


Environmental and Social Impact Assessment for Proposed Golomoti Solar Project, Dedza

Final Report

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Environmental and Social Impact Assessment for Proposed Golomoti Solar Project, Dedza

Final Report

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Acronyms and Abbreviations

AC	Alternating current
AIDS	Acquired Immune Deficiency Syndrome
AoI	Area of Influence
AST	Above-ground Storage Tank
CBO	Community Based Organisation
CESMP	Construction Environmental and Social Management Plan
CFP	Chance Find Procedure
CHAM	Christian Association of Malawi
CHSMP	Construction Health & Safety Management Plan
CLO	Community Liaison Officer
DAoI	Direct Area of Influence
DC	Direct Current
DC	District Commissioner
EAD	Environmental Affairs Department
EGENCO	Electricity Generation Company of Malawi
EHS	Environmental, health, and safety
EIA	Environmental Impact Assessment
EMA	Environmental Management Act
ERM	Environmental Resources Management
ESCOM	Electricity Supply Corporation of Malawi Limited
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
FGD	Focus ground discussion
GASO	Golomoti AIDS Support Organisation
GHG	Greenhouse gas
GVH	Group Village Headman
HIV	Human immunodeficiency virus
HR	Human Resources
HVDC	High voltage direct current
IAoI	Indirect Area of Influence
IESC	Independent Environmental and Social Consultant
IFC	International Finance Corporation
ILO	International Labour Organisation
IPP	Independent power producer
IUCN	International Union for Conservation of Nature
KII	Key informant interview
KOP	Key observation point
LRP	Livelihood Restoration Plan
MBS	Malawi Bureau of Standards
MDHS	Malawi Demographic and Health Survey
MERA	Malawi Energy Regulatory Authority
MRA	Monuments and Relics Act
MW	Megawatt
MWac	Megawatt alternating current
MWK	Malawian kwacha
NCLS	National Child Labour Survey
NEAP	National Environmental Action Plan
NEP	National Environmental Policy
NGO	Non-Governmental Organisation
O&M	Operations and maintenance
PAP	Project-affected people
PPA	Power Purchase Agreement
PS	Performance Standard
PV	Photovoltaic
RET	Renewable Energy Technology
SADC	Southern African Development Community
SEP	Stakeholder Engagement Plan
SME	Small and medium enterprise
STI	Sexually transmitted infection
TA	Traditional Authority
ToR	Terms of Reference
UNESCO	United Nations Educational, Scientific and Cultural Organisation
USD	United States dollar
USTDA	United States Trade and Development Agency
VSL	Village Savings and Loans
WHO	World Health Organisation
WRA	Water Resource Area
WRI	World Research Institute
WWEC	Water Waste and Environmental Consultants

EXECUTIVE SUMMARY

Introduction

This report presents the results of an Environmental and Social Impact Assessment (ESIA) of the proposed Golomoti Solar Project, Dedza District. The Project proponent is Golomoti JCM Solar Corporation Limited (JCM). Project sponsors include JCM Power, InfraCo Africa, and the Project's development partner is Matswani Capital (PTY). JCM Power is an independent power producer (IPP) dedicated to accelerating social, economic, and environmental sustainability in growth markets through the development, construction, and operation of renewable energy facilities and high voltage direct current (HVDC) transmission lines. InfraCo Africa seeks to alleviate poverty by mobilising private sector expertise and finance to develop infrastructure projects in sub-Saharan Africa.

The Project will take approximately 10 months to construct, and construction is expected to start in April 2020. It is anticipated that the Project will require approximately 200 workers (skilled and unskilled) during the construction phase and 20 workers (skilled) during the operation phase. The Project has an investment value of USD 35,000,000 and will be operational for a minimum of 20 years, with possible extension by mutual agreement. JCM has a Power Purchase Agreement (PPA) with the Electricity Supply Corporation of Malawi Limited (ESCOM) to deliver the power from the Project directly into the national grid through the 0.5 km transmission line to the Golomoti Substation.

Nature of the Project

The proposed Project is a 20-megawatt (MW) alternating current solar photovoltaic (PV) plant to be constructed on a 92 hectare (ha) parcel (Solar Plant Site) located approximately 0.5 km from the Golomoti Substation and less than 1 km from Golomoti Trading Centre in Dedza District. It is located within the Kachindamoto Traditional Authority. The Project will also include the construction of a short (approximately 0.5 km) transmission line from the Solar Plant Site to the Golomoti Substation, as well as a short (approximately 80 m) access road extending from the highway to the northeast (M5) to the Solar Plant Site. A detailed Project description is provided in Section 2 of this report.

Project Justification

This Project is an investment in renewable energy and will help with the diversification of the energy sector, as well as add to increased capacity for the national grid. In addition, the Project is part of the government IPP process and is part of sector reform development.

ESIA Process

JCM submitted a Project Brief to the EAD in November 2018 in compliance with Malawi's Environmental Management Act of 1996 and the EAD's Guidelines for Environmental Impact Assessment (www.sdnp.org.mw/enviro/eia). The EAD responded in a letter dated December 14, 2018. The letter states that the Project is "required to conduct an Environmental and Social Impact Assessment (ESIA) before implementation of the proposed activities on the site." The letter also includes the EAD's Terms of Reference (ToR) for the ESIA (Appendix A).

This ESIA Report was prepared in compliance with the Environmental Management Act of 1996, EAD's Guidelines for Environmental Impact Assessment, and other applicable Malawian laws and regulations, as detailed in Section 4. The report was also prepared in compliance with the EAD's ToR for the Project.

ESIA Methodology

The purpose of the impact assessment process is to identify any likely significant impacts on environmental or social receptors as a result of the Project and to develop appropriate mitigation measures to effectively manage these impacts. To determine the significance of potential impacts, this ESIA considers two main factors: impact magnitude and receptor sensitivity/vulnerability. Magnitude is a measure of the changes to a receptor that will potentially result from the Project, while sensitivity/vulnerability is a measure of how sensitive or vulnerable a receptor (e.g., people, flora, or fauna) is to these changes.

There is no statutory or internationally agreed upon definition of significance; however, this assessment will use the following practical definition:

> An impact will be judged significant if, in isolation or in combination with other impacts, it will cause a notable change from baseline conditions and may require mitigation to manage the effects on/risks to a receptor from this change.

Evaluating impact significance is an iterative process and follows the following cycle: identify potential impacts; evaluate receptor sensitivity/vulnerability; evaluate magnitude of potential impacts; determine significance of potential impacts; and determine significance of residual impacts. Additional details regarding the ESIA methodology are provided in Section 6.1.

The potential impacts assessed in the ESIA were determined based on the results of a scoping exercise, which is described in Section 6.2. The assessment of positive impacts is presented in Section 6.3, and the assessment of potential negative impacts is presented in Section 6.4.

Summary of Impacts

The key positive and potential negative impacts identified in the ESIA and a summary of their proposed enhancement and mitigation measures, respectively, are provided below. The only potential negative impact assessed to be major was economic displacement. All other potential negative impacts listed below were assessed to be moderate or minor. In terms of unplanned events, the impact of spills was assessed to be major for both construction and operation, and the impact of traffic accidents was assessed to be major for construction.

Positive Impacts

- Generation of Electricity: The generation of 20 MW of power will lead to a 7.4% increase in the generation capacity of Malawi, representing a significant benefit to the macro economy of the country. The distribution of electricity in Malawi falls within the remit of ESCOM. Given this, JCM does not have any authority with regard to the distribution of power, thus no enhancement measures are proposed
- Job Creation: The employment of approximately 200 people is anticipated for the construction phase and approximately 20 people for the operation phase. Proposed enhancement measures include a recruitment strategy, training

opportunities, a Gender Development Plan, and local sourcing of goods and services.

Negative Impacts

- Dust Emissions: Dust emissions would arise during construction from site clearance and grading, traffic and movement of vehicles over open ground and on unpaved roads, and material stockpiles from clearance and related site preparation activities. Proposed mitigation measures include minimizing removal of vegetation, sequential land clearance, not stripping topsoil until required, enforced speed limits, covering transported materials, use of surface binding agents, covering exposed ground and earthworks, covering stockpiles, wind breaks, regular vehicle maintenance, minimizing idling engines, and implementation of a Community Grievance Mechanism.
- Noise Emissions: Noise emissions would arise from construction machinery and vehicles. Proposed mitigation measures include regular maintenance and inspection of machines and equipment, selection of equipment and vehicles for noise reduction, minimization of vehicle movement, local screening/site hoardings, and implementation of a Community Grievance Mechanism.
- Soil Erosion: Site preparation and construction activities would include earthworks and site clearance that could lead to loss of topsoil, soil compaction and rutting, and soil erosion from wind and water runoff. Proposed mitigation measures include erosion control measures such as intercept drains and toe berms and construction of well-drained access roads. Mitigation measures for dust emissions (see above) are also applicable to this impact.
- Groundwater Abstraction: A borehole would be drilled to abstract water to use during construction (for concrete mixing and sanitary facilities) and operation (for panel cleaning and sanitary facilities). Proposed mitigation measures include utilization of water storage solutions (e.g., tanks) and regular monitoring of affected village supplies.
- Biodiversity: Clearing of vegetation would result in loss of habitats and fauna disturbance, risk of increased invasive alien species, and loss or reduction of biodiversity ecosystem services. Proposed mitigation measures include prohibiting hunting, avoidance of unwanted vegetation clearance, gradual removal of some vegetation to provide wildlife a chance to exit the site, minimization of vegetation clearing, prompt rehabilitation of cleared areas (e.g., temporary access roads and laydown areas) with native species, rehabilitation of disturbed areas (e.g., temporary access tracks and laydown areas), planting of seedlings in adjacent areas, removal, containment, and onsite burning of invasive plant species, regular washing of vehicles and construction equipment, cleaning of parking areas and construction camps, regular monitoring of the presence of alien invasive species in construction and rehabilitated areas, donation of woody vegetation cleared for construction to communities, and ongoing engagement with local communities in advance of vegetation clearing. Mitigation measures for loss of livelihoods as a result of land acquisition (see below) are also applicable to this impact.
- Landscape and Visual Changes: The visual character of the landscape would be impacted during construction by clearance of vegetation, presence of large construction vehicles and equipment, fencing of works and access restrictions, and construction of the plant. The visual character of the landscape during operations

would be impacted by the colour change and a massing effect created by the PV panels covering a large area, limited early morning glare, and some security lights at night. Proposed mitigation measures include minimization and rehabilitation of cleared areas, shaping of excavated and cut and fill areas to allow revegetation, no debris or waste material left at work sites, and appropriate directional and intensity settings for lighting.

- Land Acquisition and Displacement: Approximately 154 residents from six villages in Group Village Pitala are expected to be directly affected by the land acquisition for the Project. Proposed mitigation measures include implementation of a Livelihood Restoration Plan and an inclusive and participatory consultation process.
- Walking Paths: During construction, safety fencing, security, and equipment would block access to several walking paths that transect the current agricultural fields. Once such fields are no longer utilized for agriculture, it is likely that they would no longer be needed by local villagers, with the exception of the pathway that is used to travel from Thondoya to the villages in Group Village Pitala. Proposed mitigation measures include consultation with communities to assess the possibility/need for an alternative walking path.
- Vector Borne and Communicable Diseases: The presence of non-local skilled workers (approximately 30-35% of the workforce) could be susceptible to communicable diseases or bringing communicable diseases into the area that are currently not prevalent. Proposed mitigation measures include training of workers, gender considerate sanitary facilities designed to prevent contamination, a waste handling system developed to avoid creation of new vector breeding grounds, reduction of the presence of standing water on site, clean work areas, an on-site first aid area, pre-employment screening, and a worker Code of Conduct.
- STI/HIV Transmission: Increased income due to job opportunities for locals and the influx of non-local workers has the potential to create an increase in STI/HIV prevalence due to worker-community interactions, with young women seeking to exchange sexual favours for payment or valuables, and through other relationships with the workforce (expatriates or Malawians). Proposed mitigation measures include implementation of an STI/HIV Management Plan, support for a women's NGO that is addressing gender and gender-based violence (GBV) issues in Golomoti, work camp control protocols, and monitoring of GBV and sexual abuse through general stakeholder engagement and grievance management.
- Community Health and Safety: Project safety hazards may arise from the presence of construction equipment and activities, infrastructure, and traffic. The presence of such equipment and infrastructure may trigger risk/temptation of theft due to high levels of poverty in communities in the area. Incidents may also arise as a result of worker-community interactions with security guards or other staff. Proposed mitigation measures include training of security personnel, security measures to minimize safety risks and the possibility of theft, clear and visible signage to warn of risks and hazards, no firearms for and vetting of security personnel, a community engagement programme to provide information about safety hazards and their management, and community awareness of the Project's Community Grievance Mechanism.

- Labour and Working Conditions: Improper management of labour and working conditions could affect the Project workforce, and improper management of occupational health and safety can cause injuries and even fatalities, as well as affect relationships with the workforce. Proposed mitigation measures include a Human Resources Policy, implementation of a Gender Development Plan, training of contractors, implementation of a Worker Grievance Mechanism, vetting of contractors and suppliers, monitoring compliance of contractors, development and implementation of a health and safety programme, and a non-discriminatory hiring mechanism.
- Cultural Heritage: Project activities would damage an archaeological site and result in the loss of a baobab tree identified as culturally significant to the local community. Proposed mitigation measures include limited archaeological excavation of the site prior to construction activities, additional stakeholder engagement to develop a plan to transfer the cultural significance/value of the tree to another location, if feasible, or compensation for the loss of the resource, and implementation of a Chance Find Procedure.

Unplanned Events

- Spills: Spills and improper disposal of waste have the potential to affect terrestrial environments and could lead to the deterioration of soil and groundwater quality. This could lead to impacts on flora and fauna and local community users. Proposed mitigation measures include implementation of a Hazardous Spill Resource Plan, implementation of a Waste Management Plan, refuelling of equipment and vehicles in a designated area on hard standing ground, and storage of hazardous materials on an impermeable surface in a bunded storage facility.
- Traffic Accidents: Increased traffic and presence of heavy vehicles on local roads as a result of Project development increases the risk of road traffic accidents involving members of the community. Proposed mitigation measures include implementation of a Traffic Management Plan, planning of traffic routes to avoid high traffic periods (including pedestrian traffic), assessment of local road conditions and road maintenance, collaboration with relevant local and regional governments, engagement with local communities and authorities, awareness campaigns, and driving training.

A more detailed identification and assessment of the Project's positive impacts and potential negative impacts, as well as more detailed descriptions of the proposed measures to enhance and mitigate these impacts, respectively, are presented in Section 6 of this report.

Conclusion and Recommendations

JCM is committed to working with the local community and authorities during the construction and operation of the Project and will maintain open dialogue as part of their ongoing stakeholder engagement activities. JCM is also committed to implementing the management procedures (i.e., enhancement, management, mitigation, and preventive measures) detailed in Table 8-1 (construction) and Table 8-2 (operation) of the ESMP, as well as the monitoring procedures detailed in Table 8-3 (construction) and Table 8-4 (operation) of the ESMP. As a result, it is recommended the Project be approved and proceed as planned.

1. INTRODUCTION

1.1 BACKGROUND

This report presents the results of an Environmental and Social Impact Assessment (ESIA) of the proposed Golomoti Solar Project, Dedza District. The Project will take approximately 10 months to construct, and construction is expected to start in April 2020. It is anticipated that the Project will require approximately 200 workers (skilled and unskilled) during the construction phase and 20 workers (skilled) during the operation phase. The Project has an investment value of USD 35,000,000 and will be operational for a minimum of 20 years, with possible extension by mutual agreement. JCM has a Power Purchase Agreement (PPA) with the Electricity Supply Corporation of Malawi Limited (ESCOM) to deliver the power from the Project directly into the national grid through the 0.5 km transmission line to the Golomoti Substation.

Environmental Resources Management (ERM) conducted the ESIA and prepared this ESIA Report as part of a larger Feasibility Study being conducted by Power Engineers. Power Engineers is conducting the Feasibility Study under a grant from the United States Trade and Development Agency (USTDA). This ESIA Report is designed to comply with Malawian laws and regulations, specifically the Environmental Management Act of 1996 and the Environmental Affairs Department (EAD) Guidelines for Environmental Impact Assessment (www.sdnp.org.mw/enviro/eia). It is also designed to align with international lender standards, specifically the International Finance Corporation (IFC) Performance Standards on Environmental and Social Sustainability (2012). This is because: 1) the ESIA is being funded by the USTDA; and 2) the Project proponent is committed to aligning with the IFC Performance Standards in its Environmental and Social (E&S) Policy. Baseline studies for the ESIA were conducted by Geoconsult Limited (Geoconsult) and Water Waste and Environment Consultants (WWEC), both based in Lilongwe, under subcontract to Power Engineers and ERM, respectively.

1.2 NATURE OF THE PROJECT

The proposed Project is a 20-megawatt (MW) alternating current solar photovoltaic (PV) plant to be constructed on a 92 hectare (ha) parcel (Solar Plant Site) located approximately 0.5 km from the Golomoti Substation and less than 1 km from Golomoti Trading Centre in Dedza District. It is located within the Kachindamoto Traditional Authority. The Project will also include the construction of a short (approximately 0.5 km) transmission line from the Solar Plant Site to the Golomoti Substation, as well as a short (approximately 80 m) access road extending from the highway to the northeast (M5) to the Solar Plant Site.

1.3 PROJECT PROPONENT

The Project proponent is Golomoti JCM Solar Corporation Limited (JCM). Project sponsors include JCM Power, InfraCo Africa, and the Project's development partner is Matswani Capital (PTY). JCM Power is an independent power producer (IPP) dedicated to accelerating social, economic, and environmental sustainability in growth markets through the development, construction, and operation of renewable energy facilities and HVDC transmission lines. InfraCo Africa seeks to alleviate poverty by mobilising private sector expertise and finance to develop infrastructure projects in sub-Saharan Africa.

The contact details of the Project Proponent/Applicant are listed below.

Golomoti JCM Solar Corporation Limited (JCM)
Jonas Sani
CC Patrick Godfrey
Plot 3/306, Sharp Avenue
Lilongwe, Malawi
Tel: +265 999 4150 49

1.4 PROJECT JUSTIFICATION

Malawi has an installed generation capacity of 363 MW, with a large reliance on hydropower.[1] Over 95% of Malawi's electricity is generated from hydropower, with the Shire River as the main source. In the last few years, electricity generation has been reduced by up to 40% due to dwindling water levels caused by drought and low rainfall.[2] There is a high potential for solar energy development in Malawi to offset this reduction and to increase electric capacity.

Malawi's energy sector has gone through important sector reform efforts recently, including the partial unbundling of the national utility ESCOM.[3] The restructuring of Malawi's power market is underway, with strong investor interest and political will for Independent Power Producers (IPPs) to enter the market.[4]

The Golomoti Solar Project is an investment in renewable energy. It will help diversify the energy sector in Malawi and increase the capacity of its national grid. The Project is part of the government IPP process and is part of sector reform development.

There is also currently a global drive towards the generation and implementation of affordable clean energy. One of the UN Sustainable Development Goals is "Affordable Clean Energy." This goal recognises that the global economy is currently over reliant on fossil fuels, and that increasing greenhouse gas emissions are creating drastic changes to our climate system.[5] Expanding infrastructure and upgrading technology to provide clean energy in all developing countries is a crucial goal that can both encourage growth and help the environment.[6] The Golomoti Solar Project aligns with this global initiative to develop renewable energy resources in developing countries.

1.5 PURPOSE OF THE ESIA

The purpose of the ESIA was to identify and assess and develop measures to mitigate and manage the Project's environmental and social impacts in compliance with Malawian laws and regulations and in alignment with international standards. The main objectives of the ESIA are to:

[1] USAID (2018), Malawi Power Africa Factsheet Accessed at: https://www.usaid.gov/powerafrica/malawi

[2] ESCOM (nd) An Update On The Current Water Levels And The Energy Situation In Malawi Accessed at: http://www.escom.mw/waterlevels-energysituation-malawi.php

[3] USAID (2018), Malawi Power Africa Factsheet Accessed at: https://www.usaid.gov/powerafrica/malawi

[4] USAID (2018), Malawi Power Africa Factsheet Accessed at: https://www.usaid.gov/powerafrica/malawi

[5] UNDP (nd) Sustainable Development Goals Accessed at: http://www.undp.org/content/undp/en/home/sustainable-development-goals/goal-7-affordable-and-clean-energy.html

[6] UNDP (nd) Sustainable Development Goals Accessed at: http://www.undp.org/content/undp/en/home/sustainable-development-goals/goal-7-affordable-and-clean-energy.html

- Define the scope of the Project and the potential interactions of Project activities with the natural and human (including socio-economics and health) environments;
- Review national legislation and international standards and guidelines and ensure that all stages of the Project consider the requirements of Malawian legislation, internationally accepted environmental management practices and guidelines, and Project-related environmental and health and safety (EHS) policies and standards;
- Provide a description of the proposed Project components and activities and the existing physical, chemical, biological, socio-economic, and human environments with which these activities may interact;
- Assess the potential environmental and social impacts resulting from Project activities and identify viable mitigation measures and management actions designed to avoid, reduce, remedy, or compensate any significant adverse environmental and social impacts and, where practicable, maximize potential positive impacts and opportunities that may arise due to the Project; and
- Provide the means by which the mitigation measures will be implemented and residual impacts managed, through the provision of an Environmental and Social Management Plan (ESMP).

1.6 SUMMARY OF THE ESIA PROCESS

The process utilised for this ESIA is consistent with the specifications of Malawian legislation, further described in Chapter 3 of this report. The ESIA process includes the following key steps:

- Screening;
- Scoping;
- Baseline data collection;
- Project planning and design;
- Stakeholder engagement;
- Impact assessment;
- Management and mitigation plans; and
- Reporting and disclosure.

1.6.1 Screening

The screening phase of the ESIA process is intended to identify what impact assessment requirements apply to the Project. This involves having an understanding of the Project activities and components, as well as the environmental and social context in which it will be realized, to a degree sufficient to identify any “applicability triggers” that are pertinent in the Project’s administrative framework.

In the case of the Golomoti Project, the screening phase occurred concurrently with the scoping phase, consisting of a site visit to better understand the Project context and consultation with EAD to confirm impact assessment requirements (the EAD required an Environmental and Social Impact Assessment per a letter to JCM dated December 14, 2018).

1.6.2 Scoping

The aim of scoping is to identify environmental and social sensitivities and Project activities with the potential to contribute to, or cause, impacts to environmental resources and social receptors. At the scoping stage, it is necessary to identify and understand the key issues to a level that allows the remainder of the impact assessment to be planned. An important part of this process is identifying and consulting with a range of stakeholders including representatives of government, civil society groups, and communities to identify key issues and sources of information. The results of scoping for the Golomoti ESIA are described in Section 6.2 of this report.

1.6.3 Baseline Data Collection

The ESIA provides a description of the existing environmental and socio-economic conditions as a basis against which the impacts of the Project can be assessed. The baseline includes information on environmental and social receptors and resources that were identified during scoping as having the potential to be affected by the proposed Project.

The objectives of baseline data collection are to:

- Identify the key environmental and socio-economic resources and conditions in areas potentially affected by the Project and highlight those that may be vulnerable to aspects of the Project;
- Describe, and where possible quantify, their characteristics (i.e., their nature, condition, quality, and extent);
- Provide data to aid the prediction and evaluation of possible impacts; and
- Inform judgements about the importance, value, and sensitivity or vulnerability of resources and receptors.

Baseline data was collected by a team of WWEC environmental and social specialists in March and April of 2019. The team included six social specialists, two biodiversity specialists, and two cultural heritage specialists. The ESIA also utilized the results of a Hydrology and Flood Risk Assessment and a Geotechnical Study conducted by Geoconsult in support of the Project's Feasibility Study. The technical reports for these baseline studies are provided in the following appendices:

- Appendix B – Geoconsult Hydrology and Flood Risk Assessment;
- Appendix C – Geoconsult Geotechnical Study;
- Appendix D – WWEC Household Survey;
- Appendix E – WWEC Biodiversity Survey; and
- Appendix F – WWEC Cultural Heritage Survey.

1.6.4 Stakeholder Engagement Activities

Stakeholder engagement for the ESIA started during the scoping stage of the Project. The objective is to ensure that sources of existing information and expertise are identified, legislative requirements are met, and stakeholder concerns are addressed. Stakeholder engagement activities conducted for the ESIA to date are described in Chapter 7 of this report.

1.6.5 Impact Assessment

Impact assessment and development of mitigation measures is an ongoing process that begins during the project planning stage and continues as the Project progresses. The key objectives of the impact assessment process are to:

- Analyse how the Project may interact with resources and receptors identified during baseline studies in order to define, predict, and evaluate the likely extent and significance of environmental and social impacts that may be caused by the Project;
- Develop and describe effective, realistic, and practical mitigation measures that avoid, reduce, control, remedy, or compensate for negative impacts and enhance positive benefits;
- Evaluate the predicted positive and negative residual impacts of the Project; and
- Develop a system whereby mitigation measures are integrated into Project activities and become Project commitments. This is achieved through the development of an Environmental and Social Management Plan (ESMP).

The impact assessment and development of mitigation measures was undertaken between March and June 2019.

1.7 ESIA METHODOLOGY

The purpose of the impact assessment process is to identify any likely significant impacts on environmental or social receptors as a result of the Project and to develop appropriate mitigation measures to effectively manage these impacts. To determine the significance of potential impacts, this ESIA considers two main factors: impact magnitude and receptor sensitivity/vulnerability. Magnitude is a measure of the changes to a receptor that will potentially result from the Project, while sensitivity/vulnerability is a measure of how sensitive or vulnerable a receptor (e.g., people, flora, or fauna) is to these changes.

There is no statutory or internationally agreed upon definition of significance; however, this assessment will use the following practical definition:

> An impact will be judged significant if, in isolation or in combination with other impacts, it will cause a notable change from baseline conditions and may require mitigation to manage the effects on/risks to a receptor from this change.

Evaluating impact significance is an iterative process and follows the following cycle: identify potential impacts; evaluate receptor sensitivity/vulnerability; evaluate magnitude of potential impacts; determine significance of potential impacts; and determine significance of residual impacts. Additional details regarding the ESIA methodology are provided in Section 6.1.

The potential impacts assessed in the ESIA were determined based on the results of a scoping exercise, which is described in Section 6.2. The assessment of positive impacts is presented in Section 6.3, and the assessment of potential negative impacts is presented in Section 6.4.

1.8 STRUCTURE OF THE ESIA REPORT

The structure of this ESIA Report is summarised in Table 1-1.

Table 1-1: Structure of the ESIA Report.

Section	Title	Content
-	Executive Summary	Summary of the ESIA for the benefit of decision makers and the public.
Section 1	Introduction	Describes the Project's background, type, proponent, and justification, as well as the purpose of the ESIA, summary of the ESIA process, and structure of the ESIA Report.
Section 2	Project Description	Technical description of the Project schedule, facilities, and activities.
Section 3	Project Alternatives	Presents the results of an alternatives analysis.
Section 4	Policy and Legal Framework	Describes the environmental and social legislation applicable to the Project, as well as applicable international standards.
Section 5	Environmental and Social Setting	Describes the relevant environmental and social existing conditions and review of sensitive resources that may be affected by the Project.
Section 6	Impact Identification and Analysis	Describes the impact assessment methodology utilized and outcome of the scoping process. Evaluation of positive impacts. Evaluation of potential negative impacts, description of proposed mitigation measures, and evaluation of residual impacts.
Section 7	Public Consultation/ Stakeholder Engagement	Describes stakeholder engagement national and international requirements, identification and mapping, and activities conducted as part of the ESIA.
Section 8	Environmental and Social Management Plan	Compilation of the Project's mitigation and compensation measures in the form of a detailed plan to ensure that they are implemented at each stage of the Project.
Section 9	Conclusion and Recommendations	Summarizes the results of the ESIA.
Appendix A	EAD Terms of Reference	Terms of Reference for the Golomoti ESIA as set forth in an attachment to a letter from the Environmental Affairs Department (EAD) to JCM dated December 14, 2018.
Appendix B	Hydrology and Flood Risk Assessment	Baseline report prepared by Geoconsult.
Appendix C	Geotechnical Study	Baseline report prepared by Geoconsult.
Appendix D	Household Survey Report	Baseline report prepared by WWEC.
Appendix E	Biodiversity Baseline Report	Baseline report prepared by WWEC.
Appendix F	Cultural Heritage Baseline Report	Baseline report prepared by WWEC.

Section	Title	Content
Appendix G	List of Stakeholder Engagement Activities	General list of stakeholder engagement activities.
Appendix H	Stakeholder Engagement Plan.	Stakeholder Engagement Plan for the Project.
Appendix I	Technical Memo: Golomoti Protected Trees	Alternatives analysis for Project impacts to protected trees.
Appendix J	Environmental and Social Impact Assessment Team	Qualifications and roles of the team that prepared this ESIA Report.
Appendix K	Customary Land Consultation with Chief	Record of customary land consultation with Senior Chief Kachindamoto and Group Village Headman
Appendix L	National Level Baseline Information	Baseline information at a district and national level for broader context.
Appendix M	Maps	All report Maps in A3 full size

2. PROJECT DESCRIPTION

This Chapter provides a description of the proposed Project and presents an overview of the key elements and activities involved in the planned construction, operation, and decommissioning phases based on available design information.

2.1 PROJECT OVERVIEW AND LOCATION

Golomoti JCM Solar Corporation Limited (JCM) proposes to construct and operate a 20 megawatt alternating current (MWac) solar photovoltaic power plant near Golomoti, Dedza District, Malawi (Figure 2-1). The Project will also include the construction of a short (approximately 0.5 km) transmission line to connect the solar power plant to the existing Golomoti Substation, as well as a short (80 m) access road extending from the highway to the northeast (M5). The Golomoti Substation is operated by the Electrical Supply Corporation of Malawi Limited (ESCOM). The electricity generated by the solar power plant will be sold to ESCOM and will be transferred to the national grid via the Golomoti Substation. The estimated cost of the project is USD 35,000,000.

An Implementation Agreement between JCM and the Government of the Republic of Malawi, as represented by the Minister of Finance, Economic Planning, and Development and the Minister of Natural Resources, Energy, and Mining, was signed on August 23, 2018. The Implementation Agreement states that JCM “proposes to develop, design, engineer, procure, finance, construct, commission, own, insure, maintain and operate a solar photovoltaic generating power plant of up to twenty (20) Megawatts (alternating current) at Golomoti in Dedza District in the Republic of Malawi.” The Implementation Agreement further states that “Subject to and in accordance with the terms and conditions of the Power Purchase Agreement, the Company [JCM] shall generate and sell to ESCOM the energy generated at the Facility, and ESCOM shall purchase and pay for the energy made available to ESCOM from the Facility.” Finally, the Implementation Agreement states that the “Company and the Government (acting through the Ministry of Lands, Housing and Urban Development) are in the process of entering into the Land Lease Agreement in respect of the Project Site.”

The Power Purchase Agreement (PPA) between JCM and ESCOM was signed on September 13, 2018. Clause 2.1 of the PPA states that “the Seller [JCM] shall deliver and sell exclusively to the Buyer [ESCOM] the Net Electrical Output, and the Buyer shall accept and purchase the Net Electrical Output from the Seller.” The term of the PPA is 20 years from the commercial operation date, but may be extended pursuant to Clause 3.3 of the PPA.

JCM is currently drafting a Connection Agreement based on the signed PPA. The Connection Agreement will be signed upon completion of feasibility studies and ESCOM’s internal connection impact assessment.

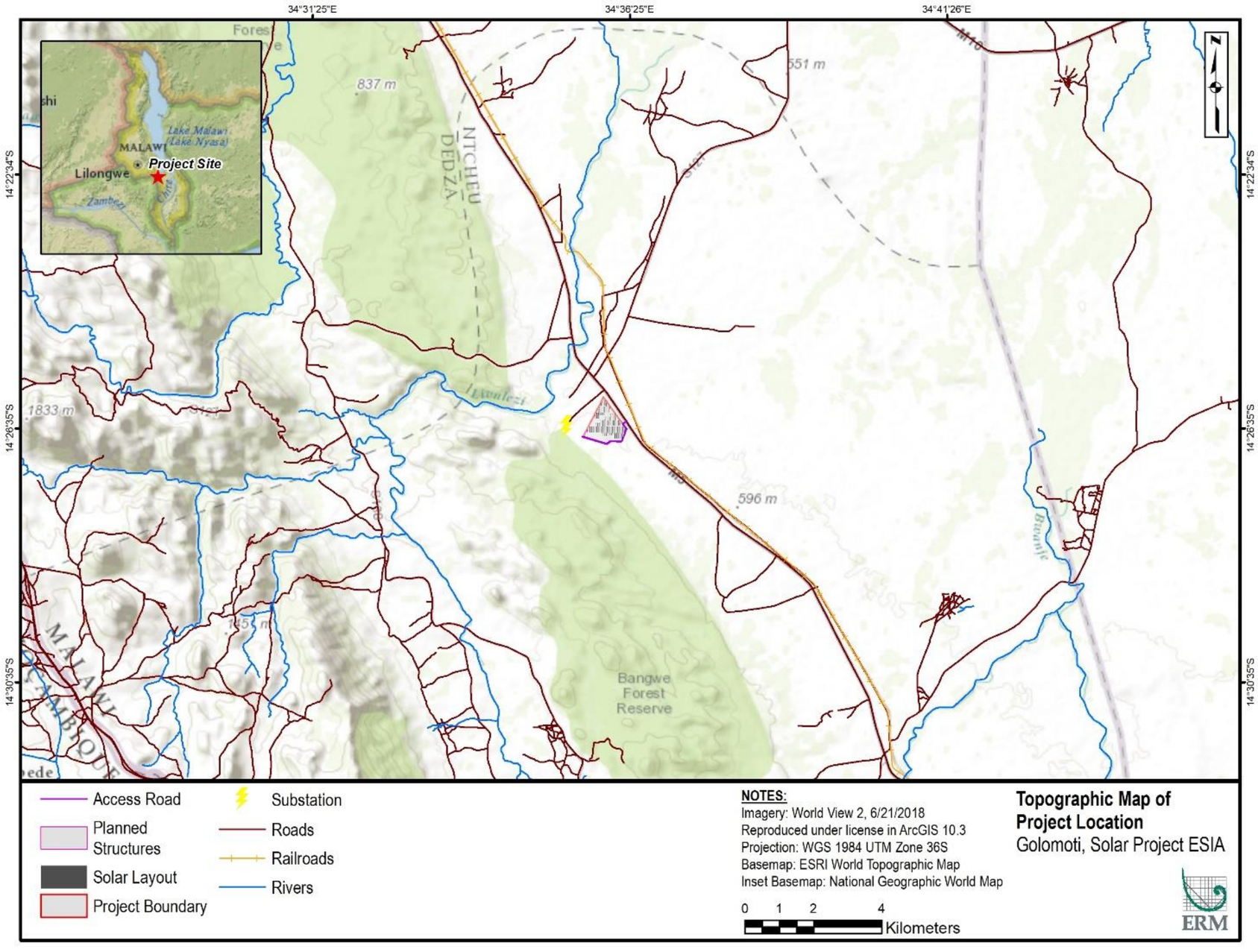
The layout for the Project is shown in Figure 2-2. Under this design, the Project will have a maximum alternating current (AC) output of 20 MWac with an expected annual generation in the range of 47,000 MW hours per year, considering a P90 probability of 0.5% degradation. The design maximizes use of the Solar Plant Site and will ensure that the Project can meet the power generation requirements in the PPA with ESCOM.

2.2 PROJECT SITE

The solar plant will be constructed on a 92 ha parcel (Solar Plant Site) located approximately 0.5 km from the Golomoti Substation and less than 1 km from Golomoti Trading Centre in Dedza District (Figure 2-1). It is located within the Kachindamoto Traditional Authority. The Project will also include the construction of a short (approximately 0.5 km) transmission line from the Solar Plant Site to the Golomoti Substation, as well as a short (80 m) access road extending from the highway to the northeast (M5). The Solar Plant Site and transmission line wayleave are collectively referred to herein as the Project Site.

