



**Environmental and Social Impact
Assessment for the Utility Scale
Project in Laúca, Malanje
Province**

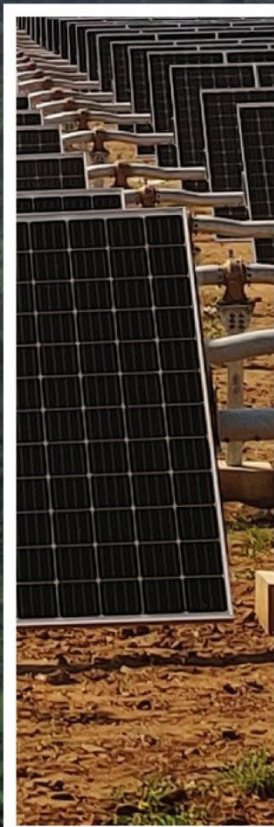
Non-Technical Summary



Sun Africa
Renewable energy solutions



OMATAPALO
ENGENHARIA E CONSTRUÇÃO



OCTOBER 2022

**Environmental and Social Impact Assessment for the Utility
Scale Project in Laúca, Malanje Province**
Non-Technical Summary



Sun Africa
Renewable energy solutions

OMATAPALO
ENGENHARIA E CONSTRUÇÃO

Clients:

Sun Africa LLC

Address: 801 Brickell Ave, Ste 1400, Miami, FL 33131, USA

Focal point: Isabel Caravana; Gennaveve Brizendine

E-mail: ica@sunafrica.com; gbr@sunafrica.com

Omatapalo Inc.

Address: 300 Delaware Ave, Suite 210, DE 19801, USA

Omatapalo – Engenharia e Construções, S.A.

Address: Edifício Kilamba, Piso 15, Avenida Marginal de Luanda,
Angola

Focal point: Maria Helena Mil Homens

E-mail: mariamilhomens@omatapalo.com

Websites: www.sunafrica.com / www.omatapalo.com

Ministry of Energy and Water

Address: PRODEL-E.P.- Empresa Pública de Produção de
Electricidade, Rua Cónego Manuel das Neves, n.º 234, Luanda

Focal Point: Joaquim Ventura, Benício Pedro Machado

E-mail: Joaquim.ventura@prodel.co.ao

Website: www.minea.gv.ao

Version	Date	Description
V.1	21/09/2022	First draft for JTM review
V.2	06/10/2022	Second draft for JTM review
V.3	10/10/2022	Final version

Environmental Consultant
Company

Holísticos, Lda. –

Serviços, Estudos &
Consultoria

Rua 60, Casa 559
Urbanização Harmonia
Lar do Patriota
Luanda, Angola

Contacts:

(+244) 226 434 549

(+244) 927 442 844

(+244) 915 034 779

E-mail:

holisticos@gmail.com

holisticos@holisticos.co.ao
[o](mailto:holisticos@holisticos.co.ao)

Website:

www.holisticos.co.ao

Facebook:

[http://www.facebook.co
m/holisticos.angola](http://www.facebook.com/holisticos.angola)



Index

1. Introduction	1
2. Legal Framework.....	1
3. Project Description	2
4. Environmental and Social Baseline	5
5. Assessment of the Potential Impacts and Mitigation Measures	14
6. Environmental and Social Management Plan	15
7. Final Remarks.....	25

List of Acronymous

CFP	Chance Find Procedure
CGGC	Chinese civil construction services company
CMP	Construction Management Plan
CR	Critically Endangered
EIL	Environmental Installation License
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
EPRP	Emergency Preparedness and Response Plan
EWMP	Employment and Workforce Management Plan
GHG	Greenhouse Gas
GM	Grievance Mechanism
HV	High voltage
IFC	International Finance Corporation
IUCN	International Union for Conservation of Nature
LVEA	Lista Vermelha de Espécies de Angola (Angola's Red List of Species)
LCCP	Local Employment and Procurement Plan
LRP	Livelihood Restoration Plan
MCTA	Ministério da Cultura, Turismo e Ambiente (Ministry of Culture, Tourism and Environment)
MINEA	Ministério de Energia e Águas (Ministry of Energy and Water)
NTS	Non-Technical Summary
PM	Particulate Matter
PV	Solar Photovoltaic
SEP	Stakeholder Engagement Plan
TMP	Traffic Management Plan
VU	Vulnerable
WMP	Waste Management Plan



Sun Africa
Renewable energy solutions

OMATAPALO
ENGENHARIA E CONSTRUÇÃO

1. Introduction

The present document is the Non-Technical Summary (NTS) of the Environmental and Social Impact Assessment (ESIA) for the Utility Scale Project in Laúca, Malanje Province. This project comprises a power plant with 400 MWp/294.8 MWac that will be connected via 400 kV high voltage (HV) lines to the national electricity grid, to be developed by Sun Africa and constructed by Omatapalo.

The ESIA report was developed to meet the requirements of Executive Decree No. 117/20 of April 22nd, which determines the mandatory environmental impact assessment (EIA) of all projects likely to cause potential environmental and socio-economic impacts. In conformity with the same Decree, projects must be classified according to their category based on a list of specifications and the nature of the project. Per the rules set by Article 9, the proposed project is classified as Category B (Presidential Decree No. 117/20, Appendix II, item 35/a) Hydroelectric power plants; thermal power stations; geothermal installations; photovoltaic, wind and wave energy projects).

The NTS is an integral part of the ESIA and was developed aiming to assess the environment in the project area and surroundings, as well as briefly presenting the potential negative and positive impacts resulting from the actions of the project. It is also intended to indicate the measures related to the minimization and maximization of impacts and to define the Environmental and Social Management Plan (ESMP).

The engineering and environmental consulting firm Jonathan T. Motherwell and Associates LLC (dba JTM) performed a gap analysis of the ESIA and this NTS (final draft) on behalf of the developer, Sun Africa LLC, and the EPC Contractor, Omatapalo, Inc. JTM has substantial experience providing world-class environmental & social consultancy services for energy projects worldwide, with particular expertise in projects involving sustainable international financing. The firm's international experience ranges from the United States to Brazil, Peru, Ecuador, Iraq, Kazakhstan, Korea, Indonesia, Papua New Guinea, Ghana, Mozambique, and South Africa.

2. Legal Framework

The current state of the country's electricity supply remains a high-risk factor in Angola's economic instability, as no commercial venture or international business can thrive without a stable and reliable supply of electricity. The energy consumption in Angola is mostly urban and residential.

This Project will serve to improve the reliability and quality of the electricity delivered by the Angolan national grid. The project will improve the efficiency, reliability, and sustainability of its electricity industry. Further, solar power provides a sustainable and clean way to generate electricity, which is aligned with the long-term growth of Angola.

The Ministry of Energy and Water (MINEA) was restructured under Decree No. 223/20 of August 28th. It proposes, formulates, manages, conducts, executes, and controls the Executive policy in the domains of energy, water, and sanitation. The Ministry of Culture, Tourism and Environment (MCTA), established under Presidential Decree No. 162/20 of June 8th, is responsible for formulating, conducting, monitoring, evaluating, and enforcing policies in the fields of culture, tourism, and the environment. This includes the implementation of strategic programs and projects to promote culture, tourism development, and environmental management.

In case of approval of the ESIA, the MCTA shall issue an Environmental Installation License (EIL) on behalf of the project proponent and indicate in it, which mitigation measures should be implemented and the respective environmental management program to be complied with as indicated in Decree No. 117/20 of April 22nd.

The ESIA report also considers the International Finance Corporation (IFC) performance standards and the Equator Principles which are adopted by the Project.

