic component.

Considering the greater significance of the interference introduced during the construction phase, the main activities of the 220 kV transmission line project likely to cause environmental impacts are presented below:

- Construction of the Longonjo substation and installation of the respective construction site;
- Movement of machinery and vehicles;
- Establishment of temporary access;
- Deforestation and earthworks;
- Definition of the protection corridor, in which trees that could interfere with the operation of the transmission line will be felled or cut down;
- Installation of supports, with temporary affectation of land use during the construction phase, in an area of around 30 m x 30 m around each support and tower construction site, and irreversible affectation of land use at the exact location of the support;
- Excavation of cavities and construction of foundation blocks, involving excavation and concreting.

It is foreseeable that the establishment and operation of the shipyard may cause negative effects on the environment, namely:

- Production of dust resulting from earth moving and temporary storage of equipment and materials, as well as other land preparation operations;
- Noise emissions from site preparation activities, the movement of vehicles accessing the site and the unloading of equipment and materials;
- Temporary compaction and waterproofing of the soil, during the period of operation of the construction site;
- Local alteration of the landscape, also during the period of its operation (presence of the tower).

5.2.1 Physical Environment

With regard to the Physical Environment and taking into account the specific nature of the route of the TL and the substation, some changes to the *status quo are expected* during both phases of the project, especially during the construction phase. Small to medium potential negative impacts are expected, associated with the dispersion of particulate matter, the emission of gases resulting from vehicle traffic (mainly heavy vehicles), as well as the generation of noise, vibrations and non-ionising radiation, the latter only during the operational phase.

5.2.1.1 Weather

Potential Impacts

The 220 kV transmission line between Belém do Dango - Longonjo and SE do Longonjo is located in a region with a subtropical highland oceanic climate (Cwb). During the preparation of the *RoW*, construction of the substation, foundations and installation of the towers, the removal of vegetation, demining, excavation and installation of the construction site will not be able to alter the parameters of the region's climate, namely: air temperature, relative humidity, wind, precipitation and the formation of heat islands.

The removal of vegetation exclusively on the 45 metre (m) wide *RoW* along the route of the TL and the maintenance of the region's indigenous ecological landscape combined with the different altitude variations in the region can also guarantee the region's thermal balance, and the effect of the incidence of the sun's rays on the ground along the 45 m wide earthworks will be imperceptible. In general terms, the physical presence and operation of the Longonjo transmission line and substation should not cause any change in the local and regional climate, so the impact is insignificant. The same is anticipated for the decommissioning phase.

Environmental Impact Assessment and Mitigation Measures

No impact is expected for this descriptor, so no measures are proposed.

Residual and Cumulative Impacts

There are no potential residual impacts for this descriptor. There are also no cumulative impacts expected, as there are very few activities that will take place in the project that could result in climate change.

5.2.1.2 Geology and Geomorphology

Potential Impacts

No significant negative impacts on geology and geomorphology are expected. Only minor superficial changes to the geomorphology within the construction areas (supports for the line towers and the site of the future SE of the Longonjo Mine), associated with the construction and improvement of access roads, excavations, earthworks along the *RoW*, land modelling and earthworks for the installation of equipment including the foundations of the towers, construction site and substation facilities. This potential impact will only occur during the construction phase, with no significant impacts expected during the operation and decommissioning phase.

Environmental Impact Assessment and Mitigation Measures

Table 5-6 describes the predicted Impact Assessment for Geology and Geomorphology, and its mitigation measures.

Table 5-6: Impact Assessment and Mitigation Measures for Geology and Geomorphology.

Phase	Construction	
	No Mitigation	**With Mitigation**
Duration	Continuous	Immediate
Extension	Regional	Location
Magnitude	Very low	Very low
Significance	Minor - Negative	Insignificant - Negative
Probability	Almost certain	Unlikely
Confidence	Low	High
Reversibility	High	High
Irreplaceability of resources	Low	Low
Comment - significance	The impacts are expected to be very few and the mitigation potential is high.	
Mitigation Measures	• The excavations to be carried out should be minimised and adjusted to the needs of the project; • It is recommended that waste rock from the excavations for the tower foundations be reused whenever possible and the rest deposited close to the excavation area; • Other waste during these activities must be managed in accordance with the RMP and transported by a duly authorised company.	

Residual and Cumulative Impacts

There are no known positive impacts on geology and geomorphology, with potential impacts predominantly related to the construction phase. Potential cumulative geomorphological impacts related to other projects planned for the surroundings (such as the Longonjo Mine Project) are not considered significant, as the impacts of this project are quite small and easily mitigated.

5.2.1.3 Soils

Potential impacts on the soil are expected during the construction phase, such as soil compaction, paving for equipment installation and soil contamination (accidental spillages of contaminants and incorrect segregation/conditioning of waste). Spillages can occur during the fuelling of fuel tanks and machinery and equipment reservoirs, or during the maintenance of vehicles and machinery. Others will result from cleaning and earthmoving activities, vehicle and machine traffic between the work fronts and the places where equipment and materials are stored (Longonjo construction site).

The places to be paved will be where the new equipment will have to be installed (mainly the tower foundations). The area paved for the foundations will occupy an area of approximately 7 metres x 7 metres. With regard to the substation at the future Longonjo Mine, its construction implies continued occupation of the land if it is not decommissioned. The area to be occupied differs depending on whether you consider the construction phase (in which the area used covers, in addition to the substation's area, all the surroundings affected by the construction processes involved) or the operation phase (in which only the substation area will be permanently affected). As it is not anticipated that the future substation will be decommissioned, as it is expected to be continuously updated and with maintenance activities, no assessment was carried out for this phase.

Soil degradation

The construction of access roads, vegetation clearance in the *RoW* and at the Longonjo substation site, earthworks and excavations for tower foundations are the main activities that can affect soil structure and cause soil compaction during the construction phase. Excavation work, earthworks and vegetation removal, especially on steep slopes, will make the soil unstable and more vulnerable to erosion. The route of the line is mostly in a low erosion risk class due to the slightly hilly topography. As a vegetation cover stabilises the soil and guarantees resistance to erosion, the removal of vegetation should be restricted to the minimum possible. Herbaceous and woody species that do not pose a risk to the project should be kept on site and will contribute to maintaining the natural stabilisation of the soil. During construction and in order to minimise potential impacts, where possible, work will be carried out in areas with little or no woodland and using existing accesses and roads (including the EN260).

At the site of the substation of the future Longonjo Mine, construction site, machine car park, or other support structures, as well as temporary accesses, progressive soil compaction will occur as a result of repeated vehicle movements. The main potential impacts of soil compaction are associated with altered drainage characteristics, namely; reduced aeration levels, which can cause anaerobic or waterlogged conditions; and can cause surface run-off and localised flooding. Compaction can also have secondary impacts on ecology, as it reduces the ability of vegetation to re-establish itself.

Potential Contamination of Soil Resources

Soils can be contaminated during the construction phase by the digging of foundation pits or by accidental spillages of hydrocarbons from heavy machinery on site or other locations with equipment and materials. For all activities involving the use of potential pollutants or hazardous materials, there will be a requirement to ensure that materials such as cement, fuels, lubricants and hydraulic fluids are carefully handled and stored to prevent spillages. A Waste Management Plan will be implemented during the construction phase, which should reduce the likelihood of this type of contamination occurring.

During the operation phase of the Longonjo substation, the risk of soil contamination from accidental spillages of hydrocarbons from maintenance vehicles, backup generators and machinery cannot be ruled out. In addition, special attention must be paid to the proper management of hazardous waste, in particular waste oils. Hazardous waste can be easily flammable, corrosive, reactive and/or toxic. They can also have other physical, chemical or biological characteristics that pose a potential risk to soil properties if handled inappropriately. As mentioned above, the Waste Management Plan will be developed for both phases (construction and operation) to ensure that the various types of waste produced (sanitary, non-hazardous and hazardous) are properly recovered, stored, treated, valorised and/or correctly disposed of.

Environmental Impact Assessment and Mitigation Measures

Table 5-7 and **Table 5-8** describe the predicted Impact Assessment for Soils (soil degradation and contamination) and its mitigation measures.

Table 5-7: Impact Assessment and Mitigation Measures for Soil Degradation.

Phase	Construction	
	No Mitigation	**With Mitigation**
Duration	Short term	Immediate
Extension	Regional	Location
Magnitude	Low	Very low
Significance	Minor - Negative	Insignificant - Negative
Probability	Likely	Unlikely
Confidence	Average	High
Reversibility	High	High
Irreplaceability of resources	Low	Low
Comment - significance	The impacts are expected to be very few and the mitigation potential is high.	
Mitigation Measures	• Minimise soil exposure during excavations and earthmoving, especially during periods of heavy rain, to reduce water erosion and the transport of solids, concentrating earthworks in the dry season whenever possible; • Vegetation must be cleared immediately before work begins to minimise the possibility of soil being exposed to wind erosion; • Vegetation removal should be kept to a minimum. Trees should be pruned to size, when exclusively necessary, and not removed (without felling); • Draw up and implement erosion and sediment control plans, especially in areas with high erosion potential; • Accelerated erosion from storm events during construction should be minimised by managing stormwater runoff (e.g. velocity control measures); • The handling of chemical products must always be carried out in such a way as to minimise the risk of spillage on the ground, in accordance with the procedures defined in the site's Environmental Management Plan; • Concrete mixers should preferably be washed in concrete batching plants to avoid contaminating the soil; • In the case of the power line, whenever construction activities result in excess soil, particularly from excavations, this should be used to cover the foundations or spread on the ground after installation of the foundation blocks, thus minimising impacts associated with the destruction of the soil for the installation of supports.	

Table 5-8: Impact Assessment and Mitigation Measures for Soil Contamination.

Phase	Construction	
	No Mitigation	With Mitigation
Duration	Short term	Immediately
Extension	Regional	Location
Magnitude	Low	Very low
Significance	Minor - Negative	Insignificant - Negative
Probability	Unlikely	Unlikely
Confidence	Average	High
Reversibility	High	High
Irreplaceability of resources	Low	Low
Comment - significance	The impacts are expected to be few and the mitigation potential is high.	
Mitigation Measures	• Develop and implement an Emergency Response Plan, including techniques for recovering contaminated soil (to be drawn up by the EPC); • Fuels and other dangerous substances must be stored in above-ground storage tanks or sealed containers, contained in a delimited area with drainage capable of capturing spillages and leaks; • Carry out maintenance on equipment and machinery in appropriate waterproofed locations. The waste resulting from this process must be properly stored and sent for environmentally appropriate disposal; • The area affected by an accidental spill (part of the ground) must be protected in spill containment *kits* and sent to an environmentally appropriate destination; • Waterproof fuel storage and fuelling facilities and generator zones, in accordance with legislation, and build settling basins to contain potential accidental spillages of lubricants and fuels; • Implement a Waste Management Plan certified by the National Waste Agency. • Choosing a suitable site for the disposal of construction waste. This must be managed appropriately and in accordance with national legislation, namely Presidential Decree No. 17/13 on Construction and Demolition Waste and Presidential Decree No. 190/12 on the Waste Management Regulations.	

Residual and Cumulative Impacts

The cumulative impact of soil degradation and contamination during the construction and operation phases of similar projects is not considered a significant impact in the region because, in general, very little vegetation will be removed in the *RoW* and on access roads, because most of it already exists. The activities that could cause such negative effects will be concentrated mainly in the area of the construction site and tower sites, which will be located 360 metres apart and are very easy to mitigate.

The overall impact footprint on the soil resource presented in the project region is considered Insignificant - Negative, with full compliance with the proposed mitigation measures and plans, including training for workers involved in refuelling motor vehicles, generators, mixing chemicals, etc. With the fulfilment of mitigation measures, no residual impacts are expected.

5.2.1.4 Water Resources

The proposed route will not cross any high-flow watercourses, it will only cross small watercourses, including some temporary ones that only have water in the rainy season. No towers will be built on these watercourses or within 30 metres of their banks. No physically significant permanent watercourses have been identified in the immediate vicinity of the planned construction site for the substation of the future Longonjo Mine. However, there are some potential impacts that could occur mainly during the works, listed below.

Project activities that will potentially have a direct effect on surface water include clearing vegetation and excavating foundations in the vicinity of surface water bodies. Additionally, there is the possibility of sediment reaching surface water bodies and increasing their sediment load. This, in turn, can have an adverse effect on water quality and affect users of these surface waters.

During construction activities, water will be needed (for example, cement mix for the foundations and drinking water for the workers). At this stage, the exact locations from which the water will be obtained are not yet known, although it will probably come from local subcontractors with valid licences to extract water from rivers. It will be abstracted at rates that do not jeopardise ecological functions and do not impede access to water for existing users. Once the *RoW is* re-established, no direct disturbance of surface water bodies is expected. No impacts on water resources are expected in the project area (transmission line and substation areas) during the operation and decommissioning phase.

Environmental Impact Assessment and Mitigation Measures

Table 5-9 describes the expected Impact Assessment for water resources and respective mitigation measures during the construction phase. As mentioned above, no impacts on water resources are expected in the project area during the operation phase.

Table 5-9: Impact Assessment and Mitigation Measures for Water Resources.

Phase	Construction	
	No Mitigation	With Mitigation
Duration	Short term	Short term
Extension	Location	Location
Magnitude	Moderate	Minor
Significance	Minor - Negative	Insignificant - Negative
Probability	Likely	Certain and Definitive
Confidence	Average	High
Reversibility	High	High
Irreplaceability of resources	Low	Low
Comment - significance	The effective mitigation potential is high with the implementation of water resource management measures, mainly with regard to the extraction of water or working near bodies of water.	
Mitigation Measures	• The oily layer stored in suitable containers must be sent to an authorised waste operator, who must ensure that the disposal of the oil avoids contamination of water resources; • Oil separators should be visually inspected every week, removing the oil layer and storing it in an appropriate container. This procedure should also be adopted whenever the limits of the equipment's safety level are reached (loss of efficiency in separating hydrocarbons); • All waste water from the site's activities will be collected and removed from the site for proper disposal in a licensed municipal facility; • Installation of watertight septic tanks (or equivalent) to collect waste water from the site, including effluent from washing vehicles and machinery; • Mobile chemical toilets should be installed on site if no other ablution facilities are available. These should be installed away from watercourses and supplied by an accredited company; • The impermeable surface that forms the base of the concrete batching plant should be slightly raised above the surrounding ground to minimise the entry of clean run-off water into the construction area; • The quality and quantity of effluent flows discharged into the environment, including rainwater, will be managed and treated to meet the applicable effluent disposal guidelines; • It is forbidden to deposit hazardous waste and materials directly on the ground or on the banks and beds of watercourses, in watershed protection perimeters, flood areas, agricultural areas and nearby residences; • The heavy machinery involved must be serviced/maintained up to date, ensuring that it is properly mechanised and minimising the likelihood of oil and/or fuel leaks;	

Phase	Construction	
	No Mitigation	With Mitigation
	• Comply with Angolan legislation on concentration limits for discharges into natural water bodies (Annex VI of Presidential Decree 261/11 of 6 October); • Dumping and/or storage of construction materials and construction waste that can release particles should be protected from wind and rain (e.g. by covering containers or storage areas for materials and/or waste) and should be located as far away as possible from sensitive areas, particularly areas close to watercourses.	
Observations	The mitigation measures proposed in the descriptors geology and geomorphology (**section 5.2.1.2**), soils (section 5.2.1.**3)** and air quality (**section 5.2.1.6**) are applicable.	

Residual and Cumulative Impacts

This project is not expected to require a large amount of surface water. The most significant water requirements will be confined to the construction phase, for the foundations of the towers and the construction of the Longonjo SE infrastructures, i.e. they will be temporary and fairly limited. No residual or cumulative impacts are expected in this descriptor.

5.2.1.5 Landscape

In general, it can be said that the impacts on the landscape caused by the construction of the transmission line and substation will be felt more intensely during the construction phase. In the operation phase they will be mitigated as a result of the implementation of mitigation measures, which although they can be minimised, cannot eliminate the potential visual or landscape impacts, given the size of the equipment to be installed as part of the project.

Potential impacts are therefore generally considered to be permanent and irreversible. As a general rule, observers will get used to the new structures over time, but their significance will not be cancelled out. The most significant potential impacts on the landscape will occur during the construction phase as a result of the construction of the Longonjo substation, removal of vegetation in the RoW, the presence of associated equipment, construction and machinery traffic, earthworks, assembly and installation of infrastructure. This potential impact is a combined effect of several aspects, including:

- Localised changes to the topography as a result of the installation of the supports, which are considered minor but permanent;

- The occurrence of discontinuities in land use, with negative impacts due to the destruction of vegetation cover and land movement. These impacts are considered temporary (short-lived);
- Interruption of the current continuity of the landscape in places where construction activities will take place, of temporary duration (short duration);
- Reduced visibility, even for a short period of time, especially in the dry season, caused by increased dust emissions and their deposition in the areas adjacent to the intervention sites, due to soil movement, considered to be of temporary duration (short term);
- Introduction of external elements to the existing landscape (e.g. building materials, prefabricated structures, etc.) of short duration.

Overall, the visual impact of the project will be negligible because, in many areas, a significant part of the TL will run parallel to the existing 60 kV transmission line between the Belém do Dango substation and the Faustino Muteka town centre. On the other hand, an extension of the proposed route for the 220 kV transmission line will require the removal of vegetation, but this activity will be minimised and carried out in strictly necessary areas. Taking into account the positioning of the towers, it will be necessary to make accesses on 50 per cent of the route. The proposed route has endeavoured to avoid areas of greater environmental sensitivity and higher vegetation density (as explained in **Section 2.2**).

During the operation phase, the overall aesthetic effect of the Longonjo TL and ES could be negative for most people, especially where the proposed lines cross natural landscapes. However, the presence of the TL and the new SE will not be something new for the region and the existing populations. The metal structures of the towers may appear disproportionate and not compatible with the agricultural landscapes, plains and/or hills of the region. This potential impact can be described as a permanent alteration of the landscape, resulting from various aspects, including:

- Reduced landscape quality;
- Visual intrusion;
- Changing the wild character and creating dominant visual elements.

The reduction in landscape quality, visual absorption capacity and spatial disorganisation generate significant impacts that will remain during the operation phase. Research and experience show that the reaction to the aesthetics of LT and SE sites differs. In some settlements close to the existing transmission lines in the region, the inhabitants don't notice them or consider them to be objectionable from an aesthetic point of view.

For some, transmission lines or other utilities can be seen as part of the infrastructure needed to sustain life and everyday activities and are therefore acceptable. For others, new transmission lines can be seen in a positive light, as they are associated with socio-economic development.

Environmental Impact Assessment and Mitigation Measures

Table 5-10 describes the Impact Assessment planned for the landscape and the respective mitigation measures during the construction and operation phase.

Table 5-10: Impact Assessment and Mitigation Measures for the Landscape.

Phase	Construction and O peration	
	No Mitigation	**With Mitigation**
Duration	Short term	Short term
Extension	Regional	Location
Magnitude	Moderate	Minor
Significance	Moderate - Negative	Minor - Negative
Probability	Certain and Definitive	Certain and Definitive
Confidence	Average	High
Reversibility	High	High
Irreplaceability of resources	Low	Low
Comment - significance	In general, the presence of the structures associated with the project will be However, it is not very noticeable in various places along the route.	
Mitigation Measures	• Speed limits should be set for heavy construction vehicles. This speed limit should not exceed 40 km/h in critical segments (residential areas, schools and health centres, etc.); • Vegetation clearing, topsoil removal and earthmoving activities should be minimised as much as possible and limited to strictly necessary areas; • All temporary construction sites, such as borrow pits and landing areas, and any other areas disturbed by construction, will be revegetated (using native species); • The shipyard, rest areas and machine parks should be located as far away as possible (minimum distance 300 metres) from any areas of sensitive use (residential areas, schools and health facilities); • Tree planting where it may be feasible to mitigate impacts on visual receptors at specific viewpoints/trajectories.	

Observations	The mitigation measures proposed in the geology and geomorphology (**section 5.2.1.2**), soils (**section 5.2.1.3**) and air quality (**section 5.2.1.6**) descriptors are applicable.

Residual and Cumulative Impacts

No residual impacts are expected for this descriptor. Minor cumulative impacts are expected, given that new equipment will be installed, in addition to existing equipment, and the presence of infrastructure and equipment associated with the operations of the future Longonjo Mine (with greater impacts on the current landscape).

5.2.1.6 Air Quality

The construction phase of the project will include a wide range of civil works necessary for the installation of the TL, substation equipment and other associated infrastructure. Activities with the potential to impact air quality will be associated with construction, from emissions of atmospheric pollutants from temporary power generators, equipment installation, vehicle and machinery traffic. Construction activities (vegetation removal, earthmoving, excavation, soil modelling, among others) will also generate emissions of particulate matter (dust).

Each of these operations has its own duration and dust generation potential, and therefore the extent of dust emissions varies substantially from day to day, depending on the level of activity, the specific operations and the prevailing meteorological conditions throughout the project areas. The locations of the towers, where most of the earthworks will take place, are expected to be approximately 360 metres from each other, and excavations will be carried out sequentially.

The following emissions would be expected during construction: emissions of nitrogen oxides (NO_2), carbon monoxide (CO), carbon dioxide (CO_2) and sulphur dioxide (SO_2), mainly from construction-related vehicles (and to a lesser extent from construction generators and other hydrocarbon-powered equipment); and particulate matter (such as PM2.5 and PM10) generated by construction-related vehicle traffic on unpaved roads.

Once the transmission line is built and operational and the *RoW* established, no significant effects on air quality are expected. Maintenance activities, and in particular

Continuous vegetation control along the RoW will result in some dust and gaseous emissions due to the fuel consumption of equipment and vehicles used for these maintenance operations, however, the expected air pollutant emissions are intermittent and of low intensity. As such, the potential impacts on air quality during the operation and decommissioning phase are considered insignificant.

During the operating phase of the Longonjo substation, sulphur hexafluoride (SF_6) could be emitted into the atmosphere. This gas is used in the cut-off chambers of substation circuit breakers due to its exceptional dielectric behaviour. In fact, SF_6 has a dielectric strength three times greater than that of air and, at the same pressure, has an arc extinguishing capacity three or four times greater than that of air. In terms of its properties, SF_6 has no reactive properties and is considered an inert gas. It is also characterised by being an odourless, colourless, non-flammable and non-poisonous gas. In the atmosphere, SF_6 contributes to the greenhouse effect and its release should be avoided. Given the nature of the pollutants emitted and the expected concentrations of the emissions in question, no impact on human health is expected during the SE's operating phase.

Environmental Impact Assessment and Mitigation Measures

Table 5-11 describes the predicted Impact Assessment for Air Quality and the respective mitigation measures. Despite the expected low significance on air quality for the project area, dust emissions may cause some degree of nuisance in existing settlements and in the vicinity of the proposed route. As such, mitigation measures are recommended to efficiently reduce the potential negative impacts caused by dust at nearby receptors.

Table 5-11: Impact Assessment and Mitigation Measures for the Landscape.

Phase	Construction	
	No Mitigation	With Mitigation
Duration	Immediate	Immediate
Extension	Location	Location
Magnitude	Moderate	Low
Significance	Minor - Negative	Insignificant - Negative
Probability	Likely	Unlikely
Confidence	Average	High
Reversibility	High	High
Irreplaceability of resources	Low	Low
Comment - significance	The expected impacts are quite small and the potential for mitigation is high.	
Mitigation Measures	• Fuels and other hazardous substances must be stored in above-ground storage tanks or sealed containers, contained	

Phase	Construction	
	No Mitigation	With Mitigation
	in a delimited area with sump drainage to capture spillages and leaks; • Speed limits should be set for heavy construction vehicles. This speed limit should not exceed 40 km/h on critical stretches, such as near residential areas; • All internal combustion machinery and equipment must be kept in a good state of maintenance to minimise tailpipe emissions. This should include preventive maintenance of machinery, equipment and vehicles, and operator training, as well as an internal vehicle maintenance monitoring programme; • Vegetation clearance and earthworks should be minimised as much as possible and limited to strictly necessary areas; • All unpaved surfaces where vehicle movement is expected near residential areas should be kept damp (e.g. via a water sprinkler truck), particularly during dry and windy conditions, to reduce dust emissions; • Heavy lorries carrying granular building materials (such as sand, earth and gravel, etc.) should not be loaded to full capacity. A free edge of approximately 0.2 metres should be maintained to prevent leakage during transport; • Lorries transporting dusty materials must have the load properly covered, avoiding the emission of particulate matter and fugitive dust; • On site, *stocks of* granular materials should be sprayed regularly with water to minimise wind-borne dust; • Prohibit the incineration/burning and disposal on the ground of any type of flammable waste or material during the activities associated with the project; • Prior to construction activities, carry out a baseline air quality survey to set the benchmark for gases (NOx, CO, CO_2 and SO_2) and particulate matter (PM2.5 and PM10); • Covering internal circulation routes and the area intended for the work with non-powdery material (gravel, crushed stone, concrete or other); • Define traffic routes that are as short as possible (taking into account the priority given to distance from residential areas, hospitals, schools, etc.)	

Residual and Cumulative Impacts

For this descriptor, small residual and cumulative impacts are foreseen (only during the construction phase), arising from the emission of combustion/exhaust gases from vehicles and machinery, and due to normal road traffic along the transmission line (especially on unpaved roads).

5.2.1.7 Noise, Vibration and Radiation

During the construction phase, noise will be generated mainly by the operation of construction vehicles and machinery and by the activities carried out on each specific work front. All of these construction and equipment operation activities will result in temporary noise emissions with potential nuisance to the community when construction activities take place in the vicinity of existing settlements along the route. Of the construction activities with the potential to generate impacts on environmental noise, some are clearly noisier, such as demining, earthmoving and vegetation clearance. Other activities, such as transporting materials and moving heavy vehicles from the construction site to the work fronts and vice versa, will generate noise, but at lower levels.

It is also important to note that some activities are very limited in time and space (such as earthworks and excavation at each tower location), while others will be more continuous (such as the movement of machinery). Low ambient noise levels are expected due to the rural location of the entire proposed route. Thus, noise levels during this phase will also depend on various factors, such as the type, quantity and state of repair of the equipment to be used and construction methods.