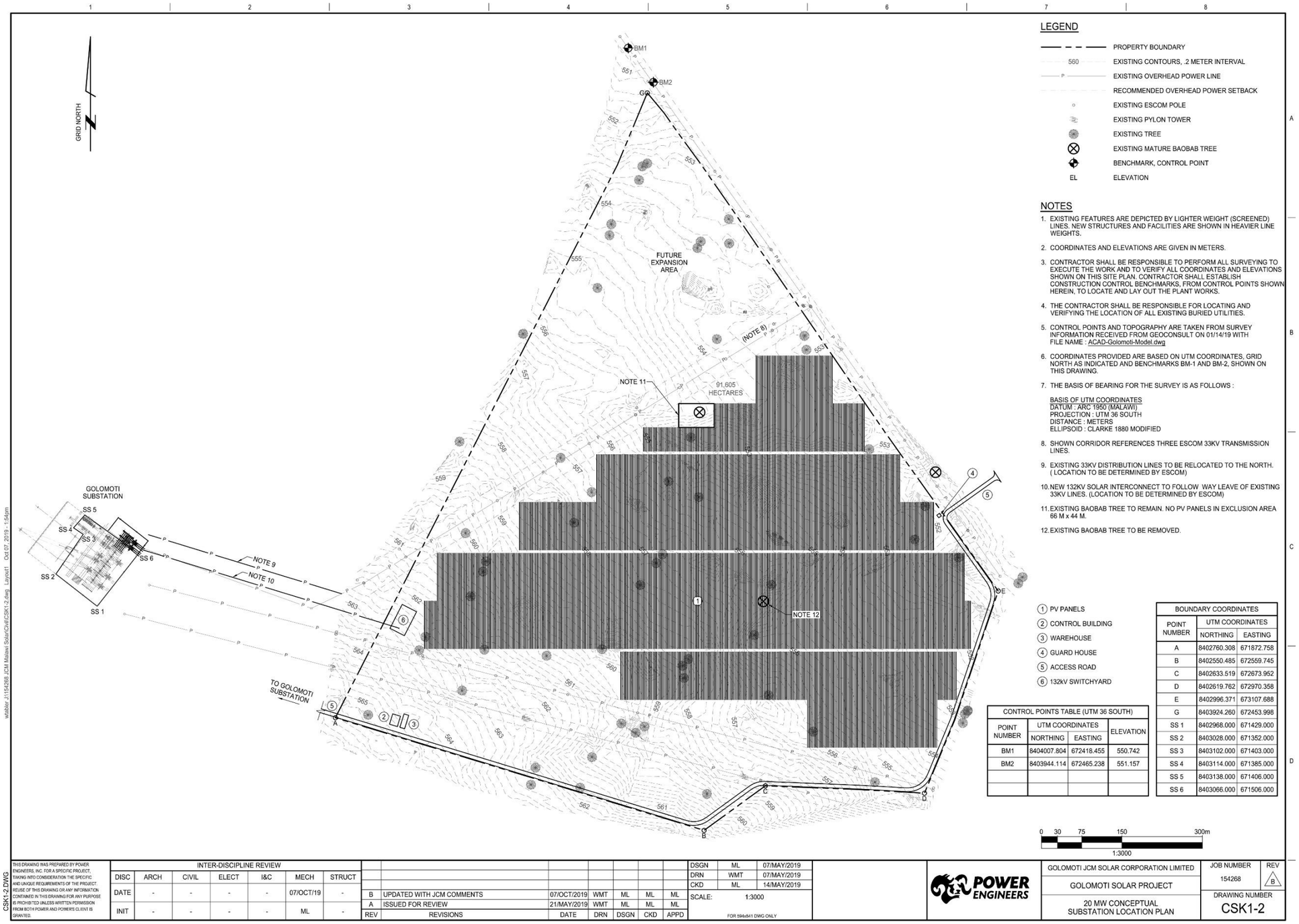
The Project Site is generally flat land and is predominantly used for subsistence agriculture. Local residents report that crops cultivated on the Project Site include maize, cotton, soy, cowpeas, and sweet potatoes. Trees on the Project Site include natural and planted trees, including mango, acacia, and baobab trees. Local residents report that medicinal plants are collected from the Project Site, although these plants can be collected elsewhere. There are also several footpaths that traverse the Project Site.

Figure 2-1: Topographic Map of the Project Location.



Source: ERM, 2019.

Figure 2-2: Site Layout.



Source: Power Engineers, 2019.

2.3 LAND OWNERSHIP

The predominant land ownership in the Project Site is customary. Customary land falls within the jurisdiction of a Traditional Authority (TA), which has been granted to a person or group and used under customary law. This land is held in trust and administered by traditional leaders (chiefs) on behalf of people in a community. The TA is mandated by the government to distribute land to individuals as well as address land disputes and report to the government through the office of the District Commissioner (DC).

JCM understands that it must consult with the Ministry of Lands on land issues, including land acquisition, and is in the process of doing so.

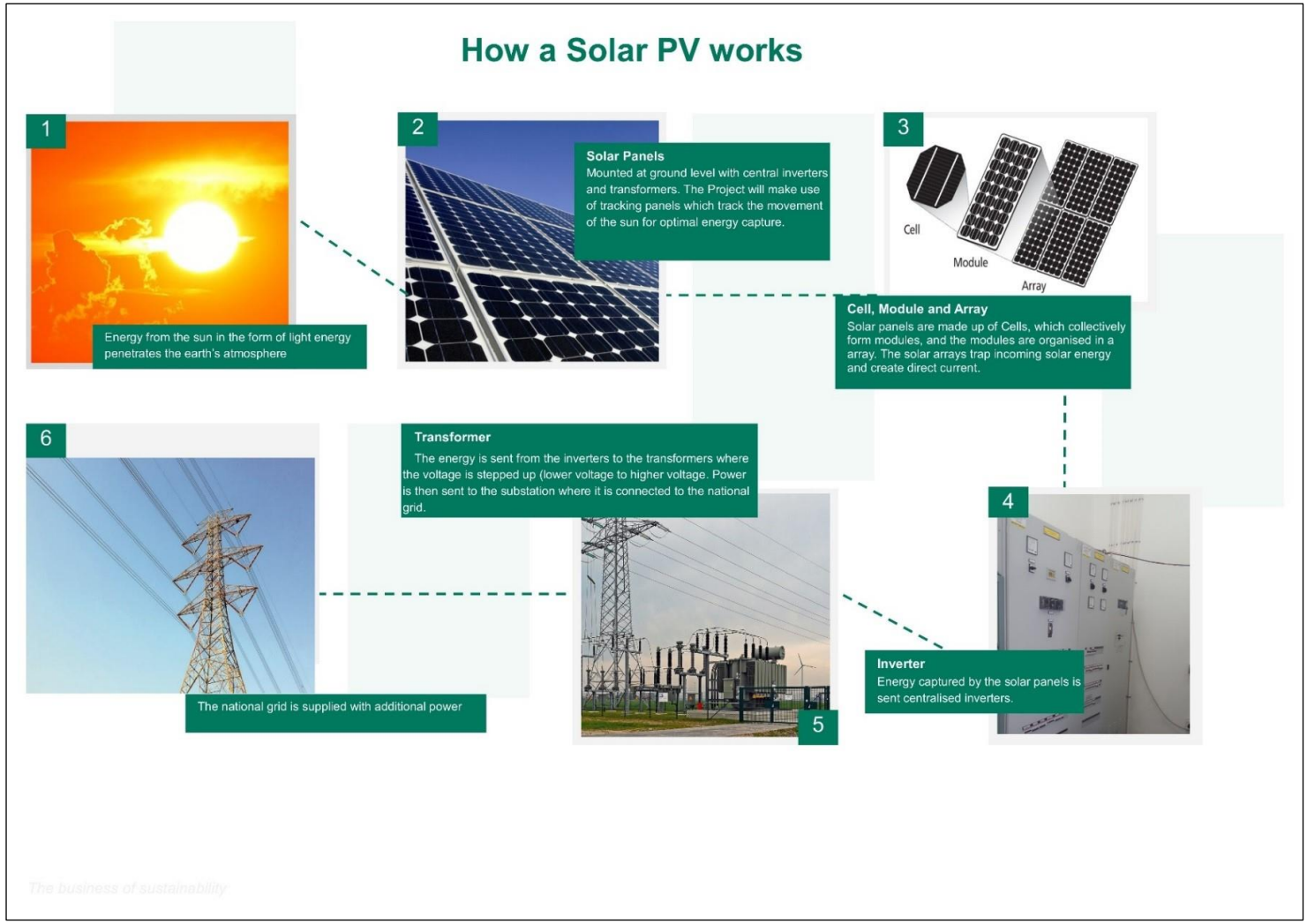
Additional information regarding the land ownership system and land uses in the Project Site is described in Chapter 6. The land acquisition for the Project is described in Section 6.4.9 and in the LRP.

2.4 PROJECT COMPONENTS

Photovoltaic (PV) technology allows the direct conversion of sunlight (photon energy) to electricity using semiconductor devices called solar cells. Solar cells are almost maintenance free, because they have no moving parts and have a relatively long life span. The photoelectric conversion process produces no pollution and can make use of free solar energy. Overall, the longevity, simplicity, and minimal resources used to produce electricity via PV systems make this a highly sustainable technology.

The general process of how solar PV technology works is illustrated in Figure 2-3. Energy from the sun in the form of light energy penetrates the earth's atmosphere. Solar arrays are mounted at ground level with trackers to follow the movement of the sun for optimal energy capture. Solar arrays are composed of modules, which are composed of PV cells. The PV cells generate direct current (DC) electricity when exposed to solar radiation. The energy is sent to inverters, which convert the DC electricity into usable alternating current (AC) electricity. The energy is and then sent to transformers, which increase the voltage. The energy is then sent to a substation, which is connected to the national grid. The national grid is therefore supplied with additional power.

Figure 2-3: How Solar Panels Work.



Source: ERM, 2018.

The PV solar technology chosen for the Project consists of the main components listed below.

- **PV cell**: The PV cell is the device that generates electricity when exposed to solar radiation. The absorbed solar energy excites the electrons inside the PV cell and produces electrical energy. All PV cells produce direct current (DC). There are three main types of solar cells:
  - Monocrystalline – Made from a single silicon crystal;
  - Polycrystalline — Made from multiple silicon crystals; and
  - Thin film — Common material used for thin film modules are cadmium telluride and copper indium gallium selenide.

  The Project will utilize polycrystalline cells.
- **PV module**: The PV module is a set of interconnected PV cells encapsulated between a transparent front (usually glass) and supporting framework in the back to allow for mounting. The modules will appear dark blue or black and will be mounted to an aluminium frame. The modules are designed to absorb solar radiation and are therefore not susceptible to reflection or glinting. The glare and reflectance levels from a given PV module are decisively lower than the glare and reflectance generated by standard glass.

  The Project will utilize PhonoSolar PS330P-24/TM (330 Wp) or similar modules, depending on market availability, best pricing, and final technical design. The Project will utilize 71,026 modules (i.e., panels). The panels will be installed in 4178 strings of 17 panels each.
- **Mounting structures**: To create a PV array, solar cells are mounted on a support system and arranged to receive solar radiation. The arrays can be “fixed” (simple stands mounted on the ground) or “tracking” (attached to a motorized apparatus that repositions the cell as the sun moves across the sky to receive maximum solar radiation). Tracking systems can be horizontal single axis, tilted single axis, or dual axis.

  The Project will utilize ArcTech Solar-Skyline mounting structures or similar with a single axis tracking system with backtracking capabilities. The backtracking operation mode is designed to reduce the shading losses during the first and last hours of the day. The Project will utilize 935 trackers with 3 m of tracker spacing.
- **PV array**: The PV array is the complete power generating plant consisting of multiple PV modules wired in series and in parallel. The PV modules will be connected by DC cables to combiner boxes mounted underneath the PV module mounting structures. Each combiner box will occupy an area of approximately one square metre. The power generated by many PV module strings is combined in the combiner box and transmitted via underground 400-1000 volt DC cables to an inverter and transformer enclosure.

  The PV array will consist of 71,026 panels installed in 4178 strings of 17 panels each, and will cover an area of 137,815 m^2. The Array Global Power Standard Test Conditions will be 23,439 kWp (panel output), and the Array Global Power Operating Conditions will be 21,295 kWp (50º Celsius).
- **Inverters**: Inverters will be utilized to convert DC energy created by the PV panels into useable alternating current (AC) energy. The voltage input for an inverter is a

function of how the PV panels are connected together and can vary from 12 volt DC to as high as 1500 volt DC. For large commercial applications such as the proposed Project, the design will call for connecting (or stringing) the PV array such that the higher voltages are utilized. The Project intends to utilize Huawei SUN2000-42 KTL (42 kW) or similar Smart String Inverters. The Project will utilize 465 inverters.

- **Plant Switchyard**: The plant switchyard receives all power from the inverters via underground cables and provides protection and control equipment required to safely manage the plant and to ensure grid code compliance regulations. The switchyard will include two 33kV:132kV transformers to increase the solar plant output to the same voltage as the grid. The primary and backup energy meters will be located in the plant switchyard to provide measurement of the plant electrical generation. The switchyard will consist of at least one small building, outdoor electrical plant and equipment, and the transformers, and will be approximately 2000 m^2.
- **O&M building, warehouse, and guardhouse**: The Project will include an operations and maintenance (O&M) building that will include a control room, offices, a meeting room, and restrooms. It will measure 14 by 19 m and will be 4.6 m tall. The Project will also include a warehouse that will measure 8 by 25 m and will be 4.6 m tall, and a guardhouse that will measure approximately 3 by 3 m.
- **Access tracks and fencing**: The Project will include tracks throughout the site to permit access for maintenance vehicles and personnel. Vegetation (such as grass) will be permitted to grow throughout the site but will be kept low. A security fence, alarm system, and close circuit television security cameras will surround the site.
- **Balance of system**: The remaining components that will make up the Project, commonly referred to as “balance of plant” components, typically include, but are not limited to, combiner boxes, DC cables, trenches, power conversion stations, AC cables and earthing, and lightning protection.
- **Transmission line**: a 132 kV transmission line will connect the plant switchyard and the Golomoti Substation. The transmission line will be approximately 0.5 km long. The wayleave for the transmission line will be 30 m (15 m on each side of the centreline). The transmission line will follow the path of the existing 33 kV ESCOM distribution lines. ESCOM will relocate the 33 kV distribution lines to allow space for the new Golomoti 132 kV line.
- **Connection to the grid**: The ESCOM Golomoti Substation will require expansion to the north to provide a bay for connection of the plant Transmission Line. The Golomoti Substation provides incoming and out-going 132 kV transmission lines and 33 kV and 66 kV distribution lines to regional communities. The Golomoti Substation includes a control room that is staffed by ESCOM employees.

Key Project components for the Project will be source by the EPC Contractor and will most likely be sourced from China.

2.5 PROJECT ACCESS

The Project will involve the construction of a short Access Road extending from the highway to the northeast (M5). The section of the access road located between the highway and the Project Site is approximately 80 m long. Once inside the Project Site, the access road will follow the eastern and southern borders of the Project Site to the

buildings to be located in its southwest corner (Figure 2-2). It will then follow the transmission line way leave to the Golomoti Substation.

2.6 PROJECT PHASES

2.6.1 Project Planning and Design

The Project has been in the planning and design phase since June 2015. During this this phase of the Project, multiple pre-feasibility and feasibility studies have been conducted, as well as engagement with government and community stakeholders. The studies that have been undertaken during this phase include:

- Grid Analysis and Market Review;
- Site Pre-feasibility Study;
- Feasibility Study (in progress); and
- Land Acquisition and Compensation Study.

This ESIA has also been conducted as part of the planning and design phase of the Project.

2.6.2 Site Preparation and Construction Phase

Site preparation will start with the construction of a short (80 m) Access Road extending from the highway to the northeast (M5). Site preparation will proceed with the clearance of vegetation, installation of fencing, and grading of the site.

The construction phase will be initiated following the completion of site preparation activities. The following activities will take place during the construction phase:

- Transportation of equipment and components to the Project Site;
- Establishment of workshops and temporary laydown areas;
- Excavation of cable trenches;
- Ramming or drilling of the mounting structure frames, depending on the geotechnical condition of the ground;
- Installation of the modules onto the frames;
- Installation of measuring equipment;
- Laying of cables between the module rows to the inverter stations;
- Construction of inverter and transformer station foundations and installation of inverter stations;
- Construction of transmission lines, switchyard, and upgrades/expansions at the Golomoti Substation, if required;
- Construction of stores, workshop, and office buildings;
- Testing and commissioning; and
- Removal of equipment and demobilisation of the construction team.

The following facilities will be constructed:

- PV panels (see #1 in Figure 2-2 for location);
- Control building, which will contain the equipment required to monitor and operate the solar power plant (#2 in Figure 2-2);

- Warehouse, which will be utilized to store equipment and supplies (#3 in Figure 2-2);
- Guardhouse, which will provide shelter for security guards (#4 in Figure 2-2);
- Access road, which will be utilized to access and traverse the Project Site (#5 in Figure 2-2); and
- Switchyard, from which the transmission line to the Golomoti Substation will extend (#6 in Figure 2-2).

The primary Project components will be delivered in the following way during construction:

- Inverters – eight truck deliveries;
- Main Transformer – One specialised abnormal load delivery;
- LV/MV Transformers – eight truck deliveries;
- PV modules – 200 truck deliveries;
- Tracker/structures – 300 truck deliveries; and
- Miscellaneous – 200 truck deliveries.

The following construction vehicles/machinery are anticipated to be on site during the construction period:

- Two Dump trucks;
- Three Bobcats;
- One tractor;
- Four water trucks;
- Four tractor-loader-backhoes;
- Ten pick-up trucks; and
- Three excavators.

Waste generated during construction will include general domestic waste, including sanitary and food waste, office waste, and organic material. Petrol and diesel by-products will be generated from the transportation of goods and personnel, generators, and heavy construction equipment. Large quantities of non-hazardous waste will be generated from the solar PV panel packaging material, which typically arrive in wood pallets. The recycling and/or donation of these materials to affected communities will be investigated. Waste will be separated at source and labelled bins will be located within the Project Site for the storage of the various categories. Staff will be trained in proper waste management practices and the importance of implementing them. Cleaning staff will be trained in the safe handling and storage of waste and hazardous materials. They will also be provided with adequate personal protective equipment.

Hazardous waste generated by the Project will comprise of petrol and diesel by-products generated from the transport of goods and personnel, generators, and heavy construction equipment. No chemicals will be utilized apart from those present in construction materials, such as paint and solvents. All hazardous waste generated during construction will be removed by the EPC Contractor and safely disposed of in a licensed facility. JCM will investigate the possibility of recycling non-hazardous

waste. Non-recyclable, non-hazardous solid waste will be sent to a licensed waste site.

Wastewater from construction activities will include temporary sanitary facilities, storm water, and drainage over potentially contaminated areas (e.g., concrete batching/mixing areas and equipment storing areas). The EPC Contractor will manage wastewater during construction. Any hazardous wastewater will be stored on site and treated, if required, before disposal.

Electricity during the construction phase will be provided through the use of diesel powered generators. It is estimated that five 24 kW generators running at ¾ capacity for 10 hours a day and 5 days a week for 43 weeks will satisfy the electricity requirements of the office trailers during construction. The estimated consumption of fuel during construction for office trailers is therefore 58,050 L. It is estimated that ten 8 kW generators running at ¾ capacity for 6 hours a day and 5 days a week for 43 weeks will satisfy the electricity requirements of the operation of equipment during construction. The estimated consumption of fuel during construction for equipment use is therefore 21,930 L.

Construction will occur over 10 months. It is anticipated that there will be approximately 200 workers (skilled and unskilled) on the Project Site during the construction phase.

2.6.3 Operational Phase

The solar PV power plant will be operated on a 24 hour, 7 days a week basis, although generation of electricity will only occur during sunlight hours. Operational activities will include:

- Cleaning of the modules by trained personnel using high pressure water hoses or hand washing;
- Vegetation management under and around the modules to allow maintenance and operation at full capacity;
- Maintenance of all components, including modules, mounting structures, trackers, inverters, transformers, switching station plant, and equipment;
- Control room management and maintenance of staff facilities;
- Supervision of electricity production; and
- Site security monitoring.

Minimal waste is expected to be generated during the operations phase. Hazardous materials used on site during operations will include fuels, oils, lubricants, cleaning products, and specialised gases (for use in switchgear). Oil that needs to be replaced will be recycled, if possible, or safely stored and removed from the site and correctly disposed. It is estimated that 50 kg of domestic waste will be produced weekly by the 20 person workforce during operations. Industrial waste production will be occasional (e.g., solar panels, electrical waste) as they will only require disposal if they become damaged.

Wastewater from operations will comprise of onsite sanitary facilities and run off from panel cleaning activities. There will be minimal sewage from sanitary facilities during operations. These facilities will operate on a septic tank system and JCM will arrange for safe disposal of waste from the septic tank. Run-off from panel cleaning and storm

water are not expected to be contaminated and adequate drainage of the site will be a design requirement for the Project Site.

During operations, the facility will be supplied with solar-generated electricity and electricity purchased from ESCOM when the plant is not generating electricity.

It is estimated that there will be up to 20 workers on the Project Site and minimal Project related traffic during operations. The breakdown of workers will be eight skilled workers, including technicians, operations, and security, and 12 unskilled workers, including general facility housekeeping (weeding), panel cleaning, and cleaners.

2.6.4 Decommissioning Phase

The proposed Project is expected to operate for at least 20 years. Once the plant reaches the end of its life, the PV modules may be refurbished or replaced to continue operations or the facility may be closed and decommissioned. If decommissioned, all components would be removed and the site rehabilitated. All materials will be recycled if possible. If this is not possible, they will be disposed of in accordance with local regulations and good international industry practise. Approximately 200 workers will be required for decommissioning.

3. PROJECT ALTERNATIVES

3.1 ACTIVITY ALTERNATIVES

JCM was awarded preferred bidder status through ESCOM's competitive tender for the supply of solar PV electricity in 2016/2017. The tender specified solar PV as the activity to generate electricity resulting in no activity alternatives being investigated.

3.2 LOCATION ALTERNATIVES

A site feasibility and alternatives analysis was conducted of the proposed Project Site and surrounding 576 km^2. Site feasibility was evaluated based on a review of landscape characteristics pertaining to three primary aspects: operational, social, and environmental. The purpose of the operational analysis was to determine the engineering feasibility for development on the proposed Project Site compared to alternative locations. The purpose of the environmental and social analyses was to identify general environmental and social preferences and constraints of the proposed Project Site and compare these to those of alternative locations.

3.2.1 Criteria and Preferences

Criteria and preferences for each of the three feasibility analyses are listed below.

3.2.1.1 Operational

- Solar Resources: Good solar resources with minimal topographic or anthropogenic obstructions;
- Topography: Flat land with little to no gradient;
- Substation Access: Within 5 km of a substation;
- Road Access: Good access to existing road network;
- Available Land: Approximately 100-200 hectares of available land; and
- Floodplains/wetlands: No floodplains or wetlands.

3.2.1.2 Social

- Population: Sparsely populated;
- Structures: Few to no structures;
- Forests: No community forest opportunity areas; and
- Points of Interest: No places of worship, schools, or other points of interest.

3.2.1.3 Environmental

- Protected Land: Does not intersect with protected land;
- Floodplains/Wetlands: No floodplains or wetlands; and
- Modified Habitat: Located on land that has already been altered or disturbed by human presence.

3.2.2 Results of the Analyses

The site feasibility and alternatives analyses were conducted using publicly available spatial information along with custom analysis of commercial high-resolution satellite imagery. A summary of the results of the analyses are provided below.

3.2.2.1 Operational

Project placement close to existing roads and an existing substation was considered to be highly preferable, as it would reduce the cost and impact of building access roads and transmission lines necessary to reach the substation. The only substation within the 576 km^2 study area is the Golomoti Substation (Figure 3-1). Potential locations to the west of the substation were considered unfeasible because the slope exceeds operational requirements. Land farther east than the proposed Project Site is flat but there are fewer access roads and they are located farther from the substation. While locations in the eastern part of the study area have a slightly greater PV production value (Figure 3-2), they are less ideal for development purposes due to their more remote location.

The proposed Project Site was found to be feasible and preferred over alternative locations from an operational perspective for the following reasons:

- It has a gradient of 0-2 degrees across the entire site;
- It has relatively good solar irradiance, with only small obstructions from transmission line towers and small hills to the southwest;
- It is located less than 1 km from Golomoti Substation;
- It is located less than 100 m from a paved road;
- It represents over 100 hectares of available land for development; and
- There are no floodplains or wetlands within or directly adjacent to the site.

3.2.2.2 Social

From a social perspective, preferred locations for development are those located outside Golomoti Trading Centre and surrounding villages, where there are relatively few structures and land has been cleared for agriculture and grazing purposes (Figure 3-2). Cleared areas represent the preferred locations for solar development as they have minimal impacts to communities compared to sites that directly affect settlements or culturally important natural landscapes. Areas to the west of Golomoti and Kabulika were considered unfeasible from a social perspective, as development would affect potential community forest opportunity areas.

The proposed Project Site was found to be feasible from a social perspective for the following reasons:

- It is relatively sparsely populated;
- It only intersects with one structure;
- There are no points of interest, places of worship, or schools within 660 m of the site; and
- There are no community forest opportunity areas within 387 m of the site.

While other socially feasible locations were identified, none of them were preferable to the proposed Project Site based on social criteria.

3.2.2.3 Environmental

Forest and vegetated areas in the western part of the study area are considered to be environmentally sensitive and thus unfeasible for development. Areas that have been cleared for agriculture or grazing purposes are prioritized for development purposes. As a result, locations directly north of and proximal to Golomoti are optimal for the development project. Locations to the east of Golomoti are predominantly grassland and could be environmentally important areas.

The proposed Project Site was found to be feasible from an environmental perspective for the following reasons:

- There are no protected areas within 2 km of the site;
- There are no wetlands or floodplains within 1 km of the site; and
- It mostly consists of land utilized for subsistence agriculture and/or grazing.

While other environmentally feasible locations were identified, none of them were preferable to the proposed Project Site based on environmental criteria.

To summarize, the feasibility and alternatives analysis found that from an operational perspective, the proposed Project Site is feasible and preferable to alternative locations. While other socially and environmentally feasible locations were identified, none of them were preferable to the proposed Project Site. When the results of all three analyses are considered together, the proposed Project Site is the preferred location, with no preferred alternatives identified within the 576 km^2 study area.

3.2.3 Land Negotiations

Land negotiations with DLO and traditional leaders were undertaken from November 2015 to March 2016. The proposed Project Site was identified through this process. Following the identification, JCM has undertaken all required steps for the leasing of land according to Malawi regulatory requirements. The record of customary land consultation with Senior Chief Kachindamoto and the Group Village Headman is provided as Appendix K.

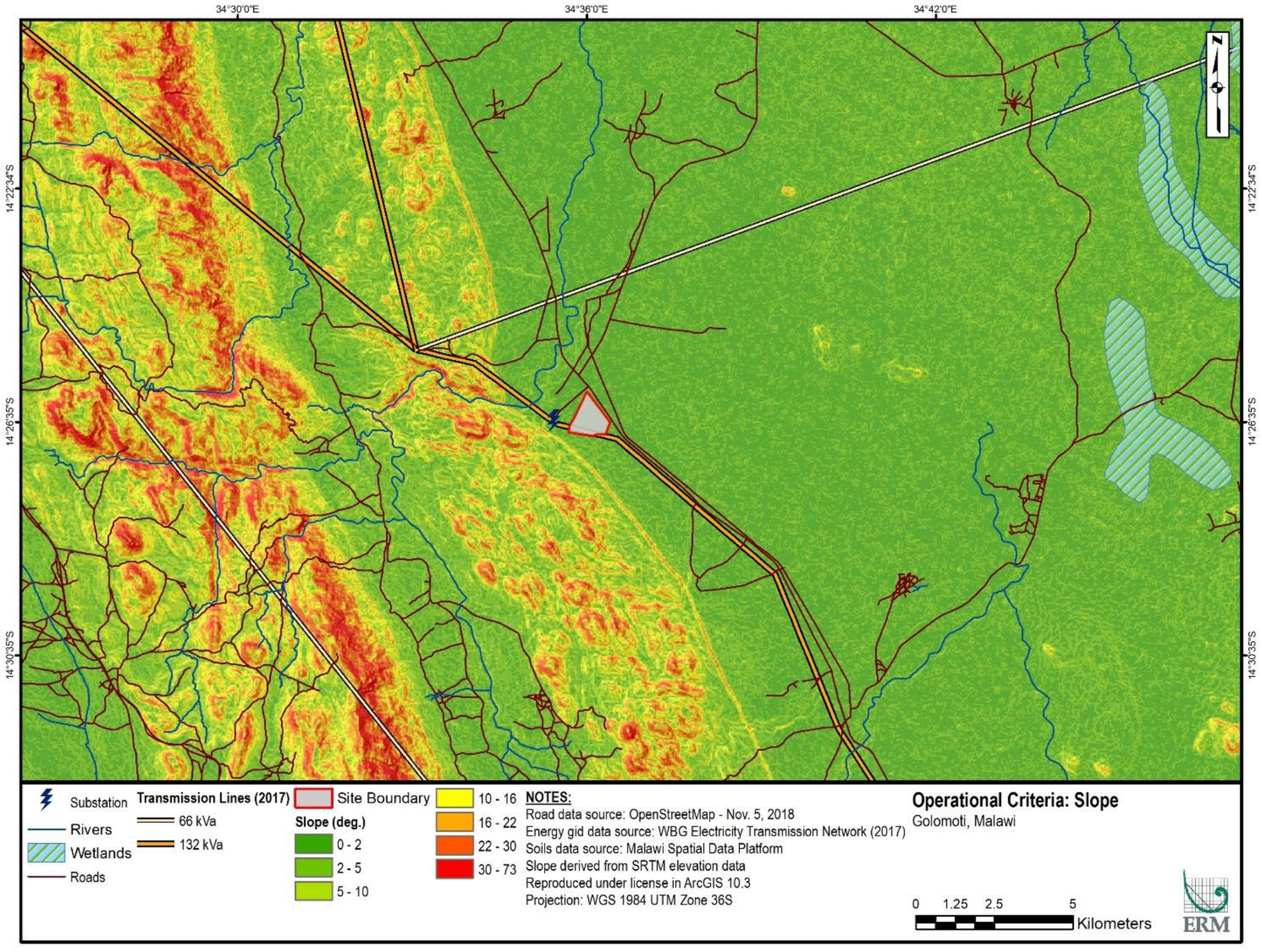
3.3 TECHNOLOGY ALTERNATIVES

Various technology alternatives will be investigated as part of the EPC bidding process for the Project. Each EPC bid will include a variety of technical specifications that will be evaluated by JCM.

3.4 NO ACTION ALTERNATIVE

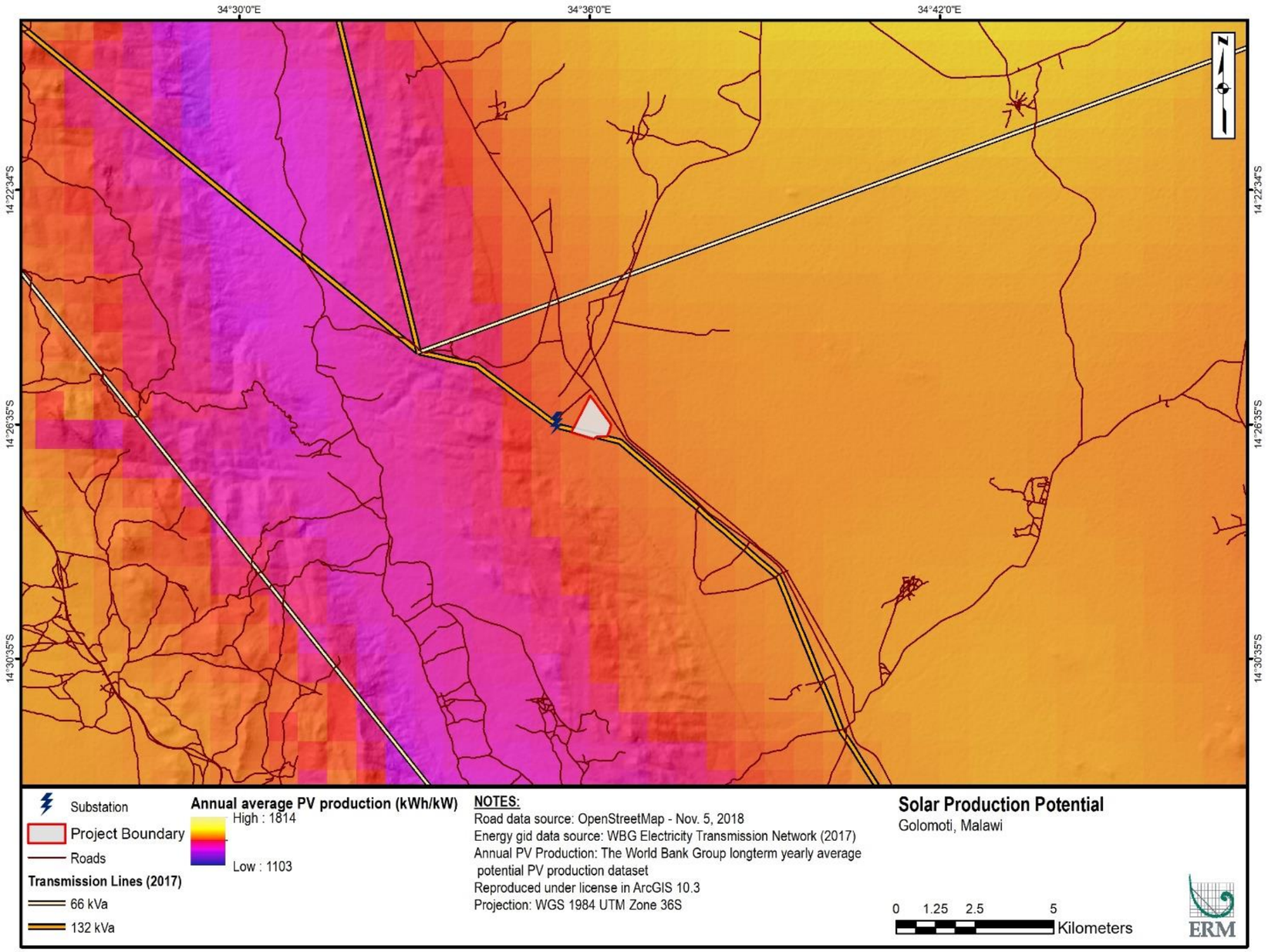
If the Project is not undertaken, then Malawi will not receive the significant increase in electricity generation for the country. In addition, temporary benefits from construction employment and permanent benefits from operational employment will not be realised. CSR programs to benefit local communities will not be undertaken.

Figure 3-1: Operational Criteria for Site Feasibility and Alternatives Analysis.



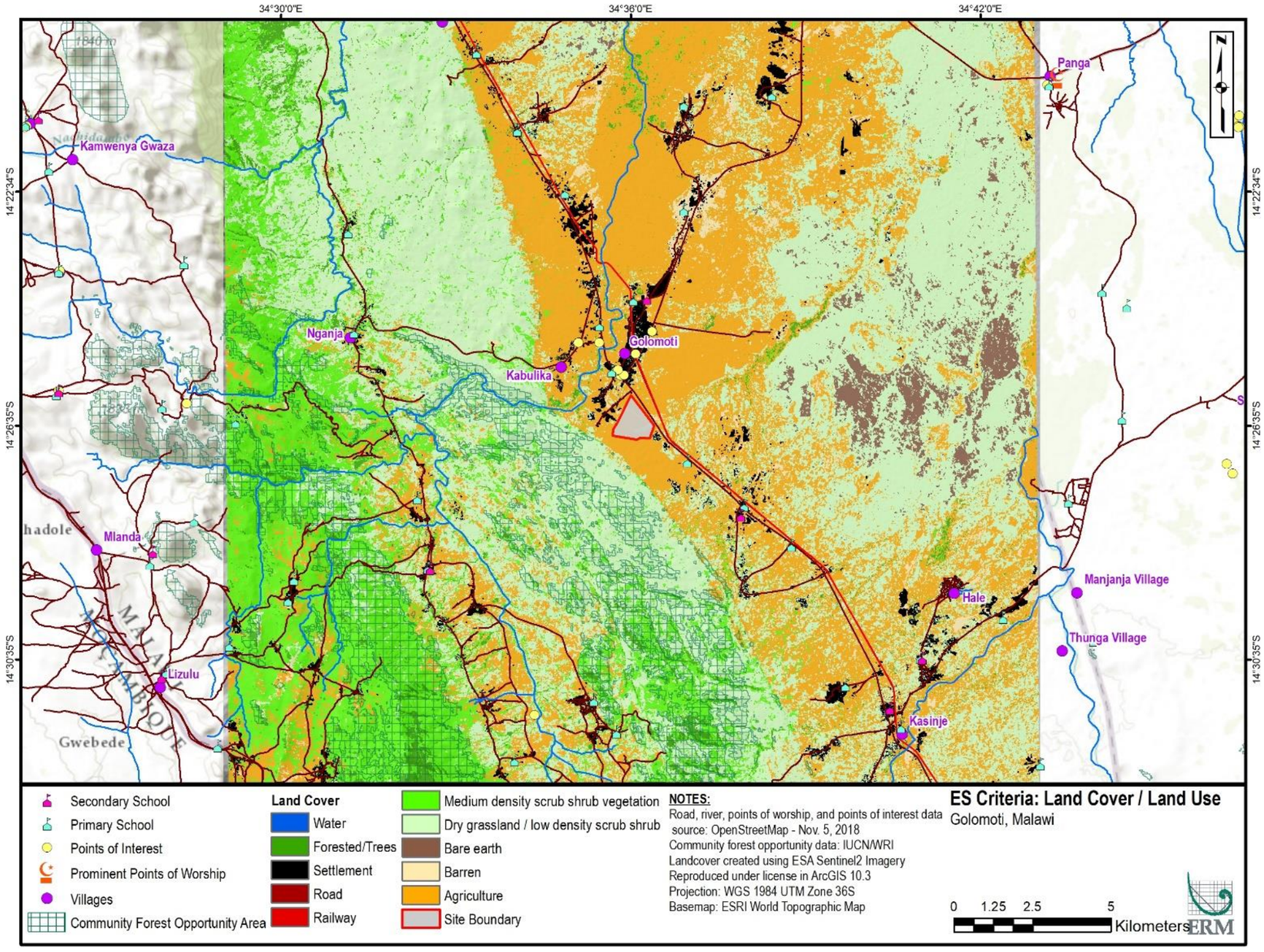
Source: ERM, 2019.

Figure 3-2: Solar Production Potential.



Source: ERM, 2019.

Figure 3-3: Social and Environmental Criteria for Site Feasibility and Alternatives Analysis.



Source: ERM, 2019.

4. POLICY AND LEGAL FRAMEWORK

This chapter presents an overview of the principal national environmental and social policies, laws, and regulations applicable to the Project, [7] as well as international treaties and conventions to which Malawi is party. It also includes an overview of international lender standards, which define international best practice. In addition, they are likely to be applicable to the Project under lender loan agreements.