3. Project Description

The Utility-Scale Project in Laúca is illustrated in **Figure 1** and will be located near the Laúca hydro power dam in Cacuso municipality, in the Muta village in Malanje Province. The project portfolio consists of both a utility-scale solar photovoltaic (PV) plant and the associated high voltage (HV) interconnection infrastructure (of approximately 5.5 km) necessary to connect to the existing electric grid and Laúca substation (see **Figure 2**). This project covers an area of 1,000 hectares and will have an installed capacity of 400 MWp.

The Project will consist of a ground-mounted solar PV module that employs mono-crystalline silicon PV technology, which will be linked to a single-axis tracking mounting structure. The main components of a solar PV power plant are PV modules, mounting (or tracking) systems, inverters, the balance of the system, transformers, and the delivery station.

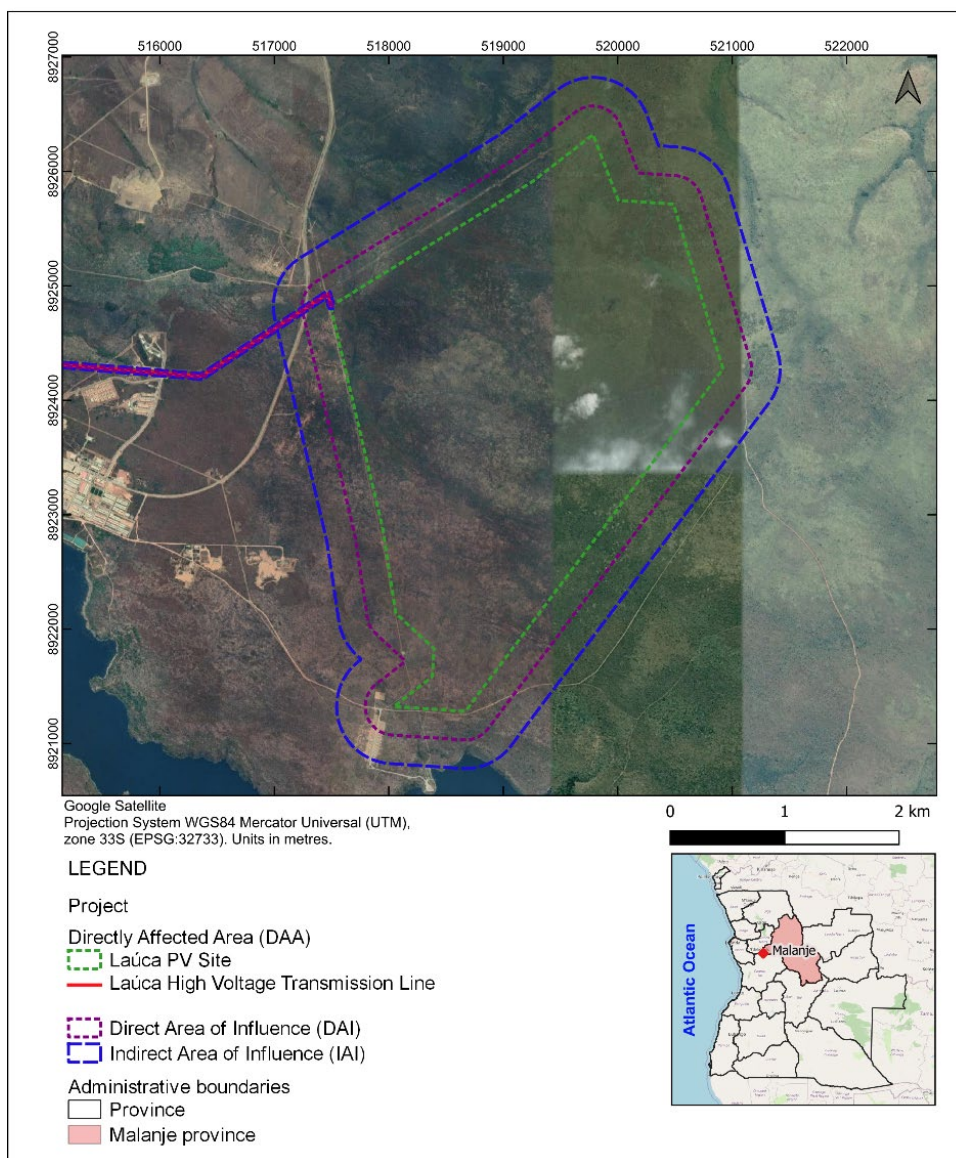


FIGURE 1: PROJECT LOCATION.

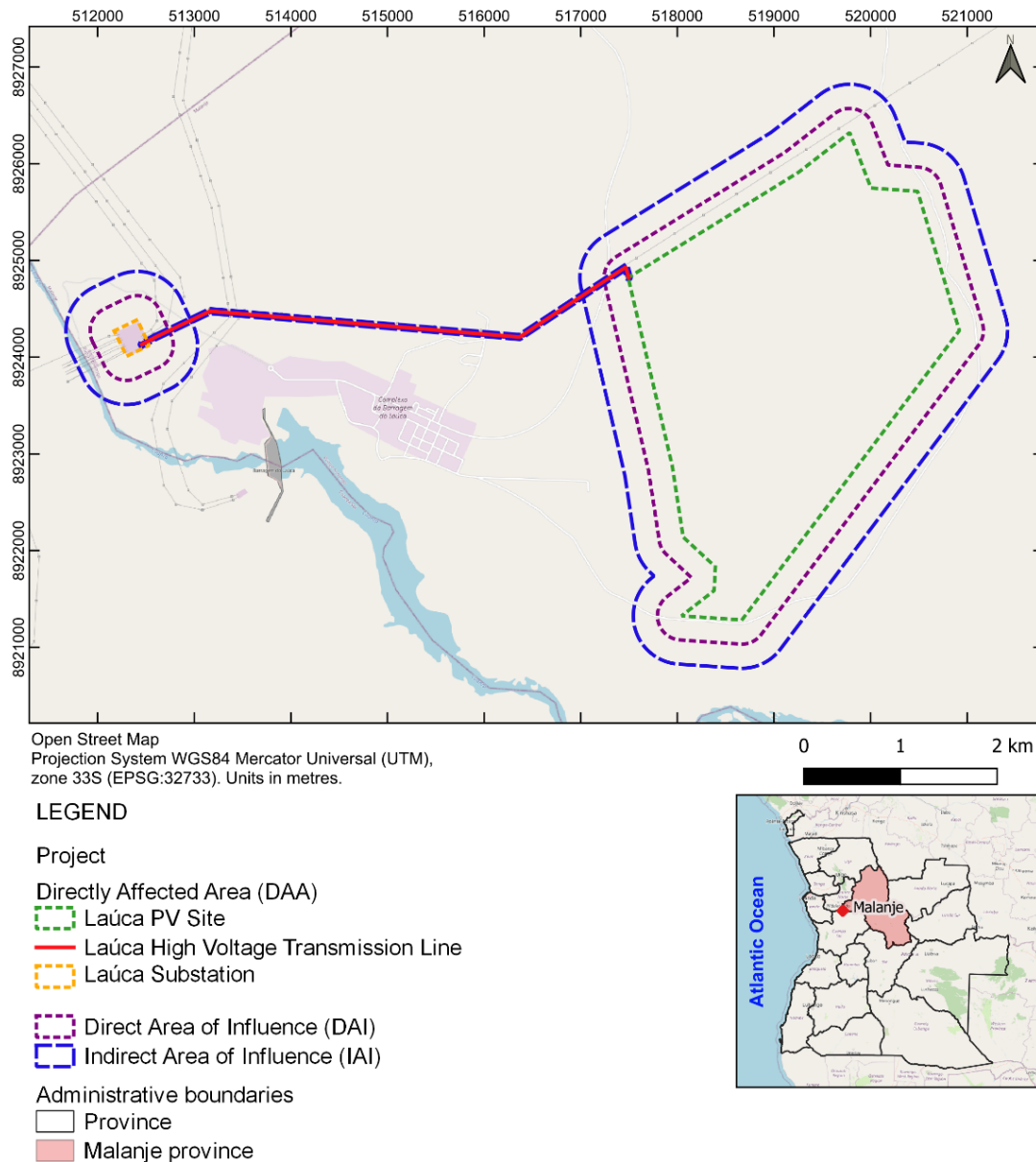


FIGURE 2: PROJECT LAYOUT.