During the operational phase of the project, various types of noise can be produced, namely: wind-induced noise, due to certain wind conditions acting on the components of the transmission line; noise emissions due to the corona effect, which will only occur under specific meteorological conditions; and induced traffic and noise during the maintenance activities to be carried out on the TL's *RoW.*

Construction activities and equipment are not expected to result in significant levels of vibration. Equipment that can generate high levels of vibration (such as impact piles or vibratory compaction) will not be used. The construction of the project will also involve some temporary and localised ground works that will generate very low vibrations. Depending on the characteristics of the soil and the distance from the nearest building, these activities may produce vibrations in neighbouring houses that are always small in magnitude. Therefore, vibration effects were excluded from the additional assessment.

When the TL is fully operational, any potential disruption to the local noise environment can be caused by a phenomenon called corona discharge[4] . Under ideal conditions (for corona discharges), the noise generated by this effect can reach sound levels of around 30 dB(A), which are perceptible to the human ear. Bearing in mind that the TL will have a protective *RoW* of 45 metres and the towers will be more than 25 m above ground level, it is unlikely that corona discharges will generate noise levels high enough to cause any kind of nuisance to people living near the transmission line.

The operation's maintenance activities will include the use of 4X4 vehicles and the occasional use of heavy vehicles responsible for vegetation control along the corridor. These vehicles will generate noise emissions, but the additional road traffic generated as a result of the project is expected to be minimal and sporadic in nature, as there will be very few visits made by the maintenance team.

Generally speaking, all equipment emits non-ionising radiation (electromagnetic radiation). The problem lies in defining the distances and levels at which this radiation can affect the well-being of living organisms. There is still no consensus in scientific circles, as some articles state that the exposure limits proposed by various institutions/organisations are not acceptable. This EIAS has taken into account the exposure limits defined by ICNIRP (ICNIRP, 1998; Health Physics Society, 1998) (see **Section 3.3.2**).

During the operation phase, there will be a slight increase in noise inside the premises of the Belém do Dango power station as a result of the operation of the new transformers; however, given current operations, this increase will be imperceptible.

The equipment (transformers) and the overhead lines and some of the equipment of the new Longonjo SE will emit non-ionising electromagnetic radiation, and it is expected that this radiation will be emitted, or lightning

[4] In certain conditions, such as rain and fog, when very high voltage values pass through the conductors of transmission lines there is some leakage of current into the air. The air, which when dry is a perfect insulator but when wet becomes a conductor, is then ionised. In this situation, the electric field gets higher and a bright effluvium, producing a slight crackle, begins to appear, with sharp edges or protrusions. Above a certain voltage level, and when observed in the dark, the entire conductor appears surrounded by a halo of bluish light, which produces noise. This phenomenon is called the corona effect or corona discharge.

with the installation of new equipment. However, respecting the safety distances (the project towers will be around 32 m high and any electromagnetic fields are negligible at that height) and the correct installation and operation of the equipment, the levels of non-ionising radiation will not represent any danger to people or other living forms. In the decommissioning phase, no impacts on this component are anticipated.

Environmental Impact Assessment and Mitigation Measures

Table 5-12 and **Table 5-13** describe the planned Impact Assessment for Noise, Vibration and Radiation, and the respective mitigation measures for the construction phases.

Table 5-12: Impact Assessment and Mitigation Measures for Noise and Vibration.

Phase	Construction	
	No Mitigation	With Mitigation
Duration	Immediate	Immediate
Extension	Location	Location
Magnitude	Low	Low
Significance	Minor - Negative	Insignificant - Negative
Probability	Likely	Unlikely
Confidence	Average	High
Reversibility	High	High
Irreplaceability of resources	Low	Low
Comment - significance	The expected impacts are quite small and the potential for mitigation is high.	
Mitigation Measures	• Construction activities, particularly the noisiest ones, should be limited to daytime hours (between 07.00 and 22.00) and working days, avoiding work at night and at weekends; • Residents of local communities near construction sites should be informed in advance by the contractor about upcoming construction activities, including information about the planned start of activities, their nature and duration. This communication should also include information on the nature and objectives of the project; • Develop and implement a Complaints Mechanism to deal with complaints associated with noise and vibration emissions; • Carry out noise monitoring campaigns during the construction phase along the proposed route; • Use soundproof generators or renewable sources as an alternative to electricity for energy-efficient equipment; • For machines with fitted cabinets, the doors and door seals will be checked to ensure that they are in good working order.	
Observations	See mitigation measures presented for geology and geomorphology (section 5.2.1.2), soils (section 5.2.1.3) and air quality (section 5.2.1.4). 5.2.1.6).	

Table 5-13: Impact Assessment and Mitigation Measures for corona and radiation discharges.

Phase	Operation	
	No Mitigation	**With Mitigation**
Nature	Negative	Negative
Duration	Immediately	Immediately
Extension	Location	Location
Magnitude	Very low	Very low
Significance	Minor - Negative	Insignificant - Negative
Probability	Unlikely	Unlikely
Trust	Average	High
Reversibility	High	High
Irreplaceability of resources	Low	Low
Comment - significance	The expected impacts are quite small and the potential for mitigation is high.	
Mitigation Measures	• Regular maintenance of the components of the Longonjo transmission line and substation, such as insulators, conductors, etc. • Carry out a survey of the intensity of electromagnetic radiation (kV/m) and magnetic fields (A/m) generated by the equipment in the SE; comparing the results with the exposure limits defined by ICNIRP, which limits exposure to electric, magnetic and electromagnetic fields (up to 300 GHz): **a.** If the radiation values are outside the ranges considered safe, consider implementing protective measures, such as installing shielding with specific alloys (effective only in reducing exposure to the electric field, not exposure to the radiation). magnetic field).	

Residual and Cumulative Impacts

Residual impacts are expected for this descriptor, even with the implementation of mitigating measures in both phases of the project, as a result of vehicle traffic, the use of machinery and equipment and the emission of non-ionising radiation, but these are of low significance for the current *status quo*. Since the route of the TL will partly parallel the existing 60 kV TL, cumulative impacts should also be expected.

5.2.2 Biotic Environment

The Biological and Ecological component foresees some potential negative impacts on habitats, vegetation, flora and fauna. According to the data from the survey carried out, the main ecosystems to be crossed by the transmission line are miombo, which is considered a fragile ecosystem, sensitive to profound changes to its components. On the other hand, it is important to emphasise that the region where the LT route is located is highly modified (as described in **Section 4.2**). For the *RoW of* the LT, it will be necessary to remove some native vegetation, only in specific locations and over a very small area. However, the removal of vegetation could contribute to the loss of biodiversity, habitat fragmentation, changes in light conditions and the possible invasion of invasive exotic species (which already exist, as mentioned in **Section 4.2.2**), whose competitiveness and growth rate are considered high.

For fauna, the expected potential negative impacts are related to the destruction of feeding and shelter areas, and the risk of electrocution of birds and other animals (e.g. climbing animals). For the Longonjo ES installation area, no major changes to its *status quo are* expected, as the ES will be installed in an area devoid of any original vegetation and already highly modified as a result of different anthropogenic activities, particularly agricultural purposes and obtaining firewood.

5.2.2.1 Habitats, Vegetation and Flora

As mentioned above, the region where the proposed route for the TL and the area reserved for the construction of the SE are located is highly modified from its original form, and no areas of high importance have been identified. In addition, and as explained in **Section 2.2**, the proposed route was designed so that areas of greater environmental sensitivity were avoided. No impacts on this component are anticipated for the decommissioning phase.

Disturbance or loss of flora and habitats

The construction of the project will result in the loss and/or disturbance of flora through the clearing or cutting of vegetation in some sections of the RoW, access roads and in the area to the SE of Longonjo, and may cause disturbance of vegetation outside work areas through the negligent behaviour of contractors, such as driving off roads and accesses, generating fires, etc. Earthworks and the circulation of vehicles will allow the dispersion of atmospheric pollutants (suspended particles). Dust is deposited on the surface of plant leaves, covering them and preventing the absorption of solar energy, as well as the absorption of carbon dioxide ($_{CO2}$) and the release of oxygen ($_{O2),}$ thus limiting their photosynthetic capacity and threatening their survival.

The potential impacts associated with the construction of the tower infrastructures are not expected to be harmful to the flora, i.e. the area to be affected is quite small (12.24 ha during the construction phase and 0.67 ha during the operation phase) considering the total length of the TL and located/confined (in addition, the towers will be at a distance of 360 metres from each other). The footprint of the access roads is larger than for the actual footprint of the towers, but still limited, and is not expected to have a potentially significant impact on flora or critical habitat if the proposed mitigation measures are implemented. In addition, during the construction and operation phase of the project, existing access routes will be used wherever possible, and the creation of new ones will only be very limited/reduced (this during the construction phase).

Indirect degradation of vegetation units and habitats

In the construction and operation phases, maintenance operations include vegetation control in the RoW, which will limit the recovery of vegetation within the corridor. Frequent maintenance operations will also contribute to the expansion of ruderal and invasive flora species. Due to the need to maintain the service corridor along the route of the TL (6 metres during construction and 3 metres during operation), in some places there will be habitat fragmentation due to the presence of the RoW. Although difficult to mitigate during the vegetation removal process, some mitigation measures should be applied. Access roads to the corridor and towers can also increase the exploitation of natural resources by the local population, both flora (e.g. timber and charcoal) and others (e.g. quarries). This can lead to vegetation degradation.

Construction activities and the transport of equipment and workers potentially facilitate the introduction of exotic and/or invasive species. Implementing behaviours that prevent this introduction, such as checking and cleaning the vehicles and transport machines that will be carrying out the work so that they do not carry plant material, can minimise and prevent the introduction of invasive exotic species. The construction and operation works have the potential to result in negative impacts on unique floral and/or faunal species, particularly *Julbernardia paniculata* and *Brachystegia spiciformis*, which are frequent in the project area of influence and have Vulnerable conservation status (see **Table 9-1** in **Annex 9**), according to the LVEA and the IUCN.

In relation to the edge effect, its effects can be very unpredictable, for some species of vegetation it can be very advantageous, however, these edges may not be suitable for others, for example for the dispersal of interior species (those that avoid edges) and can increase the impact of predators, parasites, competitors or diseases.

In general, impacts on habitats, flora and vegetation during the operation phase will result from maintenance work on the line. It is foreseeable that, in the medium and long term, there may be occasional negative impacts resulting from the felling of trees that have grown in the safety and maintenance corridor or in the protection zone near the supports, and which, due to their size, put the line at risk by being outside the safety distances.

Environmental Impact Assessment and Mitigation Measures

Table 5-14 describes the predicted Impact Assessment for Habitats, Vegetation and Flora, and the respective mitigation measures for the construction and operation phases.

Table 5-14: Impact Assessment and Mitigation Measures for Habitats, Vegetation and Flora.

Phase	Construction peration	
	No Mitigation	With Mitigation
Duration	Continuous	Immediately
Extension	Location	Location
Magnitude	Moderate	Minor
Significance	Moderate - Negative	Minor - Negative
Probability	Likely	Unlikely
Confidence	Average	High
Reversibility	High	High
Irreplaceability of resources	Low	Low
Comment - significance	The contractor's commitment to applying the recommended measures reduces potential impacts, but this requires a monitoring procedure to ensure that these measures are implemented. The flow of people along the route as an indirect impact of the presence of the line could exacerbate the disturbance of flora. However, existing access routes will be utilised whenever possible so as not to create additional access routes.	
Mitigation Measures	• Limit the movement of machinery and vehicles to work areas. • Vegetation clearance should be minimised and limited to strictly necessary areas; • Wherever possible, existing accesses should be used; • The areas selected to be subjected to deforestation or clearing activities must be marked in advance with visible markings (e.g. coloured tapes), allowing the identification of the intervention areas, thus facilitating the work of machinery operators and avoiding the cutting of vegetation that can be maintained. These operations must be as careful as the ecological or landscape interest of the vegetation formation in question; • Actions that cause negative impacts on flora and vegetation must be minimised during the construction of the transmission line and the installation of access roads, and tree felling must be duly carried out. planned, especially in the case of protected species and regenerating miombo trees;	

Phase	Construction and Operation	
	No Mitigation	With Mitigation
	• Prevent and discourage the use of fire, as it could easily get out of control, causing problems (such as loss of pasture and mortality of domestic livestock, etc.) for neighbouring communities; • Rehabilitation measures are recommended for the most affected areas, i.e. temporary access roads, construction sites, etc.), such as removal/relocation of protected species, replanting, etc; • Avoid unnecessary destruction of habitat trees, for example dead trees and old specimens. Cavity and bark-dwelling fauna species utilise these sites, particularly reptiles and mammals; • Ensure compliance with the waste management techniques proposed in the Waste Management Plan for the project; • At the end of the construction work, the original physical structure of all the affected areas must be restored. In the areas to be restored, the land must be left in conditions favourable to natural revegetation and, whenever native species of grass should be used.	
Observations	See mitigation measures presented for the descriptors geology and geomorphology (section **5.2.1.2**), soils (section **5.2.1.3**), landscape (section **5.2.1.5**) and air quality (section **5.2.1.6**).	

Residual and Cumulative Impacts

The residual impacts for this descriptor are related to the change in ecosystem structure and the way in which the flora will respond to the changes brought about by the implementation of the project. Cumulative impacts are related to the increasing pressure on ecosystems, the implementation of the project will increase this pressure.

5.2.2.2 Fauna

In terms of fauna, the potential impacts will be centred on bird populations within the development area and the immediate vicinity of the project. The main impacts are related to habitat loss associated with construction activities, resulting in the displacement of breeding and foraging areas, and habitat degradation. There are also indirect impacts associated with changes in ecosystems and biophysical processes.

During the operation phase, there is the potential for bird collisions along the transmission line route. This is more likely for larger bird species, migratory species and species that have a varied flight pattern (dipping and circling). There are no areas of particular importance for birds near the proposed route of the transmission line, namely an IBA (the nearest is approximately 50 kilometres from the route - Morro do Moco, see **Figure 4-15** in **Section 4.2.3**).

Reduced feeding, breeding and roosting areas

In the construction and operation phases, vegetation clearance and maintenance operations along the RoW, which will limit the recovery of vegetation within this corridor, and frequent maintenance operations will also contribute to the destruction of feeding and nesting points, breeding and roosting areas for fauna species, especially birds and mammals. Species that depend on trees will be particularly affected, such as amphibians, reptiles, rodents and bats that use the inside of trees as roosts; but also various species of birds that nest in trees (most small birds, night birds, birds of prey, among others); and even larger mammals that roost in trees.

Some feeding areas will be lost through vegetation clearance, although since the vegetation clearance corridor is narrow, animals should be able to feed in similar nearby areas. Special attention should be paid to bird nests which, if found in the areas, will have to be relocated by biodiversity specialists where vegetation clearance is necessary.

Increased fauna mortality and decreased species diversity

Clearing vegetation will lead to the death of some animals, potentially reducing species diversity in the project area. Organisms that are sessile during the day and roost in trees, such as bats, amphibians and reptiles, will most likely be affected, as these animals do not normally leave their roosting sites during the day. As such, they will not escape and will therefore die during vegetation removal activities. In addition, birds that nest in trees (including eggs and chicks) and especially nocturnal birds. Adult birds, which are less vigilant during the day, may also be affected during these activities. An increase in machinery, vehicle traffic and light will also lead to a high risk of being run over. Animals that move more slowly, such as reptiles and amphibians, are typically the most affected by these impacts, as they find it more difficult to move away quickly and are also difficult for drivers/operators to detect.

In the operational phase, the Longonjo transmission line and substation should have insignificant direct negative impacts on amphibians, reptiles and terrestrial mammals. The towers will be widely spaced across the landscape and the cables are inaccessible to non-climbing terrestrial species.

In contrast, the direct impact of power lines on bird communities is relatively well known. Birds can have difficulty seeing overhead power lines, particularly in poor weather conditions, causing fatal collisions, while the wingspan of larger species can cause them to cross the gap between two parallel lines, resulting in electrocution. Collision risks are difficult to assess and depend on various factors, such as the species present and their ecological behaviour, the characteristics of the landscape and the technical features of the power lines. For example, the risks are higher for nocturnal passengers, for species that migrate at low altitudes, for large birds in general and for species that fly quickly and gather in large flocks in situations of reduced visibility. As for other groups of fauna that could be affected by collisions with LT, such as bats, it should be noted that they are much less likely to be affected by these structures, thanks to their orientation and obstacle detection system.

Environmental Impact Assessment and Mitigation Measures

Table 5-15 describes the planned Impact Assessment for Fauna and the respective mitigation measures for the construction phase.

Table 5-15: Impact Assessment and Mitigation Measures for Fauna.

Phase	Construction	
	No Mitigation	With Mitigation
Duration	Short term	Short term
Extension	Regional	Regional
Magnitude	Moderate	Minor
Significance	Moderate - Negative	Insignificant - Negative
Probability	Likely	Likely
Confidence	Average	High
Reversibility	High	High
Irreplaceability of resources	Low	Low
Comment - significance	The contractor's commitment to applying the recommended mitigation measures reduces potential impacts, but this requires monitoring to ensure that these measures are implemented. The flow of people along the route, as an indirect impact of the presence of the line, could exacerbate the loss of fauna species. However, the existing access routes will be preferentially used, reducing the need for additional access.	

Phase	Construction	
	No Mitigation	With Mitigation
Mitigation Measures	• Limit the circulation of machinery and vehicles to work areas. Limit disturbances outside the confines of the workplace; • Avoid the destruction and unnecessary removal of habitat trees, for example dead trees and old specimens; • Speed limits should be set in construction areas (e.g. 40 km/h), as this would result in fewer animal deaths as well as less associated dust emissions; • The felling of trees must be properly planned, especially in the case of large native species, and must be authorised in advance by the Environmental Officer of the Surveillance team; • Avoid off-road driving and unnecessary night driving in the area, as this often results in the death of slow-moving reptiles and mammals, particularly nocturnal species; • Educate/inform contractors about dangerous and protected species in order to avoid unnecessary damage/killing of these species, as well as the consequences of illegal collection of such species.	
Observations	See mitigation measures presented for the descriptors geology and geomorphology (section **5.2.1.2**), soils (section 5.2.1.**3),** landscape (section 5.2.1.**5)**, air quality (section **5.2.1.6**) and habitats, vegetation and flora (section 5.2.1.7). **5.2.2.1**).	

Table 5-16 describes the Impact Assessment foreseen exclusively for avifauna and the respective mitigation measures for the operation phase.

Table 5-16: Impact Assessment and Mitigation Measures for Birdlife.

Phase	Operation	
	No Mitigation	With Mitigation
Duration	Permanent	Short term
Extension	Regional	Regional
Magnitude	Moderate	Smaller
Significance	Moderate - Negative	Minor - Negative
Probability	Unlikely	Unlikely
Confidence	Average	High
Reversibility	High	High
Irreplaceability of resources	Low	Low
Comment - significance	Without mitigation, the potential impacts will be more significant.	
Mitigation Measures	• Apply line signalling devices (Bird Flight Diverters); • Start a bird collision monitoring programme during the operation to determine the success of the bird collision prevention mechanisms; • Maintenance actions in the RoW should avoid the nesting period for most bird species, including the hatching of ground-nesting species; • In the event of receiving confirmation of regular bird collisions along the transmission line (based on ongoing monitoring activities), the installation of high-visibility markers should be considered for make the lines more visible to birds, reducing the risk of collision;	

Phase	Operation	
	No Mitigation	With Mitigation
	• Wherever possible and safe, provide safe artificial perches for birds and nesting platforms placed at a safe distance from energised parts of the transmission infrastructure; • Prohibit hunting in and around the project areas.	
Observations	See mitigation measures presented for the descriptors geology and geomorphology (section **5.2.1.2**), soils (section 5.2.1.**3),** landscape (section 5.2.1.**5)**, air quality (section **5.2.1.6**) and habitats, vegetation and flora (section 5.2.1.7). **5.2.2.1**).	

Residual and Cumulative Impacts

The residual and cumulative impacts for this descriptor are related to the change in the structure of the ecosystem and, probably, the food chain in the areas of the TL route, and how the fauna (birds) will respond to the changes from the implementation of the project. The changes seen in the area to the SE of Longonjo are considered insignificant given its rather small size.

5.2.3 Socio-economic environment

Negative and positive impacts are expected for this component, and the following potential impacts were considered important to assess:

Potential economic impacts:

- Creation of employment opportunities at local and provincial level;
- Opportunities to supply goods and services locally; and
- Electricity supply for the future Longonjo Mine.

Potential impacts on land and livelihoods:

- Physical displacement as a result of loss of shelter;
- Changes in transhumance patterns due to the existence of the right of way;
- Economic displacement as a result of loss of livelihood; and
- Economic displacement as a result of the loss of natural resources.

Potential health and safety impacts:

- Improved safety after demining activities;
- Increased risk of contracting diseases;

- Increased risk of traffic and work-related accidents; and
- Increased risk related to the presence of the transmission line.

Potential impacts on quality of life:

- Discomfort generated by construction activities;
- Interference in the daily activities of local communities; and
- Greater accessibility to the transmission line corridor.

For the decommissioning phase, the potential impacts for this component are considered insignificant and are not included in the assessment.

5.2.3.1 Economy and Employment

The project is highly related to the Longonjo Mine project (Projecto Mineiro de NdrPr do Longonjo, Huambo). And as mentioned in **Section 2.3**, failure to implement this Longonjo LT and SE project could jeopardise the mine project and consequently limit the socio-economic development associated with both projects (mine and LT+SE). Primary impacts are expected during the construction phase through the creation of temporary local and regional employment opportunities (60% of the opportunities will be given to local young people) and the creation of long-term benefits associated with increasing the capacity of the local labour force through on-the-job training.

Opportunities for economic development and diversification may also result from the use of local facilities and the acquisition of goods and services during the construction phase, in particular for water supply, waste management facilities, food or catering services, telecommunications (Internet) and security services, etc. To a lesser extent, the operation phase will generate some limited long-term local employment opportunities, mainly for maintenance and monitoring activities along the route of the TL and ES.

The construction phase is expected to last 12 months, and the total number of people in the labour force will be around 70, made up of 60% local workers. The

The local opportunities envisaged will mainly employ semi-skilled and low-skilled workers for a period during the construction phase.

The potential positive impacts will be temporary during the construction phase, followed by a reduction in the labour force during the LT and SE operation phase. Most of the workers are expected to come from urban areas such as Huambo, Caála and Longonjo.

In addition to construction project labour, demining activities may also generate some limited and temporary employment (unskilled labour, such as cleaning assistants, cooks, cleaners, etc.). The economic impact of the project's labour costs on the local economy is expected to be small, as the construction site will provide food and other services to the workers. However, due to the cultural variety of the workers, it should generate some income for local shops, bars, restaurants and cafés and other formal businesses in the service sector in the three municipalities covered by the project.

Finally, drinking water will be needed for the construction site, as well as water for construction activities, and a private water supplier is expected to be contracted. Similarly, solid waste will also be generated during construction and from the site and work fronts. The waste generated on site will be disposed of in duly licensed landfill sites in the region. The project will also be able to hire security services and the services of a local catering company to provide food and/or meals. As such, the use of local waste facilities and the services of a local water supply and catering company can contribute to the creation of local economic development and diversification opportunities during the construction period.

In the operation phase, the main impact associated with the project is expected to be the long-term employment of local labour to maintain the infrastructure and the maintenance corridor and monitoring activities of the TL. Once construction is complete, the operation of the TL will be handed over to RNT as the line operator. Although the exact size of the labour force needed for the operation phase is unclear at this stage, recruitment is not expected to be extensive. RNT is a state-owned company, so recruitment may be limited, as RNT may not need to hire any additional workers. The maintenance and monitoring of the line is expected to require a higher level of qualification, while the clearing of vegetation in the TL corridor will require a higher level of qualification.

require unskilled labour. With regard to SE, this will be the responsibility of a private organisation (yet to be defined).

Environmental Impact Assessment and Mitigation Measures

Table 5-17 describes the expected impact assessment for new job opportunities and boosting the economy during the construction phase. The expected impacts are positive but limited to the 12-month construction period.

Table 5-17: Impact Assessment and Mitigation Measures for Employment Opportunities and Economic Dynamisation.

Phase	Construction
No Maximisation	
Duration	Short term
Extension	National and international
Magnitude	Moderate
Significance	Moderate - Positive
Probability	Very likely
Trust	High
Reversibility	High
Irreplaceability of resources	
Comment - significance	Not applicable
Maximisation measures	• Develop a Local Employment Plan for the construction phase. This plan should include a hiring procedure to ensure that local people (both men and women) from the study area are employed wherever possible, and that this is done fairly, consistently and transparently by the contractor. The Plan must ensure that women and people with disabilities benefit equally. Workers from communities along the TL will be prioritised for low-skilled jobs; • Develop a Local Procurement Plan for the construction phase. As part of the tendering process, the contractor should develop a procurement strategy, stipulating how local purchasing of goods and services (e.g. building materials from quarries located near the study area, waste management and disposal, water supply, catering, etc.) will be carried out, in order to maximise local procurement. This plan should ensure the equal and effective participation of women and men on the purchasing committee; • All employees must receive adequate training to perform their duties properly; • The developer must work with the local Municipal Administrations and Sobas to publicise all vacancies in a way that is accessible to local communities and explain to both women and men how they can benefit from the project so that they can be economically empowered; • Efforts to create jobs must be accompanied by the protection of workers' fundamental rights, in accordance with the

Phase	Construction
No Maximisation	
	requirements established in national labour legislation (Law no. 7/15 of 15 June); • Guarantee the prohibition of the use of child labour or forced labour; • Formalise all employment contracts in writing, specifying working and payment conditions.
Observations	Maximising impacts will be the responsibility of the construction company.

In the operation phase, the project will be under the exclusive management of RNT, which will be responsible for creating the necessary means for the regular maintenance of TL, including the supply of local goods and services. This may result in the contracting of service providers; however, maximising the positive impact associated with contracting service providers will be the sole responsibility of RNT. With regard to SE, this will be the responsibility of a private entity (yet to be defined), so maximising these impacts will be the responsibility of this entity.

Table 5-18 describes the expected Impact Assessment for the electricity supply to the future Longonjo Mine during the operation phase.

Table 5-18: Impact Assessment and Mitigation Measures for the supply of electricity to the future Longonjo Mine.