4.1 MALAWIAN INSTITUTIONAL FRAMEWORK

4.1.1 Constitution of Malawi

The 1995 Constitution of the Republic of Malawi (Constitution) is the supreme law of the country. The Constitution recognises that responsible environmental management can make an important contribution towards achieving sustainable development, improved standards of living, and conservation of natural resources (SADC, 2012). The Constitution states that the environment of Malawi should be managed in order to:

- Prevent degradation of the environment;
- Provide a healthy living and working environment for the people;
- Accord full recognition of the rights of future generations by means of environmental protection; and
- Conserve and enhance biological diversity.

The Constitution includes a framework for the integration of environmental considerations into development programs. The government, its partners, and the private sector therefore have a responsibility to ensure development programs and projects are undertaken in an environmentally responsible manner.

The Constitution also sets forth the legislative basis for land acquisition in the country. Section 28 (2) of the Constitution states that “No person shall be arbitrarily deprived of property,” and Section 44 (4) states that “Expropriation of property shall be permissible only when done for public utility and only when there has been adequate notification and appropriate compensation, provided that there shall always be a right to appeal to a court of law.”

With regard to women’s rights, Section 24 of the Constitution states that:

> Women have the right to full and equal protection by the law, and have the right not to be discriminated against on the basis of their gender or marital status which includes the right… to be accorded the same rights as men in civil law, including equal capacity… to enter into contracts… [and] to acquire and maintain rights in property, independently or in association with others, regardless of their marital status…

7 Walmsley, B and Patel, S, 2011. Handbook on environmental assessment legislation in the SADC region. 3rd edition. Pretoria: Development Bank of Southern Africa in collaboration with the Southern African Institute for Environmental Assessment.

4.2 MALAWIAN NATIONAL POLICIES AND PLANS

4.2.1 National Environmental Action Plan (2004)

The National Environmental Action Plan (NEAP) was developed in 1994 (updated in 2004) in response to Agenda 21 (Rio 1992 Declaration) as an action plan for integrating environmental issues into socio-economic development programs. The objectives of the NEAP are to:

- Document and analyse all major environmental issues and measures;
- Promote sustainable use of natural resources; and
- Develop an environmental protection and management plan.

The NEAP outlines actions that need to be considered to ensure adequate environmental protection. For example, ESIAs are required for any development that may affect fragile ecosystems, and the government is required to ensure that workers are supplied with appropriate protective equipment during construction and operation.

The NEAP is applicable to the Project because it has the potential to negatively impact the surrounding environment and therefore an ESIA is required. In the ESIA, impacts and management measures are detailed and a management plan is included in accordance with the objectives of the NEAP.

4.2.2 National Environmental Policy (2004)

The National Environmental Policy (NEP) aims to create a balance between protection of natural resources and national development. The policy promotes sustainable social and economic development through sound management of the environment and natural resources. The policy seeks, among other things, to:

- Secure an environment suitable for the health and well-being of all citizens of Malawi;
- Promote efficient utilisation and management of the country's natural resources and encourage self-sufficiency in food, fuel wood, and other energy requirements;
- Facilitate the restoration, maintenance, and enhancement of the ecosystems and ecological processes essential for the functioning of the biosphere and prudent use of renewable resources;
- Integrate sustainable environmental and natural resource management into the decentralised governance systems and ensure that the institutional framework for the management of natural resources supports environmental governance in local government authorities;
- Enhance public education and awareness of various environmental issues and public participation in addressing them; and
- Promote local community, NGO, and private sector participation in environmental and natural resource management.

The NEP includes strategies on environmental planning and environmental impact assessment. The objective of environmental planning is to ensure that national and

district development plans integrate environmental concerns in order to improve environmental management and ensure sensitivity to local concerns and needs.

The NEP is applicable to the Project because it requires an ESIA. The objective of the NEP is to regularly review and administer the guidelines for ESIAs, audits, monitoring, and evaluation so that adverse environmental impacts can be eliminated or mitigated and environmental benefits enhanced.

4.2.3 National Land Policy (2002)

The National Land Policy (2002) guides land management and administration issues, provides definitions of land ownership categories, and provides details on compensation payments for land. In terms of land use planning, the policy provides that land allocation should make effective use of land and take into account the environment and the welfare of communities. In terms of environmental management, the policy aims to lend support to the policies and strategies that are already in place. The policy covers issues related to both urban and rural management of solid and liquid waste, protection of sensitive areas, agricultural resource conservation and land use, community forests and woodland management, over-dependence on wood fuel, forest programs, coordination of multiple land uses, water resources and wetlands, lakeshore environmental management, and mining and minerals.

The National Land Policy is applicable to the Project because the Project includes land acquisition.

4.2.4 National Water Policy (2004)

The National Water Policy (2004) requires that:

- Water should be managed and used efficiently and effectively in order to promote its conservation and future availability in sufficient quantity and acceptable quality; and
- All programs related to water should be implemented in a manner that mitigates environmental degradation.

The National Water Policy is applicable to the Project because the Project will draw water from groundwater resources. Permits for water extraction are not part of the ESIA process but require the approved ESIA as part of the application. Once the ESIA has been approved, the Project will apply for the water use license.

4.2.5 National Energy Policy (2018)

The National Energy Policy (2018) describes technical, financial, institutional, and socio-cultural barriers to Renewable Energy Technologies (RETs). Technical barriers include a lack of capacity in manufacturing, distributing, installing, and maintaining RETs. Financial barriers include high initial cost, a large proportion (45%) of which emanates from import duties and surtaxes. Other key financial barriers are a lack of dedicated and affordable financing mechanisms, a lack of financers and suppliers with knowledge about establishing dedicated financing mechanisms and appraising applications for credit, a lack of skills to develop business plans, a lack of knowledge about local, regional, and international financial facilities for RETs, a lack of confidence in RETs, and low returns on

investment (for financiers) and the non-availability of loans (for end users). Institutional barriers include a lack of standards and a regulatory framework, limited delivery modes, a small number of RET companies, a latent market and a small number of qualified technicians to undertake installations, a lack of deliberate policies and strategies, and a lack of information about the efficacy of RETs among policy makers, NGOs, and the public. Social-cultural barriers include gender insensitivity in the design and operation of some RETs.

The National Energy Policy is applicable to the Project because it will produce renewable energy.

4.2.6 National HIV/AIDS Policy (2012)

The National HIV/AIDS Policy (2012) provides technical and administrative guidelines for the design, implementation, and management of HIV/AIDS interventions, programs, and activities at all levels of Malawi society. It offers:

- Guidance on critical intervention areas, for example social and economic support for people living with HIV/AIDS;
- Provision of care and support for treatment to achieve a better quality of life for all people living with HIV/AIDS; and
- Protection of the human rights and freedoms of people living with HIV/AIDS.

The goals of the National HIV/AIDS Policy are to:

- Prevent the further spread of HIV infection; and
- Mitigate the impact of HIV/AIDS on the socioeconomic status of individuals, families, communities, and the nation.

The National HIV/AIDS Policy is applicable to the Project because potential HIV/AIDS impacts were investigated in the ESIA and are addressed in this ESIA Report. Measures to mitigate these impacts are in line with the policy.

4.2.7 National Health Policy (2008)

The overall goal of the National Health Policy (2008) is to improve the health status of all people in Malawi by reducing the risk of ill health and the occurrence of premature deaths.[8] The policy acknowledges the inadequate resources available for the health sector and defines the Essential Health Package, which is available to all Malawians free of charge.[9]

The National Health Policy is applicable to the Project because JCM is committed to ensuring that the health of workers and surrounding communities are not negatively impacted by Project activities.

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[8] WHO, Malawi, “Analytical summary - General country health policies,” nd. Accessed on 18-Mar-19 at: http://www.aho.afro.who.int/profiles_information/index.php/Malawi:Analytical_summary_-_General_country_health_policies.

[9] WHO, Malawi, “Analytical summary - General country health policies,” nd. Accessed on 18-Mar-19 at: http://www.aho.afro.who.int/profiles_information/index.php/Malawi:Analytical_summary_-_General_country_health_policies.

4.2.8 Republic of Malawi Gender Policy (2015)

The Republic of Malawi Gender Policy (2015) focuses on building a society where men, women, boys, and girls equally and effectively participate in and benefit from development. A key aspect of this is to increase land ownership for women and promote women's participation in community afforestation, water, and land.

The Republic of Malawi Gender Policy is applicable because JCM will, as practicable, promote gender equality in all aspects of the Project.

4.3 MALAWIAN ENVIRONMENTAL LAWS

4.3.1 Environmental Management Act (1996)

The Environmental Management Act (EMA) was enacted in 1996 to provide the legal framework for addressing environmental problems impacting Malawi, including soil erosion and land degradation, deforestation, water resources degradation and depletion, threats to fish resources, threats to biodiversity, human habitat degradation, and air pollution, including greenhouse gas emissions and climate change. The EMA requires certain development projects to conduct an ESIA to evaluate their potential environmental and social impacts and to develop measures to avoid or mitigate these impacts. The Environmental Affairs Department (EAD) of the Ministry of Natural Resources, Energy, and Mining has developed guidelines for conducting ESIAs and preparing ESIA reports in compliance with the EMA (see Section 4.3.2 of this report).

Part IV of the EMA makes provisions for the control of air and water pollution, and the act prohibits the discharge of pollutants into the environment. The EMA states that it is the duty of every person to prevent the discharge of any pollutant into the environment except in accordance with specifications made by the Minister (of Natural Resources, Energy, and Mining) or Director (of EAD). It states that the Minister is able to direct anyone to prevent and/or minimise any pollutant discharged into the environment. Finally, it requires that any discharge of pollutants be conducted in accordance with the EMA.

Section 24 of the EMA provides information on the need for projects for which an ESIA may be required, as detailed below.

- The Minister may specify the types and sizes of projects that will not be implemented unless an ESIA is undertaken;
- Before implementing a project that requires an ESIA, the project developer must submit the following information to the Director:
    - A description of the project;
    - A description of the activities to be undertaken in the implementation of the project;
    - The likely impact of those activities on the environment;
    - The number of people to be employed by the project (construction and operation);
    - Details of the environment likely to be affected by the project; and

- Any additional information that the Director deems to be relevant to the project.

A Project Brief was submitted to the EAD in November 2018, which outlined the scope of the Project. The EAD responded in a letter dated December 14, 2018 by confirming that an ESIA was required. This ESIA Report satisfies the requirements of the EMA.

4.3.2 Guidelines for Environmental Impact Assessment (1997)

The EAD issued Guidelines for Environmental Impact Assessment shortly after passage of the EMA, in 1997. The guidelines address prerequisites for EIA (Section 1.3), statutory basis for EIA (Section 1.4), integrating EIA into the project cycle (Section 1.5), the EIA process (Section 2.2), EIA roles and responsibilities (Section 2.3), and public consultation and access to information (Section 2.4). Appendix C.3 provides guidelines on the structure of EIA Reports.

The Golomoti ESIA was conducted and this ESIA Report was prepared in accordance with the Guidelines for Environmental Impact Assessment (1997).

4.3.3 Forestry Act (1997)

The Forestry Act (1997) addresses the management of indigenous forests on customary land, private land, forest reserves, protected forest areas, and plantations.[10] The objectives of the Forestry Act include to:

- Protect trees and resources in forest reserves;
- Conserve and enhance biodiversity;
- Protect and facilitate management of trees on customary land; and
- Promote sustainable utilisation of timber and other forest produce and protect fragile areas such as riverbanks and water catchment areas.

The Project Area is largely modified by human activities with most of the area being used for the cultivation of crops. There is no land take required from forest reserves, protected forest areas, or plantations. Any removal of trees, however, will be conducted in line with the Forestry Act.

4.3.4 Electricity Act (2004)

Under the Electricity Act (2004), developers are required to give no less than 30 days' notice before placing, laying down, or carrying any transmission line, distribution line, water pipeline, or other equipment through, over, or under any land without the consent of the owner, lessee, or occupier of the land.[11] Notice must be published in the *Gazette* or in a paper in general circulation. Notices should include the nature of the work and the name and location of the project. Notice must also be provided to affected people. It is the responsibility of the authorities to determine the amount of compensation, either by

[10] Republic of Malawi, Forestry Act, 1997. Accessed on 19-Mar-19 at http://extwprlegs1.fao.org/docs/pdf/mlw10025.pdf.

[11] Republic of Malawi, Electricity Act, 2004. Accessed on 18-Mar-19 at https://www.meramalawi.mw/index.php/legislation/send/2-legislation/5-the-electricity-act-2004.

payment of a lump sum, annual rental, or both, to the impacted owners, lessees, or occupiers.

The Project is in the process of securing the necessary licenses from ESCOM for the generation of electricity. The notifications required by the Electricity Act will also be made prior to the initiation of construction activities.

4.3.5 Energy Regulation Act (2004)

The Energy Regulation Act (2004) established the Malawi Energy Regulatory Authority (MERA) to regulate the energy sector, defined the functions and powers of MERA, and provided for licensing of energy undertakings.[12] The mandate of MERA is to regulate the energy sector in a fair, transparent, efficient, and cost effective manner for the benefit of consumers and operators. In addition, MERA is mandated to promote renewable energy.

The Project will generate electricity from renewable sources and its operation will be regulated by MERA. The Project will adhere to all licensing and monitoring requirements under the Energy Regulation Act.

4.3.6 Water Resources Act (2013)

The Water Resources Act (2013) provides for the management and conservation of water resources in Malawi.[13] It is the principal legislation dealing with the control, conservation, apportionment, and use of water resources in the country. The act prohibits any person to divert, dam, store, extract, or use public water except in accordance with its provisions. The act defines water pollution as any activity that directly or indirectly alters "the physical, thermal, chemical, biological or radioactive properties of any water so as to render the water less fit for any beneficial purpose for which it is, or may reasonably be, used or to cause a condition which is hazardous or potentially hazardous to public health, safety or welfare, or to animals, birds, fish or aquatic life or other organisms or to plants."

The activities of the proposed Project will require water and have the potential to pollute the water resources surrounding the Project Area. All water extraction and discharges will be conducted in accordance with the Water Resources Act and its implementing regulations.

4.3.7 Land Act (2016)

The Land Act (2016) makes provisions for various matters relating to customary, private, and public land, and enumerates the power of the Minister in respect to such land.[14] The act vests all land in the Republic in perpetuity. The act defines customary land as "all land which is held, occupied or used under customary law, but does not include any public land." It defines public land as "all land which is occupied, used or acquired by the Government and any other land, not being customary land or private land, and includes (a) any land held by the Government consequent upon a reversion thereof to the Government on the termination, surrender or falling-in of any freehold or leasehold estate

[12] Republic of Malawi, Energy Regulation Act, 2004. Accessed on 19-Mar-19 at http://extwprlegs1.fao.org/docs/pdf/mlw119224.pdf.

[13] Republic of Malawi, Water Resources Act, 2013. Accessed on 19-Mar-19 at http://extwprlegs1.fao.org/docs/pdf/mlw167598.pdf.

[14] Republic of Malawi, Land Act, 2016. Accessed on 19-Mar-19 at http://extwprlegs1.fao.org/docs/pdf/mlw170885.pdf.

therein pursuant to any covenant or by operation of law; and (b) notwithstanding the revocation of the existing Orders, any land which was, immediately before the coming into operation of this Act, public land with the meaning of the existing Orders." Private land is defined as "all land which is owned, held or occupied under a freehold title, or a leasehold title, or a Certificate of Claim or which is registered as private land under the Registered Land Act."[15]

The Project is being developed on customary land utilized by community members in the area. All land related actions will occur in compliance with the Land Act.

4.3.8 Customary Land Act (2016)

The Customary Land Act (2016) provides for the management and administration of customary land and for associated matters.[16] Customary land is the land occupied and used by members of a community who live under customary law. Customary land, however, is not communal land. Most customary land is divided into parcels allocated for the use of individuals and their families. Rights to this land are usually well defined, often for exclusive use and transmissible.

The Project is being developed on customary land utilized by community members in the area. All land related actions will occur in compliance with the Customary Land Act.

4.3.9 Land Acquisition (Amendment) Act (2016)

The Lands Acquisition (Amendment) Act (2016) empowers the Minister to acquire land in the interest of the public.

The Project is being developed on customary land utilized by community members in the area. All land acquisition will occur in compliance with the Land Acquisition (Amendment) Act.

4.3.10 Employment Act (2000)

The Employment Act (2000)[17] prohibits forced labour and discrimination based on race, colour, sex, language, religion, political or other opinion, nationality, ethnic or social origin, disability, property, birth, marital or other status or family responsibilities. It requires equal pay and establishes remedies for infringement of fundamental rights. It also sets limits on child labour and regulates contracts, working hours, weekly rest and leave, wages, and discipline and dismissal.

All Project employment will be in compliance with the Employment Act.

[15] Republic of Malawi, Land Act, 2016. Accessed on 18-Mar-19 at http://extwprlegs1.fao.org/docs/pdf/mlw41845.pdf.

[16] Republic of Malawi, Customary Land Act, 2016. Accessed on 18-Mar-19 at http://extwprlegs1.fao.org/docs/pdf/mlw170882.pdf.

[17] Republic of Malawi, Employment Act, 2000. Accessed on 19-Mar-19 at https://www.ilo.org/wcmsp5/groups/public/---ed_protect/---protrav/---ilo_aids/documents/legaldocument/wcms_125534.pdf.

4.3.11 Labour Relations Act (1996)

The Labour Relations Act (1996)[18] promotes sound labour relations through the protection and promotion of freedom of association, collective bargaining and organizational rights, and dispute resolution. It also covers trade unions and employer organizations, the Tripartite Labour Advisory Council, and the Industrial Relations Court.

All Project employment will be in compliance with the Labour Relations Act.

4.3.12 Malawi Bureau of Standards

The Malawi Bureau of Standards (MBS) is charged with the preparation and promulgation of national standards.[19] Standards are formulated through Technical Committees whose membership covers a variety of sectors. Current Technical Committees include one for environmental protection and one for pollution control. Malawi is also developing its own emissions standards. The standards developed by MBS to date that are most relevant to the Project are:

- 13.020.10 – Environmental Management (adoption of the ISO14000 series on environmental management);
- MS 173:2005 – Acoustics noise pollution (tolerance limits);
- MS 214:2013 – Drinking water (specification); and
- MS 691:2005 – Tolerance limits for domestic sewage effluents discharged into in land surface waters (specification).

All Project-related activities will be conducted in compliance with the above standards.

4.3.13 Occupational Safety, Health and Welfare Act (1997)

The principal legislation that regulates occupational health and safety in Malawi is the Occupational Safety, Health and Welfare Act (1997).[20] The act regulates conditions of employment in workplaces with regard to safety and the health and welfare of employees. The act imposes duties on employers, the self-employed, and other persons in control of premises, manufacturers, and suppliers (Wage Indicator, 2017).

The Project will comply with the Occupational Safety, Health and Welfare Act and all occupational health and safety regulations in Malawi. Working conditions on site will be monitored to ensure compliance.

[18] Republic of Malawi, Labour Relations Act, 1996. Accessed on 19-Mar-19 at http://www.ilo.org/dyn/natlex/docs/ELECTRONIC/44859/104140/F547679546/MWI44859.pdf.

[19] Malawi Bureau of Standards, Catalogue of Malawi Standards, 2015. Accessed on 19-Mar-19 at http://www.malawitradeportal.gov.mw/kcfinder/upload/files/2015%20%20Malawi%20Standards%20Catalogue_1.pdf.

[20] Republic of Malawi, Occupational Safety, Health and Welfare Act, 1997. Accessed on 19-Mar-19 at https://www.ilo.org/wcmsp5/groups/public/---ed_protect/---protrav/---ilo_aids/documents/legaldocument/wcms_125535.pdf.

4.3.14 Public Health Act (1948)

The Public Health Act (1948) is the principal law addressing public health in Malawi.[21] The act is currently under revision.

All Project activities will be conducted in compliance with the Public Health Act.

4.3.15 Gender Equality Act (2013)

The Gender Equality Act (2013) was enacted to: promote gender equality, equal integration, influence, empowerment, dignity, and opportunities for men and women in all functions of society; prohibit and provide redress for sex discrimination, harmful practices, and sexual harassment; and provide for public awareness on promotion of gender equality.[22]

The Project will, as practicable, promote gender equality in its activities, particularly through employment and community investment initiatives.

4.3.16 Marriage, Divorce and Family Relations Act (2015)

The Marriage, Divorce and Family Relations Act (2015) consolidates various laws related to marriage, including a key provision to recognise the validity of four "same legal status" forms of marriage. These are civil marriage, customary marriage, religious marriage, and marriage by reputation or permanent cohabitation. The act also sets the minimum age for marriage at 18.[23]

The Project will, as practicable, implement measures to ensure community dynamics are not impacted and that issues regarding gender-based violence are not exacerbated as a result of Project activities.

4.4 REQUIRED PERMITS

The principal agreements, licenses, and permits that JCM understands it will need to construct and operate the Project, along with their statuses, are listed in Table 4-1.

Table 4-1: Status of Principal Agreements, Licenses, and Permits.

Agreement / License / Permit	Agency	Status
Certificate of Incorporation	Registrar of Companies	Obtained

[21] Republic of Malawi, Public Health Act, 1948. Accessed on 19-Mar-19 at https://www.ilo.org/dyn/natlex/docs/ELECTRONIC/86506/97716/F553398709/MWI86506.pdf.

[22] Republic of Malawi, Gender Equality Act, 2013. Accessed on 19-Mar-19 at https://womenlawyersmalawi.files.wordpress.com/2017/06/gender-equality-act.pdf.

[23] United Nations Global Database on Violence against Women. Accessed on 19-Mar-19 at http://evaw-global-database.unwomen.org/en/countries/africa/malawi/2015/the-marriage-divorce-and-family-relations-bill.

Agreement / License / Permit	Agency	Status
Tax Payer Identification Number	Malawi Revenue Authority	Obtained
Business License	Ministry of Trade, Industry, and Tourism	Obtained
Exchange Control Approval for Non-Resident Shareholders	Reserve Bank of Malawi, through an authorized dealer bank	Obtained
Implementation Agreement	Government of the Republic of Malawi, as represented by the Minister of Finance, Economic Planning, and Development and the Minister of Natural Resources, Energy, and Mining	Signed on August 23, 2018.
Power Purchase Agreement	Electricity Supply Corporation of Malawi Limited	Signed on September 13, 2018.
Connection Agreement	Electricity Supply Corporation of Malawi Limited	Pending, to be signed upon completion of feasibility studies and ESCOM's internal connection impact assessment.
Electricity Generation License	Electricity Supply Corporation of Malawi Limited	Pending.
Generation License	Malawi Energy Regulatory Authority	Pending, contingent upon ESIA approval certificate and acquisition of land according to national procedures.
Approval of Power Purchase Agreement	Malawi Energy Regulatory Authority	Pending
Approval of Tariffs	Malawi Energy Regulatory Authority	Pending

Agreement / License / Permit	Agency	Status
Permit for Diesel Tank/Storage	Malawi Energy Regulatory Authority	Pending
Environmental Impact Assessment License	Environmental Affairs Department	Pending, contingent upon ESIA approval certificate.
Disposal of Waste	Environmental Affairs Department	Pending
Construction License	National Construction Industry Council	Pending
Water License	National Water Resources Council	Pending
Planning Permit	Ministry of Lands, Physical Planning Department	Pending
Land Lease	Minister responsible for land matters	Pending
Registration of Pension Fund	Reserve Bank of Malawi, Registrar of Financial Institutions	Pending
Registration for Occupational Health and Safety	Ministry of Labour	Pending
Temporary Employment Permits (for expatriate employees)	Minister of Home Affairs, Immigration Department	Pending
Renewable Energy Certificate	Energy Regulatory Authority	Pending

4.5 INTERNATIONAL CONVENTIONS

Malawi has concluded or ratified a number of international conventions and agreements relating to industry, development, and environmental management. In certain cases, conventions and agreements have influenced policy, guidelines, and regulations, and therefore are relevant to the planning, construction, and operation of the Project.

Table 4-2 lists the relevant international conventions and protocols to which Malawi has either concluded or ratified that are relevant to the Project. Many of these are incorporated into the various World Bank Operational Procedures and the IFC Performance Standards.

By conforming to these two sets of standards, the Project will comply with the requirements of the relevant international conventions.

Table 4-2: International Convention and Agreements Concluded or Ratified by Malawi.

Year	Name of the Convention / Agreement
2003	The Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (Basel Convention)
2001	The International Labour Organisation (ILO) Fundamental Convention related to forced labour, freedom of association, discrimination and child labour
2000	International Covenant on Economic, Social and Cultural Rights
2000	International Covenant on Civil and Political Rights
1992	United Nations Framework Convention on Climate Change
1992	Convention on Biological Diversity
1989	African Charter on Human and People's Rights
1989	Montreal Protocol on Substances that deplete the Ozone Layer
1985	Vienna Convention for the Protection of the Ozone Layer
1975	Convention Concerning the Protection of the World Cultural and Natural Heritage (World Heritage Convention), Paris
1971	Ramsar Convention on Wetlands of International Importance, especially Waterfowl Habitats (Ramsar, Iran)
1968	African Convention on Conservation of Nature and Natural Resources

4.6 INTERNATIONAL LENDER STANDARDS

In addition to national legislation, the Project is being developed in line with the standards and guidelines of international financial institutions. These standards and guidelines are intended to complement and reinforce national legislation and ensure the Project is conducted in accordance with international industry good practice and in a way that minimises risks and impacts.

The Project is currently seeking financing from Equator Principle Financial Institutions. As a result, the Equator Principles (2013) will likely be applicable to the Project. Principle 3 (Applicable Environmental and Social Standards) of the Equator Principles states that: "For Projects located in Non-Designated Countries, the Assessment process evaluates compliance with the then applicable IFC Performance Standards on Environmental and Social Sustainability (Performance Standards) and the World Bank Group Environmental, Health, and Safety Guidelines (EHS Guidelines)." Malawi is a Non-Designated Country under the Equator Principles. As a result, the International Finance Corporation (IFC) Performance Standards on Environmental and Social Sustainability (2012) and relevant World Bank EHS Guidelines will also likely be applicable to the Project.

4.6.1 Equator Principles

The Equator Principles (2013) is a risk management framework adopted by financial institutions for determining, assessing, and managing environmental and social risk in project finance. It is primarily intended to provide a minimum standard for due diligence to support responsible risk decision making. As of March 2019, 94 financial institutions in 37 countries have officially adopted the Equator Principles, covering the majority of international project finance debt in emerging and developing markets.

A summary of each principle in the Equator Principles is provided in Table 4-3.

Table 4-3: Summary of the Equator Principles.

No.	Principle	Summary of Applicable Requirements
1	Review and Categorisation	Requires projects to be categorized based on the magnitude of potential environmental and social risks and impacts.
2	Environmental and Social Assessment	Requires all Category A and B projects to conduct an assessment process to address the relevant environmental and social risks and impacts of the proposed project. For Category A and, as appropriate, Category B projects, the assessment documentation should include an Environmental and Social Impact Assessment (ESIA). Requires all projects to conduct, when combined Scope 1 and 2 emissions are expected to be more than 100,000 tonnes of CO_2 equivalent annually, an alternatives analysis to evaluate less greenhouse gas (GHG) intensive alternatives.
3	Applicable Environmental and Social Standards	Requires projects located in Non-Designated Countries, including Malawi, to align with the IFC Performance Standards.
4	Environmental and Social Management System and EP Action Plan	Requires all Category A and B projects to develop or maintain an Environmental and Social Management System, and prepare an Environmental and Social Management Plan (ESMP).
5	Stakeholder Engagement	Requires all Category A and B projects to demonstrate effective stakeholder engagement as an ongoing process in a structured and culturally appropriate manner with affected communities. Commensurate to the project's risks and impacts, appropriate documentation should be readily available to the affected communities. The results of the stakeholder engagement process should also be documented.
6	Grievance Mechanism	Requires all Category A and, as appropriate, Category B projects to establish a grievance mechanism to receive and facilitate resolution of concerns and grievances about the project's environmental and social performance.
7	Independent Review	Requires all Category A and, as appropriate, Category B projects to appoint an Independent Environmental and Social Consultant (IESC) to perform and independent review and propose an Equator Principles Action Plan.
8	Covenants	Requires the development of suitable covenants in the financing documentation to ensure host country law compliance, implementation of the Equator Principles Action Plan, and, as needed, periodic monitoring.
9	Independent Monitoring and Reporting	Requires appointment of an IESC to assess project conformance with the Equator Principles and ensure ongoing monitoring and reporting after financial close and over the life of the loan.
10	Reporting and Transparency	Requires the project proponent to ensure that, at a minimum, a summary of the key environmental and social information (and ideally the ESIA) is accessible and available online. In addition, requires the project proponent to publicly report

No.	Principle	Summary of Applicable Requirements
		GHG emission levels (combined Scope 1 and 2 emissions) during the operational phase if the project emits over 100,000 tonnes of CO_2 equivalent annually. Requires the lenders to report publicly, at least annually, on transactions that have reached financial close.

4.6.2 IFC Performance Standards

The IFC's Sustainability Framework articulates the IFC's strategic commitment to sustainable development, and is an integral part of their approach to risk management. The IFC Performance Standards on Environmental and Social Sustainability (2012) are a key part of the Sustainability Framework. The IFC Performance Standards are "directed towards clients, providing guidance on how to identify risks and impacts, and are designed to help avoid, mitigate, and manage risks and impacts as a way of doing business in a sustainable way, including stakeholder engagement and disclosure obligations of the client in relation to project-level activities. In the case of its direct investments, including project and corporate finance provided through financial intermediaries, IFC requires its clients to apply the Performance Standards to manage environmental and social risks and impacts so that development opportunities are enhanced."[24]

A summary of each Performance Standard (PS) and an indication of where they are addressed in this ESIA Report are provided in Table 4-4.

Table 4-4: Summary of the IFC Performance Standards and Where They Are Addressed in this ESIA Report.

PS	Title	Scope	Section in ESIA Report
1	Assessment and Management of Environmental and Social Risks and Impacts	Defines requirements for ensuring appropriate E&S management, policy implementation and accountability through an ESIA and associated ESMP for which the PS 1 defines requirements.	All
2	Labour and Working Conditions	Defines requirements for ensuring that workers are treated fairly and are provided with safe and healthy working conditions and international labour standards are followed.	Sections 6.3.2 and 6.3.14
3	Resource Efficiency and Pollution Prevention	Defines requirements for ensuring an appropriate level of pollution prevention and abatement.	Section 5.1 and Sections 6.4.1 through 6.4.4
4	Community Health, Safety, and Security	Defines requirements for ensuring that adverse impacts from the project on the receiving community are managed and controlled including project-related security management.	Section 5.3 and Sections 6.4.11 through 6.4.13
5	Land Acquisition and Involuntary Resettlement	Defines requirements to minimise adverse social and economic impacts from involuntary resettlement, land acquisition, or restrictions on land use.	Sections 5.3 and 6.4.9
6	Biodiversity Conservation and Sustainable	Defines requirements for ensuring that the project's impacts on nature, ecosystems, habitats, and	Section 5.2 and Sections 6.4.5 through 6.4.7

[24] International Finance Corporation, Performance Standards on Environmental and Social Sustainability, 2012. Accessed on 19-Mar-19 at https://www.ifc.org/wps/wcm/connect/115482804a0255db96fbffd1a5d13d27/PS_English_2012_Full-Document.pdf?MOD=AJPERES.

PS	Title	Scope	Section in ESIA Report
	Management of Living Natural Resources	biodiversity are appropriately minimised and managed.	
7	Indigenous Peoples	Defines requirements for the protection of Indigenous Peoples.	Not applicable to the Project as there are no Indigenous people as defined by PS 7 in the Project Area.
8	Cultural Heritage	Defines requirements to protect cultural heritage from the adverse impacts of project activities, to support its preservation, and to promote the equitable sharing of benefits from the use of cultural heritage.	Sections 5.4 and 6.4.15

4.6.3 World Bank Group EHS Guidelines

The World Bank Group Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice and are referred to in the World Bank's Environmental and Social Framework and the IFC Performance Standards. The EHS Guidelines contain the performance levels and measures that are normally acceptable to the World Bank Group and that are generally considered to be achievable in new facilities at reasonable cost by existing technology.[25] The EHS Guidelines generally provide additional details for projects to align with PS 3 (Resource Efficiency and Pollution Prevention) and, to a lesser extent, PS 2 (Labour and Working Conditions).

The following World Bank Group EHS Guidelines are applicable to the Project:

- General EHS Guidelines (2007); and
- EHS Guidelines for Electric Power Transmission and Distribution (2007).

Please note that there are currently no EHS guidelines specific to solar projects.

[25] International Finance Corporation, Environmental, Health, and Safety Guidelines. Accessed on 19-Mar-19 at https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/ehs-guidelines.

5. ENVIRONMENTAL AND SOCIAL SETTING

The objective of the environmental and social baseline is to establish the existing biophysical conditions in the Project direct and indirect AoI, as defined in Section 6.2.1. This chapter presents the baseline conditions in the Project Area and serves as the reference point against which changes can be predicted and ultimately monitored.

5.1 PHYSICAL BASELINE

This section describes the physical environment of the Project Area. The information in this section is based on a desktop review of publicly available information and specialist on-site studies.

5.1.1 Climate and Meteorology

The Project Site's climate is classified as Aw (Savannah). Golomoti has an average minimum temperature between 18 and 20 degrees Celsius and average maximum temperature between 28 and 30 degrees Celsius. Golomoti has an annual average rainfall of between 1001 and 1200 mm.

5.1.2 Air Quality

There are no notable point source air emissions in the Project Area, and there are no major urban or industrial activities near the Project Site.

5.1.3 Noise

There are no notable point source noise emissions in the Project Area. The Project Site is surrounded by agricultural land, and there are no major industrial or urban areas located nearby.

5.1.4 Geology

The Project Site is underlain by a charnockitic suite, which has been subjected to gneissic foliation. It consists of banded pyroxene-granulites, gneisses, and hypersthene granite. In addition, the area has been affected by orogenic episodes (ubendian, Irumide, and the Mozambican cycles). Plastic deformation is a common characteristic of the Project Site, which has resulted in large areas of biotite and hornblende gneisses, charnockitic granulites, and gneisses. The provincial area around the site is classified as quaternary alluvium and lacustrine sediments.

The major geological hazard of concern in the Dedza District is seismic activity. According to the Global Facility for Disaster Reduction and Recovery's ThinkHazard project tool, the Dedza District's earthquake hazard is classified as medium. Medium-risk areas indicate that there is a 10% chance of a potentially damaging earthquake occurring within the Project Area within the next 50 years. Based on this information, the impacts of seismic activity should be considered in all phases of the Project, in particular during the design and construction phases. Project planning decisions, Project design, and construction

methods should take into account the level of earthquake hazard.[26] The largest interior tremor, of magnitude 6.1, killed 8 people and damaged a few buildings in Golomoti in 1989.[27]

5.1.5 Topography

The Project Site is located in the Rift Valley Plains. The Rift Valley Plains are largely formed by the deposition of sediments eroded from the Rift Valley Escarpment. The plains extend along parts of Lake Malawi's shore and the Upper Shire Valley, and are characterized by gentle slopes and subdued relief. Average elevations throughout the plain are less than 600 metres above sea level (masl) and decline to below 100 masl in the Lower Shire Valley.[28]

The Project Site has an average elevation of 555 masl. Golomoti Trading Centre, which is located less than 1 km from the Project Site, has an elevation of 547 masl. The Project Site is located northeast of the Bangwe Forest Reserve, which encompasses an area of approximately 14 km^2.[29] The Bangwe Forest Reserve is located within the Rift Valley Escarpment, and has an average elevation of 907 m. The Rift Valley Escarpment is where the East Africa Rift descends from the Plateau in a series of stepped faults. "This zone of often precipitous slopes is, in general, highly dissected and commonly characterised by bare recent erosion surfaces."[30] The two highest points in the Bangwe Forest Reserve are Mbisa Hill, which has an elevation of 983 masl, and Bangwe Hill, which has an elevation of 890 masl. Both are located almost due south from the Project Site. The northeast boundary of the Bangwe Forest Reserve, which is where the escarpment ends and the plains begin, is located approximately 400 m southwest of the Project Site.

The closest major water body to the Project Site is the Livulezi River, the nearest point of which is approximately 1.2 km to the northwest. The Livulezi River flows into Lake Malawi, which is located approximately 18.5 km to the northeast of the Project Site.

5.1.6 Soils

The Project Site appears to contain mixed soil content, including phaeozems, luvisols, fluvisols, and vertisols. Phaeozems are humus-rich and highly arable soils that are commonly used for agricultural purposes, pasture for cattle, and wood/fuel production. Luvisols contain mixed mineralogy, high nutrient content, and generally have good drainage. Luvisols are also used for various agricultural purposes. Fluvisols are common along rivers and in level topography. They can be cultivated for dryland crops and are commonly used for grazing in the dry season. Vertisols are dark-coloured soils,

[26] Global Facility for Disaster Reduction and Recovery, Earthquake Hazards in Dedza Malawi (2009). Accessed at: http://thinkhazard.org/en/report/19307-malawi-central-region-dedza/EQ

[27] B. Halle and J. Burgess, "Country Environmental Profile for Malawi," Draft Report, Commission of the European Communities, August 2006, page 22.

[28] B. Halle and J. Burgess, "Country Environmental Profile for Malawi," Draft Report, Commission of the European Communities, August 2006, page 16.

[29] Protected Planet, 2014. Accessed at: https://www.protectedplanet.net/bangwe-forest-reserve

[30] B. Halle and J. Burgess, "Country Environmental Profile for Malawi," Draft Report, Commission of the European Communities, August 2006, page 16.

composed of ≥ 30% clay, and are typically found in climatic zones that have distinct wet and dry seasons. Due to their clay content, vertisols are generally not well suited for cultivation without significant management and labour.[31]

5.1.7 Land Use

Agricultural land covers the majority of Dedza District, followed by tree coverage, herbaceous coverage, and urban areas. Table 5-1 identifies the specific land coverage type totals and percentages.