For the PV park location, three initial sites were considered in Laúca Dam and its substation's surrounding areas. During the selection process aspects such as steep mountain slopes, solar resources, available areas, land use, local regulations, accessibility, grid connection, water availability, etc., were considered. Size limitations, physical constraints, and potential physical and/or economic resettlement were also reasons for these two sites to be screened out.

For the pre-selected sites, the following criteria was used to assess the benefits: Availability of land for unrestricted and fit-for-purpose development of the Project; Larger footprint to store equipment and materials; Topography of the area to facilitate ground leveling; Water availability for the operation phase; Long-term economic benefits arising from the development and integration of the Project into the local industry; and Access to the local workforce (during the construction and operation phases).

Technical requirements, such as production efficiency, maintenance requirements, safety issues, proximity to the grid network for power transport and the transmission line route were also considered for the site selection. In parallel, contact with local authorities were established to verify the existence of settlements and economic activities within the selected site for validation. Additionally, drone imagery was carried out to identify environmental and social sensitivities inside the site. At every level of potential site assessment, the project proponents sought to avoid areas that would be acutely impacted by potential negative impacts of the project and to select a site that would necessitate as few minimization, mitigation, and compensation efforts as feasible.

4. Environmental and Social Baseline

The section provides a description of the current environmental and social baseline of the proposed area, based on bibliographic research (previous studies on the area including Holísticos reports) and site visits. The following elements are presented: physical (climate, air quality and noise, geology and geomorphology, hydrology); biological (flora and fauna); and socio-economic conditions. A field survey was conducted from 2nd to 4th August 2022.

Climate

In Angola, the climate in the area is generally tropical and two (2) seasons are identified: the rainy season and the dry season (Cacimbo). According to the Köppen climatic classification, Malanje province has two different climates: a tropical savanna climate (Aw) (for most of the province, including the study area) and a subtropical highland oceanic climate (CwB). The average daily high temperature in Malanje for the rainy season is above 31.1°C, *with September being the hottest month* (average high of 32.2°C and low of 17.2°C). *In the dry season, the average daily high temperature is below 27°C. The coldest month is June, with an average low of 13°C and a high of 28.8°C.*

Geology

The project is in the Malanje plateau, which is one of eleven (11) mesological units defined in Angolan territory, which is characterized as gently wavy with 1000-1250 m of altitude and abruptly falls several hundred meters on its northeast bank to the lower Cassanje and the drainage of Cuango. The project is inserted in lithographic structures covered in two big geological Eras, Superior Proterozoic (Western Congo group) and Inferior Proterozoic (Oendolongo group) from the Precambrian Eon. Both are composed mainly of sedimentary rocks as Sandstone schists, Greywacke, Quartz and conglomerates.

Pedology

The province of Malanje is part of the second group of main soils in Angola named by ferralytic soils, derived from underlying rocks (gnaisses, granites, limestones and quartzites from the Western Congo group). These soils cover approximately 23% of Angola and have a low water retention capacity, being strongly leached in areas of higher precipitation. According to the Generic Characteristics of the soils, the project area are mainly Alisoils and Lixisoils. The Alisoils occur in the tropics and subtropics, and in the warm temperate regions of the world in relatively young landscapes. The high level of exchangeable aluminium in these soils is caused by rapid weathering of secondary high-activity clays such as vermiculite and smectite and the Lixisoils occur dominantly in the drier parts of the tropics and subtropics. Their high base status is partly due to less leaching, partly to admixture from airborne dust from adjacent desert regions.

Hydrology

The project's insertion area is in the Middle Cuanza Hydrographic Basin, on the right bank of the river. The southern boundary is located approximately 500 m from the Cuanza River. The medium stretch of the Kwanza River basin, where the project is located, covers an area of approximately 54,537 km², with an elongated configuration in the latitudinal direction with an approximate length of 435 km and a lateral width of 350 km. The main tributaries are the rivers Lucala, Mucoso, Lombe, Kuiji and Kuque, on the right bank, and N'Gango, Mui, Luinga and Buiza, on the left bank. Among these, the Lucala and Ngango rivers stand out due to the dimensions of their hydrographic basins.

Air Quality

Solar energy has enormous potential to mitigate climate change by directly reducing emissions, including Greenhouse Gas (GHG) emissions. By knowing the air quality data, it is possible to determine the degree of control and the technological, human, and financial resources required to mitigate the impacts of air pollution on the environment and human health. There is no air quality legislation in Angola. In this context, the International Finance Corporation (IFC) guidelines and best practices were used as applicable to the project (see **Table 1**).

TABLE 1: IFC GUIDELINES FOR AIR EMISSIONS AND AMBIENT AIR QUALITY.

Pollutant	Averaging time	Air quality guidelines
PM_{2.5} (mg/m³)	Year average	0.035
	24-hours	0.075

Source: IFC, 2007.

Spot air quality measurements were taken on 2nd of August 2022 (for P1) and 3rd of August 2022 (for the remaining points). The measurements were taken using a Haz-Dust equipment (Particulate matter-PM monitor) model EPAM-5000 properly calibrated with a Hold Peak HP-866B Pro Anemometer. From the results obtained (see **Table 2**), it appears that the maximum values for all points sampled are above the permissible threshold (24 hours averaging time) defined by the Air Quality Guidelines (IFC Air Emissions and Ambient Air Quality). However, it is necessary to emphasize the traffic in the vicinity of the sampled areas (road EN 322). For P4, the area is part of the Laúca Hydroelectric Project and vehicles used to work on the dam pass through.

TABLE 2: PARTICULATE MATTER (PM_{2.5}) MEASUREMENT RESULTS.

Ref	GPS	Temp.	Wind	Wind (m/s) *		Parameters (mg/m³)			
	Coordinates			(°C)	Direction	Max	Min	Max	Min
Day Time									
P1	9°43'32"S 15°9'33"E	22	SE	2.0	0.1	0.438	0.020	0.045	0.054
P2	9°43'58"S 15°6'50"E	19.9	SE	1.4	1.1	0.174	0.009	0.041	0.056
P3	9°41'36"S 15°10'41"E	25.8	SE	2.3	1.5	0.086	0.002	0.032	0.042
P4	9°45'86"S 15° 9'49.85"E	29.9	SE	3.3	1.3	0.298	0.007	0.037	0.053

Key: STEL - Short-Term Exposure Limit; TWA - Time-Weighted Average.

Noise

In Angola, there is no guidance on noise levels during the exploratory or operational preparation phase. However, IFC's Environment, Health, and Safety (EHS) guidelines provide criteria and guidelines that have

been adopted in this project. Table 1.7.1 of IFC's EHS guidelines is shown in **Table 3**, taken directly from the IFC document.

TABLE 3: NOISE LEVELS ACCORDING TO IFC GUIDELINES ON EHS

Receptor	Established Noise Levels – 1-hour LAeq, dB(A)	
	Daytime (07:00 – 22:00)	Night-time (22:00 – 07:00)
Residential, industrial and educational zones	55	45
Industrial, commercial	70	70

For sound data, seven (7) field measurements were made on 2nd of August 2022 (P1) and 3rd of August 2022 (for the remaining points), performed during daytime for fifteen (15) minutes each using a noise measurement equipment consisting of a Brüel & Kjær. This equipment was fitted with a Brüel & Kjær preamplifier model ZC 0026 and a Brüel & Kjær 4191 microphone. The results of the measurements are shown in **Table 4**.