Phase	Operation
	No Maximisation
Duration	Permanent
Extension	National and international
Magnitude	High
Significance	Moderate - Positive
Probability	Certain and Definitive
Confidence	High
Reversibility	High
Irreplaceability of resources	
Comment - significance	Not applicable
Maximisation measures	• Maximising impacts will be the responsibility of the operator.

Residual and Cumulative Impacts

The project, together with the Longonjo Mine project, will have cumulative impacts on the socio-economic development of the region, particularly the municipality of Longonjo.

5.2.3.2 Land and ways of life

The Longonjo substation will be built in a peri-urban area, but away from residential and/or service areas, with no infrastructure within the area. However, both TL and SE are located in areas where subsistence farming activities are carried out. Other economic activities, such as small-scale trade and street vending, informal temporary jobs (including agricultural work, construction-related work, cleaning services, etc.), informal businesses, and employment in the public and private sectors, are also observed in the three municipalities covered by the project.

Vulnerable groups include families with particularly low incomes and high dependence on land for subsistence and income generation. These families can be found throughout the project area and are predominant in rural settlements where agriculture is the main subsistence activity.

Physical displacement (involuntary resettlement)

During the implementation of the TL it will be necessary to create a partially protected zone (equivalent to the *RoW*), which is defined as a 45 m corridor centred on the alignment of the line (22.5 m to each side). The execution and implementation of the Project will lead to some form of involuntary resettlement of individuals and/or families who may be affected by the land acquisition process, since within the protection *zone/RoW* (45 m) there can be no infrastructure, and in the maintenance corridor (6 m) in the area of the towers (7 m x 7 m), no agriculture or any other activity will be allowed.

In the surveys carried out, and described in **Chapter 4,** 7 permanent buildings were identified along the 45 metre corridor. All of them are located in the village of Lumingo, in the municipality of Longonjo, around 750 metres from the Longonjo SE site. However, none of the supports needed to install the towers coincide with existing infrastructure. As such, no physical resettlement is expected, only economic resettlement as a result of the area needed for the tower supports (360 towers x 7 m x 7 m) and for the maintenance corridor (50 km x 6 m wide) along the TL, associated with the subsistence agriculture practised in these areas. As such, physical resettlement (housing) will not be the subject of an impact assessment. However, during the construction work, some infrastructure may be detected that could necessarily be removed. If this occurs, it will involve the removal of existing infrastructure (structures and associated livelihoods) and the subsequent physical displacement of affected people/social groups to other locations (involuntary resettlement), which can lead to:

- Changes at an individual and family level, in particular disturbances in established social relationships (i.e. disruption of the social network);
- Modification of movement patterns (distance to schools, health centres, livestock and agricultural areas, water sources, etc.); and
- Change or loss of income and means of subsistence, which are essential for the survival of the people/social groups affected, and which can lead to food deprivation (food insecurity) in the case of the most vulnerable groups. However, this can only happen if involuntary resettlement is not managed properly.

Economic Displacement and Temporary Moves

Economic displacement and loss of natural resources are expected in the area of the future Longonjo SE, as some agricultural land has been identified in the construction area. No changes in transhumance routes and patterns are anticipated in the region where the SE is located.

Along the approximately 50-kilometre stretch of the TL between the Belém do Dango SE and the future Longonjo SE, during the construction phase, some restrictions (economic displacement) are expected on agricultural areas and forests, which provide local communities with their produce, firewood and other natural materials/products used on a daily basis. This is due to:

- Creation of accesses (in areas where there are no access roads and adjacent access roads) and temporary working areas for the towers (30 m x 30 m, totalling 12.24 ha) within 45 m of the *RoW*;
- Trees and vegetation over 8 metres high within the 45-metre *RoW* will be removed, if present;
- Access for the cultivation of the remaining crops (less than 8 m in height) will be restricted for a short period of time during demining activities (i.e. approximately 8 hours/day per demining expert for each metre of land); and
- Construction activities within the area destined for the future Longonjo SE (a total of 1.69 ha).

In the construction and operation phases, the loss of access to land associated with the 6 m LT maintenance corridor, temporary (30 m x 30 m) and permanent (7 m x7 m) tower work areas, and the area of the future Se do Longonjo, will result in the loss of land used for seasonal crops, loss of natural resources, removal of fruit trees and other materials/products present there.

The loss of seasonal agricultural production for the establishment of the temporary working areas of the towers within 45 m of the RoW will be temporary over a period of twelve months (expected), while the loss will be permanent for seasonal crops located within the footprint of the maintenance corridor (6 m wide), the location of the towers (totalling 0.67 ha) and in the area to the SE of Longonjo (1.69 ha).

In the operational phase, the cultivation of seasonal crops will otherwise be permitted within 45 metres of the RoW (but not in the maintenance corridor, on the tower sites and in the area to the SE of Longonjo), and after demining work (landmines and unexploded ordnance). It is recognised, however, that land productivity can take time to fully re-establish itself, as seasonal crops can take three to six months, depending on the crop. This means that once the land is restored after the construction phase, land users may not experience an immediate return to their initial levels of productivity and income generation. The loss of these areas is impossible to avoid, but will be reduced given the characteristics of the project, and the region offers other alternative locations for access and use by local communities (and in accordance with the compensation process that will be implemented within the framework of this project).

It should be noted that potential damage to crops can also occur during demining activities that will take place for a limited period of time before construction activities begin. In the event of damage, there are specific procedures for calculating the value of the damage and compensating the affected parties according to the crop rates established by the Ministry of Agriculture and Fisheries (see **Tables 3-1** and **3-2** in **Section 3.1.3**).

Due to the strong dependence on land-based activities and the small size of the plots (less than one hectare on average), the level of impact of temporary land loss will be determined not only by the proportion of land lost by individual households, but also by their level of dependence on land, access to alternative land and subsistence activities and by their current income levels. Households that have little access to alternative livelihood activities and/or have a very low income, including subsistence farming, will experience a greater level of impact than those with access to alternative resources, including savings, and are therefore considered particularly vulnerable to potential land-related impacts. Furthermore, the loss of land has the potential to affect not only the livelihoods of customary landowners, but also those involved in crop-sharing schemes on a particular plot belonging to another household. These households are also vulnerable to the potential impacts of temporary land loss, as they do not have clear customary rights.

During design, an optimisation and readjustment of the initially proposed route was carried out (see more details in **Section 2.2**), and the route presented sought to minimise potential environmental and social impacts (including avoiding settlements and potential physical and economic displacement). As mentioned above, the proponent and developer will be committed to minimising land clearing, using existing accesses wherever possible. Some information on land requirements is not available at this stage, such as the amount of vegetation clearance required for access roads, somewhat limiting the definition of the scale of this impact.

Environmental Impact Assessment and Mitigation Measures

Table 5-19 describes the predicted Impact Assessment for Economic Displacement - loss of livelihoods (damage to agricultural crops and loss of natural resources, etc.) during the construction phase. The potential impact is negative but limited exclusively within 45 metres of the *RoW*. During the operation phase, the communities will be able to return to the restricted cultivation areas as long as they do not cultivate near the towers or in the TL maintenance corridor. In this return, they will only be allowed to grow low-lying agricultural products such as cassava, maize, sweet potatoes, beans, garlic, lettuce, tomatoes, pineapples and other vegetables. It is likely that the soil will need to be improved during your return (ploughing, fertiliser and compost).

Table 5-19: Impact Assessment and Mitigation Measures for Economic Displacement.

Phase	Construction	
	No Mitigation	With Mitigation
Duration	Short term	Short term
Extension	Regional	Regional or local

Phase	Construction	
	No Mitigation	With Mitigation
Magnitude	Moderate	Minor
Significance	Moderate - Negative	Minor - Negative
Probability	Likely	Likely
Trust	High	High
Reversibility	Average	High
Irreplaceability of resources	Average	Low
Comment - significance	Not applicable.	
Mitigation Measures	• Draw up and implement a Resettlement Plan that guides the resettlement and compensation process to ensure that both customary landowners and land users receive adequate compensation for the loss of crops, natural resources, related loss of income and, where necessary, have access to alternative land of equal productivity. Compensation will also take into account the investment needed to prepare new agricultural plots (for alternative land) and to return restored land to initial productivity levels for seasonal and permanent crops; • Economic displacement activities must be implemented with a high level of involvement from local and traditional government authorities (Sobas), affected people/social groups and local host communities, to ensure that the process is informed by the social and economic needs, limitations and expectations of all those involved (included in the Engagement Plan, and stakeholder engagement meetings); • A male and female Community Liaison Officer should be appointed to ensure that both sexes feel comfortable reporting complaints, and that they are preferably local and familiar with the local language and customs; • The procedures outlined in the Resettlement Plan must ensure that the individuals, households and communities affected are better off than they were before the resettlement, or, at the very least, that their circumstances are the same as they were and have not deteriorated; • Guarantee free access to efficient and timely redress mechanisms and ensure that the rights of affected and surrounding communities are respected; • Compensation will have to be equitable and standardised across the three municipalities to avoid socio-cultural conflicts in the region; • The type of compensation for natural resource losses will be agreed with the Traditional Authorities, based on the needs of the local communities, which are mutually agreed, including the Complaints and Grievances Mechanism; • The amounts of compensation for each farm or agricultural land affected must be negotiated with the owner and mainly in the presence of at least one representative of the government of Huambo province, the municipal administrations of Huambo, Caála and Longonjo; • Compensation for the loss of agricultural land and fruit trees must be determined using the Ministry of Agriculture and Fisheries' price list for agricultural products per square metre, and the entire process must be carried out in accordance with the Ministry of Agriculture and Fisheries' price list for agricultural products per square metre. must be fair, transparent and honest;	

Phase	Construction	
	No Mitigation	With Mitigation
	• Creation of multidisciplinary working committees between Ozango Minerais and the construction company, the Municipal Administrations of Huambo, Caála and Longonjo, and the Provincial Directorate of Huambo, in order to ensure a fair process with regard to compensation for damage to agricultural land, and potential displacement along the project route; • Provide a Complaints Reimbursement Mechanism for the handling of complaints/requests, and for information that may give rise to the need to implement new measures; • The grievance mechanism established during the construction phase must be maintained during operations to ensure that local communities and stakeholders have an adequate channel to voice their concerns.	
Observations	See mitigation measures presented for the economy and employment (section **5.2.3.1**).	

Residual and Cumulative Impacts

There will be a cumulative impact associated with the loss of cultivation areas associated with the future Longonjo Mine project. This will be particularly relevant for the areas closest to the area of the future Longonjo SE, as the same person/family could be affected by both projects. However, this will only be confirmed when the work to identify the existing agricultural plots in the areas of influence of the projects (LT + SE and the Longonjo Mine project) is finalised.

5.2.3.3 Community Health and Safety

The presence of the project could affect the health, safety and well-being of communities along the route of the TL and in the vicinity of the area of the future Longonjo SE. Increased traffic related to the project, demining, civil works for site preparation, including clearing and excavation works, alteration of the environment due to increased noise, decreased air quality, improper handling or disposal of waste, and accidental leaks and spillages, and the presence of the project's workforce, all present potential risks to the health and safety of local communities. Similarly, communities and stakeholder concerns around the safety of the TL once it is in operation, including exposure to electric and magnetic fields (EMFs), also have the potential to affect communities.

Safety related to Road Traffic, Site Encroachment and Demining Activities Prior to the start of construction, demining will be carried out in all areas within 45 m of the RoW that have not been previously demined and do not have a certificate of clearance.

associated demining. Prior to the demining activity, affected landowners and households located in the areas marked for demining will be notified, and a security perimeter will be established. Although demining activities will be conducted in accordance with international standards, exposure to potential mine explosions remains a risk to community safety, which can result in serious injury and death. These procedures will be detailed in the Demining Plan.

An approved demining organisation will be selected to conduct the demining activities, and will have to operate in accordance with international best practice with regard to community and occupational health and safety, such as the International Mine Action Standards and the Angolan National Technical Standards and Guidelines. In the operational phase, no risk of accidents associated with mines or unexploded ordnance is expected. Demining in the *RoW* will result in increased safety for communities travelling through the area.

During construction there will be an increase in traffic movements of heavy machinery and light vehicles on the road along the LT route and on the access roads leading to the 136 temporary work areas (tower sites) over a 12-month period. This will include, among others, water lorries, cement lorries, construction material transport, excavation machinery, etc., which is expected to increase the risk of road accidents and potential injuries or fatalities for other road users or pedestrians. The increase in vehicle traffic during the construction phase could result in greater disruption and a decrease in the well-being of the communities closest to the tower work areas (such as Calenga, Lépi, Caála and Longonjo) and along the transport routes and access roads. In addition, the builder will be obliged to operate in accordance with international best practice with regard to community and occupational health and safety.

During the operation phase, the risks of incidents and/or road accidents are negligible, since the vehicles destined for maintenance will all be light and perfectly adapted to the traffic organisation of national road no. 260. The creation and improvement of access roads to the project area (if necessary) will also increase local accessibility, benefiting mobility and communication between remote villages and municipal centres.

It is assumed that the 136 temporary working areas of the towers (30 m x 30 m each on average) will not be fenced off during construction activities. The risk of trespass is greater when the tower sites are closer to settlements and agricultural areas without electricity coverage, which increases the risk of trespass.

the risk of accidental trespass at night. Trespassing on the temporary working areas of the towers could result in accidents leading to injury or even death, especially due to the presence of large machines, tower construction parts such as metal structures, and open excavations, which can sometimes be partially filled with water, especially during the rainy season (e.g. open excavations for the erection of towers). Young people, the elderly and children are most at risk of being injured.

Increased risk of illness

The construction phase will require an influx of labourers. Although every effort should be made to attract local workers, given the condition of widespread poverty and the extremely low level of education, it is reasonable to assume - as in most other projects - that most of the labour for the construction phase will be made up of predominantly male workers. In these situations, the search for places of entertainment and prostitution is frequent.

The increase in prostitution services can result in a localised increase in Human Immunodeficiency Virus (HIV) and other Sexually Transmitted Diseases (STDs). It is not easy for vulnerable partners and sex workers to insist on forms of protection as a result of significant power disparities (including gender disparities). These conditions can also increase the risk of an increase in violence and abuse, both sexual and otherwise. Sexual abuse of women, girls and minors may also increase. Such circumstances are further compounded by power disparities, where the vulnerable (in such cases women and children) are unaware of their rights and may find it difficult, if not impossible, to access justice and redress.

Some activities will result in changes to the physical environment, with the potential to affect the health and well-being of communities. Dust and air pollutant emissions can lead to respiratory diseases. Noise emissions can lead to conditions such as *stress*, headaches and migraines. The discharge of pollutants into soil and water could lead to diseases caused by contamination such as cholera, diarrhoea, tuberculosis and hepatitis. These emissions will be of limited duration and will be contained in restricted areas of the project's implementation, and could affect social groups living in the immediate vicinity of the affected areas (in this respect, children tend to be the most vulnerable group). However, significant and continuous levels of emissions that could induce changes in health are not expected.

In the operation phase, although the non-ionising radiation and corona discharges that will be emitted by the lines and other equipment are not known, it could cause (if it is above the limits set by ICNIRP) a long-term health problem in the surrounding residents. However, the likelihood of this event is extremely low because the towers will be more than 25 metres above the ground and far from residential areas. The route of the TL is isolated and safety distances will be respected, and the expected levels of non-ionising radiation will be below the limits defined by ICNIRP. No impacts likely to affect the health and well-being of communities are expected.

Community Risk and Social Cohesion

All the potential impacts mentioned above (socio-economic environment), such as those arising from involuntary resettlement, employment of local labour, land conflicts, and short-term economic changes, will have both immediate and residual impacts on communities. Impacts such as those deriving from land use rights and compensation disputes, tension over employment (perceived favouritism), migrant workers, weakened social networks and unmet and unrealistic expectations.

As a result, communities and cohesion can be strained. When this reaches a critical threshold, the community structures on which individuals and families rely begin to unravel and change. The most vulnerable are often the first to be negatively affected and are usually hit the hardest. The important point about this impact is that it is based on the principle of multiple and cumulative impacts and its severity will largely depend on the ability to mitigate and reduce the other impacts mentioned above. Social conflicts are expected to end once the transmission line and substation work are fully completed.

Increasing Workers' Health and Safety and Labour Rights

Typical activities for the construction of substations and TLs include clearing the RoW in vegetated areas, excavation work, erecting the towers, working at height and stringing the TL. Workers carrying out demining activities are also exposed to landmine risks during the preliminary ground preparation phase. Considering that construction is identified as one of the employment sectors (formal and informal) in Angola, the locally hired labour force may have some experience in activities such as landmine clearance.

traditional and basic construction, such as excavation work. However, working practices and consideration for health and safety can fall short of international standards and best practices, such as the use of Personal Protective Equipment (PPE), which will increase the severity of the hazards to which the workforce is exposed.

Similarly, the storage and disposal of waste and hazardous materials generated by the use of materials during the construction phase can also pose a health hazard to the workforce if not handled properly. Equipment and workers transported along access roads to jobsites can also result in road accidents in the absence of a proper traffic management plan or if road safety rules are not applied. The often poor condition of existing roads can also increase the risk.

During construction, local employment will be subject to Angolan labour legislation and the applicable international standards to which Angola is a party, particularly with regard to safeguarding workers' health and safety. These include the use of appropriate equipment and facilities to enable workers to carry out their duties professionally and safely, guaranteeing rights and freedom of association, as well as providing a safe and healthy working environment for workers. The employer/contractor is therefore expected to develop and implement adequate health and safety measures for its workforce, including enforcing the use of appropriate PPE at all times.

Environmental Impact Assessment and Mitigation Measures

Table 5-20 describes the predicted impact assessment for demining activities (accident risk) during the construction phase. The expected impact is negative but limited exclusively to within 45 metres of the *RoW*, and areas in the immediate vicinity chosen for the detonation of possible explosive devices. Once the process of identifying possible unexploded ordnance along the route and in the substation area has been completed, positive impacts are expected during the operation phase as a result of increased safety for communities travelling through and around the project area.

Table 5-20: Impact Assessment and Mitigation Measures for Demining Activities.

Phase	Construction	
	No Mitigation	**With Mitigation**
Duration	Short	Short

Extension	Regional	Regional
Magnitude	High	Low
Significance	Moderate - Negative	Insignificant
Probability	Likely	Likely
Trust	Low	Low
Reversibility	Low	Low
Irreplaceability of resources	Low	Low
Comment - significance	Demining work is essential for the implementation of the project.	
Mitigation Measures	• Develop and implement a Workers' Health and Safety Management System that will cover all contractors and subcontractors, including the demining organisation to be selected for the demining process; • Implement Emergency Response Plan during demining activities in co-operation with local emergency authorities and hospitals; • Establish appropriate safety distances and perimeters for communities; liaise with local communities and authorities, including the following: hold preliminary meetings with local authorities before any work is carried out in the area; advise on safety measures to be taken by the local population while operations are underway; and hold a wrap-up meeting after the work is completed to inform the authorities locations where operations have been completed and in which areas.	
Observation	The mitigation measures proposed in Economic Displacement (**Table 5-19**) are applicable.	
Phase	**Operation**	
No maximisation		
Duration	Permanent	
Extension	Regional	
Magnitude	High	
Significance	Bigger - Positive	
Probability	Certain and Definitive	
Confidence	Low	
Reversibility	Low	
Irreplaceability of resources	Low	
Comment - significance	Not applicable	
Maximisation measures	Not applicable	
Observation	Maximising the impacts will be the responsibility of the entity that will carry out the demining.	

Table 5-21 describes the predicted Impact Assessment for road traffic (risk of road accidents) and site encroachment during the construction phase. The predicted impact is negative but limited in human terms within 45 metres of the *RoW, since* on main roads compliance with the Highway Code is mandatory and enforced by traffic regulators. During the operation phase, the risks of incidents and/or road accidents are negligible, since vehicles are not authorised to drive on the site.

intended for maintenance will all be light and perfectly adapted to the organisation of road traffic.

There may also be a positive impact in the operation phase due to the use of the line's maintenance roads by nearby communities (i.e. movement of people, flow of agricultural products, etc.).

Table 5-21: Impact Assessment and Mitigation Measures for Road Traffic and Site Encroachment.

Phase	Construction	
	No Mitigation	With Mitigation
Duration	Short	Short
Extension	Regional	Location
Magnitude	Low	Low
Significance	Minor - Negative	Insignificant - Negative
Probability	Unlikely	Unlikely
Trust	Low	Low
Reversibility	Low	Low
Irreplaceability of resources	Low	Low
Comment - significance	Not applicable	
Mitigation Measures	• Implement a Community Health and Safety Plan, adopting speed limits of 40 kilometres per hour and appropriate signage to guarantee safety and traffic conditions; maintain access control to the construction site to prevent access by people unrelated to the project; • Implement the Engagement Plan, including prior and extended communication of planned activities (and timetable) and the accesses to be used during the construction phase of the project, to enable local communities to increase awareness and manage risk; • Promote awareness-raising activities among local communities (particularly children) regarding the risks of construction and traffic movements; • Promote awareness-raising activities among workers about the culture, beliefs, habits and lifestyles of local communities, and define appropriate rules of conduct. The code of conduct should establish the disciplinary and legal implications of certain activities involving local communities; • Implement the Demining Management Plan prior to construction activities, in consultation with the competent authorities and including the local Sobas; • Implement a Complaints Mechanism for handling complaints/requests, and for receiving information to assess the degree of interference perceived by local communities and to consider the need to implement new measures; • Ensure that the site is fenced off and that signs are placed around work fronts advising people of the risks associated with trespassing. If work fronts are less than 100 metres away from a community or house, employ local community security guards to prevent the invasion.	

Phase	Construction	
	No Mitigation	With Mitigation
Observation	The mitigation measures proposed in the descriptors geology and geomorphology (**section 5.2.1.2**), soils (**section 5.2.1.3)**, landscape (section **6.2.1.5),** air quality (section 5.2.1.**6),** habitats and vegetation (section 5.2.2.**1),** and Fauna (**section 5.2.2.2**) are applicable.	
Phase	**Operation**	
	No maximisation	
Duration	Permanent	
Extension	Regional	
Magnitude	High	
Significance	Bigger - Positive	
Probability	Certain and Definitive	
Confidence	Low	
Reversibility	Low	
Irreplaceability of resources	Low	
Comment - significance	Not applicable	
Maximisation measures	Not applicable	
Observation	Maximising impacts will be the responsibility of the operator.	

Table 5-22 describes the assessment of the expected impact on community health (increased risk of contracting diseases) during the construction phase. No significant impact is expected during the operation phase. The other risks associated with the presence of the high-voltage line and substation near the communities have been classified as unplanned events.

Table 5-22: Impact Assessment and Mitigation Measures for Community Health (Increased Risk of Contracting Diseases).

Phase	Construction	
	No Mitigation	With Mitigation
Duration	Short term	Short term
Extension	Regional	Location
Magnitude	Moderate	Low
Significance	Minor - Negative	Insignificant - Negative
Probability	Likely	Unlikely
Trust	High	High
Reversibility	Average	Average
Irreplaceability of resources	Low	Low
Comment - significance	Not applicable.	
Mitigation Measures	• Implement a Health and Safety Management Plan. Given the limited supply of healthcare in the study area, this plan should include epidemiological control measures to be implemented by the builder on site to help workers and thus avoid pressure on existing healthcare facilities. This plan should also include regular screening for communicable diseases and STDs for all workers. workers assigned to the site, as well as to provide	

Phase	Construction	
	No Mitigation	With Mitigation
	protection for workers most exposed to air pollution and noise at work; • Promote awareness-raising activities among workers about water and hygiene-related diseases and Sexually Transmitted Diseases (STDs), especially HIV/AIDS and the associated code of conduct; • Promote awareness-raising activities among local communities (especially women and girls) about the impacts associated with the presence of non-local workers (health impacts, gender-based violence, sexual harassment, as well as existing legislation regarding sexual harassment and rape, and human trafficking). Women from the affected communities should be hired and trained to implement awareness-raising activities. Materials can also be designed that can be reproduced in other future projects; • Implement the Waste and Wastewater Management Plan to ensure that potential chemical and biological contamination from construction activities is properly addressed and controlled; • Ensure that the entire workforce is dually informed and educated about the above-mentioned impacts and informed about legislation, responsibility, and accountability. The repercussions and legal ramifications of any violation must be made explicit; • Ensure that adequate procedures and policies are in place to address any violation of the law and/or the rights of individuals and/or communities; • To avoid electromagnetic fields and corona discharge, installation of the transmission line above or adjacent to residential properties or other places intended for highly frequent human occupation (i.e. schools, healthcare facilities, day care centres or offices) will be absolutely avoided; • If it is confirmed that the electromagnetic fields and corona discharge levels are above the recommended exposure limits, the application of engineering techniques will be considered to reduce the discharge levels. Examples of such techniques include shielding with specific metal alloys, increasing the height of the towers, modifying the spacing of the dimensions and configuration of the conductors; • Carry out initial measurements of electromagnetic exposure levels to ensure that public exposure levels are within accepted limits, as prescribed by ICNIRP; • Educational campaigns will be carried out in the affected communities to explain what electromagnetic fields and corona discharges are and that people should not build houses within the RoW; • Permanent warning signs (danger signs) and anti-climb devices on all sides of the lattice towers.	
Observations	See mitigation measures presented in Tables **5-20** and **5-21**, and soils (**section 5.2.1.3**), landscape (**section 6.2.1.5),** air quality (**section 5.2.1.6**), habitats and vegetation (**section 5.2.2.1**) are applicable.	

Table 5-23 describes the expected Community Health Impact Assessment (Community Risk and Social Cohesion) during the construction phase. No significant impact is expected during the operation phase.

Table 5-23: Impact Assessment and Mitigation Measures for Community Health (Community Risk and Social Cohesion).

Phase	Construction	
	No Mitigation	**With Mitigation**
Nature	Negative	Negative
Duration	Short term	Short term
Extension	Regional	Location
Magnitude	Moderate	Low
Significance	Minor - Negative	Insignificant - Negative
Probability	Likely	Unlikely
Trust	High	High
Reversibility	Average	Average
Irreplaceability of resources	Low	Low
Comment - significance	Not applicable.	
Mitigation Measures	• The community complaint mechanism established during the construction phase should be maintained during the operation phase so that interested parties can report specific concerns.	
Observations	Mitigation measures proposed in **Sections 5.2.3.1** and **5.2.3.2** are applicable.	