Table 5-1: Land Coverage in Dedza District.

Land Coverage Type	Total Hectares (ha)	Percentage of Total
Flood and Rain-fed Herbaceous Crops with Small Sized Fields	223,075.0	57.5%
Open Woodland with Herbaceous Layer	92,497.80	23.8%
Rain-fed Herbaceous Crop(s) and Sparse Trees	27,264.70	7.0%
Savannah, Trees, and Shrubs	11,259.20	2.9%
Dambo, Temporarily Flooded Land	9,550.10	2.5%
Thicket	7,266.30	1.9%
Deciduous Trees	5,248.50	1.4%
Urban Areas	4,719.80	1.2%
Other Areas	7,385.40	1.8%
Total	**388,266.80**	**100%**

Source: Food and Agriculture Organization of the United Nations, "Atlas of Malawi Land Cover and Land Cover Change 1990-2010," published October 10, 2013. Accessed at: http://www.fao.org/3/a-be893e.pdf.

The Project Site is generally flat land and is predominantly used for agricultural purposes. Local residents report that crops cultivated on the Project Site include maize, cotton, soy, cowpeas, and sweet potatoes. Trees on the Project Site include native and planted trees, including mango, acacia, and baobab trees. Local residents report that medicinal plants are collected from the Project Site, although these plants can be collected elsewhere. There are also several footpaths that traverse the Project Site.

[31] Food and Agriculture Organization of the United Nations, Key to the FAO Soil Units, 1974. Accessed at: http://www.fao.org/soils-portal/soil-survey/soil-classification/fao-legend/key-to-the-fao-soil-units/en/

5.1.8 Surface Water

Dedza District has an abundance of surface water features, including rivers, streams, and Lake Malawi in Dedza East. The district's major rivers are the Linthipe, Bimbili, Mwachikula, Nadzipulu, Livulezi, and Lifidzi. The closest river to the Project Site is the Livulezi River. Its nearest point to the Project Site is approximately 1.2 km to the northwest. The Livulezi River flows into Lake Malawi, which is located approximately 18.5 km northeast of the Project Site.

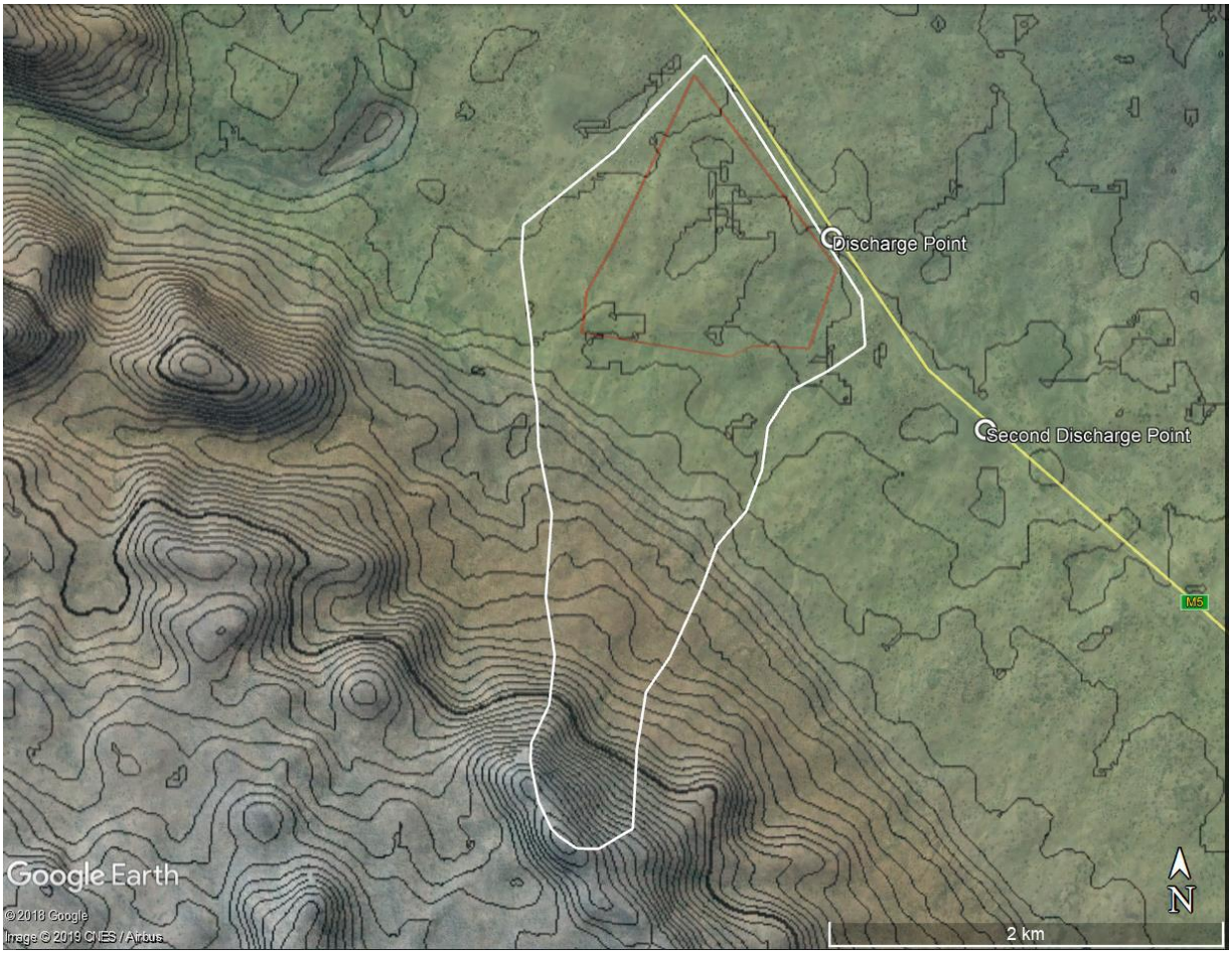
There are no permanent surface water bodies on or near to the Project Site, although there are small, temporary ponds that form during the wet season (see Appendix B).

5.1.9 Drainage

A local consultant, Geoconsult, was retained to conduct a "Hydrology and Flood Risk Assessment" of the Project Site (Appendix B). Geoconsult calculated the size of the catchment area for the Project Site based on two different topographic software models. The two models were needed to achieve a greater understanding of the ground elevation and slope on the flat flood plains. The catchment area has been reduced in size from its natural area and is now bound by the M5 highway to the northeast and the Golomoti Substation access road to the northwest (Figure 5-1). The size of the current catchment area is approximately 3.5 km^2.

The catchment area starts in the Bangwe Forest Reserve to the southwest and terminates on the Golomoti Plain. Due to the topography of the mountain range, the majority of water flowing down the escarpment is diverted north of the Project Site into the Livulezi River. Any excess water build up is channelled through two culverts located along the M5 highway, which discharge into a stream further downhill (Appendix B, Figure 17).

Figure 5-1: Catchment Area of the Project Site



Source: Hydrology and Flood Risk Assessment (Geoconsult 2019a): Figure 3

5.1.10 Groundwater

The Hydrology and Flood Risk Assessment identified three installed water boreholes near the Project Site. WBH1 is a community-installed well and services a few adjacent residences. WBH2 is located approximately 500 m northwest of WBH1. It is a government-installed borehole that services a larger group of over 40 households. WBH3 is the only borehole with an electric pump within the Project Area. It supplies a 12,000 litre tank as well as community taps. The borehole is primarily run by and utilized for the Golomoti Substation, the ESCOM staff who live nearby, and residents immediately surrounding the substation. According to reports, the boreholes were drilled a depth of 50 m and have never run dry. Information regarding flow and yield could not be obtained from the government.

The provincial area around the Project Area is classified as alluvium/weathered aquifer (Appendix B, Figure 20). A more localised map classifies the area as a weathered aquifer with a potential yield of 0.25 to 1 litre per second (l/s) (Figure 5-2). The chemical composition for weathered aquifers across the provincial area is presented in Figure 5-3. Regional water quality maps indicate low levels of sulphates, nitrates, chlorides, fluoride,

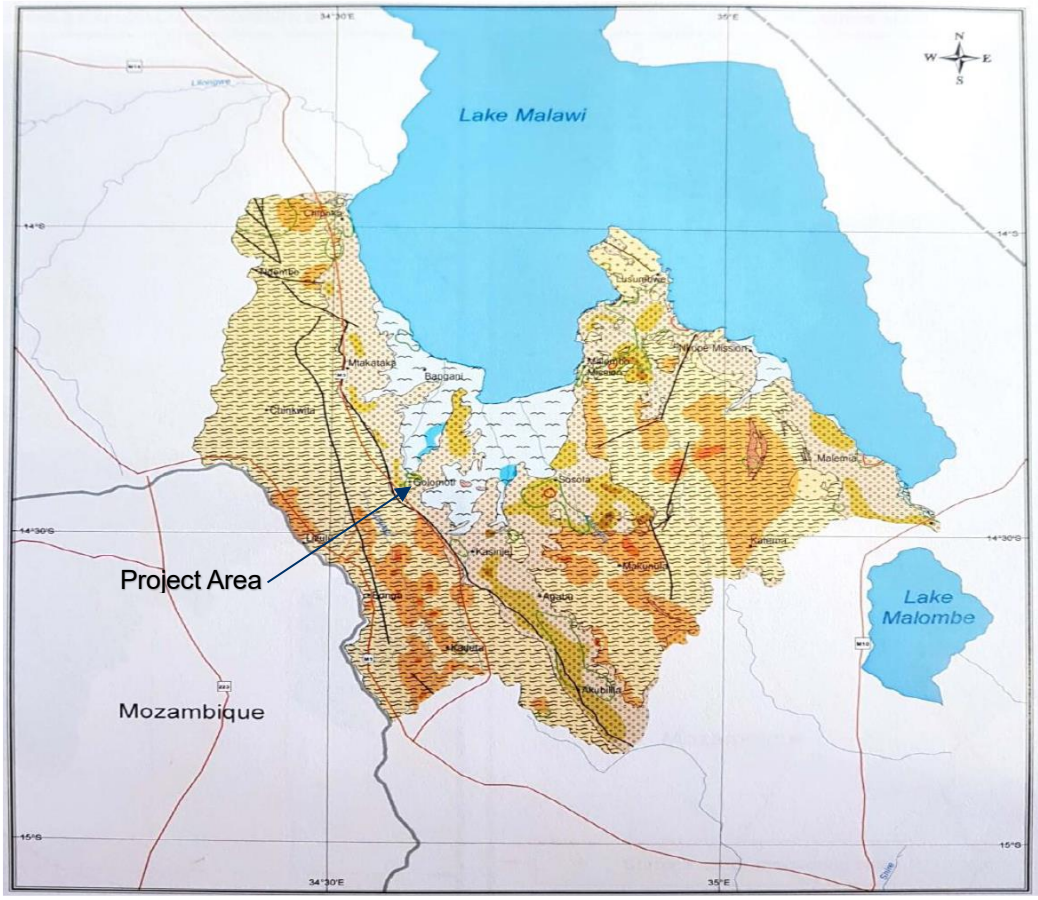
calcium, magnesium, sodium, and iron, and medium levels of acidity (Appendix B, Figures 21-29).

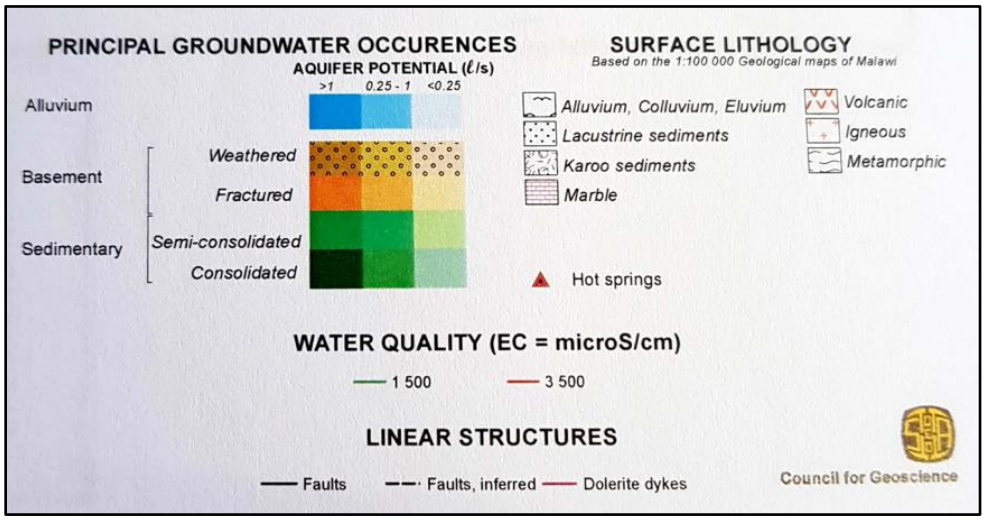
A more detailed chemical study of the Bua catchment area was conducted by the British Geological Survey.[32] The report states that there are generally low salinity values for groundwater from weathered basement in the Bua catchment of western Malawi. Total dissolved solids were found to be in the range of 200 to 740 milligrams per litre (mg/l). Low conductivity groundwater in basement aquifers from the Livulezi (central) and Dowa West (south-central) areas with electrical conductance were usually less than 750 micro Siemens per centimetre (µS/cm), but extremes of up to 4000 µS/cm were recorded.

Figure 5-2 indicates that the flow rates in the vicinity are between 0.25 and 1 l/s. The pump installed at WBH3 was a 0.75 horsepower Franklin Electric water pump. Based on the control box, it is likely a 4-inch 3200 Series pump is installed in the borehole. The performance chart for this pump indicates that it has an average yield of 9 m^3 per hour, or 2.5 l/s (Appendix B, Figure 15).

[32] "Groundwater Quality: Malawi." British Geological Survey, 2004.

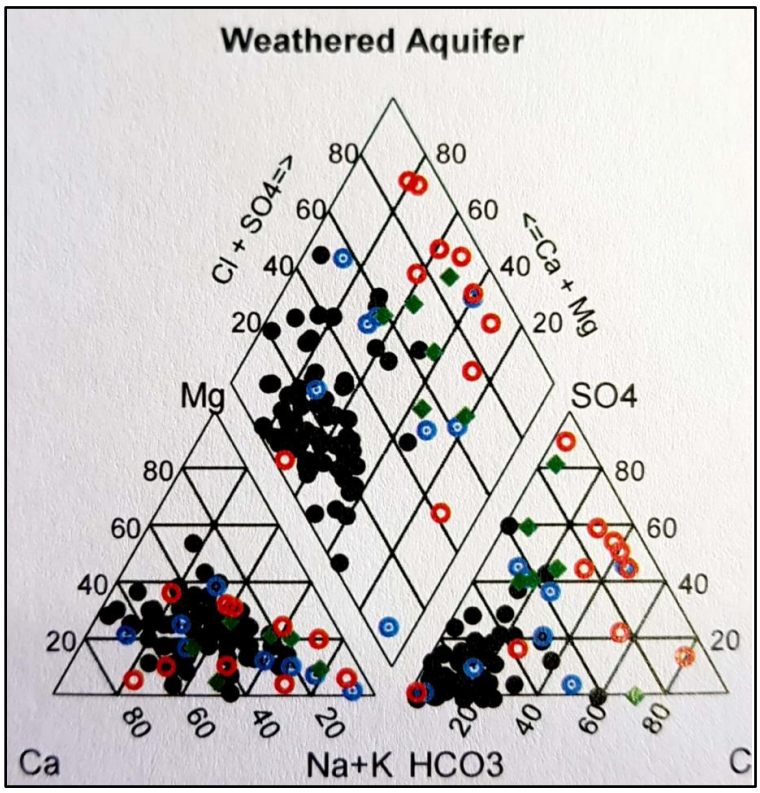
Figure 5-2: Aquifer Classification in the Project Vicinity.





Source: Hydrology and Flood Risk Assessment (Geoconsult 2019a): Figure 13.

Figure 5-3: Chemical Composition of Weathered Aquifers.



Source: Hydrology and Flood Risk Assessment (Geoconsult 2019a): Figure 14.

5.2 BIOLOGICAL BASELINE

5.2.1 Terrestrial Ecoregions

Biological baseline studies conducted in support of this ESIA had the following objectives:

- Describe and assess the habitat types on the Project Site and in the immediately surrounding areas in the context of IFC Performance Standard (PS) 6;
- Identify flora, mammal, bird, reptile, and amphibian species observed on the site and their Malawian and International Union for Conservation of Nature (IUCN) status; and
- Assess and describe any priority ecosystem services in the Project Site.

The methodology included preliminary desktop studies followed by field survey, as described in the subsections below.

5.2.1.1 Desktop Studies

Prior to initiating field surveys, the sources listed below were consulted to develop an initial characterization of the Project Site and to understand the habitats and species likely to be present.

- National Guidelines for Environmental Impact Assessment (EIA) (Government of Malawi, 1997);

- Desktop Environmental Scoping Report for Golomoti JCM Solar Power Plant Project (ERM, 2019);
- Socio-economic Profile for Dedza District (2013-2018);
- Satellite image taken in February 2018;
- Identification guides, including for:
  - Terrestrial Vegetation (Baunman 2005; Msekandian & Mlangeni 2002);
  - Birds (Dowsett-Lemaire and Dowsett 2006; Watson 2003; Stevenson & Fanshawe 2003);
  - Mammals (Monadjen 2010); and
  - Reptiles and Amphibians (Channing 2010; Frost 2010; Spawls et al. 2004).
- Various databases and websites, including:
  - Flora Zambesiaca (http://apps.kew.org/efloras/search.do);
  - IUCN Red List of Threatened species (http://www.iucnredlist.org);
  - Reptiles (http://tigr.org/reptiles);
  - Amphibians (http://amphibianweb.org);
  - Global Biodiversity Information Facility database (http://data.gbif.org);
  - Avibase (http://www.africanbirdclub.org/countries/checklists/download); and
  - IFC PS 6 (https://www.ifc.org/wps/wcm/connect/bff0a28049a790d6b835faa8c6a8312a/PS6_English_2012.pdf?MOD=AJPERES).

5.2.1.2 Field Survey

This field survey was aimed at collecting biodiversity baseline data; assessing the ecological state of the habitat of the proposed project site; assessing sensitive habitats and species of conservation concern, if any; and identifying priority ecosystem services supported by the site, if any. The field surveys were carried out in the late wet season, from March 29 to 31, 2019.

Given the heavily modified nature of the site (92.7% crop land), a single wet season survey was considered sufficient to capture the biological baseline. In the tropics, based on ERM experience, wet season surveys typically capture more of the species utilizing a site than dry season surveys.

Vegetation and Habitats

The assessment of vegetation and habitats was carried out via walking a series of transects crossing the site. Flora species encountered were identified and recorded. Plants that could not be identified on site were photographed or their specimens were collected for later identification using the Flora Zambesiaca volumes and various field guides. Particular attention was paid to species of conservation concern (i.e., endemic, protected, and endangered species). On the basis of the vegetation surveys, three distinct habitats were identified.

Birds

The standardized search method of Watson (2003) was used to survey birds by walking slowly through various vegetation communities, preferably along paths or tracks, and recording the species seen or heard within 20-minute segments in each vegetation community. Six transects spaced approximately 200 m apart were established on the proposed Project Site. Transects were walked twice in the morning, twice around midday, and twice in the evening in order to improve the chances of recording species that reveal themselves at different times of the day. Playback calls were used to encourage cryptic species to reveal themselves to supplement visual observation.

Mammals

Mammal species were recorded incidentally while surveying birds. Indirect evidence such as spoor or dung was used to confirm presence of mammal species in the Project Site, in conjunction with limited visual or audio confirmation. Mammal species were surveyed twice in the morning, twice around midday, and twice in the evening via the six transects.

Reptiles and Amphibians

Reptiles and amphibians were surveyed during the day by visual scanning of likely habitat, investigating potential refuges such as under logs, between rocks, beneath the old bark of dead trees, and in leaf litter.

5.2.2 Vegetation and Habitats

As noted above, the Project Site is Modified Habitat dominated by grazing and crop cultivation with few trees. The 92 ha Solar Plant Site is generally flat land used for subsistence agriculture. Crops cultivated on the Project Site and in surrounding areas include maize (*Zea mays*), groundnut (*Arachis hypogaea*), cotton (*Gossypium herbaceum*), sorghum (*Sorghum bicolour*), finger millet (*Eleusine coracana*), pumpkin (*Cucubirta maxima*), cowpea (*Vigna unguiculata*), Pigeon pea (*Cajanus cajana*), and okra (*Hibiscus cannabinus*). Trees on the site include natural and planted trees such as mangoes. Within the Project Site, residents also graze livestock including cattle, goats, and sheep. A seasonal wetland in the southern portion of the site, dominated by white buffalo grass (*Urochloa mossambicensis*), is used for livestock grazing. Baobab trees (*Adansonia digitata*) occur on the site, likely preserved for shade and cultural reasons, or possibly because they are protected by the Forestry Laws and Regulations due to over-exploitation.

The field surveys identified three vegetation types in the proposed Project Site:

- Cultivated mosaic woodland (85.3 ha/92.71% of Project Site);
- Secondary mixed deciduous woodland (2.9 ha/3.15% of Project Site); and
- Seasonal wetland (3.8 ha/4.14% of Project Site).[33]

[33] The three habitat types were described and named by WWEC, ERM's Malawian environmental and social contractor.

These habitat types are mapped in Appendix E, Figure 3 and described in more detail below.

5.2.2.1 Cultivated Mozaic Woodland

Cultivated Mozaic Woodland (Figure 5-4) was the dominant habitat type, comprising 92% of the Project Site. It has been cultivated with the typical, dryland subsistence crops noted above (maize, sorghum, groundnuts, cotton, maroon cucumber, watermelon, mango, sweet potato, cucumber, cowpea, pigeon peas and common pumpkin). This habitat type also supports some scattered indigenous trees, shrubs, and weeds common to disturbed former woodland converted to cropland in the region. Species present include baobab (*Adansonia digitata*), marula tree (*Sclerocarya birrea*), basil (*Ocimum americanum*), white acacia (*Faidherbia albida*), monkey bread tree (*Piliostigma thonningii*), Large fruited bushwillow (*Combretum zeyheri*), African star-chestnut tree (*Sterculia africana*), velvet wild medlar tree (*Vangueria infausta*), sourplum tree (*Ximenia caffra*), Yellow plum (*Ximenia americana*), Chinese banyan (*Ficus thonningii*), Kalahari white bauhinia (*Bauhinia petersiana*), mango (*Mangifera indica*), tropical spiderwort (*Commelina benghalensis*), billygoat weed (*Ageratum conyzoides*), Duncan grass (*Pennisetum unisetum*), okra (*Hibiscus cannabinus*), cattle bush (*Trichodesma zeylanicum*), and vetivar grass (*Chrysopogon zizanioides*).

Figure 5-4: Cultivated Mozaic Woodland.

Source: ERM, 2019.

The high representation of cultivated crops and weeds such as American basil, mango, billygoat weed, tropical spiderwort, and okra suggests that the area has been totally transformed from its natural state, with the remaining trees being retained because they provide benefits to the communities that utilize the area. Tree density was estimated to be 13 trees per ha, a very low density indicative of the conversion of the area to cropland.

The 59 plant species recorded in the Cultivated Mozaic Woodland portion of the site are listed in Table 5-2. None of the species recorded are threatened or endemic, although the baobab tree (*Adansonia digitata*) has been protected under the Forestry Act since 2012 (see Section 5.2.2.4).

Table 5-2: Cultivated Mozaic Woodland Plant Species.

Species Name	Local Name	Comment
Faidherbia albida	(Msangu) or Ana tree	Common tree typical of riparian habitat. Seed pods are eaten by livestock and the trees fix nitrogen in the soil.
Adansonia digitata	Baobab tree	Tree, typical of dry woodland
Zea mays	Maize	Cultivated annual grass used for food
Citrullus lanatus	Water melon	Cultivated annual climber used for food
Gossypium arborea	Cotton	Introduced annual herb, cultivated on farmland
Cucumis anguiria	Maroon cucumber	Cultivated annual climber used for food
Cucumis melo	Cucumber	Cultivated annual climber used for food
Vigna unguiculata	Cowpea	Annual herb, cultivated for food
Cajanus cajana	Pigeon pea	Perennial shrub, cultivated for food
Cucumis maximum	Pumpkin	Annual climber, cultivated for food
Pennisetum unisetum	Udzu or Mission grass	Common grass, typically occurring in disturbed land and invasive in some situations
Commelina baanghelensis	Tropical spiderwort	Common weed, typically occurring in disturbed land and often invasive
Acacia tortilis	Umbrella thorn acacia	Common tree of dryland. Plant is used as feed for livestock
Senna obstusifolia	Sickle Senna	Alien tree, typically introduced by communities on farmlands.
Vernonia glabra	Cornflower	An annual herb, typical of secondary woodland
Trichodesma zeylanicum	Camel bush	Annual herb, typical of secondary woodland
Sclerocarya birrea	Marula tree	Common tree, typical of dry savanna woodland
Melinis repens	Natal grass	Perennial grass, typical of dry land and used for thatching houses
Vernonia poskeana	Sandveld vernonia	Perennial herb, typical of secondary woodland

Species Name	Local Name	Comment
Vernonia glabra	Cornflower	Perennial herb, typical of secondary woodland
Stereospermum kunthianum	Zana	Small tree occurring in open woodland
Ocimum americana	American basil	Small annual herb, typical of open cultivated land.
Corchorus olitorius	Bush Okra	Small annual herb, typical of open cultivated land.
Ceratotheca sesamoides	Sesame	Wild weed and locally grows in cultivated land
Merremia pinnata	Kosrae	Common annual climber
Siphonochilus aethiopicus	Wild ginger	Annual herb, typical of cultivated land
Combretum zeyheri	Large-fruited bushwillow	Tree, typical of open dry woodland
Leucas amartinicensis	Whitewort	Annual herb, typical of cultivated land
Pannicum maximum	Guinea grass	Grass, typical of cultivated and open woodland
Cucumis sativus	Cucumber	Cultivated vegetable
Hibiscus subdariffa	Roselle	Annual woody-based Okra, used for making tonic drink
Vangueria infausta	African medlar	Tree, typical of open secondary or primary forest
Strychnos innocua	Monkey orange	Shrub, typical of cultivated land and natural secondary forest
Ximenia americana	Yellow plum	Tree, typical of cultivated land or natural secondary forest
Sorghum bicolour	Sorghum	Perennial grass usually cultivated
Eleusine coracana	Finger millet	Annual grass usually cultivated for food.
Codyla africana	Wild mango	Tree, typical of primary or secondary woodland
Andropogon shirensis	Beard Grass	Annual grass , typical of cultivated land
Senna spectabilis	Whitebark senna	Tree, introduced in cultivated land
Hyparrhenia filipendula	Fine-hood Grass	Grass, typical of disturbed land and used for thatching.
Digitaria milanjiana	Crabgrass	Grass, typical of disturbed land.
Bidens steppia	Beggarticks	Annual herb, typical of open cultivated land
Heteropogon contortus	Black spear grass	Perennial grass, typical of disturbed land.
Markhamia obtusifolia	Golden bell-bean	Tree, typical of closed and secondary woodland.

Species Name	Local Name	Comment
Biophytum kassneri	Reinwardit	Annual herb, typical of open cultivated land
Vitex mombasae	Chaste tree	Small tree, typical of open woodland and its fruits are edible
Hibiscus esculentus	Lady's fingers okra	Annual herb, cultivated plant and is edible as relish
Bidens pilosa	Black jack	Introduced weed annual herb, present as a result of soil disturbances
Impatiens gomphophylla	Balfour	Annual herb, typical of moist condition and cultivated land.
Bauhinia thonningii	Camelfoot tree	Common tree, typical of dry conditions.
Sterculia quinqueloba	Large-leaved star chestnut	Tree, typical of open woodland.
Sida acuta	Wireween	Weed annual plant, present as a result of soil disturbances.
Cissus buchannii	Mwanmphepo	Annual herb, typical of dry conditions.
Tridax procumbens	Tridax daisy	Annual weed, present due to soil disturbances.
Crinum macowanii	Spider lily	Annual herb, typical of moist conditions.
Chrysopogon zizanioides	Vetivar grass	Introduced grass, typical of moist conditions.
Ficus thonningii	Common wild fig	Tree, typical of open dry woodland
Lagenaria sicenaria	Long melon	Cultivated climber used for food
Chloris vigata	Rhodes grass	Annual grass, typical of open and disturbed habitats
Abelmoschus esculentus	Okra	Annual herb, typical of disturbed land

Source: Biodiversity Baseline Report (WWEC 2019b: Table 1-3).

5.2.2.2 Secondary Mixed Deciduous Woodland

Secondary Mixed Deciduous Woodland (Figure 5-5) was identified in two, small isolated patches totalling 2.9 ha or 3.15% of the Project Site. It was distinguished from the prior habitat type in that it was not actively cultivated and supported more trees. Tree density was estimated at 35 trees per ha.

Figure 5-5: Secondary Mixed Deciduous Woodland.

Source: Biodiversity Baseline Report (WWEC 2019b: Figure 5).

This type of habitat was considered moderately modified as species composition had been transformed due to felling of trees for fuelwood, and these patches were small islands of habitat in the larger cultivated mosaic described above, reducing the potential to function as habitat for native species of fauna. Thirty nine species were recorded and no endangered or endemic species were present. The recorded species are presented in Table 5-3.

Table 5-3: Secondary Mixed Deciduous Woodland Plant Species.

Species Name	Local Name	Comment
Pterocarpus rotundifolius	Round-leaved bloodwood	Common tree typical of dry habitat
Dalbergia nitidula	Purple wood tree	Common tree typical of dry habitat
Markhamia obtusifolia	Golden bell-bean	Tree, typical of closed and secondary woodland.
Combretum zeyheri	Large-fruited bushwillow	Tree, typical of open dry woodland

Species Name	Local Name	Comment
Sterculia quinqueloba	Large-leaved star chestnut	Tree, typical of open woodland
Sclerocarya birrea	Marula tree	Tree, typical of open dry woodland
Brachystegia spiciformis	Brachstegia	Tree, typical of closed canopy and open natural woodland
Acacia polyacantha	White thorn	Tree, typical of open dry woodland
Vitex payos	Chinese chaste tree	Tree, typical of open woodland
Pennisetum unisetum	Udzu or Mission grass	Common grass, typically occurring in disturbed land and invasive in some cases.
Solanum panduriforme	Bitter apple	Perennial herb, typical of open dry woodland and disturbed areas
Acacia tortilis	Umbrella thorn Acacia	Common tree of dryland. Plant is used as feed for livestock
Azanza garckeana	Slime apple	Tree, typical of open dry and secondary woodland
Vernonia glabra	Cornflower	An annual herb, typical of secondary woodland
Combretum adenogonium	Four-leaved bushwillow	Tree, typical of open dry and secondary woodland
Faihderbia albida	(Msangu) or Ana tree	Common tree typical of riparian habitat. Seed pods are eaten by livestock and the tree fix nitrogen in the soil.
Melinis repens	Natal grass	Perennial grass, typical of dry woodland and used for thatching houses
Piliostigma thonningii	Monkey bread tree	Tree, typical of dry woodland
Vernonia glabra	Conflower	Perennial herb, typical of secondary woodland
Adansonia digitata	Baobab tree	Tree, typical of dry woodland
Sterculia quinqueloba	Large-leaved star-chestnut	Tree, typical of dry woodland
Eucalyptus camaldulensis	Bluegum	Introduced tree, typical of disturbed natural woodland
Annona senegalensis	African custard-apple	Shrub, typical of open dry woodland
Bauhinia petersiana	Kalahari white bauhinia	Tree, typical of open dry woodland
Hyparrhenia rufa	Giant thatching grass	Annual grass, typical of open woodland
Markhamia obtusifolia	Golden bean tree	Tree, typical of open dry woodland

Species Name	Local Name	Comment
Senna siamea	Siamese cassia	Introduced tree
Pannicum maximum	Guinea grass	Grass, typical of cultivated and open woodland
Steganotaenia araliacea	Carrot tree	Shrub, typical of open woodland
Strychnos innocua	Monkey orange	Shrub, typical of dry open woodland
Vangueria infausta	African medlar	Tree, typical of open secondary or primary forest
Strychnos innocua	Monkey orange	Shrub, typical of cultivated land and natural secondary forest
Ximenia americana	Yellow plum	Tree, typical of cultivated land or natural secondary forest
Commiphora sansibarica	Corkwood tree	Tree, typical of dry open woodland
Trichodesma zeylanicum	Cattle bush	Annual herb, typical of open woodland
Crinum macuanum	Amaryllis	Perennial herb, typical of open and closed woodland
Lonchocarpus bussei	Small apple-leaf tree	Tree, typical of open dry woodland
Lonchocarpus violacea	Apple-leaf	Tree, typical of open dry woodland
Dichrostachys cinerea	Kalahari Christmas tree	Tree, typical of open dry mixed woodland

Source: Biodiversity Baseline Report (WWEC 2019b: Table 1-4).

5.2.2.3 Seasonal Wetland

A seasonal wetland habitat (Figure 5-6) comprising 3.8 ha or 4.14% of the Project Site was identified in its south-eastern portion. This area was dominated by herbaceous species with some woody shrubs. It is used for livestock grazing and is also considered Modified Habitat. Tree/shrub density was estimated at 17 trees per ha. No species recorded were endangered or endemic. The species recorded are listed in Table 5-4.

Figure 5-6: Seasonal Wetland

Source: Biodiversity Baseline Report (WWEC 2019b: Figure 6).

Table 5-4: Seasonal Wetland Plant Species.

Species Name	Local Name	Comment
Urochloa mosambicensis	White buffalo grass	Grass, typical of dry seasonal wetland
Acacia polyacantha	White thorn	Tree, typical of open dry woodland
Pennisetum unisetum	Udzu or Mission grass	Common grass, typically occurring in disturbed land and invasive in some situations.
Clematis simensis	Clematis	Annual herb, typical of moist conditions
Scleria bulbifera	Nutrushes	Sedge, typical of seasonal wetland
Vernonia glabra	Cornflower	An perennial herb, typical of secondary open woodland
Combretum adenogonium	Four-leaved bushwillow	Tree, typical of open dry and secondary woodland
Scleria racemosa	Sword grass	Sedge, typical of seasonal wetland

Species Name	Local Name	Comment
Melinis repens	Natal grass	Perennial grass, typical of dry woodland and used for thatching houses
Hyparrhenia rufa	Giant thatching grass	Annual grass, typical of open moist woodland
Markhamia obtusifolia	Golden bean tree	Tree, typical of open dry moist woodland
Senna siamea	Siamese cassia	Introduced tree
Pannicum maximum	Guinea grass	Grass, typical of cultivated and open woodland
Cynodon dactylon	Dog's tooth grass	Grass, typical of moist conditions
Chloris gayana	Rhodes grass	Grass, typical of moist conditions
Cissus grisea	Wild grape	Climber, typical of open woodland
Cissus rubiginosa	Adamant creeper	Climber, typical of moist open woodland
Embelia schimperi	Amargna	Climber, typical of moist open woodland
Grewia asiatica	Phalsa	Shrub, typical of open woodland
Grewia villosa	Mallow raisin	Shrub, typical of open woodland
Grewia retusifolia	Emu-berry	Shrub, typical of open woodland

Source: Biodiversity Baseline Report (WWEC 2019b: Table 1-5).

5.2.2.4 Ministry of Lands Survey

On July 18, 2019, the Ministry of Lands conducted a detailed land and asset survey of the Project Site. The survey identified five species listed as protected under the Forestry (Amendment) Rules, 2012, as gazetted in Government Notice No. 23 (December 31, 2012). Details on these tree species and the number of specimens identified for each are provided in Table 5-5.

Table 5-5: Protected Trees at the Project Site.

Scientific Name	Common Name	Vernacular Name	Tree Use	Number of Specimens Identified
Sterculia sp.	Ghost Tree	Mgoza	Bark used to make ropes	3
Trichilia emetic	Natal Mahogany	Msikidzi	Firewood, timber	3
Albizia gummifera	Peacock flower	Mtangatanga	Firewood, timber	66

Kigellia Africana	African sausage	Mvunguti	Medicinal use	7
Adansonia digitata	Baobab	Malambe		2

Source: Ministry of Lands, 2019.

5.2.3 Fauna

5.2.3.1 Avifauna

Malawi has approximately 650 species of birds. Of these, more than 450 species breed in Malawi and 107 are non-breeding migrants or vagrants. In terms of IUCN Red List status avifauna for Malawi, there are 3 Critically Endangered species, 7 Endangered species, 9 Vulnerable species, and 18 Near Threatened species (BirdLife International, 2019). There are 4 endemic subspecies that have been recorded in country (Kaliba, 2005). Given the largely agricultural character of the Project Site, only thirteen species were observed at the Project Site during the March 2019 wet season field survey (Table 5-6). None of the observed species are of conservation concern or endemic.

Table 5-6: Bird Species Identified on the Project Site.

Scientific Name	Relative Abundance Locally	IUCN Status
Phyllastrephus flavostriatus (Yellow-streaked Bulbul)	Common	Least Concern
Phyllastrephus placidus (Placid Bulbul)	Common	Not Listed
Cyanomitra olivacea (Olive Sunbird)	Very Common	Least Concern
Cynniris talatala (White-bellied Sunbird)	Very Common	Least Concern
Uraeginthus angolensis (Blue Waxbill)	Common	Least Concern
Serinus gularis (Streaky-headed Canary)	Very Common	Not Listed
Hedydipna collaris (Collared Sunbird)	Common	Least Concern
Streptopelia capicola (Cape Turtle Dove)	Common	Least Concern
Threskiornis aethiepicus (Scared Ibis)	Uncommon	Least Concern
Numida meleagris (Helmeted Guinea fowl)	Uncommon	Least Concern
Quelea quelea (Red headed Quelea)	Very Common	Least Concern
Pternistis afer (Red-Necked Francolin)	Uncommon	Least Concern
Bubo lacteus (Verreaux's Eagle-owl)	Common	Least Concern

Sources: Biodiversity Baseline Report (WWEC 2019b: Table 1-5) and ERM, 2019.