The equivalent continuous noise level for sampled areas is mostly below the allowed threshold (less than 55 dB). For P5, this value is approximate (54.6) and for P6 it was exceeded (58.2). The maximum noise level (peak) was above 70 dB. However, the sound gradient of the sampled points is due to the observations verified during the sampling, especially in the cases of P4, P5, P6 (located just beside the road) and P7. The noise level can be considered intermittent (when observations during sampling are taken into account), and the acoustic impact for these sensitive receivers during construction may be less noticeable due to their distance from the implementation site.

TABLE 4: RESULT OF NOISE MEASUREMENTS

Points	Coordinates	Observation	Parameters [dB(A)]			
			LAeq	LCpeak	LAFmin	LAFmax
P1	9°43'32"S 15°9'33"E	Traffic (road EN 322 north of the point), electric current from the transmission line and wind	47.1	75.6	43.2	58.0
P2	9°43'59"S 15°6'48"E	Electric current from the substation; wind and noise from the substation control room	40.0	77.0	36.1	63.5
P3	9°43'58"S 15°6'50"E	Electric current from the substation; occasional traffic (workers from The Laúca electric project) and occasional conversation	39.6	71.9	37.0	51.9
P4	9°41'31"S 15°10'10"E	Traffic (road EN 322); occasional conversation; music and wind	49.1	84.2	28.1	71.5
P5	9°45'10"S 15°10'55"E	Traffic (road EN 322); occasional conversation;	54.6	86.8	32.4	75.3

Points	Coordinates	Observation	Parameters [dB(A)]			
			LAeq	LCpeak	LAFmin	LAFmax
P6	9°41'36"S 15°10'41"E	Traffic (road EN 322); occasional conversation and wind	58.2	96.3	35.2	81.2
P7	9°45'86"S 15° 9'49.85"E	Wind and occasional conversation	38.1	84.6	30.9	58.0

Flora and Vegetation

The survey indicated that the predominant vegetation in the project site is less variable. It is composed of savanna type with shrubs and moderately scattered trees corresponding to the subplanaltic zone, with soft wavy relief and shrub density and it is very variable (**Figure 3**).



FIGURE 3: CHARACTERISTICS OF THE PROJECT SITE VEGETATION OVERVIEW.

As a result of the seasonal cycles of the vegetation fires, the arbustive stratum consists almost exclusively of pyrophytic species (fire resistant species), namely *Piliostigma thonningii* and *Erythrina abyssinica*. The Herbaceous stratum is dominated by annual grasses especially *Andropogon gayanus*, *Hyparrhenia rufa*, *Pogonarthria squamrosa*, etc. Some arboreal elements are also observed along the area, mainly *Pterocarpus angolensis*, *Sterculia quinqueloba* and *Erythropheum africanum*.

Despite the clear signs of fires and human intervention in the area, such as farms, in most of the area a natural vegetation can be observed, and it reflects the local edaphoclimatic conditions. In the fields abandoned after cultivation and along the paths, invasive plants can also be observed, especially *Chromolaena odorata* and *Leucaena leucocephala* which are two of the main species with matter of concern in the country due to their fast adaptation and dissemination in almost all types of soils.

The species that were observed during the survey are classified as “Least Concern” according to the IUCN.

Fauna

The area can present a rich **avifauna** according to studies in surroundings areas (i.e Laúca Dam). The list of threatened species includes: *Aquila rapax* (VU); *Necrosyrtes monachus* (CR); *Gyps africanus* (CR). *Mirafraga angolensis* and *Euschistospiza cinereovinacea* are both listed as vulnerable (category C) in Angola’s Red List of Species (*Lista Vermelha de Espécies de Angola-LVEA*). Endemic birds in the area include *Tauraco erythrolophus* and *Colius castanotus*. *Cercropis abyssinica*, *Pternistis afer* and *Columba sp* were some of the species recorded in the area during the site visit.

A wide diversity of **mammals** occurs in the Cuanza Basin although the prevalence of larger mammals is low due to over-hunting during the war for food and currently for both subsistence and for commercial purposes. The diversity of mammals in Malanje ranges from ungulates and carnivores to groups of smaller or more cryptic mammals, such as rodents and bats, primates, etc. *Miopithecus talapoin*, *Panthera pardus* and *Hippopotamus amphibius* are threatened species according to IUCN Red List (VU), however, only the first one is listed on the Angola Red List of Species (category C- vulnerable). *Genetta tigrine*, *Leptailurus serval*, *Panthera pardus*, *Orycteropus afer* are also listed as category C- vulnerable and *Syncerus caffer* is listed as category B- endangered. No records of mammals and reptiles were made during the site visit.

Environmental Sensitive Areas

Of the fourteen protected areas recognized by Angolan law, only Cangandala National Park and Luando Reserve are in Malanje Province; however, these are far from the project area. There are no conservation areas in the municipality of Cacuso.

Socioeconomic Environment

More details on the socioeconomic environment at the provincial and municipal levels are described in the ESIA report; therefore, this section presents information about the socioeconomic environment of the sensitive receptors in the project area.

Muta, Cassula, Quirinje and Vila dos Pescadores (Fishermen’s village) were identified as sensitive receptors due to their proximity to the project area and the possibility that they may be affected during the different phases of the project. Muta, Cassula and Quirinje are rural settlements located near the EN 322 road (the main access road to the site) and Vila dos Pescadores (Fishermen’s village) is located close to the southern limit of the project’s concession area (see **Figure 4**). Although the Vila dos Pescadores is located close to the project site, the nearest house of the village is located more than 150m from the closest project site limit.