Table 5-24 describes the predicted Community Health Impact Assessment (risk to workers' health and safety). During the construction phase, occupational accidents may occur during several of the planned construction activities, such as demining, site preparation, excavations, vegetation clearance, waste and hazardous materials management, transport and circulation, or restoration of the work site.

As with the construction phase, the operation phase can also lead to occupational health and safety issues, particularly with regard to the maintenance of the TL and SE (risk of electrocution and exposure to electric and magnetic fields) and the use of herbicides to maintain access to the line. However, it should be noted that during the maintenance of the line and substation there will be a temporary interruption of electricity, and all the work will be carried out by trained specialists with many years of experience in the sector.

Table 5-24: Community Health Impact Assessment and Mitigation Measures (risk to workers' health and safety).

Phase	Construction	
	No Mitigation	**With Mitigation**
Nature	Negative	Negative
Duration	Short term	Short term
Extension	Regional	Location
Magnitude	Moderate	Low
Significance	Minor - Negative	Insignificant - Negative

Phase	Construction	
	No Mitigation	With Mitigation
Probability	Likely	Unlikely
Trust	High	High
Reversibility	Average	Average
Irreplaceability of resources	Low	Low
Comment - significance	Not applicable.	
Mitigation Measures	• A Health and Safety Management Plan should be implemented to protect all workers involved in construction activities, even temporary workers. This plan will comply with national legislation and international guidelines and will address all aspects of labour standards relevant to the project; • Accident reporting through an accident reporting mechanism; • Contractual clauses should be established to be incorporated into the contracts of the construction company and all subcontractors that require compliance with Angolan law and the international standards to be maintained relating to workers' rights and that grant the right to audit; • Prohibit the use of alcohol and drugs, which could adversely affect the worker's ability to perform the job safely or adversely affect the health and safety of other workers, members of the community and/or the environment; • Ensure that training on health and safety measures is given to all construction workers before they start working on the project and that supervisors have adequate experience to fulfil their responsibilities, and use personal protective equipment at all times (e.g. safety helmets, fall protection equipment); • Implement regular health and safety checks and audits of workers, contractors and subcontractors and apply sanctions in the event of violations of national and project-specific standards. Such audits should include health and safety in the workplace; labour contracts, working hours, pay and conditions; accommodation and food standards; • Develop and implement a worker grievance mechanism for project workers, including contractors and subcontractors; • Establish a procedure for recording and analysing incidents and lessons learned, so that additional actions can be implemented to avoid or minimise occupational health and safety risks; • Ensure that adequate drinking water, adequate food and access to medical care is provided to all workers in the workplace and on site; • Take measures to ensure that no worker or jobseeker is discriminated against on the grounds of their sex, marital status, nationality, age, religion or sexual orientation; • Ensure that its Code of Conduct is followed to regulate the performance and behaviour of all employees, including provisions for disciplinary action for anti-social and non-social behaviour. compliance with health and safety regulations, such as failure to wear PPE.	

Phase	Construction	
	No Mitigation	With Mitigation
Observations	Mitigation measures proposed in **Sections 5.2.3.1** and **5.2.3.2** are applicable.	

Residual and Cumulative Impacts

The implementation of mitigation measures will help to significantly reduce the risks of demining activities, the risks to road traffic, the risks to communities and social cohesion, the risks to occupational health and safety and the risk of labour rights abuses. However, the risk of potential accidents still exists and could potentially lead to worker injuries or fatalities during the construction and operation phases.

Cumulative impacts in relation to the risk to the health and safety of the community could be related to the simultaneous implementation (if it coincides) of the future Longonjo Mine project.

5.2.4 Historical and Cultural Heritage

During the surveys carried out along the proposed route, both *in situ* and using LiDAR, no historical and cultural sites were identified. As mentioned above (**Section 2.2**), an exercise was carried out to analyse the initially proposed route of the TL so that all potential impacts associated with the project were minimised. This exercise also took this type of site into account. On the other hand, several areas used as informal cemeteries were identified on the site proposed for the future Longonjo SE. In order to define the location of the future Longonjo SE, the same exercise was carried out, together with the engagement and various meetings held with the Longonjo Municipal Administration, Local Traditional Authorities and other members of the community (see details in **Section 4.4**). These engagement activities not only made it possible to define the location of the future Longonjo SE, but also to keep the municipal administration and community informed, to delimit the spaces reserved for funeral ceremonies and to prevent areas used informally from expanding as the project progressed.

As a result of this reality, it is therefore imperative to scrupulously observe all precautions to prevent the project from having a direct impact on these areas and the ceremonies held. All construction and operation activities associated with the project will comply with legislation

Angolan law in force in the event of a potential route for modifying the transmission line after geological and topographical studies, under penalty of a crime against the national historical, cultural and artistic heritage.

During the fieldwork (rainy and dry seasons) no fossils, archaeological or palaeontological sites were mapped along the route of the TL or in the area of the future Longonjo SE and its surroundings.

Environmental Impact Assessment and Mitigation Measures

Table 5-25 describes the predicted Impact Assessment for damage to graves and burial sites in the project's areas of influence (RoW of the TL and location of the SE), and its mitigation measures. This impact is very unlikely to occur in this project and, if it does, it will be exclusively during the construction phase.

Table 5-25: Impact Assessment and Mitigation Measures for damage to graves and burial sites.

Phase	Construction	
	No Mitigation	With Mitigation
Nature	Negative	Negative
Duration	Short term	Short term
Extension	Regional	Location
Magnitude	Moderate	Low
Significance	Minor - Negative	Insignificant - Negative
Probability	Unlikely	Unlikely
Confidence	High	High
Reversibility	Average	High
Irreplaceability of resources	Low	Low
Comment - significance	Avoidance is the preferred mitigation, so as not to displace graves, due to their cultural repercussions and enormous sentimental value for the many families who have their loved ones buried there.	
Mitigation Measures	• If necessary, draw up and implement the Heritage Management Plan and the Graves Management Plan; • If other areas are identified during the demining process, the respective mechanisms must be activated; • Work with local community representatives to develop cultural awareness materials that will cover key issues, including the location and importance of all local cultural sites and other cultural sensitivities (graves); • Do not remove any cultural heritage, including graves, without prior consultation with the communities and in compliance with legal requirements. Any removal of cultural heritage must be carried out using the best available techniques;	

Phase	Construction	
	No Mitigation	With Mitigation
	• Develop a fortuitous search procedure, which will specify the appropriate course of action that should be followed for any discoveries cultural heritage.	
Observations	Mitigation measures proposed in **Table 5-23** are applicable.	

Residual and Cumulative Impacts

There may be a cumulative impact associated with the implementation of the future Mina do Longonjo project, where other similar areas may be found, however the likelihood of this is quite low. With the proposed mitigation measures, particularly the development of a fortuitous search procedure, the residual negative impacts on cultural resources are assessed as being of low magnitude.

5.2.4.1 Allocation of Public Infrastructure

During the construction phase of the project there will be no recourse to public infrastructures, namely: drinking water supplies, electricity, public waste disposal containers, etc. These services will be provided by companies based in Huambo province, and the construction site will be equipped with generators as a source of energy production and distribution. During the operation phase of both the TL and the ES, the pressure on these infrastructures will be negligible.

A Waste Management Plan (WMP) has also been drawn up and will be implemented to ensure the correct management of all hazardous and non-hazardous waste expected during the different phases of the project.

Environmental Impact Assessment and Mitigation Measures

Not applicable.

5.2.5 Unplanned Events

The following section presents the assessment of potential impacts resulting from unplanned or non-routine events and those resulting from accidents. These are different from the potential impacts that would be reasonably foreseeable in the normal course of activities (including the application of measures).

control) during the construction and operation phases. For the decommissioning phase, the anticipated potential impacts are considered insignificant, so they are not included in this assessment.

Unplanned and accidental events have the potential to occur during project activities and therefore the assessment of the impacts of unplanned and accidental events considers the probability of the event occurring in the magnitude of the impact. The probability is determined as **unlikely**, **possible** or **probable** based on professional judgement and quantitative information (statistical frequency), where available.

Given the nature of the project's activities, unplanned and accidental events are related to potential accidental spillages of fuel and oils from equipment and vehicle traffic accidents. If unplanned and accidental events occur, there will be effects on the biophysical and social environment. The risks of unplanned and accidental events are described in this section.

5.2.5.1 Potential Impacts on Soil and Watercourses

During construction there is the potential for fuel and oil spillages during construction activities, fuelling, maintenance of machinery and vehicles. Spillages could occur at various locations along the route of the TL, at the Belém do Dango SE and at the site of the future Longonjo SE. Spillages have the potential to affect terrestrial environments and could lead to deterioration in soil, water and sediment quality. This could lead to adverse effects on flora and fauna and local community users.

Accidental fuel spillages are infrequent, but they do occur; most frequently due to malfunctioning handling systems, poor practice by workers and force majeure. Spills are more likely to occur during refuelling and transport of substances. Large spillages of hazardous materials are rare and it is considered unlikely that a spillage would occur on an emergency scale. However, soils and watercourses could be affected if the spill occurred in the vicinity of these resources.

These potential impacts are unlikely to occur and their magnitude, should they occur, is considered low, given the characteristics of the activities to be carried out and the project's area of influence.

Significance of Impacts

For impacts on soils, the spatial scale is considered to be local. The impact may be long-term and is a direct negative impact. The overall magnitude is considered to be low. Along the *RoW* there are several areas that are used for cultivation and therefore the sensitivity is considered medium. This results in a potential negative impact of minor importance.

For the watercourse, the impact of a spill would be short to medium term, since the release of fuel or oil would probably be a discrete event (e.g. not continuous) and the effects on water quality naturally mitigated through dilution and natural attenuation. Despite the existence of few small watercourses along the RoW of the TL and none in the area and immediate vicinity of the future Longonjo SE, sensitivity is considered medium, since the communities along the route make use of the existing watercourses for various domestic, agricultural and livestock needs. The magnitude of the potential impact is considered low and the potential impact is therefore of low significance.

Mitigation measures

The following management measures will be implemented as part of the project's Environmental and Social Management Plan (ESMP):

- The project will maintain adequate clean-up and spill response capacity to deal with spillages during all phases of the project. All spillages will be immediately contained and cleaned up. Contaminated areas will be remediated and a post-remediation check (involving water and/or soil sampling) will be carried out.
- Hazardous material storage will be on a hard, impermeable surface and the bulk storage facility will be bunded. The project will restrict the storage and handling of hazardous materials and fuels to bunded areas with sufficient capacity to contain a release. There will be strict compliance with the guidelines presented in the RMP.
- Oil spill clean-up *kits* should be available wherever vehicles and equipment are refuelled or serviced, and the people responsible should be trained in their use.

Residual impacts

Potential impacts on soils are considered minor after mitigation, largely because parts of the TL route occur in cultivated areas and spills of hazardous substances here are likely to have a greater impact than spills in unused areas. Based on the context of water resources, the impacts will be minor after mitigation.

5.2.5.2 Potential Impacts on Community Health and Safety

During the construction and operation phases of the TL and ES, unplanned events could occur with the potential to negatively affect the human population. Rope activity around wires and other electrical units can be a potential hazard if proper planning is not followed. The assumption that local workers are sometimes not accustomed to using PPE must be taken into account (i.e. their attitude towards not using PPE could result in an accident/hazard).

During the operation phase, there is a possibility that lines or towers/tower parts could fail and cause injuries and/or fatalities. Furthermore, during the operation phase, contact with energised lines could result in electrocution. However, the potential impacts are all considered unlikely, as they are not likely to occur during the life of the project.

These potential impacts are unlikely to occur and their magnitude, should they occur, is considered to be low, as all safety standards applicable to the project will be used and response mechanisms to such events will be duly activated.

Significance of Impacts

Considered a negative event that could lead to permanent impacts if there were injuries and deaths. The overall impact is considered to be of moderate importance. The risk is influenced by poor quality foundations, theft of tower elements/structures, corrosion of material due to poor coating and poor quality or damaged fittings exposing the system to failure. The sensitivity of the receptor is considered moderate. Considered a significant impact, but unlikely to occur during the lifetime of the project.

Mitigation measures

The following mitigation measures will be used to reduce any potential unplanned event:

- Activities using ropes near power lines and other electrical utilities will be carried out after the line/installation has been properly shut down with prior information and authorisation.
- An emergency response mechanism should be developed in accordance with Angola's requirements and international industry standards and best practices.
- This mechanism should be developed in consultation with the competent authorities, the emergency/civil defence service and the municipal administrations covered by the project. Staff should receive training on how to respond to unplanned events.
- Risks to the general public during operation will be reduced through public awareness and education and physical measures by placing appropriate warning signs on all sides of the tower.
- The project's operational start date and safety implications will be published locally in advance.
- In addition, the risk of the transmission line falling or the towers collapsing can be mitigated by complying with design specifications, installing anti-theft devices, carrying out material quality and compliance inspections, and observing installation procedures.

Residual impacts

A residual risk of non-routine events is inherent to the nature of the type of project and is likely to remain so. Provided that the above mitigation measures are implemented, the residual risk related to unplanned events is considered minor (ropes, unplanned spillages and fires) and low for the risk due to transmission line breakage/collapse.

5.2.6 Impact Assessment Summary

This section summarises all the potential impacts assessed for the project, including the before and after mitigation assessments. Following a scoping process, this assessment

The impact assessment was centred on the interactions between the project's activities and various resources/receptors that could result in significant impacts. It also presents the main mitigation measures proposed to facilitate an overall perception of the project's potential impacts. **Table 5-26** summarises the results of the overall assessment of the potential impacts identified for the different phases of the project.

Table 5-26: Summary of the main anticipated environmental and socio-economic impacts.

Environmental and Social Variables	Project Activities/Impacts	Phase	Significance - No Mitigation	Significance - With Mitigation
Geology and Geomorphology	Minor superficial changes to the geomorphology within the construction areas (line tower supports and the site of the future SE). Longonjo Mine).	Construction	Minor - Negative	Insignificant - Negative
Soils	Loss of soil resources due to erosion and vegetation clearance along the TL route and construction area future SE of Longonjo.	Construction	Minor - Negative	Insignificant - Negative
	Soil contamination from accidental spillages of hydrocarbons from maintenance vehicles, back-up generators and machinery.	Construction	Minor - Negative	Insignificant - Negative
Water Resources	Availability and Quality of Water Resources (as a result of clearing vegetation and excavating foundations) near surface water bodies).	Construction	Minor - Negative	Insignificant - Negative
Landscape	Visual impact (removal of vegetation, presence and circulation of vehicles, machinery, presence of construction materials and equipment, etc.).	Construction	Moderate - Negative	Minor - Negative
	Visual impact (presence of the TL and SE).	Operation		
Air Quality	Exhaust emissions from road traffic, in particular: emissions of nitrogen oxides (NO_2), carbon monoxide (CO), carbon dioxide (CO_2) and sulphur dioxide (SO_2), and dust and suspended particles (such as $PM_{2.5}$ and PM_{10}).	Construction	Minor - Negative	Insignificant - Negative
	Dust and PM_{10} from construction activities (vegetation removal, earthmoving, excavation, soil modelling, etc.) borrow pits).			
Noise, Vibration and Radiation	Noise from construction activities that affect nearby communities (e.g. demining, earthworks, etc.). clearing vegetation, etc.).	Construction	Minor - Negative	Insignificant - Negative
	Noise emissions from corona discharge and traffic during maintenance in the maintenance corridor.	Operation		

Environmental and Social Variables	Project Activities/Impacts	Phase	Significance	
			No Mitigation	With Mitigation
	Electromagnetic radiation (resulting from the operation of the transformers of the future Longonjo SE).	Operation		
Habitats, Vegetation and Flora	Vegetation disturbance, habitat loss and fragmentation as a result of vegetation clearance along the route or degradation to the environment and habitat.	Construction	Moderate - Negative	Minor - Negative
	Disturbance of vegetation and potential growth of species invasives as a result of maintenance work.	Construction and Operation		
Fauna	Disturbance to avifauna, amphibians and reptiles (e.g. associated with construction activities, resulting in displacement of breeding and foraging areas, and degradation). habitat).	Construction	Moderate - Negative	Minor - Negative
	Increased bird mortality due to bird collisions during LT operation.	Operation		
Economy and Employment	Opportunities for local employment, capacity building and economic development (60 per cent of the opportunities will be provided) local young people).	Construction	Moderate - Positive	
	Economic development and diversification (purchase of goods and services during the construction phase, in particular for water supply, waste management facilities, food products or catering services, telecommunications services and security for labour camps, etc.).			
	Long-term local employment opportunities as an employee of the LT and SE operating company.	Operation	Moderate - Positive	
	Electricity supply to the future Longonjo Mine and associated socio-economic development.	Operation		
Land and ways of life	Economic displacement - temporary loss of livelihood and household income as a result of occupation temporary land along the route of the TL and the site for the SE.	Construction	Moderate - Negative	Minor - Negative
	Temporary loss of access to forest products during the demining activities.	Construction		

Environmental and Social Variables	Project Activities/Impacts	Phase	Significance - No Mitigation	Significance - With Mitigation
	Permanent loss of livelihood and income family due to permanent land occupation and restrictions.	Construction and Operation		
	Changes in land and property values.	Operation		
Community Health and Safety	Community Safety (Demining Activities)	Construction	Moderate - Negative	Insignificant - Negative
	Demining Activities (The clearance of landmines along the route and the SE site will result in increased safety for communities travelling through the area).	Operation	Bigger - Positive	
	Community Safety (Road Accidents and Trespassing)	Construction	Minor - Negative	Insignificant - Negative
	Increased risk of contracting diseases, Community Risk and Social Cohesion and Workers' Health and Safety	Construction	Minor - Negative	Insignificant - Negative
Historical and Cultural Heritage	Damage to graves and burial sites.	Construction	Minor - Negative	Insignificant - Negative
Unplanned Events - Strokes	Reduced quality of local soil and watercourses (potential for fuel and oil spills during mining activities) construction, fuelling, maintenance o f machinery and vehicles).	Construction	Minor - Negative	Insignificant - Negative
Unplanned Events - Community Health and Safety	Risks associated with construction activities and the presence of machinery and equipment.	Construction	Minor - Negative	Insignificant - Negative
	Failure of installed equipment and/or violation of safety rules/signalling resulting in injuries or fatalities.	Operation		

CHAPTER 6

ENVIRONMENTAL MANAGEMENT PLAN AND SOCIAL

6 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

An Environmental and Social Management Plan (ESMP) is an instrument to provide a project with an efficient structure to ensure the implementation and control of the actions planned in the various programmes, the appropriate environmental conditions of the infrastructures built, as well as to control information and maintain a high standard of quality during the construction activities of the 220 kV Transmission Line project between Belém do Dango and the future Longonjo Substation. This ESMP contains a set of programmes that include various measures and actions to be applied during the implementation of project activities (pre-construction, construction and operation). These programmes will stimulate improvements in the quality of life in the social, environmental, cultural and economic dimensions.

In addition to the ESMP proposed in **Table 6-1**, this includes other programmes and plans which, due to the type of project and the potential negative environmental and socio-economic impacts described in **Chapter 5,** are suggested to the project proponent and construction company. The programmes and plans proposed in this ESMP are as follows:

- Stakeholder Engagement Plan;
- Waste Management Plan;
- Resettlement Action Plan;
- Health, Safety and Environment Plan (to be developed by the construction company);
- Construction Management Plan (to be developed by the construction company);
- Emergency Preparedness and Response Plan (to be developed by the construction company);
- Demining Plan (to be developed by the demining company).

In order to comply with the environmental legislation in force, namely Presidential Decree 117/20 of 22 April and Presidential Decree 92/12 of 1 March, the Environmental and Social Management Plan aims to provide the essential elements to mitigate the potential negative impacts arising from the construction and operation phases of the project and is based on the information contained in the chapters on the project description, the institutional and legal framework, the environmental and social characterisation, as well as the potential negative impacts identified.

According to the Environmental Impact Assessment carried out in this report, these correspond to the descriptors that could be subject to the most significant disturbances and that are compatible with the justification for implementing the Environmental and Social Management Plan: Soil, Air Quality, Water Resources, Noise, Vibration and Radiation, Landscape, Flora and Fauna (birds), involuntary resettlement, temporary and/or permanent loss of livelihoods and family income, and health and safety of communities and workers.

The ESMP presented in **Table 6-1** aims to help implement mitigation measures at the different stages of the project. It determines the type of intervention, the responsibility of each party involved, as well as the deadline for implementing each activity. The recommendations of the mitigation measures and those contained in this Environmental Monitoring Programme (EMP) will be extremely important for future environmental audits of the project, as well as for ensuring that the potential impacts anticipated are insignificant. The measures described in **Table 6-1** below only include those applicable to the descriptors whose potential impacts have been classified as low to moderate, and those whose potential impacts are negligible or insignificant following the implementation of a given mitigation measure are not represented.

The respective PMA must be ensured and monitored by a technical team from Ozango Minerais and the construction company (particularly the Health, Safety and Environment Department - HSE), to carry out the following tasks:

- Evaluate performance and progress in implementing mitigation measures and the respective impact monitoring and follow-up plan;
- Ensuring the adaptability and feasibility of mitigation measures over time and space, obtaining financial and human resources from company management when necessary;
- Disclose information about the project and its potential environmental and social impacts, registering and responding to any complaints or claims made by the surrounding population and the state administrative authorities; and
- Draw up environmental and social progress reports and submit them to the National Environmental Management Institute (INGA) (according to the frequency defined in the environmental licence).

Table 6-1: Environmental and Social Management Plan.

ITEM	MANAGEMENT OBJECTIVE	PHASE (C&O)	SPECIFIC ACTIONS	MONITORING	TIMING AND FREQUENCY	RESPONSIBILITY
			SOIL AND GROUNDWATER			
1	Safeguarding soil resources in the project area, preventing erosion.	C	• Clearing vegetation and disturbing the topsoil will be minimised; • Topsoil will be stored separately from subsoil. The stockpiles must not exceed 2 metres in height, must be located away from drainage lines, must be protected from rain and wind erosion, and must not be contaminated. Whenever possible, construction work should take place during the dry season. • Topsoil should be evenly distributed over the cleared areas when reinstated. • Soil erosion will be prevented wherever possible through the use of sandbags, diversion berms, culverts, etc. • Accelerated erosion from storm events during construction should be minimised by managing stormwater runoff (e.g. speed control measures). • Soil fill in excavations will be replaced in the order of removal in order to preserve the soil profile. • Surrounding temporary and permanent access roads in order to minimise run-off. surface water and erosion.	Estimates of the volume of soil or area of arable land lost, supplemented by visual monitoring.	Continuous during all stages of construction.	Construction company HSE management.
2	Response to emergency events through the development of an Emergency Preparedness and Response Plan (EPRP).	C&O	• Develop a site-specific ERPP for soil cleaning and decontamination. • Use of spill trays or drippers to contain spillages and leaks from mobile equipment. • Use of spill control *kits* to contain and clean up small spills and leaks. • Secondary containment with drainage connection	Production of a PPRE and review of implementation, follow-up reports.	Continuous during all stages of construction.	Construction company HSE management (construction phase). RNT for the TL and the operator for the

			suitable for removing spilt liquids, to be provided for all fuel, chemical and waste storage facilities. • Carrying out regular maintenance on all off-site vehicles and all off-site refuelling vehicles and equipment whenever possible. • Implement a training programme to familiarise staff with construction emergency procedures and practices.			SE (operation phase).

ITEM	MANAGEMENT OBJECTIVE	PHASE (C&O)	SPECIFIC ACTIONS	MONITORING	TIMING AND FREQUENCY	RESPONSIBILITY
WATER QUALITY						
3	Prevention of adverse impacts on water quality (organoleptic properties).	C	• Develop a site-specific ERPP for soil cleaning and decontamination. • Activities must be carried out > 100 metres away from water bodies, except when crossings are necessary. • All wastewater that may be contaminated with oily substances must be managed in accordance with a licensed RMP and no water contaminated with hydrocarbons may be released into the environment. • Domestic wastewater must be treated and disposed of in accordance with a licensed RMP. • Measure the turbidity of nearby surface water resources in identified surface water bodies along the route of the proposed transmission line on a monthly basis immediately before construction, during construction, and for one month after construction of each section. Measurements can be taken at field using a water clarity tube.	Visual verification of the location of project activities in relation to surface water bodies. Measurement of water turbidity before, during and after construction activities (Water Quality Reports).	Continuous during construction and for one month afterwards	Construction company HSE management.

ITEM	MANAGEMENT OBJECTIVE	PHASE (C&O)	SPECIFIC ACTIONS	MONITORING	TIMING AND FREQUENCY	RESPONSIBILITY
4	Minimising the potential impact in the water quality of accidental spillages e preventing water pollution by spillages of oils/fuel/chemicals.	C&O	• Ensure that the works do not cause the presence of foam, oil, grease or other visible material in the different bodies of water where the construction works are taking place (special attention to be paid to existing watercourses crossed by the TL). • Run-off from cement/concrete areas must be strictly controlled and contaminated water must be collected, stored and treated or disposed of off-site in an approved space. • Mitigation measures should include the following: o Response strategies for a coordinated response to a stroke; o Internal organisation and responsibilities. o Communication requirements and spill response resources. o Commitment to train staff to conduct fuel and chemical handling in accordance with formal procedures to reduce the risk of accidental discharges and fire and explosion hazards; carry out regular drills to practise response actions.	Carry out inspections regular visuals for equipment and machinery containing oils and tanks storage.	Daily visual inspection of the storage and equipment supply of fuel.	SSA Management construction company (phase construction). RNT to LT and operator for SE (operation phase).
			AIR QUALITY			
5	Reduce dust emissions during construction activities.	C	• Vegetation removal will only be scheduled in the construction programme when soil removal is necessary and there is time for the exposed surfaces to be re-vegetated or stabilised. • Excavation, handling and transport of erodible materials should be avoided in high wind conditions. • During high wind conditions, the construction company's HSE Management will assess the situation and make recommendations as to whether dust abatement measures are adequate or whether activities should	Visual inspection on a daily basis.	Continuously throughout construction activities.	Construction company HSE management.