5.2.3.2 Mammals

No mammal species were observed on the Project Site during the field surveys. No large mammal species were expected given the habitat and land use. Communities reported that the Project Site does harbour some species of small mammals, however, as presented in Table 5-7. None of these are of conservation concern.

Table 5-7: Small Mammal Species Reported to Occur at the Project Site.

Scientific Name	Relative Abundance Locally	IUCN Status
Acomys spinosissimus (Spiny mouse)	Very Common	Least Concern
Lophuromys flavopunctatus (Yellow-spotted Brush-furred rat)	Very Common	Least Concern
Mus triton (Mouse)	Very Common	Least Concern
Mus musculus (House Mouse)	Common	Least Concern
Crocuta crocuta (Spotted Hyena)	Common	Least Concern
Lepus saxatilis (Cape Scrub Hare)	Common	Least Concern
Hystrix africaeaustralis (Cape porcupine)	Common	Least Concern

Sylvicapra grimmia (Common duiker)	Uncommon	Least Concern

Sources: Biodiversity Baseline Report (WWEC 2019b: Table 1-6) and ERM, 2019.

5.2.3.3 Reptiles

No species of reptiles were recorded during the field survey. Local residents reported five species of reptiles, however, that occur on the proposed Project Site and in the surrounding area (Table 5-8). None of these species are endemic or of conservation concern.

Table 5-8: Reptile Species Reported to Occur at the Project Site.

Scientific Name	Relative Abundance Locally	IUCN Status
Python natalensis (Lesser African Python)	Rare	Not Listed
Dendroaspins polylepis (Black mamba)	Rare	Not Listed
Ophiophagus hannah (King cobra)	Rare	Vulnerable
Bitis arietans (Puff Adder)	Rare	Not Listed
Ahaetulla nasuta (Vine snake)	Common	Not Listed
Chamaeleo chamaeleon (Common chameleon)	Common	Least Concern

Sources: Biodiversity Baseline Report (WWEC 2019b: Table 1-8) and ERM, 2019.

5.2.3.4 Amphibians

Ninety one species of amphibians have been recorded in Malawi, several of which are threatened and several of which are endemic.[34] A total of 4 species of amphibians was recorded on the Project Site during the survey. These species are shown Table 5-9. None of the species are endemic or of conservation concern.

Table 5-9: Amphibian Species Reported to Occur at the Project Site.

Scientific Name	Relative Abundance Locally	IUCN Status
Hyperolius pictus (Reiche's Squeaker)	Uncommon	Least Concern
Sclerophrys garmani (Garman's toad)	Uncommon	Least Concern
Sclerophyrs gutturalis (Guttural toad)	Uncommon	Least Concern
Afrixalus delicates (Delicate Spiny Reed Frog)	Uncommon	Least Concern

Sources: Biodiversity Baseline Report (WWEC 2019b: Table 1-9) and ERM, 2019.

[34] https://www.inaturalist.org/check_lists/7454-Malawi-Check-List

5.2.3.5 Habitat Sensitivity

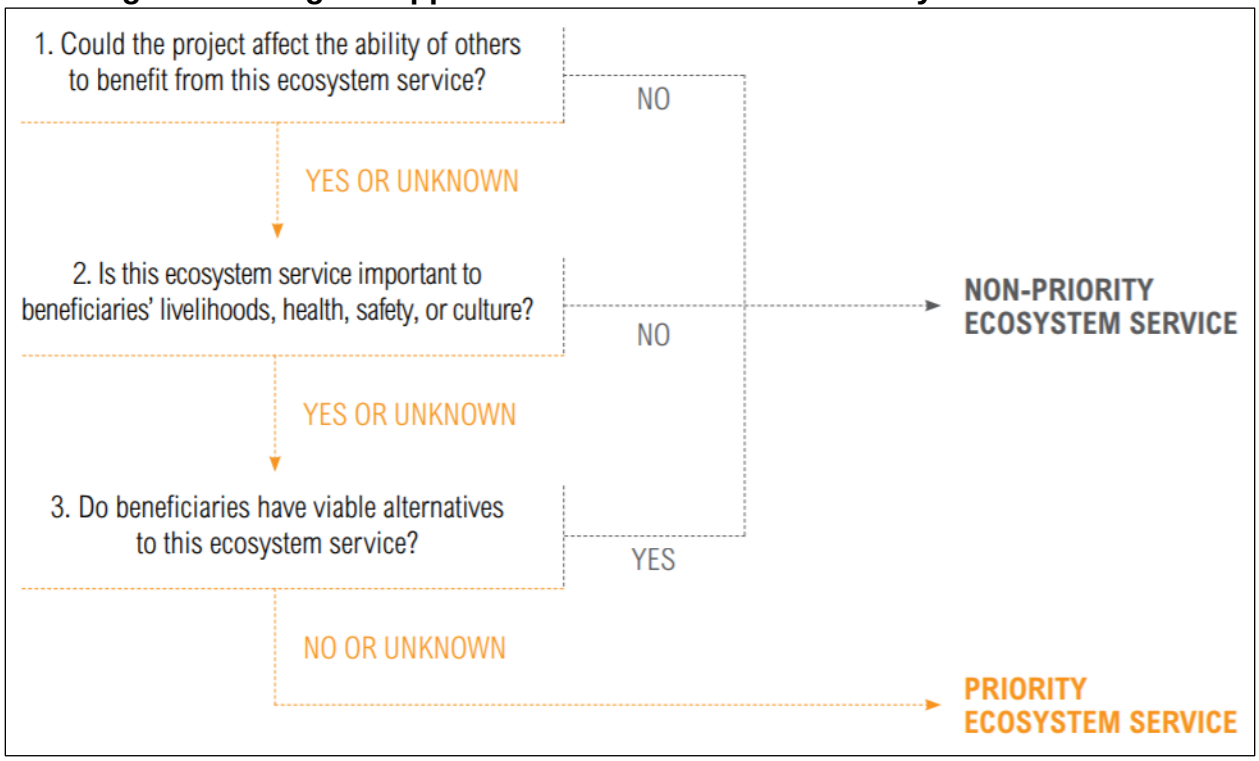
The continuous cultivation, grazing, wood gathering, and bush meat hunting observed and reported by the local people interviewed has converted the regional landscape, including the proposed Project Site, into Modified Habitat with very reduced habitat value. This was evidenced by the paucity of avifauna, mammal, reptile, and amphibian species recorded during the field surveys or reported by the local people. While some native species are present, the dominant land cover on over 90% of the site is annual agricultural crops such as maize.

5.2.4 Ecosystem Services

This analysis assesses ecosystem services in accordance with the approach adopted by the World Research Institute (WRI), which complies with requirements of IFC Performance Standard (PS) 6. The WRI approach provides a breakdown of ecosystem services that are classified into Provisioning, Regulating, Supporting, and Cultural Services.[35] This list has been adjusted to match the suite of services that are relevant to the areas associated with the Project Site. The WRI approach provides a simple and logical process to identify priority ecosystem services (Figure 5-7). PS 6 requires that disruptions to priority ecosystem services are assessed as part of an impact assessment, with mitigation measures developed to address the impacts.

[35] World Research Institute (WRI) approach to assessing Ecosystem Services is available at:
https://www.wri.org/publication/weaving-ecosystem-services-into-impact-assessment

Figure 5-7: Logical Approach for Prioritization of Ecosystem Services.



Source: WRI.

During the baseline studies, various ecosystem services were reported by communities and/or observed by the team. The use of ecosystem services, dependence of local beneficiaries, and an assessment of replaceability have been investigated through processes of consultation and incorporating expert opinion.

An overview and description of ecosystem services relevant to the Project Site is provided in Table 5-10, together with a high-level assessment of the potential impact, dependence of beneficiaries, and replaceability of services. These assessments are used to identify priority services based on the logical framework illustrated in Figure 5-7.

Table 5-10: Description and Assessment of Ecosystem Services at the Project Site.

Ecosystem Service	Description of the Service	Location Relevance	Likely Impact	Importance to Beneficiaries	Replaceability	Prioritisation Result
PROVISIONING ECOSYSTEM SERVICES						
Crops cultivated at the Project Site are sources of food and income	There are a number of cultivated food crops such as maize, groundnuts, cucumber, watermelon, sorghum, cassava and cow peas that are grown on the Project Site between December and May each year. These food crops are harvested by subsistence farmers for consumption and income	The 92 ha Project Site, of which 90% (approx. 82 ha) is cultivated land	**Yes** The Project will displace cultivated land and related livelihoods and food source	The crops cultivated are sources of food and income	Replaceable if other lands can be found for the PAPs. There is a high demand for land, which is leading to a decline in the fallow period, and hence replacement land is not readily available. This assessment is unable to confirm the replaceability of arable land as it is the Chief's responsibility to allocate land for cultivation	Priority ES
Livestock grazing land	A small portion of the Project Site is used for	The seasonal	**Yes**	Livestock are an important	Replaceable if other lands can	Non Priority ES

Ecosystem Service	Description of the Service	Location Relevance	Likely Impact	Importance to Beneficiaries	Replaceability	Prioritisation Result
	livestock grazing (cattle, goats)	wetland and other fringe areas not cultivated	The Project will displace grazing land and related livelihoods and protein sources	source of protein and revenue for communities	be found for the PAPs	
Bush meat	The site is also reportedly used for bush meat hunting though no quantification was available	The entire site though wildlife were sparse during the field survey	**Yes** The Project will eliminate people's access to and convert small hunting areas leading to a decline in bushmeat production	Only small animals are hunted and are not a staple protein source for communities	The small animals collected at the Project Site are also found in other areas nearby	Non Priority ES
Wild and introduced plant fruits	The Project Site supports native and introduced fruit bearing plants that are harvested	Across the site outside of the cultivated areas	**Yes** The Project will eliminate people's access to and convert the site to industrial areas	Source of food and income generation	The fruit bearing plants can be planted elsewhere and are also commonly found in other agricultural and bush areas	Non Priority ES
Fuelwood	Fuelwood is the main source of energy for cooking in rural areas,	Limited to 3 to 4 hectares	**No** The project will not significantly	Fuelwood is important, especially to	There are other woodland areas nearby including	Non Priority ES

Ecosystem Service	Description of the Service	Location Relevance	Likely Impact	Importance to Beneficiaries	Replaceability	Prioritisation Result
	though collection of fuelwood is a national problem leading to deforestation, erosion, and soil loss	where trees and other woody species are present	contribute to the impact on scarcity of fuelwood in the area	older women and young girls from surrounding villages	the Forest Reserve. Harvesting fuelwood in the Forest Reserve is illegal but continues. Alternatively fuel wood plots can be planted near communities and managed for continuous yield	
Thatch grass	Thatch is used for roofing structures and is also a source of income	Seasonal wetland	**Yes** Loss of access to the source	Personal use and income source	There are many other sources in the surrounding customary lands	Non Priority ES
Herbal medicines	Certain species of plants found on the Project Site and along the transmission line route are collected by communities to be used in traditional medicine which treat various illnesses	Seasonal wetland and Mixed deciduous Woodland	**Yes** The project will have impact on people due to loss of some medicinal plants	Personal use and income source	There are many other sources in the surrounding customary lands	Non Priority ES
REGULATING ECOSYSTEM SERVICES						

Ecosystem Service	Description of the Service	Location Relevance	Likely Impact	Importance to Beneficiaries	Replaceability	Prioritisation Result
Regulation of soil fertility	Clearing of vegetation and any necessary grading of the site will likely alter soil fertility though erosion and sediment control should minimize impacts	Project Site	**Yes** Clearing plants and any necessary grading will have impact on the fertility of soil	Communities depend on soil fertility for crop production	At the end of Project life, the soils can be restored to fertility	Non-priority ES
Pollination of crops	The Project Site supports a diversity of insects such as butterflies, which pollinate agricultural crops on the Project Site	Seasonal wetland and Mixed deciduous Woodland	**Yes** Clearing of the Project Site will have impact on pollinating insects such as butterflies, bees, but the significance is very low	Pollinating insects are important for production and productivity of crops	It is possible to replace plants which are homes to insects to be lost during the construction by planting around the open areas of the Project Site	Non-priority ES
Regulation of water flows	The seasonal wetland area may provide retention of runoff during the rainy season	Seasonal wetland	**Yes** The project may have a minor effect on this service given that the seasonal wetland area is relatively small	The seasonal wetland likely regulates flow to a limited extent	It is not possible to replace it	Non-priority ES

Ecosystem Service	Description of the Service	Location Relevance	Likely Impact	Importance to Beneficiaries	Replaceability	Prioritisation Result
Soil erosion control	The vegetated areas, comprising only 8% of the site, provide some erosion control function during the rainy season	Seasonal wetland and Mixed deciduous Woodland	**Yes** Clearing of vegetation on the Project Site will have some impact on soil erosion, but proper erosion control measures will minimize	Limited	Existing erosion control functions can be replaced and likely improved with good management practices	Non-priority ES
CULTURAL ECOSYSTEM SERVICES						
Cultural values	The Project Site supports a number of baobab trees which have cultural significance in Malawi and are protected under national law	Project Site	**Yes** Clearance of two baobab trees will have some cultural impact	Clearing of baobabs and other trees that farmers protect because of their social value will have impact on cultural values of the people	Given their slow growth and age of the trees, it will take many generations to fully replace the loss of these trees	Non-priority ES
SUPPORTING ECOSYSTEM SERVICES						
Biodiversity maintenance	The Project Site is entirely Modified Habitat, but still supports biodiversity such as trees, insects and birds	Seasonal wetland and Mixed deciduous Woodland	**Yes** The Project Site supports some modified habitat which will be impacted	Biodiversity underpins a host of ecosystem services, many of which are	The biodiversity values cannot be entirely replaced, but creation of native plant	Non-priority ES

Ecosystem Service	Description of the Service	Location Relevance	Likely Impact	Importance to Beneficiaries	Replaceability	Prioritisation Result
			through vegetation clearing and solar plant installation	discussed above	communities in open areas of the site can mitigate the impacts	

5.2.4.1 Outcome of the Assessment

Table 5-10 indicates that there is a wide diversity of ecosystem services present at the Project Site, many of which are underpinned by biodiversity and all of which are important to community well-being in the area.

5.2.4.2 Overall Sensitivity Assessment

Habitats in the vicinity of the Project Site (i.e., in the Project Area) show considerable evidence of transformation, with the overall floral and faunal species composition showing a divergent change from the natural state. The vegetation is dominated by plant species that provide benefits to local communities, with many non-beneficial species having been eliminated through settlement and cultivation practices. As a result, there are many species of non-native origin present. Human activity has substantially modified the area's primary ecological functions and species composition, and the habitats there conform to Modified Habitats as described in PS 6 (Paragraph 11).

The Project is not located within the vicinity of protected areas, no highly threatened or range restricted floral or faunal species are considered likely to be present (with the exception of baobab trees, which are now protected under the Forestry Act[36]), and no large congregations of species are expected to occur. What remains of the habitats are representative of a widespread vegetation formation, and are therefore not unique. Based on these observations, no Critical Habitats are expected to occur, and a Critical Habitat Assessment following PS 6 is therefore not necessary.

5.3 SOCIO-ECONOMIC BASELINE

This section describes the current socio-economic context of the Project Area, along with national and district-level information where available and relevant. The information presented in this section is based on a desktop review of publicly available information (e.g., census data, government and international institution reports, and other online sources) and specialist, on-site information gathering.

5.3.1 Primary Data Collection Activities

To ensure a sufficiently robust set of socioeconomic data for the ESIA, the primary data gathering activities listed below were carried out.

- **Household surveys:** Household surveys were undertaken in the Project Area over the course of five days from March 28 to April 1, 2019. The surveys consisted of interviews of 181 households, including Project-affected people (PAPs) that will be impacted by the upcoming land acquisition and non-PAPs whose lands would not be affected by the Project.
- **Focus group discussions (FGDs)**: FGDs were undertaken with women, men, and youth to gather differentiated information including Project perceptions, gender roles, quality of life, access to public services, health issues, and livelihoods, as well as issues that affect youth (e.g., education and employment). PAPs and non-PAPs were invited to participate to ensure diverse perspectives on the Project. It should be noted that participatory rural appraisal tools were also

[36] Malawi Gazette Supplement, dated December 3, 2012.

utilized, such as gender matrices and access and control frameworks, to gather more focused information on gender roles, equality, and possible issues of discrimination.

- **Key informant interviews (KII)**: KIIs were held with professionals and local organizations with knowledge of specific topic areas and Project perceptions, including health workers, Non-Government Organisations (NGOs), credit and savings structures, and Dedza District sectoral offices.
- **Village profiles**: Village profiles were undertaken in six of the villages near the Project Site to gather sample village-level data including demographics, public infrastructure, and livelihoods.

A full list of meetings is provided in Appendix G.

5.3.2 Geography and Administrative Structure

Malawi is a landlocked country situated in the southeast of the African continent, bordered by Tanzania to the north, Mozambique to the east, Zimbabwe to the south, and Zambia to the west. Malawi has three regions; northern, central, and southern. It is divided into 28 districts, which are further divided into constituencies that are represented by Members of Parliament, as well as wards represented by local councillors.[37] The country is also divided into Traditional Authorities (TA), which are sub-divided into Group Villages, each with its own leader known as a Group Village Headman (GVH).

The Project Site is located in the Central Region of Malawi, approximately 47 km from the Dedza District Centre and within Kachindamoto TA and the Pitala Group Village. There are six villages under GVH Pitala that are expected to be directly affected by the Project, as the Project with be located on customary land belonging to members of these villages. Those six villages are Ching'anipa, Kalumo, Nsamala, Kapesi, Chisaka and Chitseko. Another village on the eastern side of the Project Site, Thondoya, is part of the Nitcheu District but is also expected to be directly affected, though not by land acquisition.

Figure 5-8 is a map of the Project Area marking the villages listed above. As part of the stakeholder engagement/social baseline activities carried out by ERM, approximate village boundaries for the land-affected villages were marked during a walk with each village chief (or his designee). As can be observed in the map, village boundaries are loosely defined with significant overlap, a characteristic that in part demonstrates the close ties/lack of hard divisions between the villages.

The District Commissioner (DC) is the head of the District Government and has overall authority regarding land, development, and infrastructure. The DC is the first point of contact for all project developers requiring land, and to date has been instrumental in the land acquisition and compensation process undertaken for the Project.

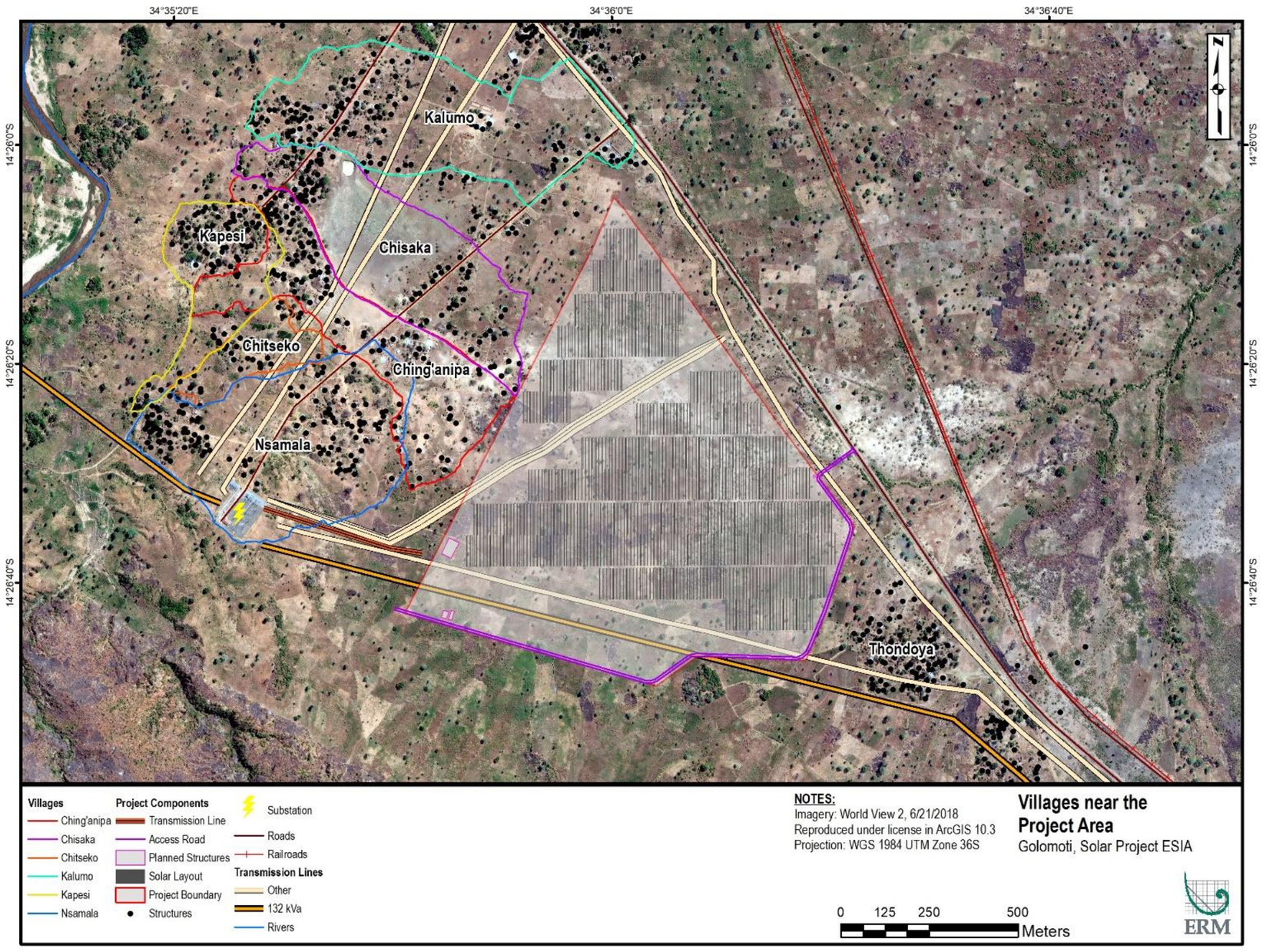
The TA/Senior Chief is custodian of the land in the TA and is responsible for overseeing the Group Villages. Each GVH is responsible for representing the

[37] Government of Malawi, Health Sector Strategic Plan 11 (2017-2022). Available at http://www.nationalplanningcycles.org/sites/default/files/planning_cycle_repository/malawi/health_sector_strategic_plan_ii_030417_smt_dps.pdf (accessed March 2019)

communities within their Group Village, supported by each village's own individual chief or headman.

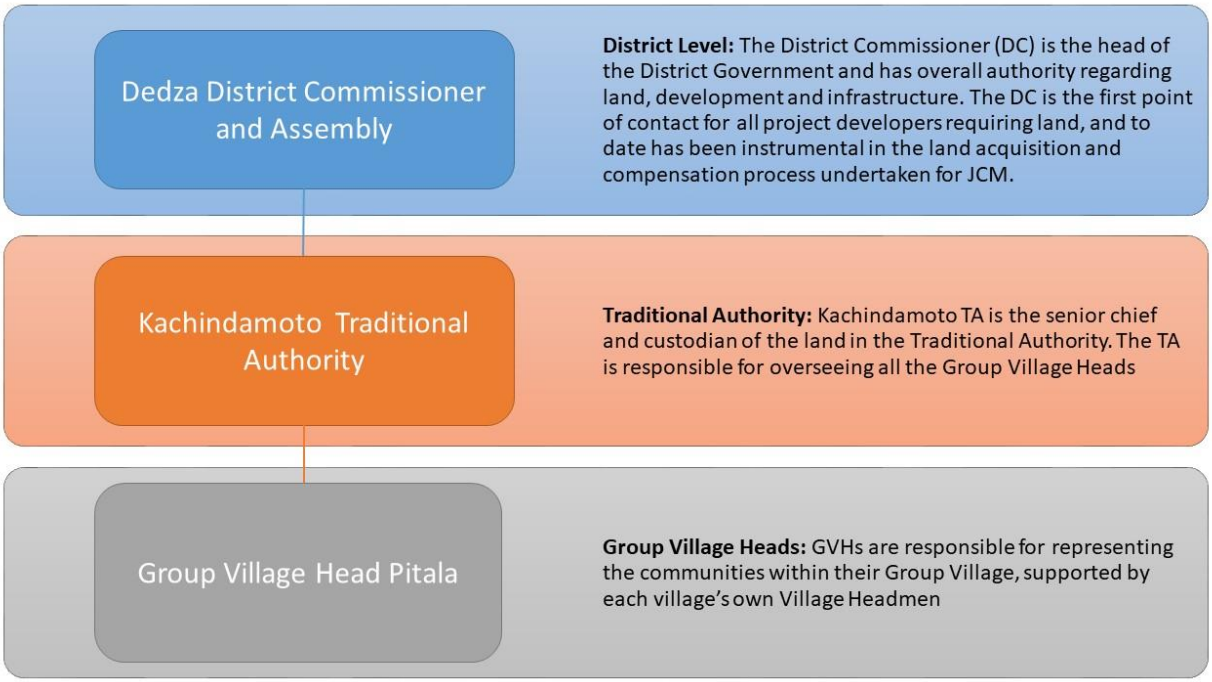
Figure 5-9 illustrates the institutional structure and the key representatives for each level.

Figure 5-8: Villages in the Project Area.



Source: ERM, 2019.

Figure 5-9: Institutional Structure.



Source: ERM, 2019.

5.3.3 Demographics

5.3.3.1 Population

At the local level, the population of the villages in the Project Area varies. Among the villages sampled as part of the Villages Profiles, Chisaka, Ching'anipa and Nsamala have the largest populations. Table 5-11 lists the reported population in the sampled villages. It is important to note that this information was gathered via Village Profiles and thus relies on estimates provided by each village's chief and is not based on actual census or survey data.

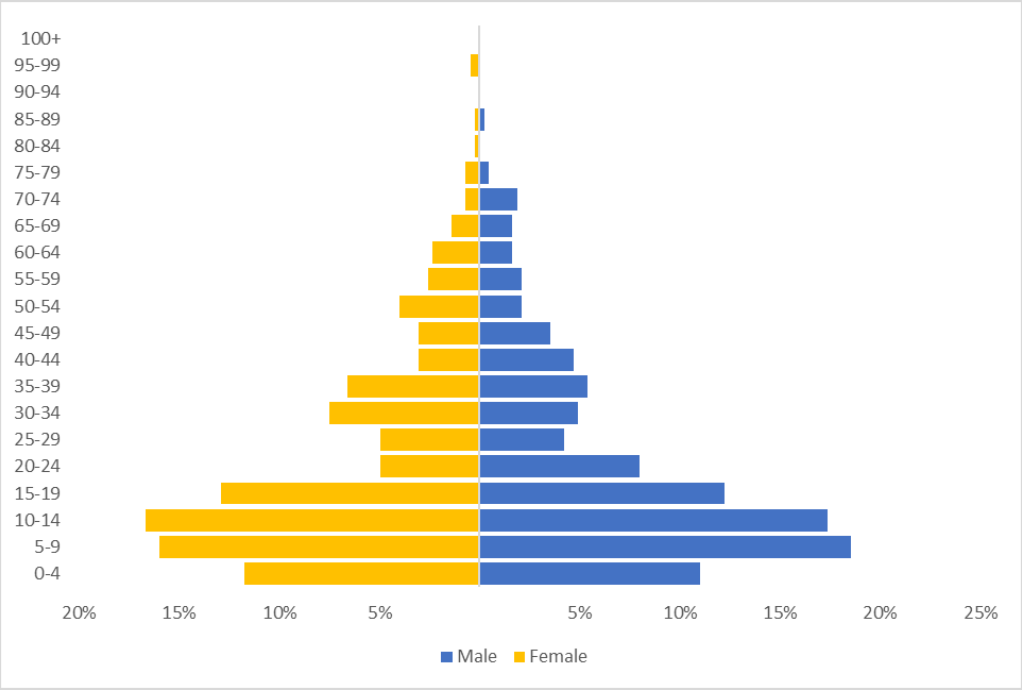
Table 5-11: Reported Population in the Project Area.

Community	Reported Population	Reported Number of Households	Average Household Size	Gender Makeup	
				Male	Female
Ching'anipa	1,100	110	9 to 10 members	25%	75%
Kalumo	500	145	4 members	40%	60%
Nsamala	1,046	123	7 to 8 members	45%	55%
Kapesi	*Not provided*	70	6 members	30%	70%
Chisaka	1,200	116	8 members	40%	60%
Chitseko	266	38	7 members	40%	60%

Source: ERM, 2019.

Figure 5-10 illustrates the population distribution by age and sex among members of those households surveyed. Similar to the national distribution, the local population is very young, with approximately 46% under the age of 15 and just 4% aged 65 and older.

Figure 5-10: Local Population Pyramid by Age and Sex.

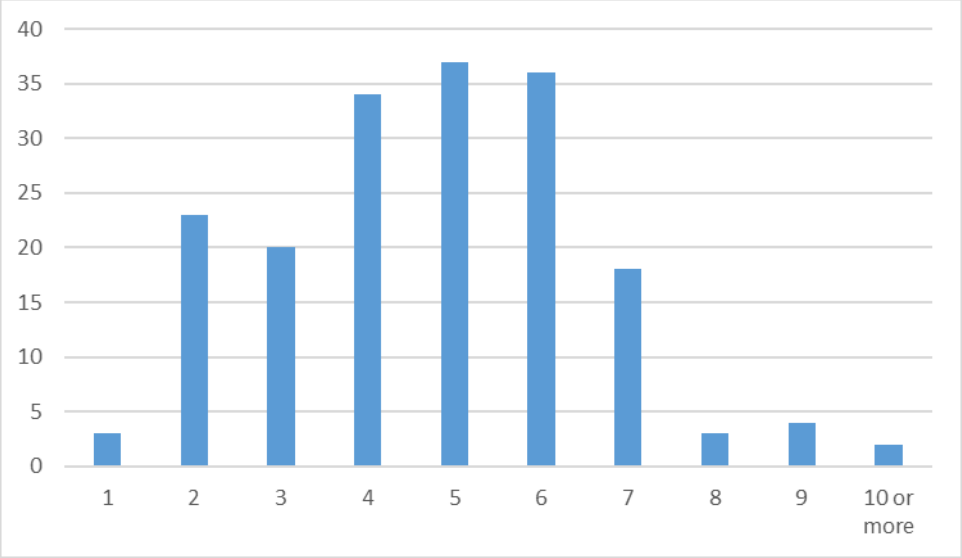


Source: ERM, from household survey data.

In terms of household membership, households in the Project Area have on average of 4.75 members, a figure slightly higher than the district average. The distribution of

the reported number of household members per household is presented in Figure 5-11.

Figure 5-11: Number of People per Household in the Project Area.



Source: ERM, from household survey data.

5.3.3.2 Migration

As part of the household surveys, interviewees were asked how long each member of the household had been living in their community. The majority of household members (84%) reported being born in the community. Among more recent arrivals, just 8% of heads of households reported being in the community five years or less. During the Village Profiles, no recent notable population increases or decreases in migration were reported.

5.3.3.3 Ethnicity, Religion and Language

The primary religion in the villages is Christianity, with 97% of surveyed households reporting it as their religion. The primary ethnicity is Ngoni, representing 59% of the surveyed households, with a significant portion (37%) belonging to the Chewa ethnicity. Chichewa is the main language spoken in the households surveyed.

5.3.3.4 Community Cohesion and Community Networks

All the villages under GVH Pitala generally have close ties, and although villages are considered distinct, in practice community members move about, not always residing in the village of their birth. Some members from Group Village Pitala have moved to Thondoya village due to marriages, and still have active ties with family from their villages of origin, and still consider themselves part of these villages. Community members in the area reported helping one another with development activities, such as maintaining local roads, and supporting one another during celebrations or mourning (e.g., during weddings and funerals). Women reported relying on one another for child care support, lending money, and sharing ideas for small business opportunities. Men said they relied on other men for financial support, farming inputs, and to exchange knowledge on matters such as water, sanitation, and hygiene.

Men reported gathering to socialize at beer drinking points within the community and at game playing points, which are usually in someone's home or in the nearby trading centre. Women did not report special gathering places for socializing but can commonly be viewed socializing in the queues for water. Women did note that "Tsimba" is a cultural gathering point in Nsamala village where women gather for cultural initiations when girls reach puberty.

5.3.4 Gender Context

5.3.4.1 Gender Roles

It was reported through household surveys and FGDs that men are generally considered the primary breadwinners and are mainly responsible for providing food for the family and caring for livestock. Meanwhile, women were reported to be primarily responsible for preparing food, fetching water and firewood, cutting thatch grass, cleaning, and other household chores. Both males and females were reported to contribute to farming and other income generating activities. During the FGD, women reported that their roles in providing for family income has increased in recent years, citing that men tend to spend their money on unnecessary expenses, such as alcohol. Women said they accomplish this through small business activities, as well as performing piece work. During the men's and women's FGDs, both groups stated that in recent years gender roles were changing and women have more opportunity to participate in labour activities once considered for men only, especially in piece work and labour considered more physical in nature, like building houses. Likewise, during the FGD with youth, youngsters reported that they believe gender roles are not as pronounced for the younger generations, stating that household chores were not differentiated greatly between boys and girls.

Men and women described their day-to-day activities as part of the participatory rural appraisal tools used during the FGDs. As can be observed in Table 5-13 summarizing the discussions, women's responsibilities for both income and non-income activities result in a notably unequal distribution of labour and greater burdens on women's time.

Table 5-12: Division of Labour.

Gender	Activity	Approximate Time Input	Resources Required	Socio-Cultural Factors/ Barriers that Influence Behaviour
	1. Farming	6 hours (wet season) 4 hours (dry season)	Hoe, seeds, fertilizer, land, agrochemicals	• Unavailability of inputs
	2. Artisanal reed cutting	2 hours	Sickle, panga knife	• Health • Tiredness
	3. Kabadza (bicycle taxi/transportation)	3 hours	Bicycles	• Tiredness • Some customers don't pay
	4. Small business/selling of goods	6 hours	Capital	• Lack of credit facilities
	5. Digging holes for electricity poles	4 hours	Hoe, Chisel, Shovel	• Delay in receiving payments
	6. Looking after animals	6 hours	Grazing land	• Lack of enough land to graze animals
	7. Hunting	1 hour	Spear and Dogs	• Injuries and wild animals
	1. Farming	4 hours	Hoe, seeds, fertilizer, land, agrochemicals, panga knife, axe, slasher	• Unavailability of inputs • Labour issues/ resources to pay • Illness • Shortage of water for irrigation (dry season)
	2. Caring for household,	3 hours	Soap, basin, water, brush	• Money for buying soap • Water shortages

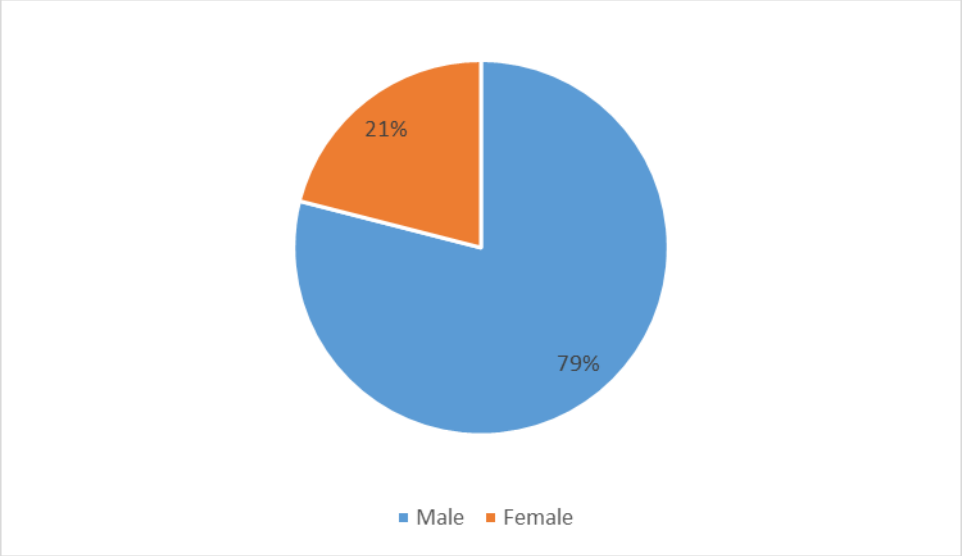
Gender	Activity	Approximate Time Input	Resources Required	Socio-Cultural Factors/ Barriers that Influence Behaviour
	including bathing children			
	3. Cleaning the homestead	5 hours	Broom, clay soils for the floor, buckets	• Being hurt by grass when applying the mud (soil) • Houses are not durable
	4. Fetching water	4 hours	Buckets	• Queue at the borehole • Long distances
	5. Collecting firewood	7 hours	Hoe, seeds, fertilizer, land, agrochemicals, panga knife, axe, slasher	• Accessibility • Availability (at times) • Distance
	6. Cooking	7 hours	Pot, cups, basin, water, maize flour, firewood	• Lack of enough firewood • Lack of money to buy food
	7. Cutting grass for thatching houses and for sale	6 hours	Panga knife, axe, sickle, slasher	• Availability (at times) • Distance
	8. Piece works (agricultural labour)	4 hours	Hoe, seeds, fertilizer, land, agrochemicals, panga knife, axe, slasher	• Not been paid after doing the work
	9. Small business/selling of goods	5 hours	Sack bags, baskets, money, pots	• Not making profits • Confiscation of properties because of not paying back loans on time • Money being stolen • Don't have a place to get a loan

Source: ERM FGDs with Men and Women.