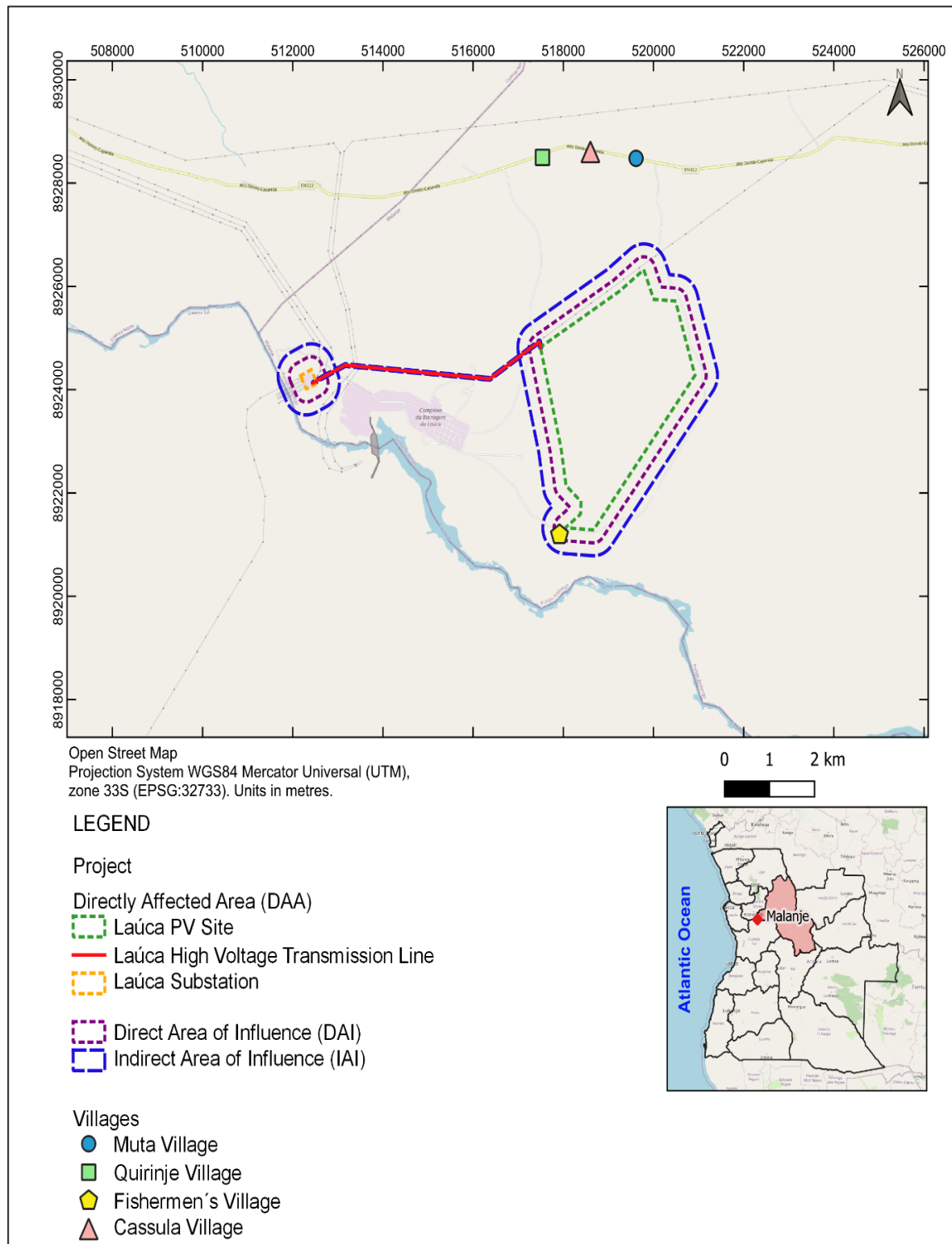


FIGURE 4: SENSITIVE RECEPTORS IN PROJECT'S AREA.

In addition to these, the following activities were identified as being underway in the vicinity of the site:

- Laúca Dam: located southwest of the area of the future project, it represents one of the largest dams at the national level. Already in operation, the dam still supports maintenance activities;
- CGGC borrow site: during the site visit, sand mining activities were identified near the northwest limit of the project's concession area, with the responsible company being CGGC (a Chinese civil construction services company). However, no further details were obtained;
- Agriculture Subsistence farms: subsistence agriculture is taking place, particularly in the southern part of the site, which belongs to inhabitants of the Fishermen's Village;
- Cultural heritage: a tomb is located approximately 300 meters southwest of the site where some inhabitants were probably buried, but there is not much information because the people living in the area are relatively new.

Regarding the activities carried out in the vicinity area of the project (**Figure 5**), special attention should be given to agricultural fields belonging to the Fisherman's village. According to the Cacuso Municipal Administration, none of the people farming in the area have surface rights over this land. These plots of land cover approximately 47 hectares (about 5% of the project area of 1,000 hectares) (**Figure 6**). Based on these findings, an inventory will be required after demining and prior to construction to identify the land users and negotiate cash compensation (and maybe alternative land). A Livelihood Restoration Plan (LRP) will be needed and active community engagement throughout the process is essential to mitigate the loss of crops and permanent loss of agricultural land (as proposed in the Stakeholder Engagement Plan developed for the project).



FIGURE 5: MAP OF THE SENSITIVE RECEPTORS AND ACTIVITIES UNDERWAY IN THE VICINITY OF THE SITE

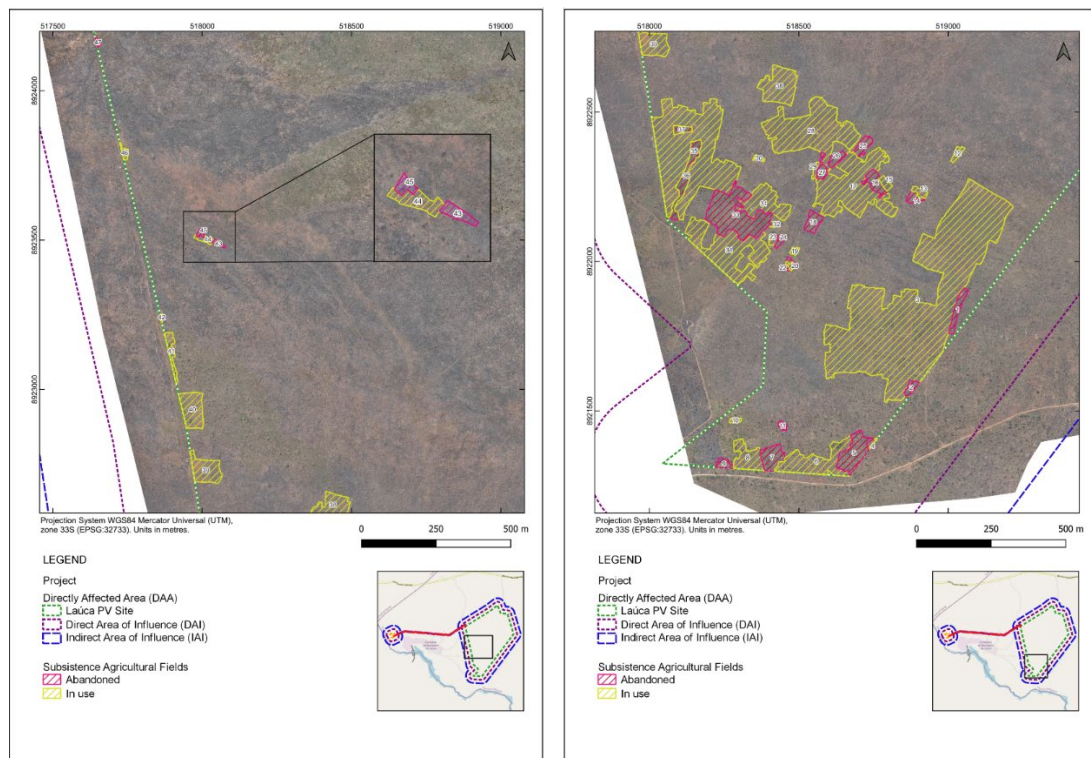


FIGURE 6: MAP OF THE AGRICULTURE FIELDS INSIDE THE PROJECT SITE AREA.

In addition to the agriculture fields occupying approximately 5% of the project area, a few other structures made of metal sheets have been identified on site (**Figure 7**). During the site visits it was not possible to meet the owners of these temporary infrastructures, but the relocation of these structures to give room for the solar panels will need to be considered in the LRP to be developed to assist the subsistence farmers.

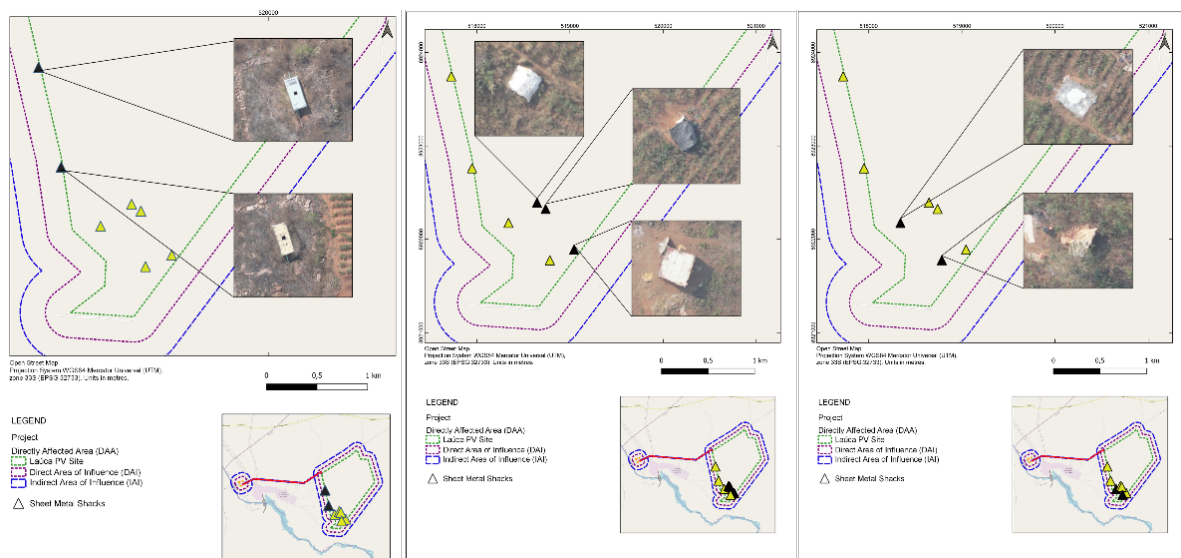


FIGURE 7: METAL STRUCTURES USED TO HOUSE AGRICULTURE TOOLS AND PRODUCTS.