ITEM	MANAGEMENT OBJECTIVE	PHASE (C&O)	SPECIFIC ACTIONS		TIMING AND FREQUENCY	RESPONSIBILITY
			• Vehicle speeds should not exceed 40 km/h along dusty roads or 20 km/h along unconsolidated areas. • Appropriate dust suppression methods should be used when dust generation is unavoidable, for example with water (in prolonged periods of dry weather).			
			NOISE, VIBRATIONS AND RADIATION			
6	Reduction of noise nuisance from construction activities on site.	C	• Working hours for construction work that generates significant noise (including work needed to improve existing access roads or create new ones), will be daytime only. • Placing noisy plant and equipment as far away as possible from noise-sensitive (RS) receptors, and using barriers (e.g. huts, acoustic pavilions or partitions) to reduce the level of construction noise at receptors wherever possible. • Wherever possible, noisy equipment will be orientated away from the nearest RS. • Alternatives to diesel and petrol engines and pneumatic units, such as hydraulic or electrically controlled units, will be used wherever possible. • Communicate construction and planning periods to communities within a 5 kilometre radius.	• Routine visual inspections of sites to support good practice. • The plan and construction times are presented visually in public areas, in newspapers, posters and on the radio, etc.	Monthly inspection and review of maintenance records.	Construction company HSE management.
7	Reduced noise generation from the movement of vehicles on the site and access roads.	C&O	• Identify off-site transport routes that avoid existing communities whenever possible.	As part of the internal procedures	Continuously throughout the construction phase.	SSA Management builder (construction phase).

ITEM	MANAGEMENT OBJECTIVE	PHASE (C&O)	SPECIFIC ACTIONS	MONITORING	TIMING AND FREQUENCY	RESPONSIBILITY
			• Normal working hours will be maintained and the associated loading/unloading activities will be restricted to daylight hours (06:00 - 18:00). Unloading activity may take place after daylight hours (06:00 - 18:00) occasionally, when unavoidable situations arise. However, transport will be carried out during the day. • Implement traffic management plans to optimise truck operation. • The equipment will be inspected and maintained regularly to ensure that it is in good working order. The condition of the silencers will also be checked. • Fitting silencers or mufflers of the type recommended by the manufacturers.	(Traffic Management Plan drawn up and implemented).		RNT for the TL and the operator for the SE (operation phase).
BIODIVERSITY						
8	Ensuring the safety of the project's construction activities without causing unnecessary clearing of vegetation and soil degradation in riparian zones.	C	• A specific method statement should be developed to regulate vegetation clearance along the TL route. • The *RoW* must be cleared in accordance with Angolan regulations for the minimum vegetation clearance distance. • Debris through vegetation clearance must not be burnt under any circumstances. Unless the local community wishes to use the cut wood for firewood, the debris must be disposed of in an approved or designated facility. Debris can also be used for rehabilitation processes (where appropriate). • Felled trees, vegetation cuttings and debris should be kept away from rivers, streams and other bodies of water. • Vegetation that doesn't grow high enough to interfere with overhead power lines is not allowed to grow. • energy, or cause fire hazards, must not be cut or trimmed, unless it is growing in the road access area. • There must be no deviation from the position of the access road without prior discussion with RNT.	Visual inspection on a daily basis.	Continuously throughout the construction phase.	Construction company HSE management.

ITEM	MANAGEMENT OBJECTIVE	PHASE (C&O)	SPECIFIC ACTIONS	MONITORING	TIMING AND FREQUENCY	RESPONSIBILITY
9	Areas disturbed during construction are returned to states that are equivalent to the state they were in before construction, including surface drainage patterns.	C	• All areas disturbed by construction activities must be landscaped and rehabilitated. • Surface drainage must be maintained during the construction phase. • Indigenous species will be used for replanting (if applicable). • The stored topsoil will be used for rehabilitation. • Before laying topsoil, all visible weeds in the laying area and topsoil must be removed. • The subsoil must be ripped up before the topsoil is laid. • When impacted by construction activity, all sloping areas must be stabilised to ensure that proper rehabilitation is implemented and erosion is controlled.	Visual inspection on a daily basis.	Continuously throughout the construction phase.	Construction company HSE management.
10	Ensure the protection of fauna during construction and the potential future impact during operation.	C&O	• Construction activities must not interfere with or cause the death of animals. • The Project will ensure that best practice measures are adopted to avoid incursion into areas adjacent to the project area, any secondary effects of pollution, altered drainage regimes, dust, sedimentation, etc. • In the event of receiving confirmation of regular bird strikes along the LT, high-visibility markers should be installed to make the lines more visible to birds, to reduce the risk of collision. • The HSE Management of the construction company and the operator will carry out regular monitoring (at least biannually, dry and wet seasons) to check whether birds are nesting in the towers. In the event of nesting, anti-perching and nesting devices will be installed to discourage birds from regularly visiting these structures. • The breeding sites of bird species must be taken into account during construction planning and nesting sites must be kept intact, avoiding disturbing breeding birds. Special care should be taken where there are broods or juveniles. • No interference with livestock should take place without the owner's authorisation.	Visual inspection on a daily basis. Assessment of road deaths, to be carried out weekly. Wildlife interaction register to be updated permanently.	On and on.	Construction company HSE management (construction phase). RNT for the TL and the operator for the SE (operation phase).

ITEM	MANAGEMENT OBJECTIVE	PHASE (C&O)	SPECIFIC ACTIONS	MONITORING	TIMING AND FREQUENCY	RESPONSIBILITY
			LANDSCAPE			
11	To minimise the visual impact of the landscape and increase the absorption of development into the surrounding environment.	C&O	• Vegetation clearance will be kept to a minimum and should not extend beyond the corridor or substation sites. • Any area excavated or cut and filled will be landscaped and revegetation authorised. • Temporary construction fencing will be removed; • No rubbish or waste materials will be left on the work sites; • The appropriate direction and intensity settings will be used throughout the lighting. • The only mitigation that can be applied during operations is the continuous rehabilitation of cleared areas to minimise visual impacts.	Visual inspection on a daily basis.	On and on.	Construction company HSE management (construction phase). Operator of the SE (operation phase).
			WASTE			
12	To avoid, manage and mitigate potential impacts on the environment caused by storage,	C&O	• Implementation of a establishing priorities and a waste management hierarchy. • In order to minimise the potential impacts of sewage generated during the construction phase, the RMP will include	RMP in force before the start of construction.	Routine weekly checks of the provisions must be carried out waste management.	Construction company HSE management (construction phase).

ITEM	MANAGEMENT OBJECTIVE	PHASE (C&O)	SPECIFIC ACTIONS	MONITORING	TIMING AND FREQUENCY	RESPONSIBILITY
	incorrect handling and disposal of general solid and hazardous waste.		also recommendations to locate sanitary facilities away from any watercourses and areas of high water tables, regularly disinfect the area around the toilets and identify suitable sewage and wastewater treatment facilities for the disposal of sewage sludge. • Provide separate and signposted containers, storerooms and areas suitable for hazardous, non-hazardous and recyclable materials. Keep an inventory of non-hazardous waste produced and transferred off-site. • For hazardous waste, store it in closed containers away from direct sunlight, wind and rain. Keep an inventory of hazardous waste produced and transferred off-site. • Under no circumstances should waste be disposed of, burnt or buried in any workplace. • Ensure that the storage area has adequate ventilation.	Drawing up an inventory of applicable laws and regulations and an inventory of the quantity and type of waste stored and recycled, both hazardous and non-hazardous. Training for contractors and engineers on the proper handling and storage of hazardous waste (Report).	Special attention should be paid to providing sufficient space, adequate resources and facilities for on-site sorting and temporary storage of construction waste. Carry out annual waste audits. Review the inventory of applicable laws and regulations on a monthly basis.	RNT for the TL and the operator for the SE (operation phase).
13	Proper transport of waste and disposal in landfill facilities designated by qualified licensed entities to avoid the accumulation of waste on site causing nuisances such as odours, pest control problems and general litter.	C&O	• Enter into a contract with waste collection and recycling companies that are duly licensed to collect waste on a regular basis. Arrangements should be agreed before construction. The waste treatment licence must be reviewed by the construction company and kept with the contract. • Close vehicles/containers tightly to minimise litter and dust during waste transport. • Train staff on how to store, handle waste, prevent leaks/waste and deal with leaks when they occur, and provide them with personal protective equipment for handling hazardous waste.	Review of licences and contracts with local waste entities. Review of the sites where the waste will be disposed of to ensure adequate facilities. Review of attendance records for	Quarterly throughout the construction and operation phases. A one-off visit to the waste facilities on site, under contract and for each new facility used (the facilities of waste treatment must comply with legislation location).	Construction company HSE management (construction phase). RNT for the TL and the operator for the SE (operation phase).

ITEM	MANAGEMENT OBJECTIVE	PHASE (C&O)	SPECIFIC ACTIONS	MONITORING	TIMING AND FREQUENCY	RESPONSIBILITY
14	Implementation of an RMP for avoid accumulation or bad on-site waste management Project during o operation.	O	• The RMP must identify and highlight the disposal options for all waste generated during the operation of transmission lines, substation sites, waste prevention, measures, material recovery and recycling programme, waste handling, storage and disposal methods, environmental, health and safety control measures, and agreements for waste management audit.	Waste Management Report.	Carry out annually an audit of waste. Carry out monthly an inventory of laws and regulations applicable.	RNT to LT and operator for the SE.
SOCIOECONOMY						
15	Improvement measures for increase the impacts potential related to employment and development	C	• An Employment Strategy and hiring procedure that will include a hiring procedure to ensure that the local population of the Study Area is employed wherever possible	Check the Local Content and the Purchasing Plan in force	Before the start of construction for Local Content and Purchasing Plan.	Resource Manager Human Resources Purchasing construction company.

ITEM	MANAGEMENT OBJECTIVE	PHASE (C&O)	SPECIFIC ACTIONS	MONITORING	TIMING AND FREQUENCY	RESPONSIBILITY
	the economy during a construction.		and that this is done fairly, consistently and transparently by the project and its contractors. Workers from villages along the LT will be prioritised for low-skilled jobs such as vegetation clearance, security guards, cleaning, etc. Low-skilled construction jobs can also be obtained in peri-urban areas along the route of the transmission line. • The Employment Strategy will outline and demand a fair and transparent recruitment process for all openings. Work will be done with local authorities to publicise all openings in a way that is accessible to local communities. • The project will provide clear information on the number and limited timeframes of job opportunities. • The construction company and other subcontractors will have to demonstrate best endeavours to fill all low-skilled service jobs with local residents (at municipal level). • To maximise capacity building and knowledge transfer to	before the start of the construction. Check the strategy Employment and procedure hiring local contractors. HR records about the percentage of local employment versus employment non-local.	Continuous during construction phase of related measures with employment and acquisitions. Quarterly for related measures with training.	

			local contractors and their employees, the construction company will develop formal training programmes and formalise, as far as possible, on-the-job training, including objectives for learning and performance monitoring.	Monitoring process local recruitment. HR records information about opportunities for employment provided (number and deadlines).		
16	Measures to mitigate potential impacts related to displacement physical e economic e impacts related in the media subsistence during a construction.	C	• Develop a Resettlement Plan (RP). • Provide compensation for the loss of assets at replacement cost and the loss of income opportunities from seasonal and permanent crops. This also includes compensation at community level for the loss of community resources, such as • fruit trees within the 45 metre *RoW* corridor and livelihood-related losses. • Ensure that resettlement activities are implemented with due dissemination of information, consultation and informed participation of the people affected. • Improve or at least restore the livelihoods and living standards of displaced people to pre-project levels, in order to facilitate sustainable improvements in socio-economic status (including the provision of alternative land for cultivation with equal or better soil productivity). • In the event of changes in land values following construction, affected landowners and/or rights holders are entitled to cash compensation at replacement values for reduced opportunities to use the land more productively. Pay special attention to the needs of vulnerable groups, identifying additional compensation and livelihood restoration measures as necessary. • Carry out an inventory and census of all affected households and publicise the PR and agreement at community level. • Implement the PR prior to land grabbing in order to ensure that replacement houses and land are ready, that the necessary infrastructure is in place, and that	Check the PR developed before from the start of construction. PR implemented before the land grab began. Register of affected stakeholders eligible for compensation and livelihood restoration.	Before the start of PR construction Before the start of earth socket for PR. Continuous throughout the construction phase to register affected stakeholders eligible for compensation/restoratio n of livelihoods and routing and clearance activities.	Proponent of Project and Builder.

			replacement livelihood resources can be accessed productively. Specifically: agreeing on the rights of households and providing compensation; providing ongoing support to • households to restore their livelihoods.			

ITEM	MANAGEMENT OBJECTIVE	PHASE (C&O)	SPECIFIC ACTIONS	MONITORING	TIMING AND FREQUENCY	RESPONSIBILITY
17	Measures to mitigate potential impacts on access to local infrastructure and/or damage during construction.	C	• Stakeholder engagement will be conducted to maintain open, clear and transparent communication with local communities regarding the use of local infrastructure by the project throughout the different phases. • It is recommended to engage with the relevant authorities to prevent damage to common property and minimise disruption to access to education and healthcare facilities. • A complaints mechanism will be implemented. • A Traffic Management Plan will be issued prior to the start of earthworks and construction to minimise traffic disruption. • When temporary road closures are necessary, alternative access to goods will be ensured and local solutions, including diversions, will be implemented to ensure uninterrupted mobility.	Check the Complaints Mechanism developed before the start of construction. Check the Traffic Management Plan developed prior to the start of earthworks and construction. Complaints Mechanism document. Records of any complaint actions and repair.	Prior to the start of earthworks and construction of the Traffic Management Plan developed. Continuous throughout the construction phase.	Construction company HSE management.

18	Measures to mitigate potential impacts of land-related restrictions.	O	• Monitor and provide the necessary follow-up to support families in restoring their livelihoods throughout the operations phase. • The complaints mechanism established during the construction phase will be maintained during operations to ensure that local communities and stakeholders have an adequate channel to voice concerns.	Complaints mechanism document. Records of any complaint and redress actions. Monitoring and follow-up records of the support provided to households family members to	Continuous throughout the operation phase.	RNT for the TL and the operator for the SE.

ITEM	MANAGEMENT OBJECTIVE	PHASE (C&O)	SPECIFIC ACTIONS	MONITORING	TIMING AND FREQUENCY	RESPONSIBILITY
			COMMUNITY HEALTH AND SAFETY			
19	Provide a framework for interactions between the project work and the local communities and ensure that mitigation measures are in place to minimise the potential impacts of road traffic, the invasion the location and activities of demining during construction.	C	• Ensure that all workers, including contractors and subcontractors, undergo pre-employment screening and regular health screening, including voluntary screening for Sexually Transmitted Diseases (STDs). • Provide access to health care for people injured by their activities. • Ensure that work sites are fenced off and that signs are placed around work fronts and construction sites, advising people of the risks associated with trespassing. When work fronts are less than 100 metres from a community or home, employ local community security guards to prevent trespassing. • Extend the Worker Code of Conduct to include guidelines on worker-community interactions and will provide training on the worker code of conduct to all workers, including contractors and subcontractors and lorry drivers as part of the induction process. • Provide primary health care and first aid in workers' camps to avoid pressure on local health infrastructures. • Develop an Emergency Preparedness and Response Plan in co-operation with local emergency authorities and hospitals. • With regard to demining, the demining operator will be obliged to establish the following mitigation measures: o Liaising with local communities and authorities, including holding preliminary meetings with local authorities, advising on safety measures to be taken by the local population, and holding a closing meeting after completion of the works to inform local authorities that operations have been completed and in which areas.	• Record of accommodation granted to each worker. • Record of verification for pre-screening for STDs. • Drawing up a Code of Conduct document. • Recording lessons learned to minimise occupational health and safety risks. • Monitoring and auditing of all contractors and subcontractors to ensure compliance with health and safety standards and project-specific standards (Report). • Training records on public health and road safety and attendance register. • Records of incidents observed when the situation deviates from normal.		SSA Management construction company.

ITEM	MANAGEMENT OBJECTIVE	PHASE (C&O)	SPECIFIC ACTIONS	MONITORING	TIMING AND FREQUENCY	RESPONSIBILITY
			• Liaising with communities and local authorities, including holding preliminary meetings with the local authorities, counselling o n security measures to be taken by the local population, and holding a closure after the works have been completed to inform the local authorities that the operations have been completed and in which areas.	public health and road safety and attendance list. Records of incidents observed when the situation deviates than normal.	clinic during the construction period in case of emergency.	
20	Measures to mitigate potential health and safety impacts of the community during the of operation in relationship a maintenance and line operation.	O	• Permanent warning signs (danger signs) and anti-climb devices on all sides of the lattice towers. • Ensure that an Emergency Preparedness and Response Plan is developed. • The Complaints Mechanism established during the construction phase will be maintained during the operation phase so that interested parties can communicate specific concerns. • Carry out a community education programme on transmission line safety. • Residents and land rights holders will receive training on safety issues and actions to be taken; for example, when a pole is located near residential areas or schools and recreational areas.	• Check that the warning/hazard signs are up and that they are easily identifiable and understandable. • Check the existence of the PPRE. • Keep a record of training sessions on transmission line safety and safety issues.	Continuously during the entire operation.	RNT to LT and operator for the SE.
21	Ensure compliance with ICNIRP guidelines on public and professional exposure a Electromagnetic Fields (CEM).	O	• If it is confirmed that EMF levels are above the recommended exposure limits, the application of engineering techniques will be considered to reduce the EMF produced by the lines. • Once the line is operational, carry out initial measurements of exposure levels to ensure that public exposure levels are not exceeded. are within the accepted limits, as prescribed by ICNIRP.	Records of EMF level tests. Registration and frequency of educational campaigns on EMFs.	Continuously during the entire operation.	RNT to LT and operator for the SE.

ITEM	MANAGEMENT OBJECTIVE	PHASE (C&O)	SPECIFIC ACTIONS	MONITORING	TIMING AND FREQUENCY	RESPONSIBILITY
			• Educational campaigns will be held in the affected communities to explain what EMFs are and that people should not build new houses along the *RoW*. • Annual monitoring of the corridor will be undertaken to ensure that people are not building new houses inside the corridor. • Carry out a survey of the intensities of electromagnetic radiation (kV/m) and magnetic fields (A/m) generated by the equipment; compare the results with the exposure limits defined by ICNIRP, which limits exposure to electric, magnetic and electromagnetic fields (up to 300 gHz): **a.** If the area of radiation values found are outside the ranges considered safe, consider implementing protective measures, such as installing shielding with specific alloys (only effective in reducing exposure). to the electric field).	Annual corridor monitoring records.		
WORKERS' HEALTH AND SAFETY						

22	Measures of mitigation for minimise the potential health and safety impacts workers and ensure the respect for your rights	C&O	• Develop and implement an Occupational Health and Safety Management System covering all contracted and subcontracted workers. • Prohibit the use of alcohol or drugs, which could adversely affect the worker's ability to perform the job safely or adversely affect the health and safety of other workers, members of the community or the environment. • Ensure that training on health and safety measures is given to all construction workers before they start working on the project and that supervisors have the necessary experience to carry out the work.	• Check the Occupational Health and Safety Management System developed before construction began. • Check the contractual clauses of the construction company and all subcontractors that require compliance with the law.	Health and Safety Labour Management and Resource Policy Human development and approved before the construction. The Code of Conduct must be developed and approved before the construction. Control of fulfilment of labour rights	SSA Management construction company.

ITEM	MANAGEMENT OBJECTIVE	PHASE (C&O)	SPECIFIC ACTIONS	MONITORING	TIMING AND FREQUENCY	RESPONSIBILITY
			to fulfil their responsibilities. • Implement regular health and safety checks and audits of workers, contractors and subcontractors and apply sanctions in the event of violations of national and project-specific standards. Such audits should include SS in the workplace; workers' contracts, working hours, remuneration and housing conditions and food standards. • Ensure that the Code of Conduct is followed to regulate the performance and behaviour of all workers, including the provision for disciplinary action for anti-social behaviour and non-compliance with health and safety regulations, such as failure to wear PPE. • Ensure adequate drinking water and safe food and access to medical care for all workers on site and in accommodation. • Recruitment will be carried out in collaboration with local authorities and agencies. Measures will be put in place to ensure that no worker or jobseeker is discriminated against on the grounds of their sex, marital status, nationality, age, religion or sexual orientation. Ensure that health and safety training is provided to all workers before they start their activities.	Angola, politics the bidder and standards international. Records of incidents observed when the situation is moving away than normal. Keeping a record of the training and assistance on health and safety. Recording lessons learnt to minimise health and safety in work. Document of the Code of Conduct	(Report). The training should be given continuously according to the progress in construction of the LT.	
CULTURAL HERITAGE						
23	Prevention of damage destruction of materials with heritage significance.	C	Develop an Opportunity Finding Procedure for dissemination to construction teams prior to the start of construction, which should include the following points: • All work must stop immediately if any human remains and/or other archaeological and historical material is discovered.	Visual inspection on a daily basis (Report).	Continuously throughout the activities construction.	SSA Management construction company (phase construction). RNT to LT and operator for SE (operation phase).

ITEM	MANAGEMENT OBJECTIVE	PHASE (C&O)	SPECIFIC ACTIONS	MONITORING	TIMING AND FREQUENCY	RESPONSIBILITY
			• Discoveries should be reported to the nearest museum, archaeologist or government authorities in Huíla and Namibe, so that a systematic and professional investigation can be carried out. • Training should be given to workers on the identification of potential relevant artefacts and the concomitant procedures to be followed once a discovery has been identified. UNPLANNED EVENTS			
			UNPLANNED EVENTS			
24	Minimising the risk of unplanned events and their impact on soil and surface water resources.	C	• The project will maintain cleanliness and the capacity to respond adequately to spillages in order to deal with them at all stages of the project. All spillages will be immediately contained and cleaned up. Contaminated areas will be remediated and a post-remediation check will be carried out. • Refuelling of equipment and vehicles will be carried out in designated, paved and impermeable areas. Collection systems will be installed in these areas to deal with possible spillages. The waste produced will be managed and treated in accordance with the project's RMP. • Hazardous material storage will be on a hard, impermeable surface and the bulk storage facility will be bunded. The project will restrict the storage and handling of hazardous materials and fuels to bunded areas with sufficient capacity to contain a release.	• Visual inspection on a daily basis (Report). • Preparation and implementation of the Spill Response Plan.	Continuously throughout construction activities.	Construction company HSE management.

The ESMP has identified a number of additional plans that will be prepared by the proponent and construction company before construction of the TL and ES begins. The specific management plans described below provide links to how they relate to the activities and impacts described in this report, as well as the department/entity identified for the implementation of each one.

Together with this ESMP, these specific plans will form the overall Environmental and Social Management System (ESMS) for the project.

6.1 Construction Management Plan

The Construction Management Plan (CMP) will focus exclusively on the construction phase of the project and will outline the mitigation measures necessary to ensure that potential negative environmental, health and safety and social impacts are avoided or, if not possible, reduced in terms of magnitude and significance. At the same time, the CMP will also specify concrete actions, responsibilities, compliance requirements and mitigation activities to be followed during the pre-construction and construction phases. The mitigations and measures that will be detailed in this plan are necessary to achieve compliance with the requirements of the project commitments, good practice and international standards. The construction company will be responsible for preparing and implementing this plan.

6.2 Waste Management Plan

The main objective of the Waste Management Plan (WMP) will be to plan the waste management operations generated during the construction and operational phases of the Project. The RMP will encourage a sustainable environment in order to minimise the production of construction, electrical, urban and other waste at source, proper segregation at source, correct identification and storage of waste, recovery of waste that can be recycled and reused, and control of potential environmental and public health risks.

The RMP was previously prepared by the project promoter and will be submitted to the National Waste Agency (ANR) for technical advice and approval.

6.3 Emergency Preparedness and Response Plan

The 220 kV transmission line construction project will cross rural regions and various areas used for agricultural activities, and due to the importance of these infrastructures for the implementation of another project (Longonjo NdrPr Mining Project, Huambo) and associated socio-economic development, it is advisable to adopt measures to prevent future risks or accidents that could affect them. To this end, the construction company will prepare and implement an Emergency Preparedness and Response Plan (PPRE) for the project.

The SRPP essentially aims to establish a preparedness and response mechanism against accidents in project activities that could occur on site and along the proposed route, as well as during line maintenance operations, such as fires in conductors, transformers, backup generators or falling steel cables and very high voltage towers due to natural phenomena (wind, rain, etc.), risks of electrocution and/or collision of motorised vehicles with the towers, and overflow or spillage of hydrocarbons, etc. This plan aims to ensure a rapid and effective response to such incidents and/or accidents. It also aims to ensure a rapid and effective response to such incidents and/or accidents. The plan will be prepared to guide preventive actions and will provide a timely response to any accident or pollution event that occurs at the Longonjo substation and along the route of the TL.

The procedures set out in the EHCP will apply to the facilities supporting the work (construction sites), the different work fronts, etc. The construction company's Health, Safety and Environment Department will be responsible for complying with the plan and all workers involved in the project, including visitors, must receive the necessary information for an appropriate response in the event of an emergency.

6.4 Engagement Plan

By addressing the different needs of the stakeholders, the project has developed an Engagement Plan, which will be modified and updated as necessary. Implementation will be the responsibility of the construction company's HSE Management and the Community Liaison Officer. Stakeholder engagement activities will include the following:

- Community involvement - recognising and ensuring the active participation of different interest groups within the affected communities. Frequent involvement during pre-construction and during site preparation and construction with the support of traditional authorities (Sobas, Seculos and Regedores).
- Engagement with Government Authorities - this will facilitate integration between project activities and ongoing provincial and municipal planning and implementation. It will also allow for partnerships, where appropriate.

Project information will be available from the construction site, and will provide relevant project information appropriate to the project phases and activities. In addition, ongoing verification and monitoring activities will be a key component of ongoing stakeholder engagement, ensuring reporting on fulfilment and performance in relation to environmental and social commitments.

The Complaints Mechanism, as defined in the SEP, will be established. This procedure will be implemented by the project to manage and address all complaints from the public. Labour-related complaints will be dealt with internally. The construction company will manage employee grievances in accordance with Angolan regulatory requirements. As mentioned above, contractors are expected to comply with Angolan labour regulations.

6.5 Communication Plan

The construction company and RNT will maintain a formal procedure for communications with regulatory authorities and communities. The construction company's HSE Management will be responsible for communicating Environmental, Health and Safety issues to and from the regulatory authorities whenever necessary.