Note: Participants in the FGDs were asked to describe usual day-to-day activities, even if they don't engage in these each day, and the time taken for each. As such, the time inputs sum to far more than 24 hours (26-28 in the case of men and 45 for women).

In married households, men were almost exclusively reported to be the head of household. Among the total households interviewed as part of the household surveys, however, there were a significant number of female-headed households, as seen in Figure 5-12.

Figure 5-12: Head of Household by Gender.



Source: ERM, from household survey data.

Among the female-headed households, the primary status of those household heads were separated/divorced (47%), followed by widowed (37%).

5.3.4.2 Access and Control of Resources / Gender Equality

During the FGDs, men, women and youth were engaged about their perceptions of gender equality and access and control of key resources in the Project Area. The results of a participatory rural appraisal tool on access and control of resources can be viewed in Table 5-13. Generally, men cited having control of key household assets such as livestock, farming equipment, the home, and their wives, and being the decision-maker for the household. The only major asset that women compete with men in terms of access and control is land, due to the matrilineal land ownership system, but women still perceived that men ultimately controlled the land.

According to women, boys have more educational opportunities than girls. Women reported that when money for school fees is lacking, boys will be favoured over girls to be sent to school. In addition, women reported that boys have the opportunity to do piece work to get money for their education, which most girls cannot manage, as they are considered weaker than boys. Men agreed that they make decisions about spending for school fees, but felt that because other assistance is targeted at keeping girls in school that boys can be disadvantaged as they receive less support for their schooling.

Table 5-13: Access and Control of Resources

Resource	Men's Perceptions		Women's Perceptions		Comments Raised During FGDs
	Access	Control	Access	Control	
Land	Women	Women	Women	Men	• Both groups cited that women have access to land as this is the matrilineal cultural system, but men viewed that women also controlled land, while women viewed that men did
Education and training	Men	Men	Men & Women	Men	• Women commented that because men control spending, they are the ones to decide spending on school fees and who gets to go to school • Men also said they decided who in the family got to go to school • Women commented that men don't want them receiving training because of jealousy/fear that they will meet other men
Technology	Men	Men	Men	Men	• Both men and women mentioned that women don't usually have phones because men are jealous
Cash	Men	Women	Men & Women	Men	• Women mentioned that men are not transparent about how much they earn selling goods in the market • Men believe that women have control of cash because they do all the household budgeting
Credit/Loans	Men	Women	Men & Women	Men	• Women stated that sometimes their husbands ask them to

					take out a loan so they don't have to be responsible for its repayment
Marketing/ selling of goods	Men	Men	Men	Men	• Men tend to be the ones to control decisions about significant sales, like livestock
Hiring of labour	Men	Women	Men	Men	• Women said that men are not honest when it comes to paying labour; that paying of labour is used as an excuse to hide spending on other things, like alcohol

Source: ERM FGDs.

5.3.4.3 Challenges Faced by Men and Women

Cases of gender-based violence against women also fell in Kachindamoto TA over the five year period between 2008 and 2012.[38] The TA, a woman named Theresa Kachindamoto, has focused on child marriages and developed programs locally to keep young girls in school. The TA recently achieved an agreement in the district to end child marriage, and over a three year period (approximately 2013-2016) annulled over 850 child marriages. She has additionally made efforts to abolish "cleansing rituals" that require girls as young as seven to go to sexual initiation camps.[39] The FGD held with youth revealed that the TA has empowered the local Youth Network to support her initiatives to identify and abolish child marriages and support one another to stay in school. Youth felt that peer-to-peer support on this important issue was aiding in reducing these challenges.

During the FGDs, women also noted that keeping girls in school was a challenge. Especially when young girls become pregnant, there is a pressure for them to marry and drop out of school to start a home. Women also complained of time poverty for both women and girls, highlighting that though females engage at similar rates to males in work and school, females have more household work while males engage in leisure activities or rest. Women cited jealously as a source of conflict in local households, at times leading to domestic violence when husbands fear their wives may be associating with other men. Men did not feel they had many challenges, but did cite unemployment and the lack of job opportunities as challenges. They tended to agree that jealously was an issue in households and caused them to exert control over their wives and certain resources (e.g., cell phones).

[38] Dedza District Socio-Economic Profile 2013-2018. https://issuu.com/dedzaeast/docs/dedza_sep_final (accessed March 2019)

[39] Inhabitat, Female chief in Malawi breaks up 850 child marriages and sends girls back to school, https://inhabitat.com/inhabitots/female-chief-in-malawi-breaks-up-850-child-marriages-and-sends-girls-back-to-school/ (accessed March 2019)

5.3.5 Governance, Security and Human Rights

5.3.5.1 Governance and Security

During the FGDs and KIIs, interviewees overwhelmingly reported that save for occasional minor theft issues, security in the community is very good and there have never be any significant security concerns.

5.3.5.2 Human Rights Context

At the local level, household surveys did not indicate that child labour is a significant issue, with just 4% of people under the age of 18 reported as having a livelihood occupation or seeking employment. Nevertheless, it should be noted that many households do not consider chores to constitute labour for children, even though children routinely engage in cattle rearing, agriculture, and small business opportunities in the area.

5.3.6 Vulnerability

Vulnerability is dependent on the level of resilience of individuals to cope with socioeconomic or bio-physical change or shocks. Resilience is based on having access to the necessary resources (e.g., savings, assets such as crops, shelter) and physical/mental capacity (e.g., strength to relocate, skills to rebuild a business) to cope and adapt to changes. Vulnerable groups are consequently more susceptible to negative impacts and/or may be disproportionately affected by such impacts. Similarly, vulnerable groups may have a limited ability to take advantage of positive impacts. Vulnerability may stem from an individual's or group's race, colour, sex, language, religion, political or other opinions, national or social origin, property, birth, or other status.

Based on household survey data and stakeholder engagement activities to validate vulnerability categories in the local context and perceptions, the list below presents groups that can be considered vulnerable in the Project Area. It is important to note that during stakeholder engagements, many stakeholders stated that they believe most people in the Project Area have similar standards of living, and most have struggled at times to meet their basic needs, especially with regard to food security. Nevertheless, the groups highlighted below were considered particularly vulnerable to shocks with limited ability to recover quickly from negative impacts.

- **Women and girls:** Women were routinely described as disadvantaged in comparison to men with regard to economic opportunity, especially for wage-earning labour. Men dominate access and control of most key resources, and are generally the decision-makers for households. Domestic violence and early pregnancy were cited as challenges that further disadvantage females compared to males. Girls were less likely to finish their education than boys, at times because fathers prioritize the education of sons when resources are short.
- **Female-headed households:** Female headed households (many widows) are more likely to experience significant poverty than dual parent/male-headed households due to more pressure balancing domestic and livelihood activities and less income earners to support children.

- **Orphans:** Though not reportedly common in the area, orphans are considered vulnerable as their network for support is extremely limited and they are not as well positioned as adults to earn adequate incomes.
- **Physically handicapped:** Those with physical impairments are considered more disadvantaged as they require more support, especially with regard to agriculture. They are often not able to be productive or work in agriculture at all, even though this is the main livelihood in the area.
- **Elderly and others with serious medical conditions (e.g., HIV/AIDS):** This group is considered vulnerable as they are more limited in terms of their physical ability to engage in livelihood and income generating activities. Most require additional care and support for their daily needs, which can be an extra hardship on their families.

Most households in the Project Area can generally be considered somewhat vulnerable as a result of poor food security, low education levels, and low levels of income, coupled with limited ability to absorb shocks (e.g., having little to no savings, ability to access credit).

5.3.7 Education and Literacy

5.3.7.1 Access to Education

In Kachindamoto TA, there were 34 total primary schools (10 government and 24 mission) in 2012. Between 2008 and 2012, boys in Kachindamoto enrolled in primary school at slightly higher rates than girls each year, making up 52.1% of enrolees in 2012. Kachindamoto had 4 secondary schools (all government schools) in 2012. Within the Project Area, all the villages utilize the same schools for local children. These are listed and briefly described in Table 5-14. No tertiary education facilities were available in the area, and community members were generally unaware of any locals who had been successful in continuing their education past the secondary level. Options for tertiary education are available in Dedza or Salima town centres, which are located far from the Project Area.

Table 5-14: Access to Education.

Type of educational facility	Name	Approximate distance	Comments/ Observations
Pre-school/ nursery	Nsamala or “Bongolola” Nursery School	0.2 km	A private nursery school which meets under a tree in Nsamala Village.
Primary	Chipuzi Primary School	0.5 km	This primary school has up to standard 7. Pupils have to move to another school which is far away (estimated between 2 to 3km) for standard 8.

Type of educational facility	Name	Approximate distance	Comments/ Observations
Secondary	Golomoti CDSS	7-8 Kilometres	It is in Chikololele village, also sometimes referred to as “Chikolele CDSS”. The schools is very far away from the area and the distance was frequently cited as a hardship for students.

Source: ERM Village Profiles.

According to household surveys, most children walk to school along a trajectory that takes 30 minutes or less (69%), with some walking more than 30 minutes and up to an hour (25%) and very few cases of longer distances. Among factors that limit children attending school, households reported that costs/financial reasons were primary limiting factors (50%), followed by illness (29%) and distance (12%). Males and females were reported to both be affected by such factors, with females reported as being somewhat more affected (58%).

Interviewees during FGDs with men, women, and youth emphasized that school fees were a limiting factor for most families and constitute the primary reason children miss school. When families lack money for school fees, youth reported they typically miss two weeks of school until the family is able to pay again. Parents believed the quality of the primary school was very good, and recounted that on average 70% of pupils in standard 8 are selected to attend good government secondary schools, including boarding schools. All groups cited the distance of the main secondary school, however, as a challenge for local students. Participants in the youth FGD said that schools often lack materials for learning and enough desks, and that the secondary school had just eight teachers, leading to average class sizes of 130 students. Youth and other KIIs stated that the toilet facilities were also lacking in the schools, presenting challenges especially for girls during their menstruations.

5.3.7.2 Literacy Levels

Household survey data suggests that among the population aged 15 to 24, 83% of males and 78% of females are literate. These rates are lower than the reported national literacy rates level. Although low, when compared to the overall literacy rates for all household members aged 15 and older, data indicates that younger generations are more literate on the whole, with a narrower gap between male and female literacy than the overall population (Table 5-15).

Table 5-15: Local Literacy Levels by Gender and Age Range

Age Range	Literacy	Male	Female
All ages over 15	Literate	76%	53%
	Illiterate	24%	47%
	Total	**100%**	**100%**
Ages 15 to 24	Literate	83%	78%
	Illiterate	17%	22%
	Total	**100%**	**100%**

Source: ERM, from household survey data.

5.3.8 Economy and Livelihoods

5.3.8.1 Livelihood Activities and Household Income

Household survey respondents most commonly reported that the primary occupation for household members aged 18 and above was farming (67%), followed by trading/market and selling (10%). Very few reported formal sources of employment. These are consistent with sources of household income, which were stated to be business/trading, agriculture, and informal employment (including piece work or day labour).

Household surveys suggest that the median monthly income is MWK 30,000, or approximately USD 41 per month (using an exchange rate of MWK 732 to USD 1). This equates to approximately USD 1.35 per day for the household, falling well below the international poverty line of USD 1.90 per person per day. Along these lines, most households (65%) reported that their incomes made it either “very difficult” or “difficult” to make ends meet (i.e., to pay necessary expenses). A smaller 28% reported their incomes were satisfactory, while only 7% rated their incomes as easily sufficient to meet their expenses. In terms of prominent expenses borne by most households surveyed, respondents reported the following annual expenses in order of significance: food, farming inputs, clothing, electricity, and healthcare/medication.

Very few households (18%) reported having savings. Of those that did, the most common forms were through Village Savings and Loans (VSL) and cash. To a lesser extent, livestock was considered a form of savings. Formal access to credit is not common in the Project Area, and just 31% of household survey respondents reported that a household member had accessed credit or borrowed money in the past year. Borrowing was mostly done informally through a friend or relative or through a local VSL, a type of savings club. VSLs are very common in Malawi, and generally function based on members pooling savings to be able to offer a source of borrowing funds to fellow members when needed. In the Project area, VSL members reported that loans are typically short-term in nature, with a payback period of a month in most cases, and are provided at 20% interest. Those households that had borrowed money or accessed credit reported the challenges/barriers listed in Table 5-16.

Table 5-16: Barriers to Accessing Credit.

Barriers	Percentage of Households
No barriers	35%
Not available locally	24%
Lack of bank account/credit history	2%
Interest payment too expensive	35%
Other	3%

Source: ERM, from household survey data.

During stakeholder engagement activities, VSLs were cited as the only formal access to credit resource in the local area.

The average monthly household income in the Project area is 45,741 MWK, while the median monthly income is 30,000 MWK. Income quintiles (in which reported incomes in the data set are divided into five equal groups) are an interesting means of drawing comparisons between income groups and to be able to detect where inequalities or vulnerabilities may lie. The quintile mean, shows the average income in each group, while the share shows the percentage of total income held in aggregate by members of a given quintile.[40] As seen in Table 5-17, income quintiles in the community show relatively unequal income distribution highly skewed towards the top quintile.

Table 5-17: Monthly Income Quintiles.

Quintile	Quintile Mean (MWK)	Share of Total Household Incomes
Bottom Quintile	7,861	3%
Second Quintile	16,288	7%
Middle Quintile	27,676	12%
Fourth Quintile	43,285	19%
Top Quintile	131,218	59%

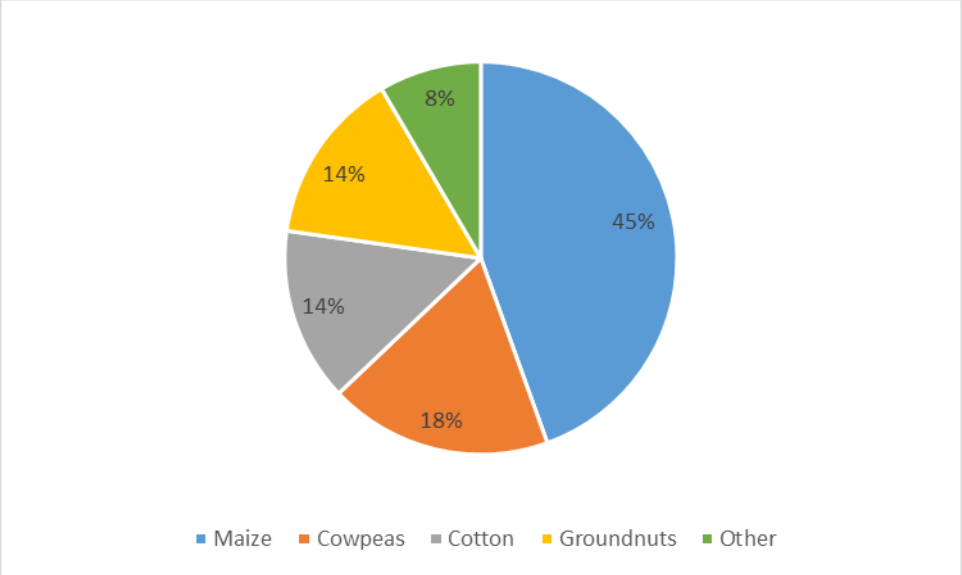
Source: ERM, from household survey data.

The low income levels observed may be partially attributed to the fact that many households engage in livelihood activities for subsistence rather than to generate income. For example, when asked about the top crops produced by the household, most reported that these crops were produced for consumption (52%), followed by sales (24%) or a combination of consumption and sales (23%). Top crops produced by the households are presented in Figure 5-13. The predominance of maize

[40] For reference, because each quintile represents 20% of the households, a 20% income share in each quintile would represent a mathematically equal distribution of household income.

production and the subsistence nature of agriculture is further evidenced based on the overwhelmingly most common staple food reported to be consumed by households – Nsima, a maize-based porridge. Meanwhile, cowpeas and cotton are primarily grown to generate income.

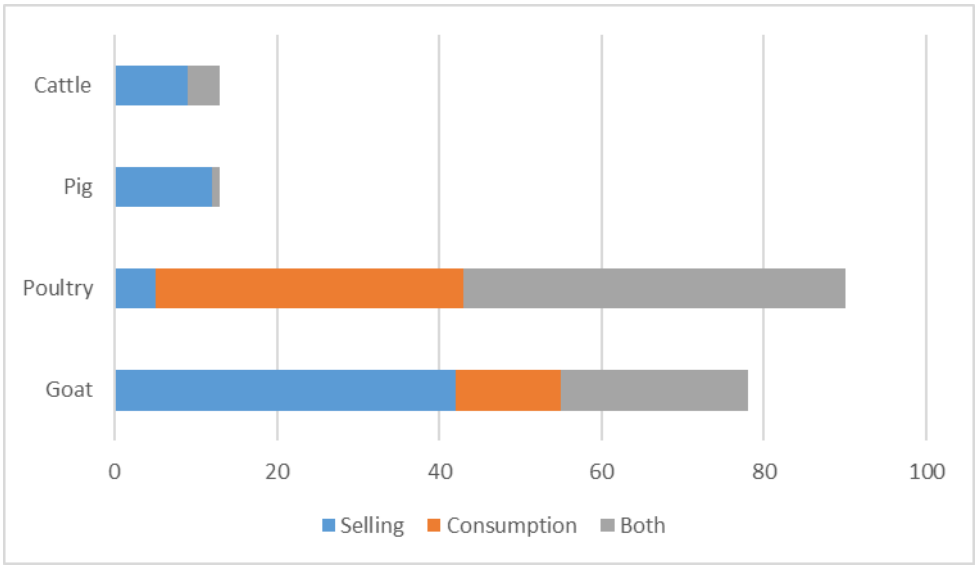
Figure 5-13: Top Crops Produced by Households.



Source: ERM, from household survey data.

Roughly 70% of households keep some livestock, primarily poultry (chickens and ducks) and goats, keeping and average of 16 and six animals, respectively (Figure 5-14). Poultry is primarily kept for household consumption and some sales, while goats tend to be raised more for income generating purposes and some consumption. Caring for livestock and daily herding to graze and water was explained to be primarily the charge of boys, while parents are responsible for ensuring that livestock are penned and safe each day.

Figure 5-14: Livestock Kept by Households and Uses.



Source: ERM, from household survey data.

Food shortages were reported as being very common among respondents to the household surveys, 72% of which stated they experienced food shortages from time to time, including during the last year. The primary reasons for food shortages were said to be limited money to buy food, followed by climate-related challenges, such as drought and flooding, and lack of adequate farming inputs. Consistent with national trends, food shortages were generally reported to last approximately two months, with January and February cited as the most common months, with some shortages occurring in December and March.

Another important source of income for households is small business opportunities, facilitated by the immediate proximity of the Golomoti trading centre on the M5 road just a short walk from most of the villages. Many community members sell goods either through a rented stall or selling on foot on the street. Goods include farm produce, butchered meat, prepared foods, snacks, and other small items. Many community members also reported earning income through casual labour opportunities or bicycle taxi/transportation, especially males.

Further detail on land-based livelihoods is provided in the following section.

5.3.9 Land Ownership and Use

5.3.9.1 Land Ownership

Among the parcels of land held or utilized by the households interviewed in the household surveys, respondents reported that 90% of these were customary land, while 7% of parcels were under a leasehold regime and the rest belonged to another category, including rented or privately owned/purchased. Approximately 85% of the parcels described by household survey respondents were reported to be under one hectare (on average approximately 0.6 hectares). It is common for households to have claim to more than one parcel of land, with the average being two parcels per household. No land conflicts were reported by village leaders or community members.

5.3.9.2 Land Use

Land in the Project Area is generally flat and predominantly used for agricultural purposes. Common crops cultivated in the Project Area include maize, cotton, groundnuts, cowpeas, and sweet potatoes. Trees on the Project Site include native and planted trees, including mango, acacia, and baobab. Local residents report that medicinal plants are collected from the Project Site and elsewhere. There are also several walking paths that traverse the Project Site (Figure 5-15). During the Village Profiles, many of the chiefs noted that while everyone has inherited customary land in their families, some families rent additional land for agricultural purposes because their family land is not enough to support their households, though this typically is explained to be a very small percentage of families.

5.3.9.3 Agriculture

As described in Section 5.1.7.2, maize, cowpeas, cotton, and groundnuts are cultivated by households in the Project Area, primarily for household consumption but also for income generation to a more limited extent. The most common challenge cited by households regarding agriculture was drought/lack of enough water, followed by lack of agricultural inputs and pests/diseases. In terms of watering crops, most crop

cultivation relies on rainfall, but some community members reported utilizing the nearby Livulezi River for irrigation.

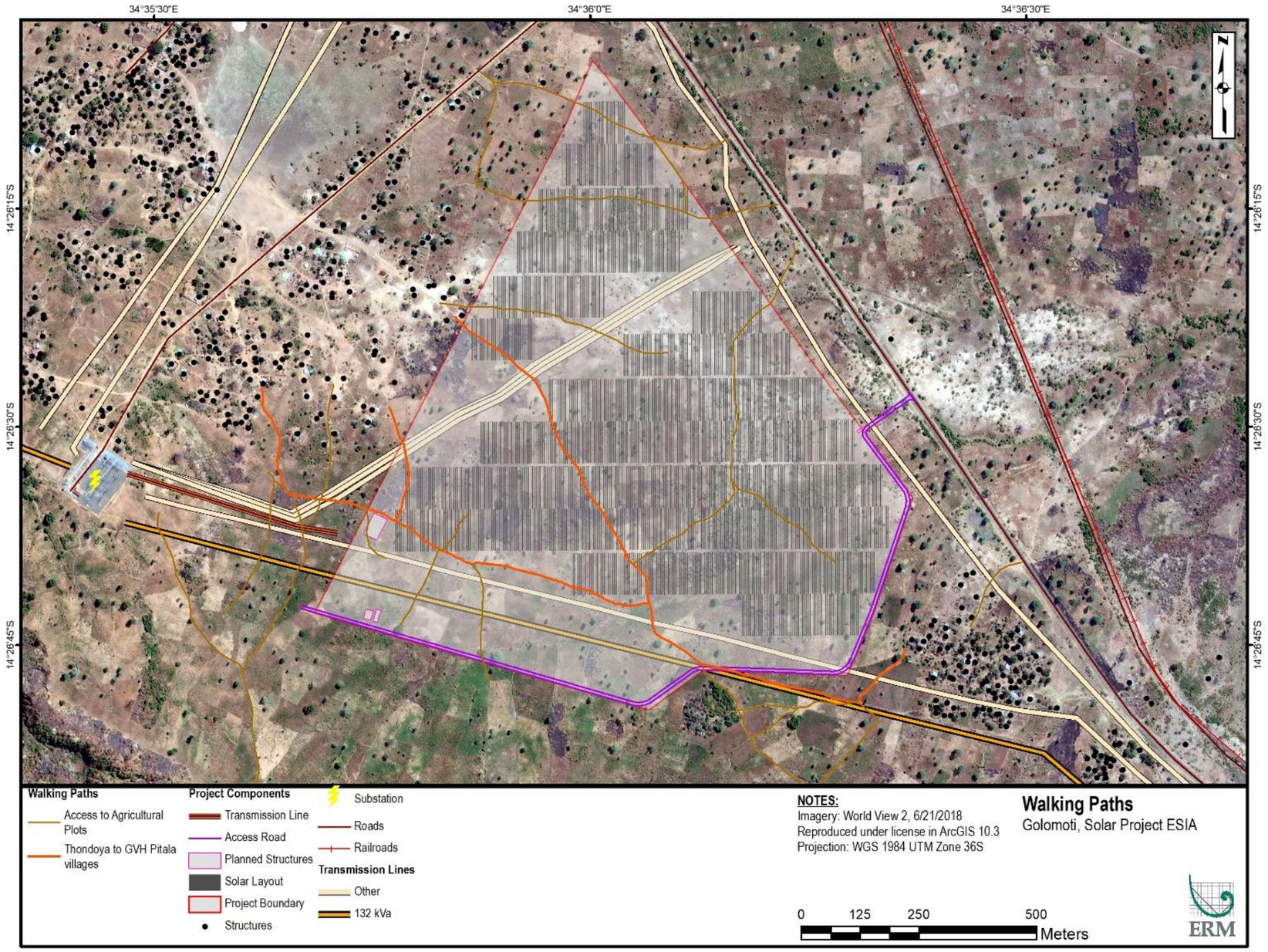
5.3.9.4 Utilisation of Natural Resources / Forest Products

Households reported utilizing various natural resources primarily found outside of their own land. The most important of these are fuelwood (for cooking and charcoal production) and grass (for construction), with some use of timber, medicinal plants, bush meat (e.g., birds and hare), and mushrooms. Of these resources, a majority of households (87%) reported that they are for consumption rather than sale. Viewed by product, however, firewood and grass tend to be primarily for the household, while the sale of charcoal, though illegal, is a significant source of income for families. During the FGDs, community members reported that everyone generally has equal access to natural resources. Women reported that the walk to collect firewood can take up to two hours and that there is a forest that is accessible, but people were beginning to encroach on the protected forest for charcoal production.

5.3.9.5 Livestock

Livestock is also reared in the Project Area, near homes in the case of smaller animals and in nearby areas to for those animals that can be herded. An open field in Chisaka village, which is privately owned but available for community use, is used to graze cattle and has a small pond from which cattle can drink. Cattle are also taken to the Livulezi River to drink. The most common animals kept by households are poultry (chicken and ducks) followed by goats. The most common challenge cited by households regarding livestock was animal health/disease. Other challenges cited were theft and lack of grazing land.

Figure 5-15: Walking Paths in the Project Area.



Source: ERM, 2019.

5.3.10 Health

5.3.10.1 Healthcare System and Access to Healthcare

When ill, residents of the Project Area most commonly frequent community health centres, followed by government hospitals. Among the households surveyed, 67% reported feeling there were barriers to accessing healthcare, for the reasons listed in Table 5-18. During the FGDs and KIIs, interviewees also emphasized overcrowding and long wait times as healthcare challenges.

Table 5-18: Barriers to Accessing Healthcare.

Barrier	Percentage of Households
Lack of finances	27%
Distance	37%
Poor service	36%

Source: ERM, from household survey data.

The median annual amount spent by households on health care was reported to be approximately MWK 12,000. The distances in terms of travel times to health facilities reported by households are presented in Table 5-19.

Table 5-19: Travel Time to Health Facilities.

Time to Reach Health Facility	Percentage of Households
15 minutes or less	3%
16-30 minutes	15%
31-60 minutes	30%
61-90 minutes	43%
More than 90 minutes	9%

Source: ERM, from household survey data.

Despite distances, households reported reaching health facilities with fairly regular frequency as presented in Table 5-20.

Table 5-20: Household Visits to Health Facilities in Last 3 Months.

Number of Visits	Percentage of Households
1-2 times	54%
3-4 times	35%
5-6 times	7%
More than 6 times	4%

Source: ERM, from household survey data.

5.3.10.2 Health Prevalence Rates

At the time of the household surveys, households reported that the following were relatively common illnesses/ailments: malaria/fever, respiratory infection, diarrhoea, skin rash, and bilharzia. Though detailed health indicators are not available for the local level with regard to average life expectancy for men and women, the population distribution of household members, illustrated in Figure 5-17, suggests that local averages are likely similar to Dedza District averages, and much lower than national averages, as observed in the smaller concentrations of the population in upper age brackets.

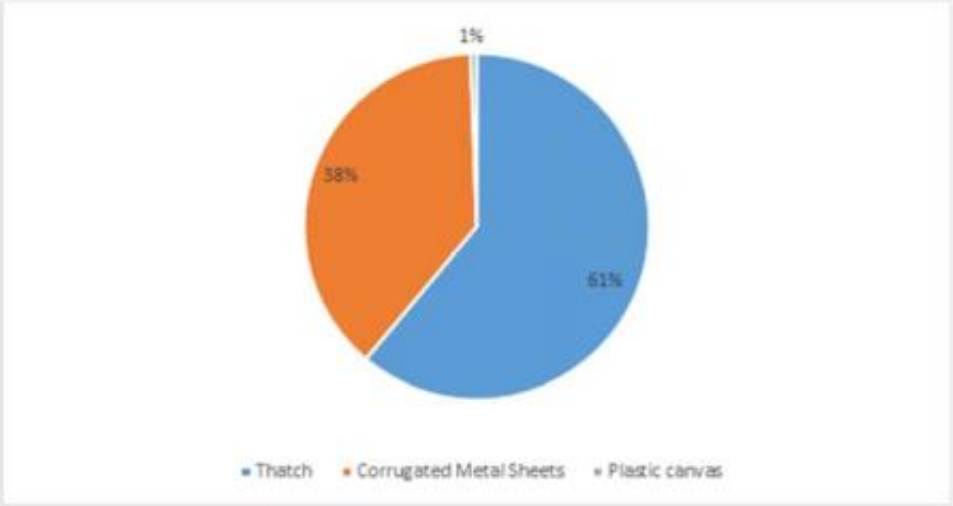
5.3.11 Community Infrastructure and Services

5.3.11.1 Housing

Houses are clustered to the northwest and to the east of the proposed Project Site. There are a variety of housing structures in the community. Most houses are fairly small and have between two and three rooms.

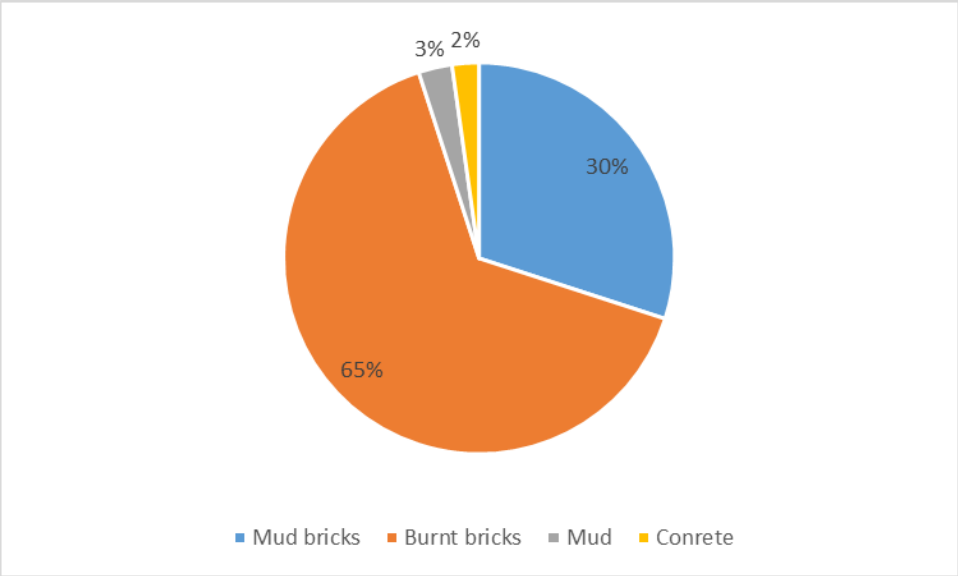
Burnt as well as unburnt bricks, bamboo, and soil are some of the materials utilized for the construction of walls. The main floor types for the structures in the community are mud and cement. Roofing materials for the majority of the structures are grass and corrugated metal (referred to as corrugated iron). Figure 5-16 through Figure 5-17 illustrate the prevalence of the main building materials used for housing in the communities. During FGDs, community members stated that burnt bricks and metal sheet houses are the most desirable for their durability but more costly to build.

Figure 5-16: Building Material for House Roofing.



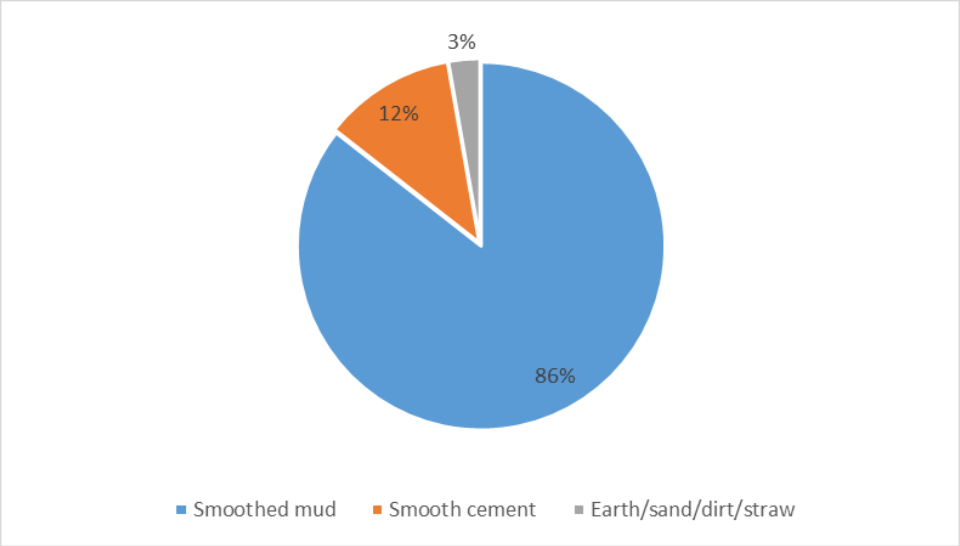
Source: ERM, from household survey data.

Figure 5-17: Building Material for House Walls.



Source: ERM, from household survey data.

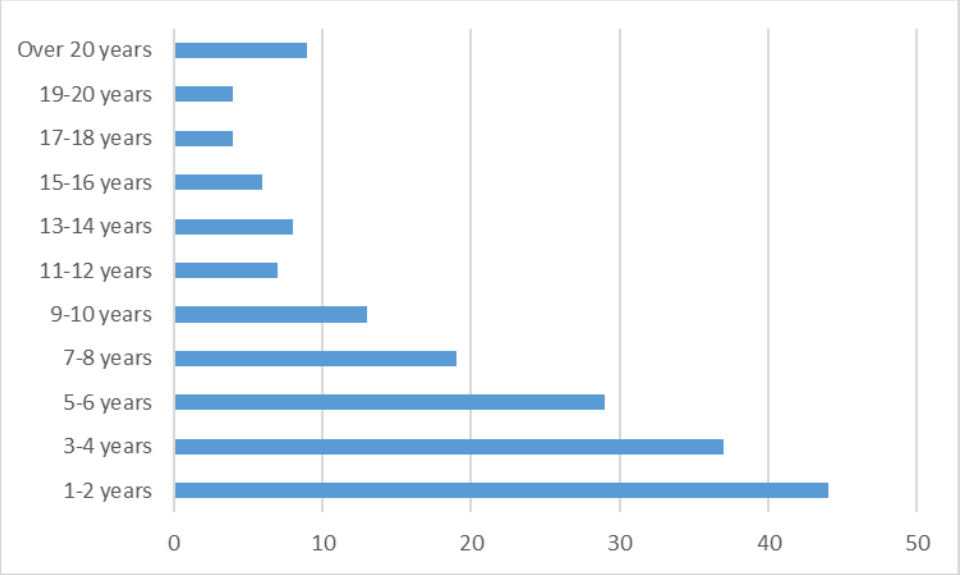
Figure 5-18: Building Material for House Floors.



Source: ERM, from household survey data.

As illustrated in Figure 5-19, these materials often do not weather well and thus houses tend to be "young," with 72% being eight years old or less, with an average age of 7.3 years.

Figure 5-19: Age of Houses.



Source: ERM, from household survey data.