The villages studied are under the direction of traditional authorities structured as established by the Government: Sobas and Associate Sobas. Currently available demographic data is limited and based on numbers provided by the sobas: Muta, around 240 habitants; Cassula, more than 60 habitants; Quirinje has no information available; and Fishermen's village has approximately 230 habitants.

Living conditions are precarious due to the lack of basic infrastructure, such as water supply and sanitation, in addition to the scarcity and precariousness of health and education services, lack of transport system, and lack of employment. Most of the villages lack medical services or medication, leading the population to resort with greater frequency to the Dondo Municipal Hospital and to Cacuso. Fishermen's village is the only one with "medical facilities," however, there is a lack of human resources and medication, also the infrastructure is not adequate.

The villages of Muta and Fishermen are the only ones with schools (up to the fourth grade). The lack of teachers and materials is a major issue. Muta receives students from other villages (Cassula and Quirinje) and for later classes, students must study in Malanje, Dondo or even in the capital Luanda.

In all villages, houses are made of adobe with a plate roof (**Figure 6**). Only in the Fishermen's village are some houses made of blocks (built during the construction of the Laúca dam).



FIGURE 6: MAIN LIVING CONDITIONS AT THE VILLAGES.

None of the villages have running water. In the villages of Muta, Cassula and Quirinje, water is obtained through the fountain. This water is mostly used for household chores and irrigation of farms. Water for consumption is provided weekly by the Laúca dam project and kept in individual reservoirs. In the Fishermen's Village, the water is channeled and has a reservoir for the village, in addition to individual reservoirs. The village is located near the Laúca dam and so they have access to the river.

Except for the Fishermen's village, there is no sanitation and no treatment of domestic waste. Waste is thrown out in the village surroundings and when it accumulates it is burned. In some cases, it is buried in holes made when dirt is dug out for making adobes for house construction. As to latrines, most families relieve themselves in the open air. All communities have access to electricity from the Laúca dam. Even so, access to electrical appliances is scarce if not non-existent due to weak economic power.

There is no regular public transportation system serving the communes. Most of the populations engage in agriculture as their main economic activity, and a very small number of young men work on the Laúca project. The main products include roots and tubers, pulses, and oilseeds. Fishing takes place in the Fishermen's village and hunting is not common in the communities, being carried out by few individuals and generally for their own consumption.

During the interviews with the communities (**Figure 7**), they expressed what are considered the main problems in the villages: medical services, education, lack of employment and means of transport, and access to water.



FIGURE 7: SOCIAL SURVEY AT MUTA VILLAGE.

5. Assessment of the Potential Impacts and Mitigation Measures

The scope of the ESIA report considers the environmental and social impacts that could potentially result from Project activities (e.g., pre-construction and mobilization, construction and installation, operation, and decommissioning) under the direct control of the Consortium responsible for the activities (Sun Africa LLC, Omatapalo Inc., and Omatapalo – Engenharia & Construções, S.A.) and its sub-contractors. Sun Africa is leading the necessary development activities of the project and Omatapalo is leading the Engineering, Procurement, and Construction services.

The ESIA report describes what will happen by predicting the magnitude of impacts and quantifying these to the extent practicable. The term 'magnitude' is used as shorthand to encompass all the dimensions of the predicted impact, including the nature of the change (what is affected and how); its size, scale, or

intensity; its geographical extent and distribution; its direction (positive or negative); its duration, frequency, reversibility, etc.; and where relevant, the probability of the impact occurring as a result of accidental or unplanned events.

The evaluation of the information on the magnitude of the impacts was made explaining what this means in terms of its importance to society and the environment. The evaluation of impacts presented here is based on the judgment of the ESIA team, informed by reference to Angola's legal standards, government policy, Sun Africa's standards, and current good practice. Where standards are not available or provide insufficient information on their own to allow grading of significance, significance has been evaluated taking into account the magnitude of the impact and the value or sensitivity of the affected resource or receptor.

The environmental and social assessment was based on current information, including a detailed project description and any associated aspects, project site environmental, and social baseline data allowing the characterization and identification of risks and impacts and mitigation measures. For the potential environmental and social impacts assessment, the mitigation hierarchy approach was adopted, allowing the assessment of the project's compliance with the hierarchy's tenets to: (a) Anticipate and avoid risks and impacts; (b) Where avoidance is not possible, minimize or reduce risks and impacts to acceptable levels; (c) Once risks and impacts have been minimized or reduced, mitigate; and (d) Where significant residual impacts remain, compensate for or offset them, where technically and financially feasible. **Table 5** presents a summary of the impacts on environmental resources and receptors assessed in this chapter, including their significance before and following the recommended mitigation measures.

6. Environmental and Social Management Plan

The Environmental and Social Management Plan (ESMP) will provide the means for ensuring that all proposed mitigation measures and Project commitments are tabulated into actionable items that can be assigned ownership. The ESMP is a dynamic document and subject to review and calibration as part of an ongoing environmental management and improvement program and provides a framework for verifying that proposed mitigation measures (which are commitments made by the Consortium and its subcontractors) are taken forward into the planning and implementation of the Project pre-construction and construction phases.

In addition to the Project ESMP, the Consortium will develop issue-specific management plans to address areas related to environmental impact and environmental management. These plans include but are not limited to the following: Stakeholder Engagement Plan (SEP) and Grievance Mechanism (GM); Construction Management Plan (CMP); Waste Management Plan (WMP); Traffic Management Plan (TMP); Chance Find Procedure (CFP); Emergency Preparedness and Response Plan (EPRP); Employment and Workforce Management Plan (EWMP); Local Employment and Procurement Plan (LCCP) and the Livelihood Restoration Plan (LRP).

The strategy of the SEP, which includes the grievance mechanism to be followed, aims to involve all stakeholders during all Project phases (ESIA development, pre-construction, construction, commissioning, and operation) in order to ensure active participation, harmonization of interests and the creation of widened consensus. This is a dynamic strategy (also a live document) that, on the one hand, also seeks to contribute to the dissemination of information on the project and, on the other, to carry out consultation of stakeholders, stimulating synergies and forms of active participation.

The LRP will be prepared in line International Standards, presenting actions that will be taken to avoid, minimise, mitigate, and otherwise manage the adverse impacts on peoples' livelihoods. This document will provide background information on livelihoods in the project area, report on the findings of the social surveys, identify feasible livelihood restoration options and alternative economic activities, and propose an implementation schedule for activities and programs (including recommendations for implementation and identification of the roles and responsibilities). Not only will it include the identification of measures to avoid potentially adverse effects, but it also intends to enhance potential benefits; and, when avoidance is not feasible, to minimize, mitigate, or compensate for such effects.

The plan set out in **Table 5** below specifies all the measures that the Consortium currently proposes to adopt in relation to impacts identified in the ESIA, along with the timing and responsibility for implementing the measure.