Meetings will be held as necessary between the construction company and the appropriate regulatory agency and community representatives to analyse HSE performance, areas of concern and emerging issues. Negotiations will be transparent and stakeholders will have access to personnel and information to address concerns raised.

The project will implement a grievance mechanism through which community members can raise any issues of concern. Complaints can be verbal or written and are usually specific complaints about damage/injury or complaints or suggestions about the way the project is being implemented. When a complaint is brought to the attention of the project team, it will be recorded, assessed and dealt with/resolved. The person or group with the complaint is obliged to provide grounds for lodging a complaint or loss claim, so that a proper and informed assessment can be made.

Whenever a complaint or claim is deemed valid, steps must be taken to rectify the matter or agree compensation for the loss.

In all cases, the decision taken and the reason for the decision will be communicated to the relevant stakeholders and recorded. Where disagreement over the outcome remains, an arbitration procedure may be required to be supervised by a third party (e.g. a government official). Local community stakeholders will be informed on how to implement the grievance procedures.

CHAPTER 7

FINAL CONSIDERATIONS

7 FINAL CONSIDERATIONS

With the aim of powering the future Longonjo Mine (NdrPr Longonjo Mining Project, Huambo), Ozango Minerais, with the technical support of ENERLINE, intends to build a 220 kV transmission line of approximately 50 kilometres between the existing substation in Belém do Dango and the future substation of the Longonjo Mine (project still to be started). The proposed route for the TL will include the municipalities of Huambo, Caála and Longonjo.

The 220 kV transmission line project between Belém do Dango and Longonjo, with connection to the future Longonjo Mine substation, together with the Longonjo Mine project, has strategic economic and social potential for the development of Huambo province, with emphasis on the potential for socio-economic development in the region. Although temporary, the construction of the project is expected to provide new job opportunities for several young people along the route of the TL (municipalities of Huambo, Caála and Longonjo) and bring additional tax revenue to the region.

Under Angolan environmental regulations, high-voltage transmission lines are an undertaking for which an ESIA report is mandatory. In 2021, Ozango Minerais commissioned Holísticos to carry out an ESIA report. This report was developed by Holísticos to fulfil Angola's requirements for Environmental Licensing and the respective Environmental Impact Assessment procedures, as well as complying with international best practice in the environmental and energy sector (energy transport).

This EIAS report has identified and assessed the different potential environmental and social impacts associated with the project. The potential negative impacts expected during the construction and operation phases (see **Chapter 5**) range from negligible to moderate negative. The construction company and other subcontractors, under the supervision of the monitoring company and the project proponent (Ozango Minerais) will implement the mitigation measures, compensation and environmental monitoring programmes outlined in the Environmental and Social Management Plan (see **Chapter 6**). As such, the project is ready to proceed with the implementation of the mitigation measures proposed in this report, so any potential residual impacts can be mitigated during planning and construction and managed throughout the project's life cycle. Potential positive impacts are anticipated in the form of local employment, socio-economic development for the region, capacity building and local employment opportunities to medium term. Reinforcement measures have also been identified to further develop these positive opportunities.

In light of the above, and the potential environmental and socio-economic impacts identified in the Environmental and Social Impact Assessment, and based on the feasibility of the proposed mitigation measures, no environmental and social impediments have been identified for the implementation of the project. However, its implementation must scrupulously consider the Environmental and Social Management Plan (ESMP) proposed here and its respective environmental and occupational health and safety management programmes and plans presented in **Chapter 6**, as well as the national legislation in force, Ozango Minerais' applicable policies, international best practices and guidelines and additional measures that may be recommended by the Ministry of Culture Tourism and Environment.

CHAPTER 8

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9 ANNEXES

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Annex 11 - Certificate from Holísticos

Annex 1 - Proof of Delivery of the RMP

Protocolo

OZANGO MINERAIS S.A

Contribuinte nº 5417174149
TÍTULO DE EXPLORAÇÃO Nº 298/05/01/T.E/ANG - MIREMPET/2020
CÓDIGO Nº 031/07/51/0/2020
CRIPM Nº 1/GMGM/2016
LICENÇA AMBIENTAL Nº 2893069200/2021

À

AGÊNCIA NACIONAL DE RESÍDUOS

ATT: EXMA. PCA NELMA CAETANO

LUANDA

Referência N.º: PGR - LT - OM/Hol - 152022

ASSUNTO: **Envio do Plano de Gestão de Resíduos para o Projecto da Linha de Transmissão de 220kV Belém do Dango - Longonjo, Província do Huambo**

Excelência,

Em conformidade com o Artigo 5º, alínea g), do Decreto Presidencial N.º 181/14 de 28 de Julho e demais legislação ambiental em vigor, somos a submeter para a apreciação e parecer desta Agência o Plano de Gestão de Resíduos do projecto em epígrafe.

Este Plano de Gestão de Resíduos é parte integrante do Estudo de Impacte Ambiental e Social (EIAS) do Projecto da Linha de Transmissão de 220kV Belém do Dango - Longonjo, Província do Huambo, que atravessará os municípios do Huambo, Caála e Longonjo.

Aproveitamos para informar que este plano foi realizado pela empresa de consultoria ambiental angolana, Holísticos – Serviços, Estudos & Consultoria, Lda., que se encontra registada no Ministério da Cultura, Turismo e Ambiente (MCTA).

Antecipadamente gratos pela melhor receptividade e atenção que vossa Excelência possa dispensar a esta nossa solicitação, subscrevemo-nos com elevada estima e consideração.

Atentamente,

Pela Ozango

Ozango Minerais, S.A. NIF 5417174149 Luanda - Angola

1384
16 Junho 22
Mauro Pedro

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Annex 2 - Training Plan for Environment, Safety and Hygiene at Work

Annex 3 - Burden and Social Benefits Distribution Plan

Annex 4 - Engagement Plan

Annex 5 - Legislative

Name of legislation	Legislation	Name/Scope
		Environmental sector
Basic Environmental Law	Law no. 5/98 of 19 June	Establishes the general duty to defend the environment and the sustainable use of natural resources, as well as the obligation to carry out Environmental Assessment procedures on projects that may have a negative impact on the environment. have implications for the environment.
National Strategy for the Implementation of the United Nations Framework Convention on Climate Change and the Protocol of Kyoto	Resolution 52/08 of 5 June	It aims to establish the framework for Angola's legislative, technical and human intervention to help stabilise the country's greenhouse gas emissions and technological development. This strategy proposes measures to reduce gas emissions by investing in electricity transmission and distribution lines, as well as encouraging decentralised production from energy sources with lower emissions (such as hydroelectric, wind and solar).
Regulation laying down rules on the production, export, re-export and import of substances that deplete the ozone layer. ozone layer	Presidential Decree no. 153/11 of 15 June	It lays down the rules for the production, import, export and re-export of substances, equipment and apparatus containing substances that deplete the ozone layer. Any importer of substances that deplete the ozone layer must register the *stock of* these substances and submit information on the purchasers and the amounts purchased to the environmental authority on a quarterly basis.
Liability for environmental damage	Presidential Decree no. 194/11 of 7 July	It establishes responsibilities for the risk and degradation of the environment based on the "polluter pays" principle in order to prevent and repair environmental damage.
Public Consultation	Executive Decree 87/12 of 24 February	It establishes the rules for holding public consultations on public or private projects subject to EIA, the purpose of which is to gather opinions, suggestions and other contributions from the public interested in said projects, and to guarantee the participation and consultation of the holders of subjective rights or legally protected interests, within the scope of the decisions taken in the EIA administrative procedure, defining the composition of the jury for the public consultation, the duties of the President of the Board of Directors and the powers of the President of the Board of Directors. session and the applicable procedures.
Terms of Reference for the preparation of EIAs	Executive Decree no. 92/12 of 1 December March	Approves project registration forms and establishes guidelines for the preparation of studies subject to Environmental Impact Assessment.
Regulation for the Prevention and Control of Air Pollution National waters	Presidential Decree no. 141/12 of 21 June	Approves the regime for the prevention, monitoring and control of pollution of national waters by pollutants originating in particular from ships, boats, platforms and industrial establishments.

Name of legislation	Legislation	Name/Scope
Waste Management Regulation	Presidential Decree no. 190/12 of 24 August	lays down general rules on the generation, deposit in soil and subsoil, release into water or air, treatment, collection, storage and transport of any waste, except that of a radioactive nature or subject to the specific regulations.
Executive Decree on Construction and Demolition Waste Management	Executive Decree no. 17/13 of 22 January	It establishes the legal regime governing the management of waste resulting from building works or demolitions or landslides, abbreviated to construction and demolition waste (CDW), including its prevention and reuse and its collection, transport, storage and sorting operations, treatment, recovery and disposal.
Organic statute of the National Waste (ANR)	Presidential Decree no. 181/14 of 28th July	Creates the ANR and defines its organisational status. One of its attributes is to analyse and issue opinions on the Waste Management Plans of entities, proponents and companies that generate associated waste. to the municipal waste stream.
Forestry Regulations	Presidential Decree no. 171/18 of 23rd July	Regulates the sustainable management of forest resources and their ecosystems and aims to establish rules on conservation and rational use, taking into account the dimension of the forest and its ecosystems. social, economic and cultural environment of these resources.
Regulations for the Shipment of Waste Destined for Reuse, Recycling and Recycling Valorisation	Presidential Decree no. 265/18 of 15 November	It establishes the rules and procedures for the operational and administrative control of the shipment of waste destined for reuse, recycling and recovery outside the country. This Order applies only to non-hazardous waste destined for re-use, recycling and recovery, to be shipped abroad.
General Regulations for Environmental Impact Assessment and Environmental Licensing Procedures	Presidential Decree no. 117/20 of 22 April	Approval of the General Regulations on Environmental Impact Assessment and the Environmental Licensing Procedure, establishing the rules and procedures that, due to their nature, location or size, are likely to cause significant environmental and social impacts, applicable to all public or private activities that may directly or indirectly influence environmental components, and regulating Impact Assessment, Environmental Licensing and Supervision. Fines and Fees and repeal of Decree no. 51/04 of 23 July - On Environmental Impact Assessment, and of Decree no. 51/04 of 23 July - On Environmental Impact Assessment, and of Decree no. 51/04 of 23 July - On Environmental Impact Assessment. Decree no. 59/07 of 13 July - On Environmental Licensing.
Amendment of the Environmental Conservation Areas Act	Law no. 12/21 of 7 May	Amendment to the Environmental Conservation Areas Law, approved by Law no.º 8/20, of 16 April, with regard to the definitions of Mining Activities to be understood as the set of activities that include the recognition, prospecting, research, evaluation and exploitation of mineral resources, and Oil and Gas Activities to be understood as the set of activities that include prospecting, research, evaluation, development and production of oil and gas, development and production of oil and gas, while also amending aspects concerning mining and oil and gas activities in nature reserves and national parks and infringements, including the construction or transformation of facilities in Environmental Conservation Areas or areas of relevant interest without the necessary authorisation and exploitation. of natural resources in such areas

Name of legislation	Legislation	Name/Scope
Regulation on the Annual Quota for Non-Hazardous Waste	Joint Executive Decree no. 12/21 of 6 May	The purpose of this Executive Decree is to set the annual quota of non-hazardous waste to be transferred outside the country during the 2021 economic year for reuse, recycling and recovery.
Table of Fees to be Charged for Issuing and Renewing Environmental Licences for Impact Assessment Environmental	Presidential Decree no. 83/22 of 12 April	Defines the fees to be charged for issuing and renewing environmental licences for installation, operation and decommissioning, registration of consultants and costs associated with the Environmental Impact Assessment process, including the public consultation process.
	Energy sector	
Substation Safety Regulations	Decree no. 42895, of 31 March March 1960	Approves the safety standards for substations and transformer stations in order to establish the necessary technical conditions that must be met during the operation of substations and workstations in order to protect people and the environment. safeguard collective interests.
High Voltage Transmission Protection Regulation	Decree 46.847 of 1966	It regulates the protection and safety of high-voltage lines. Restrictions include: i) houses and structures are allowed as long as the distance between the axis of the transmission line and the top of the structure is more than 4-5m; ii) plantations and trees are allowed as long as the distance between them and the axis of the high-voltage lines is more than 4m; and iii) Establishment of a 50m protection corridor. width.
General Electricity Law	Law no. 14-A/96 of 31st May	Establishes the general principles of the legal regime related to the activities of production, transmission, distribution and utilisation of electrical energy.
Licensing Regulations for Production, Transport and Distribution Facilities Energy	Decree no. 41/04 of 2 July	Defines the principles and rules that must be observed during the licensing of Electrical Installations that are designed, built and operated for the purpose of producing, transporting and distributing electricity for public consumption and the legal and administrative provisions that regulate the establishment and operation of such installations.
Regulation of Energy Production, Transmission, Distribution and Commercialisation Activities Electrical	Presidential Decree 76/21 of 25 March	Approval of the Regulation on Electricity Generation, Transmission, Distribution and Supply Activities, which establishes the legal framework applicable to the exercise of these activities, defining the composition, players and principles of the National Electricity System (SEN), which comprises the Public Electricity System (SEP) and the Non-Binding Electricity System (SENV).
	Territorial Planning Sector	
Town and Country Planning Law	Law no. 3/04 of 25 June	The object of this law is the biophysical space, consisting of all urban land and rural areas, subsoil, continental shelf and inland waters, with a view to ensuring actions that result in the occupation and utilisation of the aforementioned spaces through the implementation of spatial and urban planning instruments.

Name of legislation	Legislation	Name/Scope
Land Law	Law no. 9/04 of 9 November	It establishes the general bases of the legal regime of the lands included in the original property of the State, the land rights that can be levied on them, and the general regime for the transfer, constitution, exercise and extinction of these rights.
General Land Concession Regulations	Decree no. 58/07 of 13 July	It establishes the legal framework for the granting of free land in Angola and does not apply to privately owned land. It also states that when land is expropriated for public use or temporarily requisitioned, fair and adequate compensation is always due to the owner and affected holders of other rights property.
Public Expropriation Law	Law no. 1/21 of 7 January	The Public Utility Expropriation Law (LEUP) establishes the principles and rules to be observed in public utility expropriation by the competent Public Administration Bodies. Within the framework of the Expropriation process, several general principles must be followed, including the principles of legality, justice, proportionality, impartiality, public utility, fair and immediate compensation, respect for private property and land rights of local communities and the right to reversion. It is important to mention that, in addition to the State, Local Authorities can benefit from expropriation and any public or private legal person who is recognised as such, provided there are good reasons to do so. justified for public utility.
Water sector		
Water Law	Law no. 6/02 of 21 June	Establishes the general principles of the legal regime inherent to the use of water resources, applicable to inland waters, both surface and groundwater, which form part of the national hydrological cycle, regulating the public water domain, the general policy for its management and development, as well as the competences attributed to the public authorities. related state institutions.
Water Quality Regulation	Presidential Decree no. 261/11 of 6 October	It establishes water quality standards and criteria with the aim of protecting the aquatic environment and improving water quality according to its main uses. They apply to inland waters, both surface and groundwater, as well as waters for aquaculture, livestock farming, agricultural irrigation and seaside resorts.
Regulations for the General Use of Water Resources	Presidential Decree no. 82/14 of 21 April	It defines the regime for the general use of water resources, including the mechanisms for planning, management and economic and financial remuneration.
Public Water Supply and Sanitation Regulations Wastewater	Presidential Decree 83/14 of 22 April	Defines the regime for the exercise of public water supply and wastewater sanitation activities.
National Water Plan	Presidential Decree no. 126/17 of 13 June	It defines, in a technically, socially, economically and environmentally sustainable, integrated and articulated manner, the guidelines and strategies for water resource management, the inventory of significant issues, the definition of planning scenarios and the definition of short, medium and long-term measures and actions for the water cluster in Angola.
Biodiversity sector		

Name of legislation	Legislation	Name/Scope
National Policy on Forests, Wildlife and Conservation Areas	Resolution no. 1/10 of 14 January	It promotes the sector's contribution to the country's sustainable development, through the preservation, conservation, development and rational use of forests, wildlife and conservation areas, for the benefit of present and future generations.
Basic Law of Forests and Wildlife	Law no. 6/17 of 25 January	Establishes rules to guarantee conservation and rational use and sustainable use of forests and wildlife o n national territory.
Red List of Threatened Species	Executive Decree no. 252/18 of 13 March July	Approval of the Red List of Angolan Species, which is made up of Category A - Extinct Species (Ex), Category B - Endangered Species (AEx), Category C - Vulnerable Species (Vul) and Category C - Vulnerable Species (Vul). Category D - Invasive Species.
National Strategy and Action Plan for Biodiversity 2019-2025	Presidential Decree no. 26/20 of 6 February	The National Biodiversity Strategy and Action Plan 2019-2025 aims to incorporate measures for the conservation and sustainable use of biodiversity into development policies and programmes. biological diversity and the fair and equitable distribution of biological resources for the benefit of all Angolans.
Organic Statute of the National Institute for Biodiversity and Conservation	Presidential Decree no. 96/21 of 21 April	Approval of the Organic Statute of the National Institute for Biodiversity and Conservation (INBC), a legal person governed by public law, with national scope and under the superintendence of the Executive Power Holder through the responsible Ministerial Department for the Environment, endowed with legal personality, administrative, financial and patrimonial autonomy, whose purpose is to ensure the development and implementation of the policy for the sustainable management of biodiversity and the national system, which defines its powers and regulates its organisation in general and in particular its executive services, financial management, assets and personnel and repeals Presidential Decree no. 10/11 of 7 January.10/11, of 7 January, which approved the previous Statute.
	Health and Safety Sector	
Occupational Health and Safety Systems	Decree no. 31/94 of 5 August	It enshrines the rights of workers to work in a safe and hygienic working environment, to receive free collective or personal protective equipment and to be regularly informed about matters relating to their health and safety. safety, hygiene and health at work.
General Regulations for Occupational Safety and Hygiene Services in the Labour Market Companies	Executive Decree no. 6/96 of 2 February	Establishes the principles for promoting safety, hygiene and health at work in companies, commercial and industrial establishments and cooperatives.
General Regulations on Health and Safety Signs at work	Executive Decree 128/04 of 23 November	It establishes the minimum requirements for the placement and use of occupational health and safety signs and applies to public, mixed, private and cooperative companies.

Legal Framework for Accidents at Work and Illnesses Professionals	Decree 53/05 of 15 August	Approves the legal regime for accidents at work and occupational diseases, considering as such the sudden event that occurs in the course of labour activity in the service of the company or institution that causes the worker injury or bodily harm of a serious nature.

Name of legislation	Legislation	Name/Scope
		resulting in partial or total, temporary or permanent incapacity for work, or death.
Regulations for Safety Accessories, Special Warnings, Use of Fire Extinguishers, First Aid Equipment and Light Signalling of Velocipedes	Presidential Decree no. 145/17 of 26 June	It regulates the obligation, characteristics, use and dispensation of safety belts, retro-reflective waistcoats, pre-signalling, fire extinguishers in motor vehicles used for public passenger transport and depending on the tare weight or gross weight, first aid equipment, the installation, characteristics and use of special warning devices and light signals for bicycles and special regulations regarding ambulances, also regulating penalties for infringements and is applicable to all vehicles in circulation in national territory.
	General	
Administrative Offences Act	Law no. 12/11 of 16 February	It establishes the general bases applicable to administrative offences committed individually or collectively by citizens or public or private legal entities.
Order setting the value of the Tax Correction Unit	Order no. 174/11 of 11 March	Fixing the value of the Tax Correction Unit (UCF), applicable whenever any sums have to be paid or settled, after the normal deadline, by way of tax, fee and other revenue due to the State, under the terms of tax or quasi-fiscal laws, for the month of January 2011, in the amount of 88.00 Kwanzas, under the terms of of the General Tax Code.
Criminalisation of the Offences Underlying Money Laundering Capital	Law no. 3/14 of 10 February	Its purpose is to criminalise a series of conducts, with the aim of adapting Angolan criminal legislation to the protection of certain fundamental legal assets. This law includes environmental offences.
General Labour Law	Law no. 7/15 of 15 June	Approval of the General Labour Law applicable to all workers who, in the territory of the Republic of Angola, provide paid work on behalf of an employer, within the organisation and under the authority and direction of that employer, such as in public, mixed, private companies, cooperatives, social organisations, international organisations and diplomatic and consular representations, also applying to apprentices and work provided abroad by nationals or foreigners hired in the country by national employers, and repeal of the previous General Law. of Labour, approved by Law no. 2/00, of 11 February.
Regulation of Relocation Operations	Presidential Decree no. 117/16 of 30 May	It defines the rules, procedures and criteria to be used during the process of resettling and relocating populations in specific situations, such as natural disasters, rehabilitation and urban regeneration, public works and housing fires, and aims to improve the social conditions of the population.
Public Expropriation Law	Law no. 1/21 of 7 January	The Public Utility Expropriation Law (LEUP) establishes the principles and rules to be observed in the expropriation of public utility by the competent bodies of the Public Administration. Within the scope of the expropriation process, a number of general principles must be observed. followed, including the principles of legality, fairness, proportionality, impartiality, public utility, compensation

Name of legislation	Legislation	Name/Scope
		fair and immediate, respect for the private property and land rights of local communities and the right to reversion. It is important to mention that, in addition to the State, Local Authorities can benefit from expropriation and any public or private legal person who is recognised as such, provided there are good reasons to do so. justified for public utility.

Annex 6 - Multilateral Environmental

Multilateral Environment Agreement	Resolution no.	Date of Ratification
Biodiversity		
Convention on Biological Diversity (CBD)	23/97 of 4 July	01.04.1998
Convention to Combat Desertification in Countries affected by severe drought and/or desertification, particularly in Africa (CCD)	12/00 of 5 May	03.06.1997
Convention on Migratory Species of Wild Animals (Bonn Convention)	14/03 from 15 April	15.04.2003
Convention on the Conservation of Nature and Natural Resources in Africa (Maputo Convention)	5/14 of 21 January	03.2014
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	1/07 of 14 February	14.02.2007
Convention on Wetlands of International Importance, especially as Waterfowl Habitats (Ramsar Convention)	27/16 of 22 July	Letter of Accession no. 4/16 of 23 August
Climate Change		
United Nations Framework Convention on Climate Change (UNFCCC)	13/98 of 28 August	17.05.2000
Paris Agreement on Greenhouse Gas Emissions Targets	37/20 of 12 October	Letter of Accession no. 8/20 of 20 October
Cultural Heritage		
Convention Concerning the Protection of the World Cultural and Natural Heritage		07.11.1991
Hazardous and non-hazardous waste		
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal	29/16 of 25 July	Letter of Accession no. 3/16 of 23 August
Bamako Convention on the Prohibition of the Importation of Hazardous Wastes, the Control of Transboundary Movement and the Management of Such Wastes in Africa	34/16 of 1 August	Letter of Accession no. 1/16 of 23 August

Annex 7 - International Organisations

International Organisations	Description
World Bank	Founded in 1944, the World Bank Group is one of the largest sources of development assistance around the world. Today, the Bank works in more than 100 developing economies, bringing a mix of finance and ideas to improve living standards and eliminate the worst forms of poverty. For each of its clients, the Bank works with government agencies, non-governmental organisations and the private sector to formulate assistance strategies.
United Nations Environment Programme	The 1982 United Nations Environment Programme (UNEP) Guidelines and Principles of Environmental Law on Offshore Drilling and Mining are one of the first examples of international guidelines on environmental regulation in the context of petroleum activities: The main provisions of this document are summarised in the following points: • The state must take preventive measures to combat, limit and reduce pollution and other negative environmental impacts resulting from the prospecting and exploitation of hydrocarbons and other minerals at sea, and to this end it must adopt regulations and participate in international cooperation. National regulations and legislation should be no less effective than international rules and standards. • The granting of an authorisation must be preceded by an environmental assessment. Authorisations should not be granted if there are clear signs that the operations under consideration will cause significant adverse impacts that are impossible to avoid. • States have a responsibility to ensure that activities within their jurisdiction do not cause damage to the environment of other states or areas outside the limits of national jurisdiction. • States must ensure that safety and implementation measures are taken and that contingency plans are in place for operations at sea; they must also ensure that appropriate measures are taken to determine environmental liability and compensation for damage caused as a result of activities at sea.
International Union for Conservation of Nature (IUCN)	It is an international association of governmental and non-governmental members. Its objectives are to seek to influence, stimulate, encourage and help the different societies worldwide to conserve the integrity and diversity of nature, as well as to strive for the sustainable use of natural resources. The declarations of this convention entered into force in Angola on 27 May 2003 (through Resolution n.º 21/03) through the approval of its statute. Angola has joined the International Union for Conservation of Nature and Natural Resources (IUCN) became a member state of that organisation on 8 November 2004.
International Finance Corporation (IFC); founded in 1956; Angola has been a member of the UN since 1 December 1976.	The World Bank Group promotes sustainable private sector investment in developing countries. IFC's Performance Standards (published in 2006 and updated in January 2012) are based on the Safeguard Policies and have been expanded to include issues such as greenhouse gases, human rights and community safety, security and health. The IFC's Health, Safety and Environmental Guidelines for oil and gas projects were published in 2007. These are technical reference documents with general and specific examples of good practice. international industry practices, which stipulate performance levels

International Organisations	Description
	generally considered achievable by new technology installations at a reasonable cost.
Equator Principles	The Equator Principles are intended to serve as a basis and framework for common use. These Principles deal with environmental assessments, protection of natural habitats, pest management, dam safety, indigenous populations, involuntary resettlement of populations, cultural property, child, forced or bonded labour, projects in international waters and occupational health and safety. It establishes voluntary principles, including adherence to the IFC Performance Standards, to address risks and problems environmental and social damage caused by global operations project transactions.

Annex 8 - Ozango Minerais S.A. Environmental Policy

OZANGO MINERAIS S.A

OZANGO MINERAIS S.A.

POLÍTICAS DE GOVERNANÇA EMPRESARIAL

POLÍTICA DE SAÚDE, SEGURANÇA E AMBIENTE

A saúde e segurança de todo o pessoal que trabalha nas nossas instalações é de grande importância para a Empresa.

Para efeitos desta política, '**empregado**' inclui qualquer consultor ou empreiteiro da Empresa.