5.3.11.2 Water and Sanitation

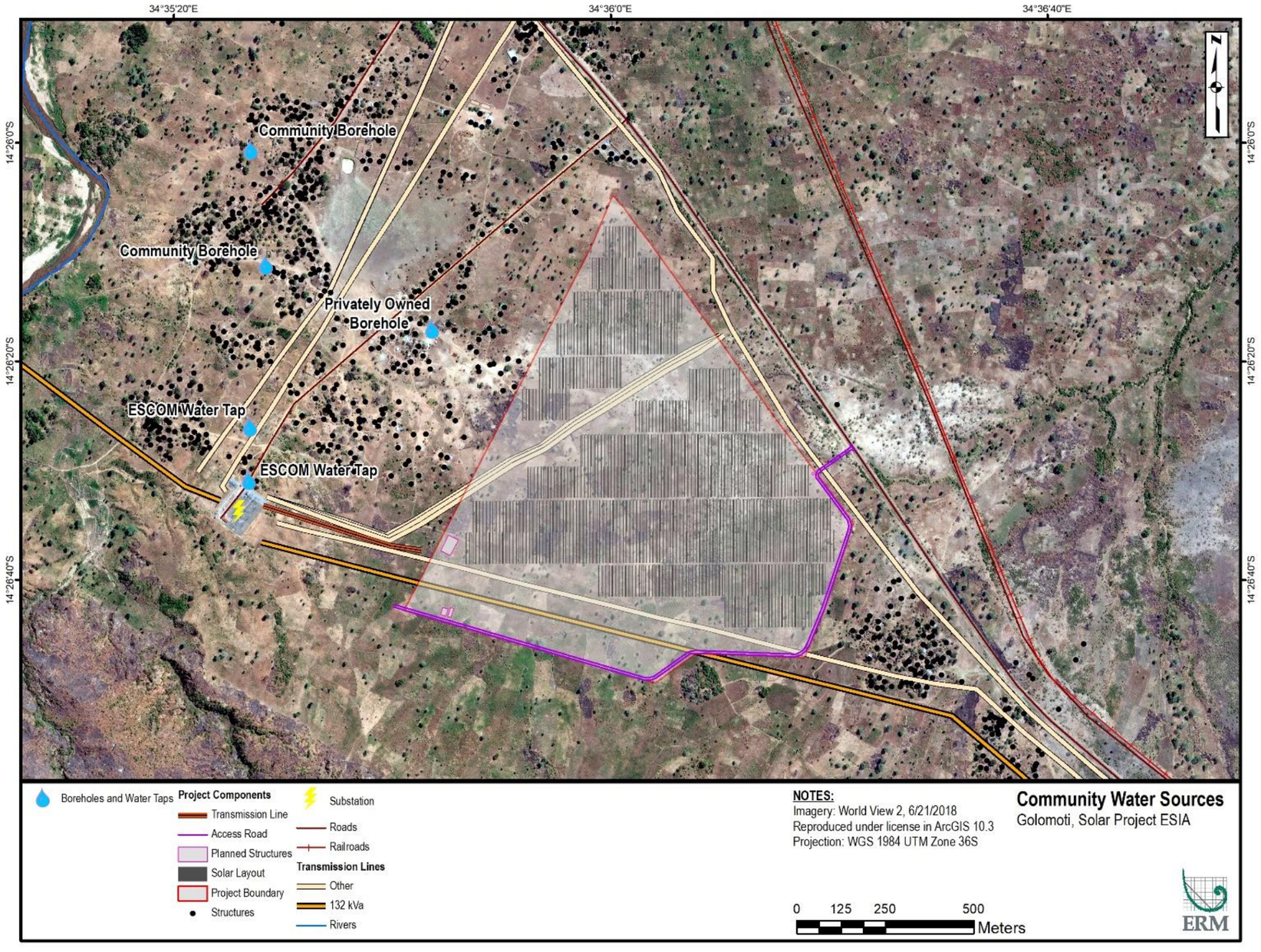
According to 2011 estimates for Kachindamoto TA, there were approximately 392 functioning boreholes, representing 1 per every 231 people, a rate better than the national level of 250 people per borehole. There has been a steady increase from 2007 through 2010 in the number of improved sanitary conditions (san plat pit latrines) in Kachindamoto, growing from 390 in 2007/2008 to 2,248 in 2009/2010, which has

been attributed to the work of Concern Universal, an NGO that promotes water and sanitation in the district.[41]

According to the household surveys, drinking water is primarily supplied via boreholes, with some use of two taps that belong to ESCOM but are open for community use (Figure 5-20). There are three boreholes in the area, one of which is privately owned but generally open for community members to use. Boreholes are also the primary supply of domestic water used for bathing and cooking, with some additional uses of rain harvesting and river/streams during the wet season. Adult females are nearly exclusively responsible for fetching water. Among households surveyed, 59% reported having challenges with regard to their water supply. The main challenges cited for both seasons were said to be wait times to access water and water shortages, the latter unsurprisingly being more prominent during the dry season. On average, the wait times were said to be approximately 30 minutes, increasing to approximately 2 hours during the dry season when water levels drop. Distances were notably not cited as a significant challenge, with most households reporting water sources to be less than one kilometre from their dwelling. The only source of conflict mentioned during the stakeholder engagement activities were related to disputes arising around boreholes. These seem to be brought on by the long wait times and disagreements over place/rules surrounding the queues. For example a borehole shared between Nsamala and Kalumo villages has a queue for each village and villagers must take turns, interchanging between villages.

[41] Dedza District Socio-Economic Profile 2013-2018. Available at https://issuu.com/dedzaeast/docs/dedza_sep_final (accessed March 2019)

Figure 5-20: Approximate Location of Community Boreholes.



Source: ERM, 2019.

Locally, boreholes are typically managed by Water Council Committees. The Nsamala/Kalumo community borehole supplies water to eight villages and is managed collectively by ten committee members. The committee includes representatives from six villages, as well as a Chairman, Vice Chairman, Secretary, and Vice Secretary. The committee collects and manages fees from all of its members, with all users responsible for contributing financially in case the borehole requires repair or maintenance. Each user is responsible for contributing 300 MWK, twice per year. If the user cannot afford the payment, the committee will restrict their access to the borehole and they are required to gather water elsewhere (e.g., river or other community boreholes). According to the committee members interviewed, the water quality was tested once in 2000 (following installation) and has not been tested since. Nevertheless, members feel that the water quality is generally good. Members also expressed content with the level of sanitation around the borehole.

During stakeholder engagement activities in the communities, community members generally reported being satisfied with hygiene and sanitation practices in the local area. Households generally have their own traditional pit latrine constructed from mud, with some having a san plat pit latrine. Very few (4%) reporting having no latrine/using the bush. Households generally reported hand washing, most limited to water only. Some credit this practice to educational support from an NGO that helped to encourage the placement of hand washing provisions near latrines some years past. Men are typically responsible for constructing and maintaining the latrine for the household, using simple tools and materials. During FGD discussions, the main challenges with regard to latrines mentioned by community members were leaks and durability during the rainy season. Latrines were reported to typically last between three to five years before filling up. Once the pit latrines are full, they are closed, filled with soil, and abandoned, and new latrines are built. Other household waste that cannot be composted or fed to animals was reported to be usually disposed of in an allocated rubbish pit in the village.

5.3.11.3 Energy Sources

Lighting/Electricity

Homes in the immediate Project Area are not connected to the grid despite their proximity to the Golomoti Substation. The main source of lighting in households in the Project Area is battery-powered torches. It was reported that the use of battery torches is very expensive. Other sources of lighting include solar home systems and solar lamps.

Approximately 40% of households report having a mobile phone. Most charge their phones in a shop in the Golomoti trading centre, with some utilizing a small solar panel in their homes.

Cooking

Firewood is the most common source of energy used for cooking by households during both the wet and dry seasons. Charcoal is a secondary source of energy. Charcoal is used more in the wet season than in the dry season, likely because it is a dry fuel source. Firewood is almost always collected rather than purchased, and adult females tend to hold the exclusive responsibility for collecting firewood. Women report that walking to areas where they can collect firewood takes approximately two hours each way.

5.3.11.4 Traffic and Transportation

Transportation infrastructure near the Project Site is limited to the national M5 highway, which is tarred and has a single lane in each direction. The remainder of the roads within the villages are dirt roads. The dirt roads are functional for everyday community use, but rains present challenges to these roads. The roads are difficult to pass when they are saturated, and degrade once dry, requiring frequent repair.

The main mode of transportation in communities is overwhelmingly walking, though most households have access to bicycles with some use of motorbikes and buses to travel further distances. During stakeholder engagement activities in the Project Area, many community members cited the favourable location of the villages, especially their proximity to the Golomoti trading centre, and highlighted that villagers generally do not have to travel far to meet their daily needs.

5.3.12 Community Development Priorities

Local development challenges and areas for improvement were discussed as part of FGDs, KIIs, and Village Profiles. During the Women's FGD, participants commented that quality of life in the community was challenging and that many households struggle to meet basic needs, not least of which is providing food for families. Women stated that vulnerability was primarily linked to a household's ability to meet basic needs. Women generally viewed that access to credit, improved farming production, and better water access would enable a better quality of life and higher standard of living. During the Men's FGD, participants commented that the quality of life in the community was good and boasted of good security. Among priorities that would enable community members to have a better quality of life and higher standard of living, men mentioned that increased access to water, access to credit, and a secondary school closer to the villages would be positive. Men viewed that vulnerability was often linked to an overreliance on agriculture and, as such, community members would benefit from building capacity in alternative income generating activities. Youth mentioned it was important for young people to stay in school, and that it was a priority to avoid drop outs due to early pregnancy or families' inability to pay school fees. In terms of what would help youth in their development, FGD participants thought that technical training/skills development could help reduce youth unemployment and aid in income earning diversification for their families. They also mentioned that there was a lack of recreational activities for youth in the community, and that a sports league would be a positive outlet. As part of the Village Profiles, each chief was asked to provide the top three community development priorities and why each was important. The results of those discussions are summarized in Table 5-21.

Table 5-21: Community Development Priorities.

Village	Priorities	Justification for Priorities
Ching'anipa	1. Water supply	The village wants to have its own borehole, as its population is too high to depend on water from other villages. This will help to reduce disputes at the water points where people from the village currently get water.
	2. Nursery school	Children should start school at a young age to be more prepared and equipped for primary school.
	3. Health care service	People currently have to travel long distances to get health care services. Easier accessibility would help in reducing mortality rates of people including pregnant women because of distance and inadequate health care services at present.
Chitseko	1. Water supply	The village needs a borehole for water supply so that people don't walk long distances to search for water.
	2. Transportation to the hospital	The community would benefit from either bicycles or a vehicle for transportation to the hospitals because health clinics are far from the village.
	3. Nursery school	Children should start school at a young age to be better prepared for primary school.
Nsamala	1. Water supply (borehole)	Another borehole is needed so that water needs are met in the community; one borehole is not enough to support the whole village.
	2. Nursery school	There is already a nursery school in the village but they meet under a tree, so there is a need for a classroom block.
	3. Roads	The community needs permanent roads in the village because when the maintenance or roads projects by government end, the community will goes back to poor road quality.
Chisaka	1. Water	There is only one borehole in the village which is not enough.
	2. Secondary school	There is no secondary school near the community.
	3. Electricity	Many people do not have access to electricity in the village.
Kalumo	1. Hospital	There is no hospital close to the village.

	2. Water	One borehole is not enough for the village.
	3. Ambulance	There is a need for an ambulance for the community.
Kapesi	1. Water	There is only one borehole in the village which is not enough for the village.
	2. Health clinic	There are no nearby health clinics for community members to utilize.
	3. Nursery school	The village does not have a nursery school for young children.

Source: ERM Village Profiles.

5.3.12.1 Community-Based Organizations

Community-Based Organizations are not very common in the Project Area, with approximately 15% of households reporting a member belonging to a CBO. The most prominent CBO is the Village Savings and Loans (VSL).

VSLs are common in rural areas in Malawi and are designed to pool savings among members in order to create a source of lending funds. During stakeholder engagement activities, ERM met with two different VSLs in the Project Area, one composed entirely of women and one mixed gender group. Membership in the VSLs is well defined. Members must contribute capital monthly to participate and must borrow. The mixed VSL has approximately 120 members, and the women's VSL has approximately 18 members. Community members from the VSLs and non-members alike emphasized the VSLs provide the only formal access to credit in the local area, which is much needed to help them with income generating activities such as inputs for agriculture or to increase their market access.

Another CBO in the local area is the Golomoti AIDS Support Organization (GASO). GASO works through schools and other outlets in the communities, such as youth clubs, to provide education on HIV awareness and prevention. At the time of this report, GASO supported 56 youth clubs (approximately 1,983 youth).

5.3.12.1 Non-Governmental Organizations (NGOs)

NGOs are not common in the Project Area. The NGOs listed below are among the few that were mentioned during stakeholder engagement activities.

- **World Food Programme**: Provides food such as legumes, maize, and cooking oil to people to support their nutrition. This aid is provided to the less privileged only.
- **UNICEF**: Provides flour in primary schools for making porridge to help keep children in school.
- **UP (**https://united-purpose.org/malawi): Works in the community on the issues of climate change and agriculture. Locals credited UP with learning new methods of agriculture that have been successful.

5.4 CULTURAL HERITAGE BASELINE

This section provide baseline information on tangible cultural heritage resources in Malawi and on the Project Site. For the purposes of this baseline, tangible cultural heritage is defined using the IFC PS 8 definition of cultural heritage as well as the definitions of "monument" and "relic" contained in the Monuments and Relics Act (MRA) of Malawi (Table 5-22). The types of cultural heritage defined as monuments or relics in the MRA meet the criteria for tangible cultural heritage resources under IFC PS 8.

Table 5-22: IFC PS 8 and MRA Definitions of Cultural Heritage.

Term	Source	Definition
Cultural Heritage	IFC PS 8	(i) Tangible moveable or immovable objects, property, sites, structures, or groups of structures, having archaeological (prehistoric), paleontological, historical,

Term	Source	Definition
		cultural, artistic, and religious values; (ii) unique natural features or tangible objects that embody cultural values, such as sacred groves, rocks, lakes, and waterfalls; and (iii) certain instances of intangible forms of culture that are proposed to be used for commercial purposes, such as cultural knowledge, innovations, and practices of communities embodying traditional lifestyles.
Monument	MRA	a) any area of land which has distinctive scenery or which contains rare or distinctive vegetation; (b) any structure, building, erection, ruin, stone circle, monolith, altar, shrine, pillar, statue, memorial, fortification; (c) any grave, tumulus, cairn, place of interment, pit dwelling, trench, excavation, working, rock, rock-shelter, midden, mound, cave, grotto, rock sculpture, rock painting and wall painting; (d) inscription or any other site or article of a similar kind or associated therewith which is of archaeological, palaeontological, ethnological, prehistorical, historical, artistic or scientific value or interest.
Relic	MRA	a) any fossil of any kind; (b) any artefact, implement, coin, document and manuscript; (c) any chiefly, religious or war regalia; (d) ornament or article (not being a monument), which is of archaeological, palaeontological, geological, anthropological, ethnological, prehistorical, historical, artistic or scientific value or interest.

Sources: IFC PS 8 and the MRA.

As described in Table 5-23, these types of tangible cultural heritage can be broadly divided into three categories: archaeological, built heritage, and living heritage resources.

Table 5-23: Types of Cultural Heritage Resources.

Resource Type	Definition
Archaeological	Concentrated and patterned physical remains of past human activity. A resource may include artefacts, plant and animal remains, structural remains, and soil features. This definition includes prehistoric and historic terrestrial and marine archaeological sites Examples: surface artefact scatters; subsurface, stratified village site; historic/ancient building or structure ruin; prehistoric or historic cemeteries; iron smelting sites.
Built heritage	Above ground, standing structures (buildings, monuments, infrastructure, etc.) with historical, cultural, religious, and/or artistic value to stakeholders. Examples: Traditional/folk houses;

Resource Type	Definition
	historic/colonial buildings; historic railways; historic churches and mosques.
Living heritage	A structure or natural landscape feature that is a part of a living cultural tradition and/or where cultural traditions are performed or practiced. Examples: sacred groves of trees, mountains, waterfalls; historic or modern churches, mosques, shrines; ritual/initiation rite compounds.

Source: ERM, 2019.

The local cultural heritage baseline provides information on the types of cultural heritage found in the districts of Dedza and Ntcheu and within the Project Site. The Malawi Directorate of Antiquities maintains a list of monuments and relics in Dedza and Ntcheu districts that are protected at the national level (i.e., are listed in the National Gazette), as well as monuments and relics that are significant at the district and local level. Table 5-24 provides summary information on national and locally significant cultural heritage in Dedza and Ntcheu districts.

Table 5-24: Nationally and Locally Significant Cultural Heritage in Dedza and Ntche Districts.

District	National or District List	Resource
Dedza	National	Chencherere Rock Shelters with Paintings**:** Six rock shelters on the Chentcherere hill north of Dedza District. Located within the core zone of the Chongoni Rock Art World Heritage Site, the shelters contain two types of paintings, red and white. The red paintings are believed to have been made by the Batwa from as early as the 16th century, while the white are believed to have been by earlier Bantu speaking people.[42]
		Chongoni Rock Art World Heritage Site: The resource covers an area of 126.4 km^2 in central Malawi and consist of 127 rock art sites. The sites include paintings by BaTwa hunter-gatherers who inhabited the area beginning in the Late Stone Age. The majority of the rock art was painted by farmers beginning in the first millennia A.D. during the Iron Age with Chewa agriculturalists continuing to create rock paintings at the site into the 20th century. The art documents the history of the local Chewa population,

[42] www.culture.gov.mw/index.php/divisions/department-of-antiquities, accessed on 20-May-19.

District	National or District List	Resource
		including the shift from hunting and gathering to agriculture, the invasion of the Ngoni, and the arrival of Europeans. They document the time depth of culturally significant symbols and initiation rites.[43]
	District	Rock Art Sites at Mphunzi and in the Chongoni Forest Reserve, Chencherere Archaeological Excavation Site, Old Diamphwe Bridge, Makhamba Shrine and Archaeological Excavation Site, Mua Museum
Ntcheu	National	Memorial to Chief Gomani Chikuse: Constructed in 1927 by the Ngoni tribe of Ntcheu in memory of their king and one of the greatest pre-colonial rulers of Malawi, Chief Gomani Chikuse I. He was killed on October 27, 1896 by a colonial administrator. After his death, his people constructed a tomb at the place where he was buried (somewhere between Dombole and Chiole) as an indication of growing consciousness of colonial oppression.[44]
	District	Rock Paintings at Mlanda

Source: ERM, 2019.

The nationally and locally significant cultural heritage in Dedza and Ntcheu include archaeological, built heritage, and living heritage resources. The archaeological resources include internationally, nationally, and locally significant rock art sites, as well as a locally significant record of local Chewa history and traditional practices. These two sites, along with the locally significant sites of Mphunzi and Mlanda, are important living heritage sites that form part of the modern Chewa cultural landscape. The Memorial to Chief Gomani Chikuse is both a significant built heritage resource due to its association with a locally and nationally significant historical figure as well as an early monument to colonial resistance.

5.4.1 Project Site

The cultural heritage baseline studies included a cultural heritage field survey of the Project Site. The field survey and subsequent cultural heritage impact assessment was aligned with IFC PS 8 and the government of Malawi's Cultural Policy and the requirements of the Monuments and Relics Act. The field survey consisted of interviews with residents of the villages surrounding the site and a systematic pedestrian survey of the 91.605 ha Solar Plant Site. The cultural heritage survey identified 27 cultural heritage resources: 22 archaeological finds, one local historic

[43] https://whc.unesco.org/en/list/476.

[44] www.culture.gov.mw/index.php/divisions/department-of-antiquities, accessed on 20-May-19.

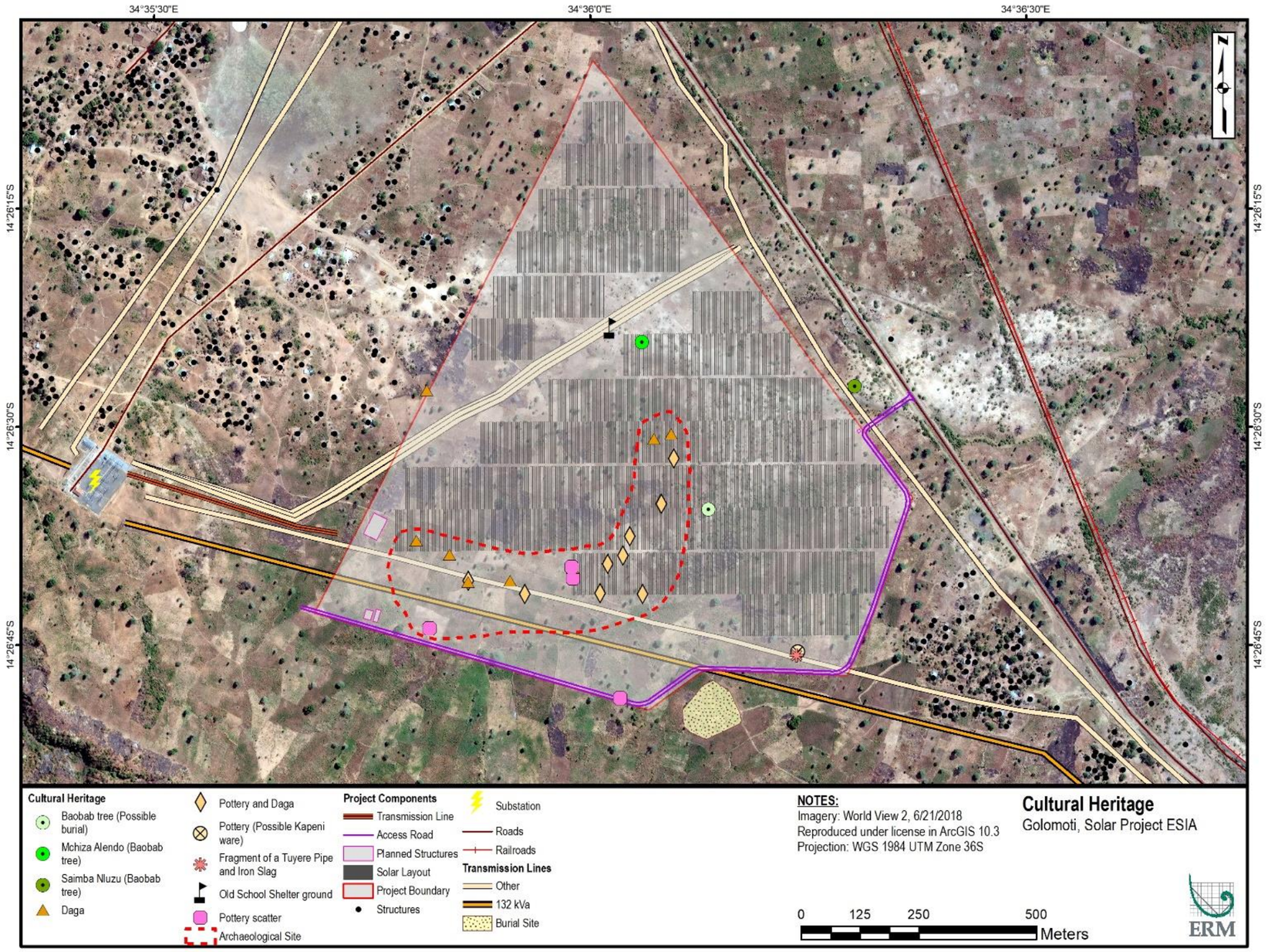
school house site, and four living heritage resources (three baobab trees and one cave) (Figure 5-21).

Interviews with local residents determined that the area around the site is occupied by people from the Yao, Ngoni, and Chewa ethnic groups. The majority of those interviewed stated that the proposed Project Site has been used for agriculture for as long as they could remember. The interviewees, however, stated the Project Site contained the remains of an old school shelter and three baobab trees important in local ritual and folklore. The interviewees also stated there was a cave, locally referred to as M'Bisa or "That Which Hides," in the nearby hills overlooking the Project Site that was part of local oral traditions and folklore. Additional information about the baobab trees within the Project Site and M'Bisa Cave is provided in Table 5-25.

In addition to the historic and living heritage resources, the field survey team identified 22 archaeological finds within the Project Site. Eighteen of the archaeological finds were concentrated in a roughly crescent-shaped area measuring 600 x 200 m in the southern half of the Solar Plant Site. These finds consisted of isolated or small potsherd scatters, small scatters or isolated finds of "daga" (burnt/baked clay from house walls), and iron slag and a possible tuyere pipe fragment suggesting a possible iron smelting site (Figure 5-22 and Figure 5-23). The field archaeologists identified a possible Kapeni ware potsherd dated to the 9th-15th centuries A.D. Although the majority of the potsherds were undecorated and not indicative of a particular time period, the archaeologists tentatively dated the finds to the 13th-18th century, during the local Iron Age.

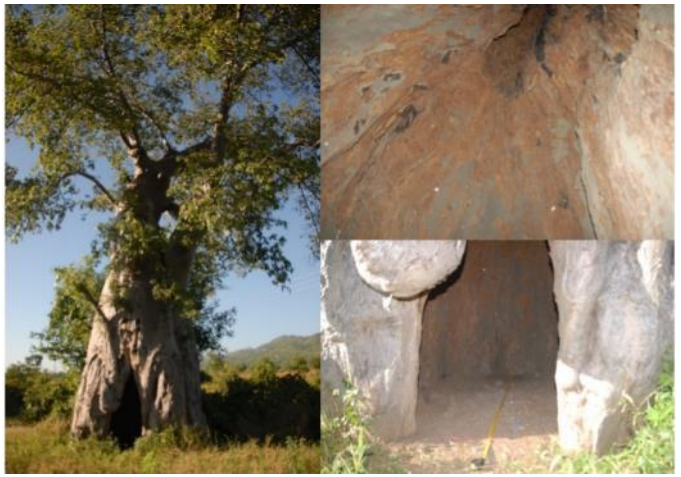
The field archaeologists interpreted the finds as the remains of up to 10 house sites and a possible iron smelting site, which suggest the 600 x 200 m artefact scatter is an archaeological site containing the remains of a small Iron Age village or hamlet. The 600 x 200 m archaeological site incorporates 18 of the individual artefact finds, with the remaining five artefact finds representing isolated finds likely associated with the larger archaeological site. The field archaeologists recommended additional archaeological investigations within the potsherd and daga concentration to determine the extent, integrity, and age of the archaeological finds in the Project Site.

Figure 5-21: Cultural Heritage Resources Identified in the Project Site.



Source: ERM, 2019.

Table 5-25: Living Heritage Sites Identified during the Project Area Cultural Resources Field Survey

Resource Type	Description	Photograph
Baobab Tree	The tree is called “Saimba Nluzu” by the local population, which translates to “do not whistle.” Oral traditions state that the area around the tree was dangerous, although most of the informants could not remember what made the place around the tree dangerous. A few local informants stated that the area was inhabited by either spirits, snakes, wild animals, and/or thieves that made the tree dangerous. They stated that local traditions recommended that people passing by the tree should not make any noise or whistle to avoid being attacked by spirits, snakes, wild animals, and/or thieves. Local informants also stated there may be a burial within the cavity at the base of the tree.	
Baobab Tree	The tree is called Mchiza (Mchiritsa) Alendo by the local population, which translates to “healer of visitors.” Local informants provided differing narratives about the tree as either healing visitors or that the tree provided baobab seeds for consumption to new arrivals in the area. Informants also stated that the tree was a resting or meeting place or that the tree offered baobab seedlings to boys that grazed their livestock in the adjacent fields.	

Resource Type	Description	Photograph
Baobab Tree	The tree (younger than the other two trees) was never given a name. Local informants stated the tree may have been used as a burial site for people that died from leprosy. Across Malawi, there is a tradition of burying those who died from leprosy in caves or baobab trees. Other informants stated that owls frequently use the tree, which adds to its mystical reputation as owls are believed to foretell death, bring bad luck, and are associated with witchcraft.	
M'bisa Cave	The local name for the cave is M'bisa, which translates to "that which hides." The cave overlooks the Project Site from a nearby hill. According to most local informants, there is a well-known story associated with the cave that states the population of a village at the foot of the hill fled into the cave to escape attack and the entire village population disappeared into the cave. The local population believes that the souls of the villagers were lost in the cave and still linger nearby. The image on the right is a view of the hillside containing the cave from the Project Site. Follow-up stakeholder engagement meetings determined that the cave is located on the southern slopes of	

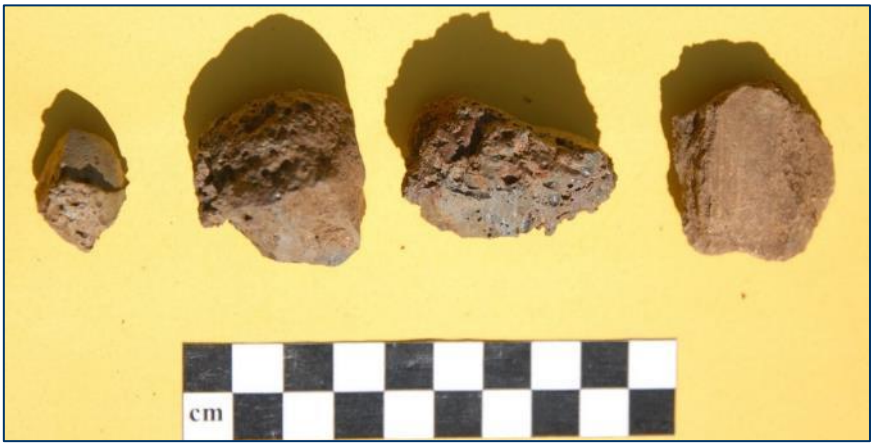
Resource Type	Description	Photograph
	the nearby hills and does not face the Project Area. As a result, the Project will not be visible from the cave.	

Source: Cultural Heritage Baseline Report (WWEC 2019c). Photos are WWEC 2019c: Figures 2, 3, 4, and 5.

Figure 5-22: Potsherd Found during the Field Survey.

Source: Cultural Heritage Baseline Report (WWEC 2019c: Figure 6).

Figure 5-23: Pieces of Slag (left) and a Possible Tuyere Pipe Fragment (far right) Found during the Field Survey.



Source: Cultural Heritage Baseline Report (WWEC 2019c: Figure 11).

6. IMPACT IDENTIFICATION AND ANALYSIS

6.1 IMPACT ASSESSMENT METHODOLOGY

ERM prepared this impact assessment according to its standard methodology, which has been used and refined through hundreds of internationally accepted projects including solar power plants, and is aligned with an approach typically used when conducting an impact assessment to international standards such as the IFC Performance Standards.

6.1.1 Methodology Overview

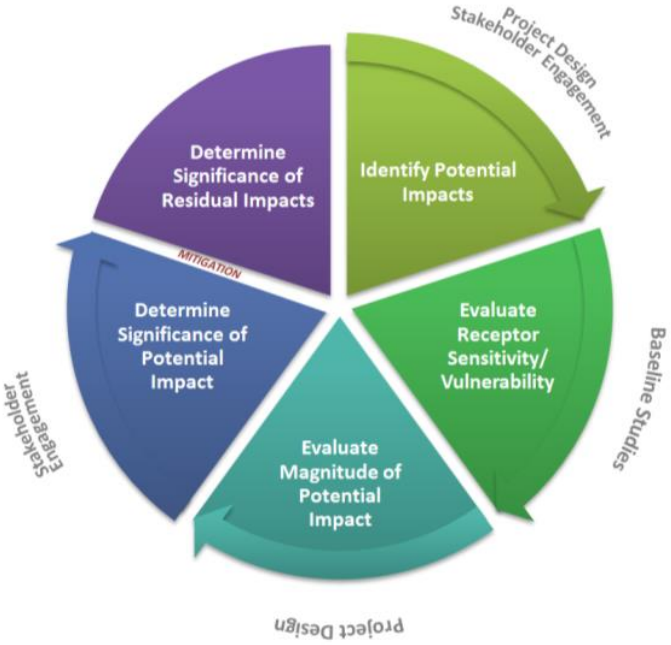
The purpose of the impact assessment process is to identify any likely significant impacts on environmental or social receptors as a result of the Project and to develop appropriate mitigation measures to effectively manage these impacts. To determine the significance of potential impacts, this ESIA considers two main factors: impact magnitude and receptor sensitivity/vulnerability. Magnitude is a measure of the changes to a receptor that will potentially result from the Project, while sensitivity/vulnerability is a measure of how sensitive or vulnerable a receptor (e.g., people, flora, or fauna) is to these changes.

There is no statutory or internationally agreed upon definition of significance; however, this assessment will use the following practical definition:

> An impact will be judged significant if, in isolation or in combination with other impacts, it will cause a notable change from baseline conditions and may require mitigation to manage the effects on/risks to a receptor from this change.

Evaluating impact significance is an iterative process and follows the cycle depicted in Figure 6-1.

Figure 6-1: Cycle of Impact Significance Evaluation.



Source: ERM, 2018.

6.1.2 Determining Impact Magnitude

This ESIA considers the aspects of magnitude listed below in order to assign a magnitude rating and design appropriate mitigation measures.

- **Nature of impact**: Is it positive/beneficial or negative/adverse?
- **Type of impact**: Does the impact occur as a result of a direct or indirect interaction with an aspect of the Project?
- **Duration**: How long will the impact occur?
  - Temporary: Maintaining for a portion of the construction phase.
  - Short-term: Maintaining for the entire construction phase or a portion of the operation phase.
  - Long-term: Maintaining for the entire operation phase.
  - Permanent: Maintaining indefinitely.
- **Geographic Extent**: What is the geographical extent and distribution of the impact?
  - Limited: Impacts will occur within a relatively small geographic area (e.g., single village).
  - Local: Impacts will occur within a single district (but potentially multiple villages).
  - Regional: Impacts will occur in two or more districts.
  - Transboundary: Impacts will occur beyond Malawi national boundaries.
- **Frequency**: Will the impact be continuous or intermittent?
  - Remote: Occurs once over the entire Project life cycle.
  - Rare: Occurs about once a year.
  - Occasional: Occurs at least once every six months.
  - Often: Occurs at least once a month.
  - Constant: Occurs on a daily basis (construction or operations).
- **Likelihood**: What is the probability of the impact occurring?
  - Unlikely: The event is unlikely but may occur at some time during normal conditions.
  - Possible: The event is likely to occur at some time during normal conditions.
  - Certain: The event will occur at normal conditions (i.e., it is essentially inevitable, for example, construction impacts such as site clearing and grading).

Though the above aspects provide guidance to assessing magnitude, subject matter experts in each discipline evaluate the magnitude rating holistically. Based on these characterizations, one of the following magnitudes is assigned:

- Positive;
- Negligible;
- Small;

- Medium; or
- Large.

6.1.3 Resource/Receptor Vulnerability/Sensitivity

Vulnerability can apply to physical, biological, cultural, or human receptors and considers some combination of sensitivity to change, vulnerability of the receptor with respect to the change, and importance of the receptor. With respect to importance, this is usually based on a consideration of factors such as legal protection, government policy, stakeholder views, and economic value. For example, habitats that meet the definition of "critical habitat," "natural habitat," or "legally protected and internationally recognized areas" under IFC Performance Standard 6 are assigned a high vulnerability rating. Standard vulnerability levels used in this ESIA are summarized below.

- Low: The receptor has ample capacity to assimilate the impact.
- Medium: The receptor has some capacity to assimilate the impact.
- High: The receptor has little to no capacity to assimilate the impact.

Where sufficient information is available, the assignment of a vulnerability rating may take into consideration any identifiable trends in receptor vulnerability. Note that in the case of beneficial/positive impacts, no vulnerability rating is assigned.

6.1.4 Impact Significance Rating

An overall significance rating of **Negligible**, **Minor**, **Moderate**, or **Major** is assigned by combining the magnitude rating and the sensitivity/vulnerability rating using the matrix shown in Table 6-1. These ratings are provided on a pre-mitigation basis (i.e., assuming no implementation of mitigation measures). It is important to note that impact prediction and evaluation take into account any embedded controls (i.e., physical or procedural controls that are already planned as part of the Project design, regardless of the results of the impact assessment process). An example of an embedded control is a standard acoustic enclosure installed around a piece of major equipment. This avoids assigning a magnitude based on a hypothetical version of the Project that disregards the embedded controls. Note that only negative impacts are assigned one of these significance ratings (positive impacts are simply designated "positive").

Table 6-1: Significance Matrix.

Magnitude of Impact	Sensitivity/ Vulnerability/ Importance of Receptor or Resource		
	Low	Medium	High
Negligible	Negligible	Negligible	Negligible
Small	Negligible	Minor	Moderate
Medium	Minor	Moderate	Major
Large	Moderate	Major	Major

Residual significance ratings are also provided, based on re-evaluation of the magnitude and vulnerability ratings after implementation of the recommended mitigation measures. In most cases, the sensitivity/vulnerability/importance of a receptor is unaffected by proposed mitigation measures. The mitigation measure is typically intended to reduce the magnitude of a predicted impact, thereby reducing its overall significance.

6.2 OUTCOME OF SCOPING

The scope of the assessment falls under three broad categories:

- Spatial scope (the Area of Influence, or AoI, as defined in Section 6.2.1);
- Temporal scope (the time periods over which the impacts may be experienced, as described in Section 6.2.2); and
- Technical scope (the Project activities and how they interact with potentially relevant environmental and social resources and receptors as described in Section 6.2.3).

Potential environmental and social issues have been evaluated as part of the scoping exercise in order to determine whether they are likely to give rise to significant risks and impacts and, therefore, the extent to which they should be included in the ESIA. Based on an understanding of the design and location of the Project and the local and regional environmental issues that are likely to be relevant, ERM has identified and reviewed those issues that may be material considerations. These have been "scoped in" to this ESIA and will form the technical scope of the ESIA. Some impacts have been "scoped out" of the ESIA and will not be investigated further.

6.2.1 Spatial Scope

The baseline section of the ESIA will present an overview of the biophysical and socioeconomic characteristics of the area in which the development will take place (i.e., within the Project "footprint"), as well as the surrounding areas that may be directly or indirectly affected by the proposed Project. This Area of Influence (AoI) includes the Project Site (i.e., the Solar Plant Site, Transmission Line corridor, and short Access Road), the area surrounding the site potentially affected by the Project, and nearby communities.

The IFC Performance Standards require project proponents to identify and manage environmental and social risks and impacts within their AoI. The AoI is defined in IFC Performance Standard 1 as:

> *The area likely to be affected by: (i) the project and the client's activities and facilities that are directly owned, operated or managed (including by contractors) and that are a component of the project; (ii) impacts from unplanned but predictable developments caused by the project that may occur later or at a different location; or (iii) indirect project impacts on biodiversity or on ecosystem services upon which Affected Communities' livelihoods are dependent.*
>
> *Associated facilities, which are facilities that are not funded as part of the project and that would not have been constructed or expanded if the project did not exist and without which the project would not be viable.*

Cumulative impacts that result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted.