TABLE 5: ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

Potential Impacts	Mitigation Measures	Means of Verification	Responsible Party	Timing
Soil And Geology (low value)				
Loss or physical damage to soil resources through site preparation/construction	<ul style="list-style-type: none"> The area of land allocation should be defined in the CMP, in order to avoid the allocation of areas that will not be intervened; Manage soil stripping, stockpiling, handling, re-spreading and re-vegetation in a manner that minimizes degradation in soil quality and maximizes the potential for successful vegetation growth; Protect soils outside the construction footprint by minimizing the movement of vehicles and equipment outside designated areas; Accelerated erosion from storm events during construction shall be minimized through managing storm water runoff (e.g. velocity control measures); Contour temporary and permanent access roads / laydown areas so as to minimize surface water runoff and erosion; Spread mulch generated from indigenous vegetation across 	Estimates of soil volume or area of cultivable soil lost completed by visual monitoring	Omatapalo	During site preparation and construction phases

Potential Impacts	Mitigation Measures	Means of Verification	Responsible Party	Timing
	<p>exposed soils after construction, and</p> <ul style="list-style-type: none"> The area affected by an accidental spill (the affected portion of the soil) must be secured in spill containment kits, and be forwarded to an environmentally adequate final destination. 			
Contamination from discharges and spills during construction and operation	<ul style="list-style-type: none"> Install secondary containment for storage of hazardous materials. Place containers carrying hazardous materials above ground where possible. Implement spill detection system. Enforce speed restrictions on vehicles on access roads. 	To keep a log of spill events (volume, substance, and potential cause). Keep a record of the actions implemented to prevent the occurrence of spills.	Omatapalo	During site preparation and construction phases
<p align="center">Habitats and Flora and Fauna (high value species of conservation interest; medium value forest; low value savannah grassland and species of low conservation interest)</p>				
Loss and disturbance of habitats during site preparation, construction and operation	<ul style="list-style-type: none"> No mitigation recommended. UXO clearance to be conducted before any work onsite; Conduct clearing in a controlled way to reduce the potential for fire to spread outside the Project area, in the PV park; Vegetation that does not grow high enough to cause interference with the transmission line, or cause a fire hazards, should not be trimmed or cut unless it is growing in the road access area to the PV park; Vegetation clearing will be kept to the absolute minimum and should not extend beyond the corridor or PV site; All areas disturbed by construction activities shall be landscaped and rehabilitated. 	<p>Monitor contractor's management of the removed vegetation in order to prevent potential fires caused by dried vegetation.</p> <p>Visual inspection on a daily basis.</p> <p>Road kill assessment performed on a weekly basis.</p> <p>Wildlife interaction record to be</p>	Omatapalo	Site preparation and construction

Potential Impacts	Mitigation Measures	Means of Verification	Responsible Party	Timing
		updated permanently		
Disturbance of/harm to wildlife from site preparation, construction and physical presence of the Project	<ul style="list-style-type: none"> Roll out a TMP to optimize Project vehicle use in terms of traffic levels and frequency. Construction activities shall not interfere with or cause fatalities to animals; No interference with livestock shall occur without the owner's permission; The breeding sites of wild bird species must be taken into consideration in the planning of the construction (CMP) and be kept intact, and disturbance to breeding birds avoided. Special care shall be taken where nestlings or fledglings are present; Alien invasive vegetation should be removed immediately and disposed of at a licensed waste disposal facility. The area should be quarantined, and monitoring efforts should be increased; Use of low emission, directional lighting where possible. 	<p>Implement the TMP and assess vehicle use, traffic flow, safety records and maintenance logs.</p> <p>Visual inspection on a daily basis.</p> <p>Road kill assessment performed on a weekly basis.</p>	Omatapalo	Weekly during site preparation and construction
Injury or mortality to wildlife from Project traffic	<ul style="list-style-type: none"> Roll out a TMP to optimize Project vehicle use in terms of traffic levels and frequency. 	Manage vehicles trips, including destination and load, per logistics plan to optimize routes and day trips of vehicles.	Omatapalo	Daily during site preparation and construction
Impacts to habitats and species from unplanned hazardous spills	<ul style="list-style-type: none"> Develop and implement an emergency response program. 	<p>Number of incidents.</p> <p>Record of the actions implemented to prevent the occurrence of spills.</p>	Omatapalo	Daily during site preparation and construction

Potential Impacts	Mitigation Measures	Means of Verification	Responsible Party	Timing
Water Resources (low/medium value)				
Drawdown of the water table resulting from Project water consumption	<ul style="list-style-type: none"> Reduce the quantity of water used as part of Project activities through leveraging results of groundwater study; Activities shall be conducted > 100 m away from water bodies; Ensure adequate siting of portable toilets on site and appropriate on going management of these facilities. 	<p>Visual verification and audit reports.</p> <p>Daily inspection of onsite facilities.</p>	Omatapalo	Site preparation and construction
Groundwater contamination from early survey works and accidental spills	<ul style="list-style-type: none"> Implement a spill mitigation plan, including measures to prevent, prepare for and respond to unplanned events; Domestic wastewater shall be treated and disposed of in accordance with an approved waste management plan; Use bounding, drains/gullies and interceptors (with oil-water separators) around liquid storage, fueling, construction vehicle parking and maintenance areas. 	<p>Number of incidents</p> <p>Record of the actions implemented to prevent the occurrence of spills.</p>	Omatapalo	Site preparation and construction
Dust Emissions and Noise				
Emissions affecting the local air quality	<ul style="list-style-type: none"> Removal of vegetation shall be scheduled in the CMP only when soil stripping is required and there is time for exposed surfaces to be revegetated or stabilized as soon as possible. No vegetation burning will be allowed; Excavation, handling and transport of erodible materials shall be avoided under high wind conditions; Where possible, soil stock piles should be located in sheltered area where they are not exposed to wind. Vehicle speeds shall not exceed 40 km/hr along dust roads or 20 	Visual inspection on a daily basis	Omatapalo	Daily during site preparation and construction

Potential Impacts	Mitigation Measures	Means of Verification	Responsible Party	Timing
	<p>km/h along unconsolidated and vegetated areas;</p> <ul style="list-style-type: none"> Appropriate dust suppression methods should be used when dust generation is unavoidable, e.g. dampening with water (in prolonged periods of dry weather). 			
Noise nuisance generated due to construction activities	<ul style="list-style-type: none"> Working hours for significant noise generating construction work (including works required to upgrade existing access roads or pavements), will be daytime only; Siting noisy equipment as far away as possible from noise sensitive receptors (particularly near settlements), and use of barriers (e.g. site huts, acoustic sheds or partitions) to reduce the level of construction noise at sensitive receptors wherever possible; Where practicable noisy equipment will be orientated to face away from the nearest noise sensitive receptors; Alternatives to diesel and petrol engines and pneumatic units, such as hydraulic or electric-controlled units, will be used, where practicable; Where practicable, stationary equipment will be located in an acoustically treated enclosure. 	Routine visual site inspections endure good practice is being adhered to.	Omatapalo	Daily during site preparation and construction
Noise nuisance generated due to vehicle movement on site and access to the PV site and transmission line	<ul style="list-style-type: none"> Identify transportation routes off site that will avoid existing communities, where possible. Normal working hours will be loading/ unloading activities will be restricted to day-time (06:00 to 18:00 hours). Unloading activity may be done after day-time (06:00 -18:00) occasionally 	Routine visual site inspections endure good practice is being adhered to, and as part of internal procedures	Omatapalo	Daily during site preparation and construction