Não é esperado que nenhum trabalhador realize actividades que ele considere razoavelmente inseguras.

Cada trabalhador tem a responsabilidade de trabalhar de forma segura e abordar as suas preocupações de saúde e segurança, assim que estas surjam.

O objectivo da Empresa é conduzir as operações de uma forma eficiente, proporcionando:

1. um local de trabalho seguro e saudável;
2. informação sobre os perigos do local de trabalho e formação sobre como trabalhar em segurança, e
3. consulta a todos os níveis de pessoal sobre questões de saúde e segurança.

A responsabilidade pelo desempenho em termos de saúde e segurança, incluindo a formação de cada funcionário, recai sobre a Direcção e Gestão da Empresa. A identificação de potenciais riscos à saúde e segurança requer uma avaliação contínua por parte dos empregados, da gestão e do Conselho de Administração.

POLÍTICA CORPORATIVA AMBIENTAL E DE RESPONSABILIDADE SOCIAL

A Empresa procura empenhar-se em desenvolver uma actividade conscienciosa, tendo em consideração o significado social da presença da Empresa na comunidade. A Empresa procura manter práticas de gestão ambientalmente saudáveis e eficientes para as suas actividades operacionais, de exploração e mineração. A Empresa considera a responsabilidade ambiental e social corporativa como um meio de contribuir para a sociedade e para o ambiente através do nosso negócio.

Os objectivos da Empresa são:

1. cumprir as leis ambientais, os regulamentos, o regime de arrendamento e as condições de licenciamento aplicáveis como um padrão mínimo para as suas práticas ambientais e procedimentos de gestão;
2. integrar processos ambientais e de reabilitação nas suas actividades de exploração, planeamento mineiro, exploração mineira e metalurgia;

3. comunicar de forma significativa com órgãos governamentais, autoridades estatutárias, comunidades locais e grupos de gestão ambiental para manter uma postura proactiva nas questões ambientais e comunitárias;
4. abordar as preocupações não só dos agentes económicos, mas também dos agentes sociais, ambientais e outros;
5. ouvir a comunidade, identificar impactes sociais e trabalhar com a comunidade para minimizar esses impactes;
6. facilitar a educação dos empregados e contratados em relação aos seus papéis e responsabilidades na gestão ambiental com respeito às actividades da Empresa;
7. contribuir para a construção de comunidades prósperas e respeitar a cultura dos nossos países e comunidades anfitriões;
8. acolher a participação da comunidade no nosso negócio através das oportunidades de emprego e da consideração de oportunidades de negócio comercialmente válidas;
9. desenvolver um trabalho de planificação para o dia em que a Empresa deixar a comunidade, com o objectivo de assegurar que a transição seja positiva;
10. realizar monitorização, auditoria e revisão regulares de procedimentos ou práticas, conforme apropriado, para reflectir a responsabilidade corporativa da Empresa em questões ambientais e sociais; e
11. fornecer recursos suficientes para atingir os níveis de protecção de gestão ambiental e de construção comunitária necessários, incluindo a capacidade de melhoria contínua.

O Conselho é responsável por assegurar que esta política seja efectivamente implementada. Cada colaborador tem a responsabilidade de assegurar que estes objectivos sejam alcançados. Para os fins desta política, **'empregado'** inclui qualquer consultor ou empreiteiro da Empresa.

Data: 14 de Março de 2022

Edson Paulo C. Nunes
Director Geral

Table 9-1: List of species (flora) identified in the project area.

Family	Scientific name	Size	Habitat	DAFOR	Status	
					LVEA	IUCN
Fabaceae	*Albizia antunesiana*	A	Mb	3		
Asphodelaceae	*Aloe zebrina*	C	Mb	5		
Poaceae	*Andropogon gayanus*	C	Mb	2		
Anisophylaceae	*Anisophyllea boehmii*	B	Mb	3		
Anonnaceae	*Anonna stenophylla*	D	Anh	3		
Fabaceae	*Bobgunia madagascariensis*	B	Mb	4		VU
Fabaceae	*Brachystegia floribunda*	A	Mb	3		
Fabaceae	*Brachystegia puberula*	A	Mb	4		LC
Fabaceae	*Brachystegia tamarindoides*	A	Mb	3		
Fabaceae	*Brachystegia russeliae*	D	Anh	2		
Fabaceae	*Brachystegia spiciformis*	A	Mb	1	VU	VU
Fabaceae	*Burkea africana*	A	Mb	3		DD
Apocynaceae	*Carissa edulis*	B	Mb	4		
Combretaceae	*Combretum collinum*	A	Mb	3		LC
Combretaceae	*Combretum platypetalum*	D	Mb	4		
Combretaceae	*Combretum zeyheri*	A	Mb	4		LC
Euphorbiaceae	*Croton mubango*	A	Mb	4		
Fabaceae	*Cryptosepalum exfoliatum* subsp. *suffruticans*	D	Anh	2		
Araliaceae	*Cussonia angolensis*	A	Mb	3		
Malvaceae	*Dombeya rotundifolia*	A	Mb	3		LC
Apocynaceae	*Dyplorhynchus condilocarpon*	B	Mb	3		
Melliaceae	*Ekebergia benguelensis*	B	Mb	3		
Fabaceae	*Entada abyssinica*	B	Mb	4		LC
Fabaceae	*Erytrina abyssinica*	B	Mb	4		
Fabaceae	*Erytrophleum africanum*	A	Mb	4		VU
Mirtaceae	*Eucalyptus* sp.	A	Mb	4		
Mirtaceae	*Eugenia malangensis*	D	Anh	5		
Rubiaceae	*Fadogia fuchsioides*	B	Anh	4		
Proteaceae	*Faurea rochetiana*	B	Mb	3		
Moraceae	*Ficus craterostoma*	A	Mb	5		
Moraceae	*Ficus thonningii*	A	Mb	4		LC
Rubiaceae	*Gardenia jovis-tonantis*	B	Mb	4		
Celastraceae	*Gymnosporia senegalensis*	B	Mb	3		
Euphorbiaceae	*Hymenocardia acida*	B	Mb	2		LC
Poaceae	*Hyparrhenia* sp.	C	Mb	2		
Fabaceae	*Isoberlinia angolensis*	A	Mb	3		
Fabaceae	*Julbernardia paniculata*	A	Mb	2		VU
Anacardiaceae	*Lannea edulis*	D	Anh	4		
Dipterocarpaceae	*Caloneurus monotes*	A	Mb	4		
Ochnaceae	*Ochna pygmaea*	B	Mb	5		

Family	Scientific name	Size	Habitat	DAFOR	Status	
					LVEA	IUCN
Ochnaceae	*Ochna schweinfurthiana*	B	Mb	4		LC
Cactaceae	*Opuntia ficus-indica*	F	Mb	4		
Crysobalanaceae	*Parinari curatelifolia*	A	Mb	3		VU
Poaceae	*Penisetum purpureum*	C	Pa	4		
Poaceae	*Phragmites mauritianus*	E	Pa	4		
Fabaceae	*Piliostigma thonningii*	B	Mb	3		
Pinaceae	*Pinus sylvestris*	A	Mb	4		
Proteaceae	*Protea angolensis*	B	Mb	4		
Proteaceae	*Protea gaguedi*	B	Mb	4		LC
Euphorbiaceae	*Pseudolachnostylis maprouneifolia*	B	Mb	3		LC
Clusiaceae	*Psorospermum febrifugum*	B	Mb	3		LC
Clusiaceae	*Psorospermum mechowii*	D	Anh	5		
Fabaceae	*Pterocarpus* angolensis*	A	Anh	3	VU	LC
Rubiaceae	*Rothmania engleriana*	B	Mb	3		LC
Euphorbiaceae	*Sclerocroton oblongifolia*	D	Mb	4		
Polygalaceae	*Securidaca longipedunculata*	B	Mb	3		VU
Fabaceae	*Senegalia senegalensis*	A	Mb	5		
Apiaceae	*Steganotaenia araliacea*	**B**	Mb	4		LC
Loganiaceae	*Strychnos cocculoides*	**B**	Mb	3		
Loganiaceae	*Strychnos* pungens	**B**	Mb	3		
Apocynaceae	*Strophanthus welwitschii*	B	Mb	2		
Mirtaceae	*Syzygium guineense*	B	Mb	4		LC
Combretaceae	*Terminalia brachystelma*	B	Mb	4		
Combretaceae	*Terminalia sericea*	B	Mb	4		LR
Asteraceae	*Tithonia diversifolia***	B	Mb	3		
Euphorbiaceae	*Uapaca kirkiana*	A	Mb	4		LC
Euphorbiaceae	*Clear Uapaca*	A	Mb	4		LC
Lamiaceae	*Vitex madiensis*	B	Mb	3		
Olacaceae	*Ximenia americana*	B	Mb	3		LC

Legend: Size: A- arboreal; B- shrubby; C- herbaceous; D- geoxylic suffrutice; E- aquatic plant; F- Succulent (**)- Invasive plant; Status: VU- Vulnerable; LC- Least Concern; DD- Insufficient data. LVA- Angola Red List; IUCN- International Union for Conservation of Nature; DAFOR: 1- Dominant; 2- Abundant; 3- Frequent; 4- Occasional; 5- Rare.

Table 9-2: List of species (avifauna) occurring in the project area.

Family	Species	COMMON NAME	UIC N1	END.	MIGR A3	RIISC O4	ABUND.	PRES.5
Anatidae	*Dendrocygna viduata*	Face-kissing duck white	LC	AD	R	M	C	PO
	Dendrocygna bicolor	Duck-blower	LC	AD	R	M	I	PO
	Plectropterus gambensis	Iron duck	LC	AD	R	A	C	RC
	Nettapus auritus	Eared duck	LC	AD	R	A	I	RC
	Anas capensis	Cape teal	LC	AD	R	M	I	PO
	Anas undulata	Yellow-billed duck	LC	AD	R	M	C	RC

Family	Species	COMMON NAME	UICN1	END.	MIGRA3	RIISCO4	ABUND.	PRES.5
	Anas erythrorhyncha	Red-billed teal	LC	AD	R	M	C	PO
Numididae	*Numida meleagris*	Guinea fowl	LC	AD	R	M	C	PR
Phasianidae	*Peliperdix coqui*	Stone francolin	LC	AD	R	M	C	RC
	Scleroptila finschi	Francolin de Finsch	LC	EQ	R	M	R	PO
	Pternistis afer	Red-collared francolin	LC	AD	R	M	A	RC
	Coturnix delegorguei	Harlequin quail	LC	AD	M	B	I	PO
Podicepedidaand	*Tachybaptus ruficollis*	Little grebe	LC	AD	R	B	C	RC
Ciconiidae	*Ciconia abdimii*	Abdim's stork	LC	AD	M	A	I	PO
Ardeidae	*Ardeola ralloides*	Cattle egret	LC	AD	R	B	I	RC
	Bubulcus ibis	Heron	LC	AD	R	B	C	RC
	Ardea cinerea	Heron	LC	AD	R	M	C	PO
	Ardea melanocephala	Black-headed egret	LC	AD	R	M	C	RC
	Ardea purpurea	Reddish egret	LC	AD	R	M	I	RC
	Egretta garzetta	Little egret	LC	AD	R	B	C	RC
Scopidae	*Scopus umbretta*	Hammerbird	LC	AD	R	B	C	PR
Phalacrocooracidae	*Microcarbo africanus*	African cormorant	LC	AD	R	M	C	RC
Pandioonidae	*Pandion haliaetus*	Osprey	LC	AD	M	M	R	PO
Accipitridae	*Elanus caeruleus*	Grey Kestrel	LC	AD	R	B	C	RC
	Milvus aegyptius	Yellow-billed black kite	LC	AD	R	M	C	RC
	Gypohierax angolensis	Palm vulture	LC	AD	R	A	C	PO
	Circaetus cinereus	Short-toed eagle	LC	AD	R	M	I	PO
	Circaetus cinerascens	White-tailed eagle	LC	AD	M	M	I	PO
	Terathopius ecaudatus	Dancing eagle	NT	AD	R	A	I	PO
	Circus ranivorus	Marsh harrier	LC	AD	R	A	I	RC
	Polyboroides typus	Small secretary	LC	AD	R	M	C	PO
	Melierax metabates	Goshawk	LC	AD	R	B	C	PO
	Micronisus brag	Sparrowhawk	LC	AD	R	B	I	PO
	Accipiter tachiro	African goshawk	LC	AD	R	B	I	PO
	Accipiter minullus	Little hawk	LC	AD	R	B	I	PO
	Accipiter ovampensis	Ovambo Hawk	LC	AD	R	B	I	PO
	Kaupifalco monogrammicus	Lizard hawk	LC	AD	R	B	C	PO
	Buteo buteo	Common buffalo	LC	AD	M	M	C	PR
	Buteo auguralis	Red-capped whelk	LC	AD	R	M	C	RC
	Buteo augur	Bútio-augur	LC	AD	R	M	I	PO
	Aquila spilogaster	Domino eagle	LC	AD	R	M	R	PO
	Hieraaetus wahlbergi	Wahlberg's Eagle	LC	AD	M	M	C	PO
Falconidae	*Falco rupicolus*	African Kestrel	LC	AD	R	B	C	RC
	Falco ardosiaceus	Grey kestrel	LC	AD	R	B	C	PO

Family	Species	COMMON NAME	UICN1	END.	MIGRA3	RIISCO4	ABUND.	PRES.5
	Falco dickinsoni	Dickinson's Frankincense	LC	AD	M	B	I	PO
	Falco vespertinus	Vesper hawk	NT	AD	M	B	I	PO
	Falco amurensis	Amur Falcon	LC	AD	M	B	R	PO
	Falco subbuteo	Ogea-Eurasian	LC	AD	M	B	I	PO
	Falco biarmicus	Alphane	LC	AD	R	M	C	PO
	Falco peregrinus	Peregrine falcon	LC	AD	M	M	I	PO
Otididae	*Eupodotis senegalensis*	White-bellied bustard	LC	AD	R	M	I	PO
	Lissotis melanogaster	Black-bellied bustard	LC	AD	R	M	C	PO
Rallidae	*Crex egregia*	African quail	LC	AD	M	B	C	PO
	Amaurornis flavirostra	Black-winged Teal	LC	AD	R	B	C	PO
	Porphyrio madagascariensis	African Cayman	LC	AD	R	M	I	PO
	Gallinula chloropus	Common moorhen	LC	AD	R	M	C	RC
	Fulica cristata	Crested coot	LC	AD	M	M	C	RC
Turnicidae	*Turnix sylvaticus*	Bullfinch	LC	AD	R	B	C	PR
Burhinidae	*Burhinus capensis*	Cape Caraway	LC	AD	R	B	C	PO
Charadriidae	*Vanellus armatus*	White lapwing	LC	AD	R	B	C	PO
	Vanellus senegallus	Abibe-caruncluated	LC	AD	R	B	C	RC
	Charadrius hiaticula	Great Spotted Sandpiper	LC	AD	M	B	C	PO
	Charadrius tricollaris	Three-collar lamb	LC	AD	M	B	C	PO
Jacanidae	*Actophilornis africanus*	African alligator	LC	AD	R	B	C	PO
Scolopacidae	*Tringa stagnatilis*	Thin green leg	LC	AD	M	B	C	PO
	Tringa nebularia	Common green leg	LC	AD	M	B	I	PO
	Actitis hypoleucos	Rock Sandpiper	LC	AD	M	B	C	PO
Glareolidae	*Rhinoptilus chalcopterus*	Bronze Corridor	LC	AD	M	B	I	PO
Columbidae	*Columba livia*	Homing pigeon	LC	AD	R	M	C	PR
	Streptopelia semitorquata	Red-eyed night-owl	LC	AD	R	M	C	RC
	Streptopelia capicola	Rola do Cabo	LC	AD	R	B	C	PR
	Spilopelia senegalensis	Rola from Senegal	LC	AD	R	B	C	PO
	Turtur chalcospilos	Emerald roll	LC	AD	R	B	C	PO
	Oena capensis	Rattle	LC	AD	R	B	I	PO
	Treron calvus	African green pigeon	LC	AD	R	M	I	PO
Psittacidae	*Poicephalus meyeri*	Meyer's parrot	LC	AD	R	B	I	PO
Musophagide and	*Tauraco schalowi*	Turaco de Schalow	LC	AD	R	B		PO
Cuculidae	*Centropus cupreicaudus*	Copper-tailed cuckoo	LC	AD	R	B	C	PO
	Centropus superciliosus	Eyebrow cuckoo	LC	AD	R	B	C I	PR
	Centropus grillii	African black cuckoo	LC	AD	R	B	I	PO
	Clamator levaillantii	Cafeteria Cuckoo	LC	AD	M	B		PO

Family	Species	COMMON NAME	UICN[1]	END.	MIGRA[3]	RIISCO[4]	ABUND.	PRES.[5]
	Clamator jacobinus	Jacobin cuckoo	LC	AD	M	B	C	PO
	Chrysococcyx caprius	Cuckoo-bronze-major	LC	AD	M	B	C	PR
	Chrysococcyx klaas	Minor tanning cuckoo	LC	AD	R	B	I	PO
	Cuculus clamosus	Black cuckoo	LC	AD	M	B	I	PO
	Cuculus solitarius	Red-breasted cuckoo	LC	AD	M	B	C	PO
	Cuculus gularis	African cuckoo	LC	AD	M	B	I	PO
Tytonidae	*Tyto alba*	Barn owl	LC	AD	R	B	C	PO
Strigidae	*Otus senegalensis*	African eared owl	LC	AD	R	B	C	PO
	Bubo africanus	Snitch	LC	AD	R	B	I	PO
	Strix woodfordii	Forest owl	LC	AD	R	B	I	PO
	Glaucidium capense	Barred owl	LC	AD	R	B	I	PO
	Asio capensis	Marsh owl	LC	AD	R	B		PO
Caprimulgidae	*Caprimulgus rufigena*	Red-faced nightjar	LC	AD	M	B	C	PO
	Caprimulgus pectoralis	Golden-necked nightjar	LC	AD	R	B	C	PO
	Caprimulgus tristigma	Freckled nightjar	LC	AD	R	B	R	PO
	Caprimulgus fossii	Noitibó from Mozambique	LC	AD	M	B	C	PO
	Macrodipteryx vexillarius	Whalebill	LC	AD	M	B		PO
Apodidae	*Cypsiurus parvus*	Tree swallow	LC	AD	R	B	C	PR
	Apus apus	European black swift	LC	AD	M	B		PO
	Apus affinis	Lesser Swift	LC	AD	R	B	C	PR
	Apus horus	Barred swift	LC	AD	R	B		PO
	Apus caffer	Swift swallow	LC	AD	R	B	R	PO
Coliidae	*Colius castanotus*	Angolan pigtails	LC	EE	R	B		PO
Coraciidae	*Coracias naevius*	White eyebrow roller	LC	AD	R	B	C	PO
	Coracias caudatus	Lilac-breasted Roller	LC	AD	R	B	C	PO
	Eurystomus glaucurus	Yellow-billed Roller	LC	AD	M	B	C	PO
Alcedinidae	*Halcyon leucocephala*	Barred Woodpecker-grey	LC	AD	R	B	R	PO
	Halcyon albiventris	Brown-bellied woodpecker	LC	AD	R	B	R I	PO
	Halcyon chelicuti	Striped woodpecker	LC	AD	R	B		PO
	Halcyon senegalensis	Woodpecker	LC	AD	R	B	C	PO
	Corythornis cristatus	Red-cockaded woodpecker	LC	AD	R	B	C	RC
	Ceryle rudis	Lesser spotted woodpecker	LC	AD	R	B	C	RC
Meropidae	*Merops hirundineus*	Bee-eater	LC	AD	R	B	C	RC
	Merops pusillus	Golden bee-eater	LC	AD	M	B	C	RC
	Merops bullockoides	White-fronted Bee-eater	LC	AD	R	B	I	PO
	Merops persicus	Persian bee-eater	LC	AD	M	B		PO
	Merops apiaster	European bee-eater	LC	AD	M	B	C	PO
Upipidae	*African Upupa*	African Saviour	LC	AD	R	B	C	PO

Family	Species	COMMON NAME	UICN1	END.	MIGRA3	RIISCO4	ABUND.	PRES.5
Phoeniculidae	*Rhinopomastus aterrimus*	Black mockingbird	LC	AD	R	B	C	PO
Bucerotidae	*Tockus alboterminatus*	Crowned Calau	LC	AD	R	B	C	PR
Lybidae	*Pogoniulus chrysoconus*	Bearded-yellow	LC	AD	R	B	C	PO
	Lybius torquatus	Black-collar beards	LC	AD	R	B	C	RC
Indicatoridae	*Prodotiscus zambesiae*	Elegant green-back indicator	LC	AD	R	B	R	PO
	Prodotiscus regulus	Elegant brown-black indicator	LC	AD	R	B	R	PO
	Indicator minor	Grey-headed indicator fish	LC	AD	R	B	I	PO
	Indicator indicator	Indicator-large	LC	AD	R	B	I	PO
Picidae	*Jynx ruficollis*	Brown sore throat	LC	AD	R	B	I	PO
	Campethera bennettii	Bennett's woodpecker	LC	AD	R	B	I	PO
	Campethera abingoni	Golden-tailed woodpecker	LC	AD	R	B	C	PO
	Dendropicos fuscescens	Cardinal woodpecker	LC	AD	R	B	C	PO
	Dendropicos namaquus	Short-toed woodpecker	LC	AD	R	B	I	PO
Motacillidae	*Motacilla flava*	Yellow aloe	LC	AD	M	B	I	RC
	Motacilla capensis	Alvéola do Cabo	LC	AD	R	B	C	RC
	Motacilla clara	Arabic aloe	LC	AD	R	B	C	PO
	Motacilla aguimp	Black aloe	LC	AD	R	B	C	PO
	Macronyx fuelleborni	Fülleborn Sentinel	LC	AD	R	B	I	PO
	Anthus nyassae	Woodpecker	LC	AD	R	B	I	PO
	Anthus vaalensis	Petinha-creme	LC	AD	M	B	C	PO
	Anthus leucophrys	Smooth-billed petrel	LC	AD	R	B	C	RC
	Anthus caffer	Woodpecker	LC	AD	R	B	C	PO
Platysteiridae	*Batis molitor*	Batis-common	LC	AD	R	B	C	RC
Prionopidae	*Prionops plumatus*	White shoelace	LC	AD	R	B	C	PO
	Prionops retzii	Retz black shoelace	LC	AD	R	B	I	PO
Malaconotida and	*Malaconotus blanchoti*	Grey-headed shrike	LC	AD	R	B	C	PO
	Chlorophoneus sulphureopectus	Orange-breasted shrike	LC	AD	R	B	C	PO
	Bocagia minuta	Shrike-soother swamps	LC	AD	R	B	I	PO
	Tchagra australis	Brown-crowned stingray	LC	AD	R	B	C	PR
	Tchagra senegalus	Black crowned snake shrike	LC	AD	R	B	C	PO
	Dryoscopus cubla	Cushion shrike austral	LC	AD	R	B	C	PO
	Laniarius major	Tropical shrike	LC	AD	R	B	C	RC
	Nilaus afer	Brubru	LC	AD	R	B	C	PO
Campephagidae	*Coracina pectoralis*	Grey-and-white lizard	LC	AD	R	B	I	PO

Family	Species	COMMON NAME	UIC N1	END.	MIGR A3	RIISC O4	ABUND.	PRES.5
	Campephaga flava	Black lizard	LC	AD	M	B	I	PO
Laniidae	*Lanius minor*	Little grey shrike	LC	AD	M	B	I	PO
	Lanius collaris	Common tax shrike	LC	AD	R	B	C	RC
Oriolidae	*Oriolus auratus*	African figwort	LC	AD	M	B	I	PO
	Oriolus larvatus	Black-headed figwort-oriental	LC	AD	R	B	C	PR
Dicruridae	*Dicrurus adsimilis*	Hard-tailed drones	LC	AD	R	B	C	RC
Monarchidae	*Terpsiphone viridis*	Paradise Flycatcher-common	LC	AD	R	B	C	PR
Corvidae	*Corvus capensis*	Cape hawk	LC	AD	R	B	I	PO
	Corvus albus	Gralha-seminarista	LC	AD	R	B	A	RC
Stenostiridae	*Elminia albicauda*	White-tailed blue	LC	AD	R	B	I	PO
Paridae	*Parus leucomelas*	White-winged tit	LC	AD	R	B	I	PO
Alaudidae	*Mirafra africana*	Red-necked lark	LC	AD	R	B	I	PR
	Mirafra rufocinnamomea	Cassowary lark	LC	AD	R	B	C	PO
	Pinarocorys nigricans	Shady lark	LC	AD	M	B	I	PO
	Chersomanes albofasciata	Sporade lark	LC	AD	R	B	I	PO
	Calandrella cinerea	Red-bellied lark	LC	AD	R	B	I	PO
	Eremopterix verticalis	Grey dorsal lark	LC	AD	R	B	I	PO
Pycnonotidae	*Pycnonotus tricolor*	Common black bulbul	LC	AD	R	B	C	RC
Hirundinidae	*Psalidoprocne pristoptera*	Common black swallow	LC	AD	M	B	C	RC
	Pseudhirundo griseopyga	Grey swallow	LC	AD	M	B	C	RC
	Riparia cincta	Great barn swallow	LC	AD	R	B	C	PO
	Hirundo rustica	Barn swallow	LC	AD	M	B	C	PO
	Hirundo albigularis	Throat Swallow white	LC	AD	M	B	C	RC
	Hirundo angolensis	Swallow from Angola	LC	AD	R	B	C	RC
	Hirundo smithii	Wire-tailed Swallow	LC	AD	R	B	C	PO
	Hirundo dimidiata	Pearl-breasted swallow	LC	AD	M	B	I	PO
	Ptyonoprogne fuligula	African rock swallow	LC	AD	R	B	C	PO
	Delichon urbicum	Swallow	LC	AD	M	B	C	PO
	Cecropis abyssinica	Lesser crested swallow	LC	AD	M	B	C	RC
	Cecropis semirufa	Red-breasted Swallow	LC	AD	M	B	I	PO
	Cecropis senegalensis	Mesquite Swallow	LC	AD	M	B	C	RC
Macrosphenidae	*Melocichla mentalis*	Whiskered nightingale	LC	AD	R	B	C	PO
Acrocephalidaand	*Acrocephalus rufescens*	Greater nightingale swamps	LC	AD	R	B	I	PO
	Acrocephalus gracilirostris	Marsh nightingale	LC	AD	R	B	I	PO

Family	Species	COMMON NAME	UICN1	END.	MIGRA3	RIISCO4	ABUND.	PRES.5
	Acrocephalus arundinaceus	Great Crested Nightingale	LC	AD	M	B	I	PO
	Acrocephalus schoenobaenus	Pitchfork	LC	AD	M	B	I	PO
	Acrocephalus baeticatus	Reed nightingale-African	LC	AD	M	B	I	PO
	Hippolais icterina	Felosa-icterina	LC	AD	M	B	I	PO
Locustellidae	*Bradypterus baboecala*	African juniper berries	LC	AD	R	B	I	PO
	Schoenicola brevirostris	Broad-tailed fluff	LC	AD	M	B	C	PO
Cysticolidae	*Cisticola lepe*	Weasel from Angola	LC	AD	R	B	C	PR
	Cisticola chiniana	Rattle weasel	LC	AD	R	B	C	RC
	Cisticola rufilatus	Red-tailed weasel	LC	AD	R	B	C	RC
	Cysticola lais	Weasel	LC	AD	R	B	I	PO
	Cisticola pipiens	Chilling weasel	LC	AD	R	B	I	PO
	Cisticola robustus	Robust weasel	LC	AD	R	B	I	PO
	Cisticola natalensis	Christmas weasel	LC	AD	R	B	C	PO
	Cisticola brachypterus	Short-tailed weasel	LC	AD	R	B	C	PO
	Cisticola fulvicapilla	Red-headed weasel	LC	AD	R	B	C	PO
	Cisticola ayresii	Weasel of Ayres	LC	AD	R	B	I	PO
	Prinia subflava	Brown-flowered prinnia	LC	AD	R	B	C	PO
	Camaroptera brevicaudata	Grey-browed Camaroptera	LC	AD	R	B	C	PO
	Calamonastes undosus	Mioombo Crab Feline	LC	AD	R	B	R	PO
	Eremomela icteropygialis	Yellow-bellied hermomela	LC	AD	R	B	R	PO
	Eremomela salvadorii	Eremomela de Salvadori	LC	AD	R	B	I	PO
	Eremomela scotops	Green barbell hermomela	LC	AD	R	B	I	PO
	Eremomela atricollis	Eremomela	LC	AD	R	B	I	PO
Leiothrichidae	*Turdoides jardineii*	Brown swab	LC	AD	R	B	I	PO
	Turdoides hartlaubii	Hartlaub's swabber	LC	AD	R	B	C	PO
Zosteropidae	*Zosterops senegalensis*	Yellow-white eye	LC	AD	R	B	C	PO
Hyliotidae	*Hyliota flavigaster*	Yellow-rumped godwit	LC	AD	R	B	C	PO
Certhiidae	*Salpornis spilonotus*	Climbing vine	LC	AD	R	B	I	PO
Sturnidae	*Creatophora cinerea*	Carunculate starling	LC	AD	R	B	C	PO
	Lamprotornis nitens	Cape starling	LC	AD	R	B	C	PO
	Cinnyricinclus leucogaster	Violet-breasted stork	LC	AD	M	B	C	PO
Turdidae	*Psophocichla litsitsirupa*	Pied-billed thrush	LC	AD	R	B	C	PO
	Turdus pelios	African thrush	LC	AD	R	B	I	PO
	Turdus libonyana	Chickadee thrush	LC	AD	R	B	I	PO
Muscicapidae	*Cossypha heuglini*	Cossifa de Heuglin	LC	AD	R	B	C	PO

Family	Species	COMMON NAME	UIC N1	END.	MIGR A3	RIISC O4	ABUND.	PRES.[5]
	Cossypha natalensis	Christmas cossip	LC	AD	M	B	R	PO
	Erythropygia leucophrys	Striated nightingale	LC	AD	R	B	C	PO
	Saxicola torquatus	Charterhouse	LC	AD	R	B	C	RC
	Oenanthe pileata	Barnet	LC	AD	R	B	R	PO
	Oenanthe monticola	Chasco-montese	LC	AD	R	B	I	PO
	Oenanthe familiaris	Chasco-familiar	LC	AD	R	B	C	PR
	Myrmecocichla nigra	Black anthill	LC	AD	R	B	C	RC
	Dioptrornis brunneus	Angolan flycatcher	LC	EE	R	B	R	PO
	Bradornis pallidus	Pale flycatcher	LC	AD	R	B	C	RC
	Muscicapa striata	Grey warbler	LC	AD	M	B	C	RC
	Muscicapa caerulescens	Blue-fronted flycatcher	LC	AD	R	B	I	PO
Nectarinidae	*Anthreptes longuearei*	Violet hummingbird	LC	AD	R	B	I	PO
	Chalcomitra amethystina	Black hummingbird	LC	AD	R	B	I	RC
	Chalcomitra senegalensis	Scarlet-breasted Hummingbird	LC	AD	R	B	C	PO
	Nectarinia kilimensis	Tan hummingbird	LC	AD	R	B	C	RC
	Cinnyris ludovicensis	Mountain hummingbird	LC	EE	R	B	I	PO
	Cinnyris oustaleti	Oustalet Hummingbird	LC	EQ	R	B	I	RC
	Cinnyris talatala	White-bellied hummingbird	LC	AD	R	B	R	PO
	Cinnyris venustus	Belly Hummingbird yellow	LC	AD	R	B	C	RC
	Cinnyris cupreus	Copper hummingbird	LC	AD	R	B	C	PO
Passeridae	*Passer domesticus*	House Sparrow	LC	AD	R	B	C	PO
	Passer diffusus	Southern grey-headed sparrow	LC	AD	R	B	C	PR
Ploceidae	*Ploceus ocularis*	Lunette weaver	LC	AD	R	B	C	PO
	Ploceus xanthops	Golden weaver	LC	AD	R	B	C	PO
	Ploceus cucullatus	Handloom weaver	LC	AD	R	B	C	PR
	Quelea quelea	Red-billed Quelea	LC	AD	R	B	C	PO
	Euplectes hordeaceus	Crowned cardinal-tecellar red	LC	AD	R	B	C	PO
	Euplectes capensis	Uropygian cardinal-techelon - yellow	LC	AD	R	B	C	RC
	Euplectes axillaris	Red spade widow	LC	AD	R	B	C	RC
	Euplectes macroura	Yellow-bellied widow	LC	AD	R	B	C	PO
	Euplectes ardens	Red-collared widow	LC	AD	R	B	C	RC
	Euplectes progne	Widow-rabilong	LC	AD	R	B	I	PO
Estrildidae	*Pytilia afra*	Golden-winged Maracachão	LC	AD	R	B	C	RC
	Pytilia melba	Green-winged teal	LC	AD	R	B	C	PO
	Lagonosticta nitidula	Brown fire breast	LC	AD	R	B	C	RC
	Lagonosticta senegala	Red-bellied fire breast	LC	AD	R	B	I	PO

Family	Species	COMMON NAME	UICN1	END.	MIGRA3	RIISCO4	ABUND.	PRES.[5]
	Lagonosticta rhodopareia	Jameson's fire breast	LC	AD	R	B	C	PO
	Uraeginthus angolensis	Sky-breast	LC	AD	R	B	C	RC
	Coccopygia bocagei	Bico-de-lacre de Angola	LC	EE	R	B	I	PO
	Estrilda paludicola	Lack-of-head beak-grey	LC	AD	R	B	C	RC
	Estrilda astrild	Common lacewing	LC	AD	R	B	C	RC
	Lonchura cucullata	Tan Nun	LC	AD	R	B	C	PR
Viduidae	*Vidua chalybeata*	Blue Widow	LC	AD	R	B	I	PO
	Vidua purpurascens	Purple widow	LC	AD	R	B	C	PO
	Vidua macroura	Widowhood	LC	AD	R	B	C	PO
	Vidua paradisaea	Paradise-rabilong widow	LC	AD	R	B	C	PO
	Vidua obtusa	Widow-of-paradise-rabilarga	LC	AD	R	B	C	PO
Fringilidae	*Crithagra capistrata*	Black-faced canary	LC	AD	R	B	I	PO
	Crithagra atrogularis	Black-throated canary	LC	AD	R	B	I	PO
	Crithagra mozambica	Mozambique canary	LC	AD	R	B	C	RC
	Crithagra sulphurata	Sunflower canary	LC	AD	R	B	I	PO
Emberizidae	*Emberiza tahapisi*	Stone scribbler	LC	AD	R	B	C	RC
	Emberiza flaviventris	A breaststroker gold	LC	AD	R	B	C	RC

Legend: [1] (IUCN): LC - Least Concern; DD - Data Insufficient; NT - Near Threatened; VU - Vulnerable; EN - Endangered; CR - Critically Endangered; [2] (ENDEMISM): AD - Widely Distributed; EE - Endemic Species; QE - Nearly Endemic Species; SE - Endemic Subspecies; [3] (MIGRA): R - Resident; M - Migratory; [4] (RISK): A - High; M - Medium; B - Low; [5] (PRESENCE): RC - Confirmed Record PR - Probable; PO - Possible; NE - Not Expectable.

Table 9-3: List of species (mammals) that occur in the project area.

Family	Scientific Names	Names in Portuguese	UICN1	END.[2]	ABUND.[3]	PRES.[4]
Canidae	*Canis adustus*	Rayed jackal	LC	AD	F	PO
Felidae	*Felis silvestris*	Wildcat	LC	AD	I	PO
Herpestidae	*Atilax paludinosus*	Marsh mangrove	LC	AD	(	RC
	Herpestes ichneumon	Corkscrew	LC	AD	(	PO
	Herpestes sanguineus	Little red mangrove	LC	AD	(	PO
	Mungos mungo	Striped mongoose	LC	AD	(	PO
Viverridae	*Civettictis civetta*	African civet	LC	AD	(	PO
	Genetta angolensis	Geneta de Angola	LC	AD	I	PO
	Genetta maculata	Red-breasted genet	LC	AD	(	PO
Bovidae	*Sylvicapra grimmia*	Common bush goat	LC	AD	I	PO
Rhinolophidae	*Rhinolophus fumigatus*	Horseshoe Bat by Rüppell	LC	AD	I	PO
Vespertilionidae	*Neoromicia capensis*	Cape Pipistrelle	LC	AD	I	PO
Procaviidae	*Heterohyrax brucei bocagei*	Bocage's Damon	LC	SE	(	PO
Leporidae	*Lepus victoriae*	African common hare	LC	AD	(	RC

Family	Scientific Names	Names in Portuguese	UICN1	END.[2]	ABUND.[3]	PRES.[4]
Macroscelididae	*Elephantulus brachyrhynchus*	Elephant shrew short	LC	AD	C	PO
Cercopithecidae	*Papio kindae*	Yellow baboon	LC	AD	R	PO
Bathyergidae	*Fukomys mechowi*	Mechow's mole rat	LC	AD	I	PO
Hystricidae	*Hystrix africaeaustralis*	Southern porcupine	LC	AD	C	PO
Muridae	*Dasymys incomtus*	Swamp Rat	LC	AD	C	PO
	Gerbilliscus leucogaster	Peter's gerbil	LC	AD	C	PO
	Gerbilliscus validus	Savannah gerbil	LC	AD	C	PO
	Grammomys dolichurus	Woodrat	LC	AD	C	PO
	Mastomys natalensis	Multiple-nipple mouse	LC	AD	C	PR
Petromuridae	*Funisciurus congicus*	White-striped squirrel	LC	AD	C	PO

Legend: [1] (IUCN): LC - Least Concern; DD - Data Insufficient; NT - Near Threatened; VU - Vulnerable; EN - Endangered; CR - Critically Endangered; [2] (ENDEMISM): AD - Widely Distributed; EE- Endemic Species; QE - Nearly Endemic Species; SE - Endemic Subspecies; [3] (ABUNDANCE): A - Abundant; C - Common; I - Uncommon; R - Rare; [4] (PRESENCE): RC - Confirmed Record PR - Probable; PO - Possible; NE - Not Expectable.

Table 9-4: List of species (reptiles) that occur in the project area.

Family	Scientific Names	Names in Portuguese	UICN1	END.[2]	ABUND.[3]	PRES.[4]
Testudinidae	*Kinixys spekii*	Peaked back turtle	NE	AD	I	PO
Gekkonidae	*Aphroedura wulfaackei*	Angolan gecko	NE	EE	R	RC
	Chondrodactylus pulitzerae	Pulitzer gecko	NE	AD	C	PR
	Hemidactylus mabouia	Tropical house gecko	NE	AD	C	PR
	Lygodactylus angolensis	Angola dwarf gecko	NE	EQ	C	PO
Lacertidae	*Ichnotropis bivittata bivittata*	Angolan spider lizard	NE	AD	C	PO
Gerrhosauridae	*Gerrhosaurus nigrolineatus*	Line-plate lizard-black	NE	AD	C	PR
	Panaspis wahlbergii	Wahlberg's snake-eyed lizard	NE	AD	I	PO
	Trachylepis albopunctata	Variable Angolan lizard	NE	AD	C	PR
	Trachylepis bayonii	Bayonet lizard	DD	EQ	C	RC
	Trachylepis spilogaster	Kalahari tree lizard	NE	AD	C	RC
	Trachylepis sulcata	Western rock lizard	NE	AD	C	RC
	Trachylepis wahlbergii	Wahlberg's striped lizard	NE	AD	C	RC
Chamaeleonidae	*Chamaeleo dilepis quilensis*	Common chameleon	LC	AD	C	RC
Agamidae	*Acanthocercus cyanocephalus*	Agama-das-arvores-de-angola	LC	AD	C	PO
	Agama aculeata	Agama do chão	LC	AD	C	RC
	Agama schacki	Sack-stone agama	NE	EE	C	RC
Viperidae	*Bitis arietans*	Surucucu	NE	AD	C	PO
Lamprophiidae	*Boaedon angolensis*	Angolan house snake	NE	EE	C	PO

Family	Scientific Names	Names in Portuguese	UICN1	END.²	ABUND.³	PRES.⁴
	Hemirhagerrhis viperina	Western hognose snake	NE	AD	I	PO
	Lycophidion multimaculatum	Spotted wolf snake	NE	AD	I	PO
	Psammophis leopardinus	Sand leopard snake	NE	AD	C	PO
	Psammophis mossambicus	Olive snake	NE	AD	C	RC
	Psammophylax tritaeniatus	Skaapsteker's striped snake	LC	AD	C	PO
Elapidae	*Naja nigricollis*	Black-necked spitting cobra	NE	AD	C	PO
Colubridae	*Crotaphopeltis hotamboeia*	Red-lipped snake	NE	AD	C	PO
	Dasypeltis scabra	Egg-eating snake common	LC	AD	C	PO
	Dispholidus typus punctatus	Speckled snake	NE	AD	C	PO

Legend: [1] (IUCN): LC - Least Concern; DD - Data Insufficient; NT - Near Threatened; VU - Vulnerable; EN - Endangered; CR - Critically Endangered; [2] (ENDEMISM): AD - Widely Distributed; EE- Endemic Species; QE - Nearly Endemic Species; SE - Endemic Subspecies; [3] (ABUNDANCE): A - Abundant; C - Common; I - Uncommon; R - Rare; [4] (PRESENCE): RC - Confirmed Record PR - Probable; PO - Possible; NE - Not Expectable.

Table 9-5: List of species (amphibians) that occur in the project area.

Family	Scientific Names	Names in Portuguese	IUCN1	END.²	ABUND.³	PRES.⁴
Pipidae	*Xenopus petersii*	Rã-de-unhas-de-Peter	LC	AD	C	PR
Bufonidae	*Sclerophrys pusilla*	Cheeky toad	LC	AD	C	RC
	Sclerophrys regularis	Common African toad	LC	AD	C	PO
Hyperoliidae	*Hyperolius angolensis angolensis*	Rela-vermelha-de-angola	LC	AD	C	RC
	Hyperolius benguellensis	Long-lasting relationship	LC	AD	C	PO
	Hyperolius cinereus	Monard relationship	LC	EE	C	RC
	Hyperolius nasutus	Comparative relationship pointed	LC	AD	C	PR
	Kasina kuvangensis	Kasina-do-kuvango	LC	AD	C	PO
Arthroleptidae	*Leptopelis anchietae*	Tree frog	LC	EE	C	PR
	Leptopelis bocagii	Arboricultural frog bocage	LC	AD	C	PR
Ptychadenidae	*Ptychadena oxyrhynchus*	Rocket frog	LC	AD	C	PO
	Ptychadena porosissima	Rocket frog	LC	AD	I	PO
Phrynobatrachidae	*Phrynobatrachus parvulus*	Rã-das-poças-anã	LC	AD	I	PO
	Phrynobatrachus natalensis	Common frog	LC	AD	C	RC
Pyxicephalidae	*Amietia angolensis*	Rã-do-rio-de-angola	LC	AD	I	PO
	Tomoptera tuberculosa	Rã-de-areia-de-pele-rugosa	LC	AD	C	PR

Legend: [1] (IUCN): LC - Least Concern; DD - Data Insufficient; NT - Near Threatened; VU - Vulnerable; EN - Endangered; CR - Critically Endangered; [2] (ENDEMISM): AD - Widely Distributed; EE - Endemic Species; QE - Nearly Endemic Species;

SE - Endemic Subspecies; [3] (ABUNDANCE): A - Abundant; C - Common; I - Uncommon; R - Rare; [4] (PRESENCE): RC - Confirmed Record PR - Probable; PO - Possible; NE - Not Expectable.

Annex 10 - Project information leaflet

ESTUDO DE IMPACTE AMBIENTAL E SOCIAL DO PROJECTO DA LINHA DE TRANSMISSÃO 220 KV ENTRE BELÉM DO DANGO E LONGONJO, PROVÍNCIA DO HUAMBO

Histórico

A empresa Ozango Minerais S.A. possui um Título de Prospecção para metais ferrosos, elementos de terras, metais raros e metais preciosos. Foi-lhe concedida a Licença de Exploração Mineira para o Projecto Mineiro de Neodímio – Praseodímio (NdPr) localizado no Longonjo na província do Huambo, que inclui a construção de uma mina com exploração a céu aberto, a pouca profundidade e com longo tempo de vida útil, incluindo uma lavaria para tratamento e beneficiação do minério.

A inexistência de uma linha de transmissão poderá comprometer o arranque e funcionamento deste Projecto que é de vital importância para o desenvolvimento da região pelo que a Ozango Minerais pretende construir uma linha de transmissão de 220 kV entre a subestação de Belém do Dango e a futura subestação da Mina de Longonjo. Tendo em consideração os potenciais impactes deste Projecto está a ser desenvolvido o respectivo Estudo de Impacte Ambiental e Social (EIAS), para apoiar o Licenciamento Ambiental de todas as actividades relacionadas ao Projecto.

1

Descrição do Projecto

Com o objectivo de estabelecer a ligação a 220 kV entre a Subestação de Belém do Dango (existente e em funcionamento) e a Subestação da Mina de Longonjo (por construir) para proceder ao estabelecimento de uma linha de distribuição de energia eléctrica que irá alimentar a mina. A linha de transmissão terá um comprimento aproximadamente de 48 km estando prevista a implantação de cerca de 136 torres metálicas com uma envergadura aproximada de 16 metros. Para a manutenção das torres durante a operação da linha de transmissão será mantido o corredor de 45 metros.

As actividades necessárias e de apoio à execução do Projecto incluirão a instalação dos estaleiros de apoio à obra, sinalização e abertura de acessos, desminagem de possíveis engenhos explosivos não detonados, desmatação, abertura ou criação da faixa de protecção, trabalhos de topografia, trabalhos de construção dos maciços de fundação, montagem das bases, colocação de dispositivos de balizagem aérea e a sinalização de advertências diversas, entre outros.

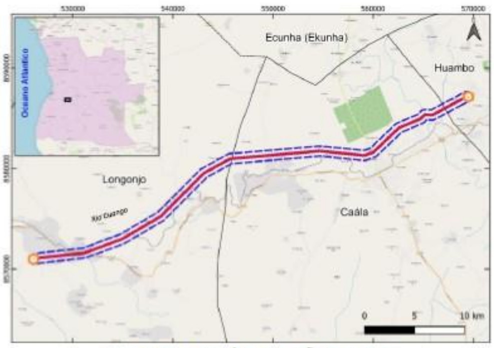

Figura 1: Pormenor da área de inserção do projecto.

A fase de construção da linha de transmissão irá decorrer por um período de 12 meses e estima-se que o Projecto empregará 70 pessoas na fase de construção. Espera-se que o Projecto tenha uma vida útil de pelo menos 40 anos.

2

Estudo de Impacte Ambiental e Social

De acordo com o Decreto Presidencial n.º 117/20 de 22 de Abril sobre o Regulamento Geral de Avaliação de Impacte Ambiental e do Procedimento de Licenciamento Ambiental um Projecto desta natureza requer uma Licença Ambiental para a sua implementação.

Deste modo, está a ser elaborado um Estudo de Impacte Ambiental e Social (EIAS) tendo em conta a legislação ambiental em vigor e as boas práticas internacionais. O objectivo do EIAS é a descrição do projecto e da situação de referência ambiental e social da área de implementação do mesmo assim como a identificação e análise prévia de como as actividades do Projecto resultarão em potenciais impactes sobre as componentes ambientais (ar, água, solo, vegetação, fauna, *habitats* sensíveis, patrimónios culturais, etc.) e a qualidade de vida das pessoas e comunidades (incluindo povos indígenas) próximas a área de concessão. O EIAS também visa propor medidas exequíveis para evitar, minimizar ou compensar o ambiente e as comunidades dos impactes identificados.

A caracterização ambiental e social da área de influência do Projecto será feita através de análise documental, levantamentos de campo e estudos de base especializados para as seguintes componentes:

. Clima e Meteorologia
. Geologia e Geomorfologia
. Fisiografia
. Pedologia (solos)
. Hidrologia
. Flora e Fauna
. Ambiente Sonoro
. Qualidade da Paisagem
. Uso da Terra
. Socioeconomia
. Património Histórico e Cultural
. Áreas de Conservação Ambiental e Espécies Ameaçadas

Questões Fatais

Neste tópico será feita uma análise daquelas questões que poderão ser consideradas como sendo questões fatais (com base no Anexo V do Decreto Presidencial n.º 117/20 de 22 de Abril) que possam impedir a implementação do Projecto de Linha de Transmissão. Da análise preliminar efectuada não foram constatadas questões fatais.

Auscultação às Partes Interessadas

A Holísticos irá realizar encontros com as Administrações Municipais do Huambo, Caála e Longonjo, com autoridades tradicionais e outras partes interessadas onde serão abordados detalhes do Projecto e os potenciais impactes ambientais, sociais e culturais (positivos e negativos). Com o objectivo de divulgar amplamente o Projecto serão realizados encontros de auscultação pública das partes directamente afectadas.

A etapa de auscultação pública é de extrema importância para o processo de EIAS, uma vez que o processo possibilita o exercício conjunto e participativo de identificação de preocupações e expectativas face ao Projecto, avaliação justa e completa dos potenciais impactes do Projecto, bem como a definição de medidas de mitigação adequadas.

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Potenciais impactes

Os principais impactes identificados incluem:

Fase de Instalação

Positivos
- Criação de empregos.
- Dinamização socioeconómica.

Negativos
- Perda e perturbação de habitats.
- Perda permanente dos recursos do solo.
- Alteração do ambiente sonoro da área.
- Redução pontual da qualidade do ar.
- Afectação da fauna e flora.

Fase de Operação

Positivos
- Criação de empregos.
- Dinamização socioeconómica regional.
- Desenvolvimento associado ao funcionamento da mina.
- Redução dos gases de efeito de estufa.
- Melhoria da qualidade de vida.

Negativos
- Alteração da paisagem.
- Perturbação da avifauna.
- Risco de acidentes.

Plano de Gestão Ambiental e Social

Será desenvolvido um Plano de Gestão Ambiental e Social que irá contemplar as principais medidas de mitigação e compensação do Projecto e que estará assente num conjunto de outros planos previstos pela legislação ou solicitados pelas autoridades.

- ✓ Plano de Gestão de Resíduos.
- ✓ Plano de Engajamento com as Partes Interessadas.
- ✓ Plano de Acção de Reassentamento.
- ✓ Plano de Formação em Saúde, Segurança e Ambiente.

Próximos Passos

De forma a complementar o processo do EIAS, vão ser concluídos levantamentos ambientais, socioeconómicos e culturais nos municípios do Huambo, Caála e Longonjo na província do Huambo. Após a finalização do EIAS, o mesmo será submetido às autoridades governamentais responsáveis pela actividade do Projecto e ambiental em Angola (Ministério da Energia e Águas e o da Cultura, Turismo e Ambiente) para aprovação.

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Annex 11 - Holísticos certificate

República de Angola

MINISTÉRIO DA CULTURA, TURISMO E AMBIENTE

GABINETE JURIDICO

CERTIFICADO DE CONSULTORIA AMBIENTAL

N.º 12159922221

O Gabinete Jurídico do Ministério da Cultura, Turismo e Ambiente, atesta que foram cumpridas todas as formalidades legais conducentes ao Registo Técnico da Sociedade de Consultoria Ambiental HOLISTICOS SERVICOS, EST.& CONSULTORIA, LIMITADA, nos termos do Decreto Executivo nº 86/12, de 23 de Fevereiro de 2012, que aprova o Regulamento sobre o Registo Técnico de Sociedade de Consultoria Ambiental.

Emitida em,	Válida até,
25 de Março de 2022	25 de Março de 2023

Assinatura

REPÚBLICA DE ANGOLA
MINISTÉRIO DA CULTURA TURISMO E AMBIENTE
Gabinete Jurídico
LUANDA

DANIEL JOÃO JORGE

(DIRECTOR DO GABINETE JURÍDICO)

A autenticidade deste documento poderá ser verificada através dos passos a seguir:
1. Aceda ao Portal MINAMB (https://sia.minamb.gov.ao/validacaodocumentos)
2. Introduza o código **RCCONST-MTI2OTY2Mzk=** no campo "Código de Validação"
3. Clique em "Pesquisar"
Número do Certificado: **12159922221**

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