Potential Impacts	Mitigation Measures	Means of Verification	Responsible Party	Timing
	<p>when unavoidable situations occur but only at the PV site.</p> <ul style="list-style-type: none"> Implement TMP to optimize the operation of truck transportation. 			
Infrastructure and Services				
Road deterioration due to increased traffic caused by the movement of workers and materials to and from the Project site	<ul style="list-style-type: none"> Inform local government and communities about planned traffic increase and associated safety measures to be utilized. Develop and implement a SEP that incorporates measures to address critical stakeholder concerns, engagement and communication protocols in the event of incidents involving local population, feedback mechanism. Ensure procedures are in place for dealing with claims in the event of an incident. 	Routine visual site inspections endure good practice is being adhered to, and as part of internal procedures	Omatapalo	Daily during site preparation and construction
Land Acquisition				
Potential impacts on community subsistence agriculture leading to loss of crops and arable land	<ul style="list-style-type: none"> Develop and implement a Livelihood Restoration Plan; Develop and implement a grievance mechanism; and Contract a professional community liaison officer who will ensure in compliance with national law and IFC requirements on land acquisition and will manage all grievances. 	Number of Grievances related to loss of arable land and metal structures	Omatapalo	Site preparation and before construction
Community Health and Safety				
Potential impacts on community safety, in particular, road accidents, and trespass on the working site potentially resulting in accidents leading to injuries and fatalities	<ul style="list-style-type: none"> Provide access to health care for those injured by its activities Ensure that signs are put up around work fronts, road and construction site advising people of the risks associated with trespass. Undertake a program of SEP to inform local communities of the risks of trespassing onto sites, the meaning of signs, and the 	Number and type of incidents identified through Assessments and Audits	Omatapalo	Site preparation and construction

Potential Impacts	Mitigation Measures	Means of Verification	Responsible Party	Timing
	<p>dangers of playing on or near equipment (towers) or entering fenced areas (PV parks). Special attention to be paid in schools and markets along the transmission routes and in areas where towers will be built close to residential or school areas.</p> <ul style="list-style-type: none"> Omatapalo will develop Emergency Response and Preparedness Plans (EPRP) in cooperation with local emergency authorities and local hospitals. 			
Inadequate waste management	<ul style="list-style-type: none"> Omatapalo will prevent (or at least minimize) the potential for community exposure to hazardous materials, including both accidental and planned releases, and the transport of hazardous wastes and materials. If there is a potential for life-threatening hazards, operations may need to be modified, or substances causing the hazard substituted or eliminated. Omatapalo also needs to have systems in place to control the safety of deliveries of raw materials and the transportation and disposal of wastes in compliance with the WMP. 	Number and type of incidents identified through Assessments and Audits	Omatapalo	Site preparation and construction
Impact from workers presence and potential interaction with local populations	<ul style="list-style-type: none"> Ensure that all workers are housed in accommodation camps rather than in the local settlements in order to minimize interaction with local communities and related health and safety impacts. Ensure all workers undergo pre-employment screening and regular health screening including voluntary screening 	<p>Number and type of breaches identified through Assessments and Audits</p> <p>Number of trainings provided / delivered</p>	Omatapalo	Site preparation and construction

Potential Impacts	Mitigation Measures	Means of Verification	Responsible Party	Timing
	<p>for Sexually-Transmitted Diseases (STDs).</p> <ul style="list-style-type: none"> Ensure all workers including subcontractors receive education around transmission routes and symptoms of communicable diseases of concern and STDs. Omatapalo will develop a Worker Code of Conduct with guidelines on worker-community interactions and will provide training on the worker code of conduct to all employees including subcontractors as part of the induction process. 			
Disturbance to population and workers from Project associated noise	<ul style="list-style-type: none"> Post warnings of the proposed construction activities and maintain surveillance throughout the construction works. Publicly communicate activities to inform and keep local communities aware and updated on Project's activities; Notify relevant authorities, associations and population groups of Project phases, activities, construction development plans (CMP), timing, truck routes, etc. 	Number of grievances received, pending and closed out (per month, year, area/city)	Omatapalo	Site preparation and construction
Road Accidents and Security				
Road conditions	<ul style="list-style-type: none"> Develop and implement a TMP, assess local road conditions and be responsible for road maintenance during Project construction to minimize traffic risks associated with roads deteriorated from Project activities, particularly the erection of the towers. 	Number and type of non-compliances identified through Assessments and Audits	Omatapalo	Site preparation, construction, and commissioning
Site trespass and Accidents	<ul style="list-style-type: none"> Erect signs around work fronts and construction site warning of risks associated with trespassing, particularly in the 	Number and type of incidents identified through	Omatapalo	Site preparation, construction

Potential Impacts	Mitigation Measures	Means of Verification	Responsible Party	Timing
	<p>PV park. All signs will be in local Portuguese.</p> <ul style="list-style-type: none"> Erect fencing around facilities to minimize the risk of trespassing. Fencing will be checked weekly to ensure that it is in good condition and to look for any signs of entry. 	Assessments and Audits		and commissioning
Public Security	<ul style="list-style-type: none"> Project security systems will comply with Angolan laws and regulations; Communicate the construction times and plan to the communities existent in the proposed project area, particularly along the transmission line; Access to GM will be provided to ensure complaints are received and addressed; Omatapalo and subcontractors will conduct a reasonable investigation to ensure that hired security personnel are not involved in past abuses; Omatapalo and subcontractors will also check that security personnel are adequately trained in the use of force (and where applicable, firearms), to show appropriate conduct toward workers and communities, and require them to act within the applicable law. 	Number of grievances received, pending and closed out (per month, year, area/city)	Omatapalo	Site preparation, construction and commissioning
Unplanned Events				
Risk during stringing activities	<ul style="list-style-type: none"> Omatapalo will follow the method statement for overhead stringing particularly along the urban and peri-urban areas; the activities will be managed by experienced Supervisors. Stringing activities near wires and other electrical utilities will be done after proper shutdown 	<p>Number and type of incidents identified through Assessments and Audits</p> <p>Number of trainings</p>	Omatapalo	Site preparation, construction and commissioning

Potential Impacts	Mitigation Measures	Means of Verification	Responsible Party	Timing
	of the line/utilities with prior information and permission.	provided / delivered		

7. Final Remarks

Solar power facilities like those proposed for the Malanje Province Photovoltaic Project reduce the environmental impacts of combustion used in fossil fuel power generation. Further, the development, construction, and operation of the proposed solar facilities are expected to create both direct and indirect employment and bring additional income to the region.


An aspect that needs to be considered is the existence of subsistence agricultural activity in some parts of the site including active and abandoned areas and metal sheets infrastructures. Before construction, as part of the Stakeholder Engagement Plan (SEP) and after the demining process, there will be a need to undertake an inventory of the land users of the area and to develop a Livelihood Restoration Plan (LRP) to be able to provide cash compensation and arable land for the current subsistence farmers as well as an adequate solution for the metal structures used to keep agricultural equipment and to store agricultural products which will need to be removed to give room for the solar panels.

Impacts on resources associated with site construction, operation, and decommissioning (i.e., soil and geology, air quality, noise, habitats and terrestrial flora/fauna, water resources, infrastructure, and community health) range from not significant to moderate/minor. Particular attention is to be given to sites located near environmental and social sensitive receptors. The Consortium and their contractors will implement the mitigation measures and monitoring programs outlined in the ESMP to address the minimal impacts identified. As such, the Project is ready to move forward with the proposed mitigation measures in place, and, as a result, any residual impacts can be mitigated during planning and construction and managed throughout operation and, ultimately, decommissioning.




Holísticos – Serviços, Estudos e Consultoria, Lda.
Urbanização Harmonia, Rua 60, Casa 559, Lar do Patriota
Luanda | República de Angola

 + 244 222 017 962

 + 244 927 442 844
+ 244 912 034 779

 2426, Apartado IV

 holisticos@holisticos.co.ao

 www.holisticos.co.ao

 www.facebook.com/holisticos.angola

Soluções Ambientais para um Futuro Sustentável