6.2.1.1 Direct Area of Influence

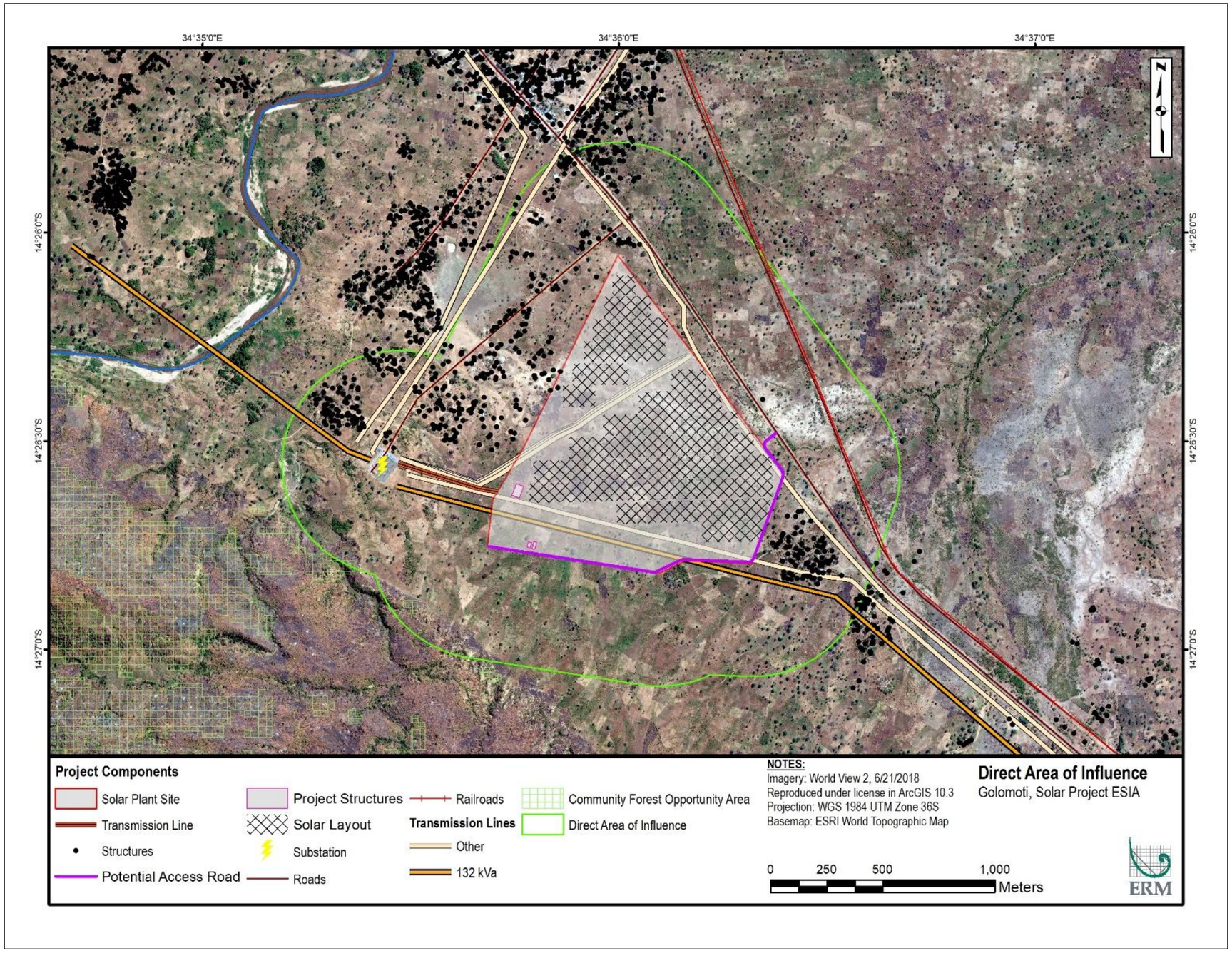
The Direct Area of Influence (DAoI) includes the Project footprint as well as the receiving environment surrounding the site. This encompasses the 92 ha Solar Plant Site, the 0.5 km Transmission Line corridor, the 80 m Access Road, and the surrounding communities likely to be affected by the Project activities during construction, operation, and decommissioning.

ERM proposes that the DAoI be defined as follows:

- 500 metres around the Solar Plant Site, which encompasses the proposed Access Road; and
- 500 metres on either side of the centreline of the transmission line from the Solar Plant Site to the existing Golomoti Substation.

The DAoI encompasses the villages to the northwest and southeast of the Project Site, which will be impacted by the construction of the Access Road, related health and safety impacts (e.g., noise, dust, traffic) during construction of the Project, and potential immigration of job opportunists to the area. The proposed DAoI is depicted in Figure 6-2.

Figure 6-2: Golomoti Direct Area of Influence.



Source: ERM, 2019.

6.2.1.2 Indirect Area of Influence

The Indirect Area of Influence (IAoI) encompasses communities beyond the DAoI that may be affected by the Project, although to a lesser extent. ERM proposes the IAoI to include the Group Village Pitala, which is composed of eight villages, and Golomoti Trading Centre. JCM has developed a Memorandum of Understanding with the Group Village Pitala and the Traditional Authority Kachindamoto, within which the Group Village Pitala is located, regarding social investment programs for the Project. Golomoti Trading Centre is located less than 1 km from the Project Site, and is a likely source of workers.

The DAoI and IAoI are collectively referred to as the Project Area.

6.2.2 Temporal Scope

The temporal scope of the assessment refers to the time periods over which impacts may be experienced. The Project phases to be assessed in the ESIA are:

- Site preparation and construction;
- Operation; and
- Decommissioning.

6.2.3 Technical Scope

The range of environmental and social topics to be addressed in the ESIA is referred to as the technical scope. An assessment has been undertaken by specialists for each of the environmental and social topics that have been scoped in for the ESIA. The environmental and social issues that comprise the technical scope of the ESIA and the reasons for their inclusion are listed in Table 6-2.

Please note that decommissioning impacts have been assumed to be comparable to construction impacts.

Table 6-2: Technical Scope.

Topic	Phase	Potential Source of Impact	Scoped In	Scoped Out	Potential Affected Receptors	Actions Required to Assess Potential Impacts
Employment and the Economy	Construction	Employment opportunities and the need for the supply of goods and services	✓		Neighbouring villages and wider district/regional/national economy	Assess the livelihoods, income sources, and commercial activities in the Project Area to determine the possibility for supplying goods and services. Include livelihood restoration measures in the LRP.
	Operation	Generation of electricity	✓		National economy	Assess the economic impact of the electricity that would be generated by the Project.
Air quality	Construction	Earthworks and vehicle and equipment emissions	✓		Human health (Note: air quality impacts to ecology receptors have been scoped out)	Semi-qualitative assessment of potential impacts from construction dust on human health.
	Operation			✓		The solar plant will produce no emissions, and other emissions (i.e., vehicle emissions) will be minimal during operation.
Noise	Construction	Earthworks, construction activities, and vehicles and equipment	✓		Neighbouring villages	Semi-quantitative assessment of construction noise impacts.
	Operation			✓		The solar plant will produce little noise, and other noise emissions (e.g., periodic maintenance activities) will be minimal during operation.
Soil	Construction	Earthworks	✓		Human health (Note: soil quality impacts to ecology receptors have been scoped out)	Conduct geotechnical study and subsequent impact assessment.
	Operation			✓		No earthworks are anticipated during operation.
Groundwater	Construction	Water consumption and wastewater	✓		Human health (Note: groundwater impacts to ecology receptors have been scoped out)	Conduct hydrogeological study and subsequent impact assessment.
	Operation		✓			
Biodiversity	Construction	Site clearance and construction activities	✓		Flora and fauna	Conduct biodiversity baseline survey to produce a habitat map and species mapping and assess impacts to any identified locally, nationally, or internationally important species.
	Operation			✓		No new areas will be cleared or otherwise disturbed during operation.
Landscape and Visual	Construction	Presence of new solar plant infrastructure	✓		Neighbouring villages	High-level landscape and visual impact assessment and identification of any visual sensitive receptors, if any.
	Operation		✓			
Land Acquisition and Displacement	Construction	Primarily land take, with potential removal of one structure	✓		Land users and community members	Identify project affected people with the support of relevant Group Village/Village Headmen and the District Office. Confirm the land uses in impacted areas.
	Operation			✓		No new land will be acquired during operation.

Topic	Phase	Potential Source of Impact	Scoped In	Scoped Out	Potential Affected Receptors	Actions Required to Assess Potential Impacts
Walking Paths	Construction	Restriction of access to Project Site	✓		Neighbouring villages	Assess the impact of restriction on traversing the Project Site on surrounding communities.
	Operation		✓			
Vector Borne and Communicable Diseases	Construction	Site housekeeping and worker/community interactions	✓		Neighbouring villages	Conduct a household survey and assess the construction impacts of Project activities on surrounding communities.
	Operation			✓		The workforce during operation will be small and locally resident.
STI/HIV Transmission	Construction	Worker/community interactions	✓		Neighbouring villages	Conduct a household survey and assess the construction impacts of Project activities on surrounding communities.
	Operation			✓		The workforce during operation will be small and locally resident.
Community Health and Safety	Construction	Worker/community interactions	✓		Neighbouring villages	Conduct a household survey and assess the impacts of Project activities on surrounding communities.
	Operation		✓			
Labour and Working Conditions	Construction	Presence of workforce	✓		Workforce	Compare and update (if necessary) Project policies so they are in line with Malawian regulations and international best practices.
	Operation		✓			
Cultural Heritage	Construction	Site clearance and earthworks	✓		Cultural heritage resources (archaeological and sacred sites) and neighbouring villages	Conduct a cultural heritage baseline survey, including stakeholder consultation, and assess impacts to identified resources.
	Operation			✓		No site clearance or earthworks are anticipated during operation.
Unplanned Events	Construction	Spills and traffic accidents	✓		Human health (Note: impacts to ecology receptors have been scoped out)	Assess the impact of unplanned spills and traffic accidents (through qualitative traffic assessment).
	Operation		✓			
Climate Change	All phases	Greenhouse gas generating activities		✓	Human health (Note: impacts to ecology receptors have been scoped out)	Scoped out as operational emissions will be below 25,000 tonnes CO_2e per year.

6.3 ASSESSMENT OF POSITIVE IMPACTS

6.3.1 Generation of Electricity

This section assesses the positive impacts that would occur during the operation phase from the generation of electricity.

6.3.1.1 Summary of Baseline Conditions

The current installed capacity of Malawi's grid is 439 MW. The national grid is heavily reliant on hydropower, which makes up 384 MW, or 87.5% of the generation capacity.[45] Due to drought and low rainfall, electricity generation has been reduced by up to 40% due to dwindling water levels.[46] There is also high potential for solar energy development in Malawi, however, which could help support better balance for the grid.

At the household level, the lack of electricity means that much of the population tends to use wood and charcoal for cooking, which contributes to deforestation across the country and poor indoor air quality and associated health effects.

6.3.1.2 Potential Impacts: Operation

The Project will generate 20 MW of power, which will be transmitted to the national grid for distribution in the Central Region of Malawi. The increased power supply from the facility will enable ESCOM to store additional hydropower reserves during the day so that peak demand can be managed more efficiently in the evening. It will also reduce dependency on diesel-powered emergency generation sets, which would lower cost to the end consumer and reduce the impact on climate change.

6.3.1.3 Assessment of Impacts: Operation

The increased power supply to the national grid throughout the operation of the solar PV facility will be a direct, positive impact. The extent of the impact will be regional, as the power generated by the Project will supplement the electricity supply to the Central Region of Malawi. The duration of the impact will be long-term, lasting throughout the operation phase, and the Project will boost the installed capacity of the national grid by approximately 5%.

The overall significance of the generation of electricity is rated as Positive as seen in Table 6-3.

Table 6-3: Impact Assessment: Generation of Electricity

Impact	Generation of Electricity	
Impact Nature	Negative	Positive
	The generation of electricity is a positive impact.	
Impact Type	Direct	Indirect

[45] USAID, Malawi, Power Africa Fact Sheet, November 20, 2018. Accessed at: https://www.usaid.gov/powerafrica/malawi

[46] ESCOM (nd) An Update On The Current Water Levels And The Energy Situation In Malawi. Accessed at: http://www.escom.mw/waterlevels-energysituation-malawi.php

Impact	Generation of Electricity				
	The additional energy is a direct impact of the Project, constituting its primary purpose.				
Impact Duration	Temporary	Short Term	**Long Term**	Permanent	
	The impact is considered long term since it will maintain for the duration of the operation life of the Project (expected to be 20 years).				
Impact Extent	Limited	Local	**Regional**	Transboundary	
	The impact extent is regional, as the energy from the Project will supplement the Central Region's power supply.				
Frequency	Remote	Rare	Occasional	Often	**Constant**
	The generation of electricity will be constant throughout the lifetime of the Project.				
Likelihood	Unlikely	Possible	**Certain**		
	Power generation is certain to occur during operation.				
Impact Magnitude	**Positive**	Negligible	Small	Medium	Large
	Based on the parameters above, and the stated methodology for this exercise, the magnitude is considered positive.				
Resource/ Receptor Vulnerability	Not vulnerability rating is assigned as the impact is positive.				
Impact Significance	**The impact is positive.**				

6.3.1.4 Enhancement Measures

The distribution of electricity in Malawi falls within the remit of ESCOM. Given this, JCM does not have any authority with regard to the distribution of power, thus no enhancement measures are recommended.

6.3.1.5 Residual Impact Significance

The residual impact of increased power supply for the Malawian national grid during the operational phase will remain a positive impact as seen in Table 6-4.

Table 6-4: Residual Impact of Generation of Electricity

Impact	Project Phase	Significance (Pre-enhancement)	Residual Impact Significance (Post-enhancement)
Generation of Electricity	Operation	Positive	Positive

6.3.2 Employment

This assessment identifies the positive impacts that will occur during the construction and operation phases as a result of direct employment and third-party services required for the construction and operation of the Project.

6.3.2.1 Summary of Baseline Conditions

Nationally, Malawi's economy is primarily agriculture based and formal job opportunities are scarce, with 89% of employed persons engaged in informal employment. In the Project Area, community members have little job opportunities beyond agriculture, and almost all income-earning opportunities are the result of informal employment. Many livelihood activities that consume the time of community members, in particular women, do no generate income but rather are carried out primarily for subsistence purposes, such as farming, food processing, and collection of natural resources such as firewood. Most households reported that their incomes were insufficient, making it difficult to meet their expenses. Among those households suffering from food shortages, a primary reason cited for such shortages was a lack of money to buy food when needed.

6.3.2.2 Potential Impacts: Construction and Operation

Approximately 200 workers would be required during the construction phase including skilled and unskilled workers. During the operation phase, the number would reduce to approximately 20. JCM estimates that 65% to 70% of positions will be appropriate for unskilled labour, and plans to hire locally as much as possible. In addition, there would be possibilities to engage local small and medium enterprises (SMEs) in the local and broader district area with procurement opportunities.

The majority of the jobs and procurement opportunities in which residents of the Project Area may be engaged will be short term in nature, mostly during the construction phase, lasting approximately 10 months.

6.3.2.3 Assessment of Impacts: Construction and Operation

Table 6-5 provides an assessment of potential impacts related to job creation during construction and operation.

Table 6-5: Impact Assessment: Employment

Impact	Employment and the Economy				
Impact Nature	Negative				Positive
	Job creation and use of local SMEs to supply goods and services will create a positive impact for some individuals, households, and businesses in the local community and in Dedza District.				
Impact Type	Direct			Indirect	
	Where individuals are hired through JCM or the EPC Contractor, the impact would be direct, while the impact on SMEs would be indirect.				
Impact Duration	Temporary	Short Term	Long Term	Permanent	
	The impact would largely be concentrated during the construction phase, as the need for workers and goods and services would reduce significantly during operation.				
Impact Extent	Limited	Local	Regional	Transboundary	
	The impact is likely to be felt to some degree by some households and small businesses in most if not all of the villages in the Project Area.				
Frequency	Remote	Rare	Occasional	Often	Constant
	The benefits will largely be limited to just before (recruitment) and during construction, when there will be the greatest concentration of the need for workers and goods and services.				
Likelihood	Unlikely	Possible	Certain		
	Though exact levels of hiring are yet unknown, it is certain that many community members and small businesses would benefit from job creation associated with the Project.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
	Based on the parameters above, and the stated methodology for this exercise, the magnitude is considered positive.				
Resource/ Receptor Vulnerability	No vulnerability rating is assigned as the impact is positive.				
Impact Significance	**The impact is positive.**				

6.3.2.4 Enhancement Measures

In order to enhance the positive impact related to job creation, the following measures will be implemented:

- A recruitment strategy will be established and implemented for staff required before and during construction to enable the community to access job opportunities.
- Although recruits will require a basic level of skills prior to recruitment, training opportunities and apprenticeships will be provided to males and females in local communities in order to enhance their skills, increasing employability and career development opportunities at a later stage.
- A Gender Development Plan will be developed and implemented to promote gender equality in job opportunities as well as to support the mitigation of gender-based violence and other gender-related issues within the workforce and externally (e.g., in Project-affected communities).
- Goods and services required for construction and operation will be sourced in Dedza District as much as possible. If a good or service is not available in Dedza District, it will be sourced in Lilongwe and at a national level prior to sourcing outside of Malawi.

6.3.2.5 Residual Impact Significance

With the enhancement measures listed above, the impact significance is expected to remain positive.

Table 6-6: Residual Impact of Job Creation

Impact	Project Phase	Significance (Pre-enhancement)	Residual Impact Significance (Post-enhancement)
Job Creation	Construction and Operations	Positive	Positive

6.4 ASSESSMENT OF POTENTIAL NEGATIVE IMPACTS

6.4.1 Air Quality

Air emissions from construction activities will be temporary and associated with the following activities:

- Combustion emissions from the operation of construction machinery and generators;
- Particulate (dust) emissions from exposed areas and earthmoving activities;
- Vehicle emissions from supply vehicles and generator operation; and
- Welding operations.

Little to no emissions are anticipated during the operational phase through management of on-site vehicle speed, vegetation, and soil landscaping. As indicated

in Section 6.2, air quality impacts during operations have been scoped out of further assessment.

The assessment of potential impacts to air quality is limited to the assessment of dust generated during construction from both construction traffic movements and earthworks/construction works.

6.4.1.1 Summary of Baseline Conditions

Due to the rural nature of the Project Area, there are no existing (or continuous) air emissions within close proximity to the Project Site. Occasional air emissions result from burning or clearing activities, however, that occur within residential communities around the Project Area (communities exist within 200 m of the Project Site).

6.4.1.2 Potential Impacts: Construction

Dust emissions would arise during construction from the following activities:

- Site clearance and grading of the Project Site;
- Traffic and movement of vehicles over open ground and on unpaved roads; and
- Material stockpiles from clearance and related site preparation activities.

Dust emissions may result in nuisance issues at nearby sensitive receptors due to airborne and dust deposition, causing temporary increases in ambient concentrations of particulate matter (PM_{10}). In addition, dust emissions would arise due to traffic along unpaved roads during the construction phase.

The vehicles used during the construction of the Project would primarily be Heavy Goods Vehicles associated with bringing in materials and equipment. During construction, the primary Project components would be delivered in the following way:

- Inverters - truck deliveries;
- Main transformer - specialised abnormal load deliveries;
- LV/MV transformers – truck deliveries;
- PV modules – truck deliveries;
- Tracker/structure – truck deliveries; and
- Miscellaneous – truck deliveries.

6.4.1.3 Assessment of Impacts: Construction

The construction of the Project would take approximately 10 months and predominantly occur during the dry season, beginning in April 2020. During the wet season (December to late March), the conditions within the Project Area are not conducive for dust emissions. In addition, emissions would not occur constantly over the construction period, but would instead peak during site clearance and delivery of panels and mounting structures. Exposure to dust generating activities and associated dust emissions are therefore likely to primarily occur in the dry season and over a short period during the construction phase. The villages of Kalumo, Msamala, Kapesi, Chisaka, Ching'anipa, and Chitseko are located within 200 m of the Project Site, and Thondoya is located directly adjacent to its south-eastern boundary. These communities would likely have a high sensitivity to Project construction activities. The impact duration for these communities would be short term (over 10 months and

primarily during the dry season within this period). The impact magnitude is considered **Small**, and the receptor sensitivity is considered **High**. As a result, the impact significance is assessed as **Moderate** within 200 m of the Project Site (Table 6-7).

Table 6-7: Assessment of Air Quality Impacts during Construction.

Impact	**Dust Emissions**				
Impact Nature	Negative		Positive		
	The potential impacts (dust emissions) are negative.				
Impact Type	Direct		Indirect		
	The impacts would be a direct result of construction activities.				
Impact Duration	Temporary	Short Term	Long Term	Permanent	
	The impacts would be short term, occurring only during construction (approximately 10 months).				
Impact Extent	Limited	Local	Regional	Transboundary	
	The impacts would be confined to within 500 m of the Project Site.				
Frequency	Remote	Rare	Occasional	Often	Constant
	During the dry season, there is the potential for dust on a daily basis, but this is less likely during the rainy season (December to April).				
Likelihood	Unlikely	Possible	Certain		
	Groundworks would produce conditions that could result in dust emissions.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
	Based on the above, the impact magnitude is considered to be small.				
Resource/ Receptor Vulnerability/ Sensitivity	Low	Medium	High		
	The sensitivity of receptors (residential communities) considered high due to their proximity (the closest being within 20 m of the site boundary).				
Impact Significance	**Negligible**	**Minor**	**Moderate**	**Major**	
	Based on the small impact magnitude and the high sensitivity, the impact significance is assessed to be moderate within 200 m from the Project Site and minor from 200-500 m.				

6.4.1.4 Mitigation Measures

The measures listed below would be implemented to mitigate the Project's air quality impacts.

- Removal of vegetation and soil cover will be restricted to that which is necessary for the Project.
- Land clearance will be sequential and the smallest possible area for working will be exposed where ground and earthworks are undertaken.
- Stripping of topsoil will not be conducted earlier than required (i.e., the Project will maintain vegetation cover for as long as possible) in order to prevent the erosion (wind and water) of organic matter, clay, and silt.
- A speed limit of 30 kph on unpaved surfaces will be enforced and national speed limits on public roads will not to be exceeded.
- Transported materials will be covered with tarpaulins to prevent fugitive dust.
- Surface binding agents will be utilized on exposed open earthworks, when feasible.
- Exposed ground and earthworks will be covered as much as possible with sheeting, shade cloth, or tarpaulin where wind generated dust occurs.
- Stockpiles stored longer than six weeks will be vegetated or covered with sheeting, shade cloth, or tarpaulin to reduce soil loss from wind or storm water runoff.
- Stockpiles will be located as far away from receptors as possible and will be covered with sheeting, shade cloth, or tarpaulin.
- Wind breaks will be erected around key construction activities and, if possible, in the vicinity of potentially dusty works to minimise impacts to the nearby temporary residential accommodation and permanent residential receptors.
- Construction vehicles will be regularly maintained to minimise exhaust emissions.
- Vehicles will be switched off when not in use, unless impractical for health and safety reasons (e.g., maintenance of air conditioning).
- Complaints received from local community members through the Community Grievance Mechanism will be reported to the CLO.

6.4.1.5 Residual Impact Significance

With the implementation of the mitigation measures listed above, the residual impact significance during construction is anticipated to be **Minor** (Table 6-8).

Table 6-8: Pre and Post Mitigation Air Quality Impacts.

Impact	Project Phase	Impact Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Dust Emissions	Construction	Moderate	Minor

6.4.2 Noise

Noise from construction activities will include that produced by diesel mobile construction and earth moving equipment, drilling, and foundation work. Traffic associated with the transportation of construction materials, transformers, generators, other equipment and materials, and construction workers will also result in increased noise levels along transportation routes.

The operation of the solar PV power plant is not expected to generate significant noise emissions. As indicated in Section 6.2, noise impacts during operations have been scoped out of further assessment.

This assessment identifies the potential impacts on the local acoustic environment that may arise as a result of the Project's noise emissions. Emissions would occur during the construction phase and arise from construction activities (e.g., earth moving equipment, welding, traffic).

6.4.2.1 Summary of Baseline Conditions

Due to the rural nature of the Project Area, there are no existing continuous noise emissions near the Project Site. There are residential communities within 200 m of the Project Site, with the closest being within 20 m.

6.4.2.2 Potential Impacts: Construction

During the construction phase, the main potential impacts on the acoustic environment are related to the noise emissions from construction machinery and construction vehicles being utilized for the activities listed below.

- **Site preparation**: This includes significant noise-producing activities such as vegetation clearance and minor earthworks. These activities would require heavy construction vehicles and equipment (e.g., excavators, dozers, dump trucks).
- **Civil works and installation**: This includes noise-producing activities such as drilling for mounting structure frames, construction of inverter and transformer station foundations and installation of inverter stations, and construction of stores, workshop, and office buildings.
- **Road traffic offsite**: The movement of vehicles for transportation of materials and personnel on local roads and/or new access roads close to communities would also generate noise emissions.

All the construction activities mentioned above have the potential to result in an overall increase in the background noise level close to the Project Site and to potentially disturb occupants at the nearest receptors.

Noise would be generated during the construction phase (and potentially at a lower level during decommissioning). The noise during this phase would be short term, over a total construction period of nine months. Based on UK guidance (BS 5228), noise levels that exceed 65 dB LAeq at a receptor would represent significant noise impacts. This assumes that work is carried out during the daytime, and that no noise generating work is required at night. According to the World Bank Group General EHS Guidelines (2007), noise levels should not exceed 55 dBA LAeq during the daytime and 45 dBA LAeq during the night at residential receptors.

Traffic associated with construction activities is highly variable through the various stages of construction and depends on the activities taking place. During construction, the primary Project components would be delivered in the following way:

- Inverters - truck deliveries;
- Main transformer - specialised abnormal load deliveries;
- LV/MV transformers – truck deliveries;
- PV modules – truck deliveries;
- Tracker/structure – truck deliveries; and
- Miscellaneous – truck deliveries.

6.4.2.3 Assessment of Impacts: Construction

Noise impacts from construction activities at the Project Site would persist for the construction period and would therefore be short term in nature. Emissions would be limited to the Project Area and would therefore be limited in nature. Noise emissions associated with construction would be variable in nature and depend on the particular activities being undertaken, as well as the number and type of equipment in operation. All construction work and traffic movements would take place during the day. As a result, there should be no activities with the potential to cause sleep disturbance. In addition, noise emissions would peak during site preparation and delivery of panels and mounting frames.

The exact location of construction equipment has not been confirmed, but community houses/buildings within approximately 100 m from the nearest construction activities (a backhoe loader with a sound level of up to 84 dB LAeq at 10 m) would result in a noise level of 67 dB LAeq at the nearest receptor (façade). There are several houses within 100 m of the Project Site.

In terms of nearby receptors, there are residential communities adjacent to the Project Site. The magnitude of the impact is considered **Small**, as it would be short term, and the sensitivity of the receptors are considered to be **High**. As a result, the impact significance is assessed to be **Moderate** within 100 m of the Project Site (Table 6-9).

Table 6-9: Assessment of Noise Impacts during Construction.

Impact	Noise Emissions			
Impact Nature	Negative		Positive	
	The potential impacts (noise emissions) are negative.			
Impact Type	Direct		Indirect	
	The impacts would be a direct result of construction activities.			
Impact Duration	Temporary	Short Term	Long Term	Permanent
	The impacts would be short term, occurring only during construction (approximately 10 months).			

Impact	Noise Emissions				
Impact Extent	Limited	Local	Regional	Transboundary	
	The impacts would be largely confined to within 100 m of the Project Site.				
Frequency	Remote	Rare	Occasional	Often	Constant
	The impacts would be occasional (only during the day).				
Likelihood	Unlikely	Possible	Certain		
	Certain Project activities would produce noise emissions.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
	Based on the above, the impact magnitude is considered to be small.				
Resource/ Receptor Vulnerability	Low	Medium	High		
	The sensitivity of the receptors (residential communities) is considered to be high due to their proximity (the closest being within 20 m of the site boundary).				
Impact Significance	**Negligible**	**Minor**	**Moderate**	**Major**	
	Based on the small impact magnitude and the high sensitivity, the impact significance is assessed to be moderate within 100 m of the Project Site.				

6.4.2.4 Mitigation Measures

The measures listed below will be implemented to mitigate the Project's noise impacts.

- Machines and equipment will be maintained in good working condition and inspected regularly.
- Equipment and vehicles will be selected in accordance with best available techniques for noise reduction.
- Vehicle movements within and around the site will be minimised as much as possible.
- Local screening/site hoardings will be utilised to screen noise where appropriate.
- Complaints received from local community members through the Community Grievance Mechanism will be reported to the CLO.

6.4.2.5 Residual Impact Significance

With the implementation of the mitigation measures listed above, the residual impact significance is anticipated to be **Minor** (Table 6-10).

Table 6-10: Pre and Post Mitigation Noise Impacts.

Impact	Project Phase	Impact Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Noise Emissions	Construction	Moderate	Minor

6.4.3 Soils

This assessment identifies potential impacts to soil resources resulting from the Project. Impacts would occur during construction as a result of Project Site and wayleave clearance and preparation.

6.4.3.1 Summary of Baseline Conditions

The Project Site appears to contain mixed soil content, including phaeozems, luvisols, fluvisols, and vertisols. Phaeozems are humus-rich and highly arable soils that are commonly used for agricultural purposes, pasture for cattle, and wood/fuel production. Luvisols contain mixed mineralogy, high nutrient content, and generally have good drainage. Luvisols are also used for various agricultural purposes. Fluvisols are common along rivers and in level topography. They can be cultivated for dryland crops and are commonly used for grazing in the dry season. Vertisols are dark-coloured soils, composed of ≥ 30% clay, and are typically found in climatic zones that have distinct wet and dry seasons. Due to their clay content, vertisols are generally not well suited for cultivation without significant management and labour.

The Project Site is generally flat land and is predominantly used for agricultural purposes. Local residents report that crops cultivated on the Project Site include maize, cotton, soy, cowpeas, and sweet potatoes. Trees on the Project Site include native and planted trees, including mango, acacia, and baobab trees. Local residents report that medicinal plants are collected from the Project Site, although these plants can be collected elsewhere. There are also several footpaths that traverse the Project Site.

6.4.3.2 Potential Impacts: Construction

Site preparation and construction activities would include earthworks and site clearance (including the transmission line wayleave). These activities could lead to the following effects on soil resources within and surrounding the Project footprint:

- Loss of topsoil;
- Soil compaction and rutting; and
- Soil erosion from wind and water runoff (and sediment release to land and water).

The 92 ha Solar Plant Site would be cleared of vegetation and levelled. In addition, approximately 1.5 ha (0.5 km x 30 m) would be cleared for the transmission line wayleave. Compaction and increased erosion from increased exposure of bare ground to wind and water are likely to cause changes and/or degradation to soil structure and quality. Erosion may also occur when surface water flows come into contact with areas of bare soil, especially on sloped terrain. Precipitation within the Project Site would also likely impact the exposed soil and increase surface run-off, resulting in loss of

topsoil, which binds the soil together for more stability. Continued loss of topsoil would lead to increased levels of erosion.

Rainstorms during the wet season can increase the potential for erosion. In addition, the compaction of subsoils through site grading and levelling, and the presence of heavy vehicles and machinery during construction, would result in lower permeability of the soil and therefore decrease infiltration and increase run-off. Without appropriate mitigation measures, run-off from hardstanding areas, in addition to exposure to wind and rainfall, may increase erosion and alter the natural drainage characteristics of the soil.

6.4.3.3 Assessment of Impacts: Construction

Impacts to soil would be short term, during the 9 month construction phase, and largely limited to within 100 m of the Project Site. The impacts would be occasional, largely restricted to the site clearance phase of construction. In terms of nearby receptors, there are residential communities adjacent to the Project Site. The magnitude of the impact is considered **Small**, as it would occur over a temporary period, and the sensitivity of the receptors are considered to be **High**. As a result, the impact significance is assessed to be **Moderate** within 100 m of the Project Site (Table 6-11)

Table 6-11: Assessment of Soil Impacts during Construction.

Impact	**Soil Erosion**				
Impact Nature	Negative			Positive	
	The potential impacts (e.g., erosion) are negative.				
Impact Type	Direct			Indirect	
	The impacts would be a direct result of construction activities resulting in an impact on the quality of soil in and around the Project Site.				
Impact Duration	Temporary	Short Term	Long Term	Permanent	
	The impacts would be short term, occurring only during construction (approximately 10 months).				
Impact Extent	Limited	Local	Regional	Transboundary	
	The impacts would be largely confined to the Project Site, with the potential for some erosion in immediately surrounding areas.				
Frequency	Remote	Rare	Occasional	Often	Constant
	The impacts would largely be restricted to the site clearance phase of construction.				
Likelihood	Unlikely		Possible		Certain

Impact	Soil Erosion				
	Certain construction activities (e.g., grading) would result in soil impacts.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
	Based on the above, the impact magnitude is considered to be small.				
Resource/ Receptor Vulnerability/ Sensitivity	Low		Medium		High
	The sensitivity of the resource is considered to be high due to the importance of soil quality in the agricultural economy of the Project Area and the low permeability of the clayey soils across the Project Site.				
Impact Significance	**Negligible**	**Minor**	**Moderate**		**Major**
	Based on the small impact magnitude and high sensitivity, the impact significance is assessed to be moderate.				

6.4.3.4 Mitigation Measures

The first 10 measures listed in Section 6.4.1.4 and those listed below will be implemented to mitigate the Project's soil impacts.

- Erosion control measures such as intercept drains and toe berms will be constructed where necessary.
- Access roads will be well drained in order to limit soil erosion.

6.4.3.5 Residual Impact Significance

With the implementation of the mitigation measures listed above, the residual impact significance is anticipated to be **Minor** (Table 6-12).

Table 6-12: Pre and Post Mitigation Soil Impacts.

Impact	Project Phase	Impact Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Soil Erosion	Construction	Moderate	Minor

6.4.4 Groundwater

Construction activities that will require water include concrete mixing and sanitary facilities for workers. The Project will drill a borehole at the Project Site during construction to provide the water required for construction activities. In the event that the borehole proves to be insufficient, or use of the borehole significantly impacts the water production of boreholes in adjacent communities, the Project will utilize water bowsers that contain approximately 20,000 L to provide the water required for construction. The source of the water has not yet been identified, but could be from a

nearby lake or river. A local consultant, Geoconsult, was retained to conduct a "Hydrology and Flood Risk Assessment" of the Project Site (Appendix B). The report states that the Livulezi River, approximately 1.2 km to the northwest of the Project Site, "is perennial and is a sustainable source of water for all construction and site requirements" (Appendix B, page 9). The Project will obtain the necessary permits to drill the borehole and take water from nearby water bodies.

Water usage during operations will include domestic use and panel cleaning. Panel cleaning will be ad hoc rather than scheduled. The Project will only clean the panels if output starts to decline due to dust. Water will also be required for onsite staff, which is estimated to be 30 L per worker per day.

This assessment identifies potential impacts to groundwater as a result of the Project. Impacts would occur during construction and operations, and primarily relate to the use of groundwater by the Project.

6.4.4.1 Summary of Baseline Conditions

The climate of Malawi is tropical continental and largely influenced by Lake Malawi. There are three main seasons: cool and dry, from May to August; warm and dry, from September to November; and warm and wet, from December to April. Climate recorded at Golomoti indicates that the months of April to November have significant numbers of days with no precipitation.

Groundwater resources within the Project Area are associated with the weathered zone above fractured bedrock. The aquifer thicknesses are commonly 10 to 25 m. The aquifer is partly confined by an overlying thickness of 5 to 20 m of tightly compacted clays and soils that have very low permeability. Where groundwater is encountered, it is commonly near the base of the clays and under pressure, indicating that it is held within a confined aquifer.

Rural areas in Malawi are highly dependent on groundwater to support their livelihoods. In areas that experience a low stream density, groundwater supply plays a leading role in terms of servicing the community domestic and agriculture needs. This is the case for communities in the Project Area. Baseline studies identified the presence of three boreholes in the communities adjacent to the Project Site. In addition, there are two ESCOM water taps near the Golomoti Substation.

6.4.4.2 Potential Impacts: Construction and Operation

Construction activities that would require water include concrete mixing and sanitary facilities for workers. The Project would drill a borehole at the Project Site during construction to provide the water required for construction activities. In the event that the borehole proves to be insufficient, or use of the borehole significantly impacts the water production of boreholes in adjacent communities, the Project will utilize water bowsers that contain approximately 20,000 L to provide the water required for construction. The source of the water has not yet been identified, but could be from a nearby lake or river. A local consultant, Geoconsult, was retained to conduct a "Hydrology and Flood Risk Assessment" of the Project Site (Appendix B). The report states that the Livulezi River, approximately 1.2 km to the northwest of the Project Site, "is perennial and is a sustainable source of water for all construction and site requirements" (Appendix B, page 9). The Project would obtain the necessary permits to drill the borehole and take water from nearby water bodies.

Water usage during operations would include domestic use and panel cleaning. Panel cleaning would be ad hoc rather than scheduled. The Project would only clean the panels if output starts to decline due to dust. Water would also be required for onsite staff, which is estimated to be 30 L per worker per day.

Depending on local aquifer conditions, Project abstractions from the borehole that it intends to drill have the potential to reduce the water level at the three nearby community borehole and two ESCOM water taps.

6.4.4.3 Assessment of Impacts: Construction and Operation

Use of the borehole to be drilled by the Project is expected to be rare. As a result, the magnitude of the potential impact is considered to be **Small** during both the construction and operation phases. The sensitivity of the impacted resource is considered to be **High**, as neighbouring communities rely on the aquifer from which the Project borehole would abstract water, and community members already indicate that the aquifer is not always sufficient to meet their needs. The impact significance is therefore assessed to be **Moderate** (Table 6-13).

Table 6-13: Assessment of Groundwater Impacts during Construction and Operation.

Impact	**Groundwater Abstraction**				
Impact Nature	Negative			Positive	
	The potential impacts (lowering of the water table within village abstraction wells leading to water shortages for other users) are negative.				
Impact Type	Direct			Indirect	
	The impacts would be a direct result of Project abstraction of water for construction and operational uses.				
Impact Duration	Temporary	Short Term	Long Term	Permanent	
	The impacts would be long term, occurring during both construction (approximately 10 months) and operation (20 years).				
Impact Extent	Limited	Local	Regional	Transboundary	
	The impacts would be restricted to the Project Area, impacting the seven neighbouring villages.				
Frequency	Remote	Rare	Occasional	Often	Constant
	The impacts would be rare, as the Project intends to truck in water for most of their construction needs and intends to minimize panel cleaning.				
Likelihood	Unlikely	Possible	Certain		

Impact	Groundwater Abstraction				
	The impacts are considered to be possible, as the Project intends to truck in water for most of their construction needs and intends to minimize panel cleaning.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
	Based on the above, the impact magnitude is considered to be small.				
Resource/ Receptor Vulnerability	Low		Medium		High
	The sensitivity of the resource is considered to be high due to the importance of groundwater to neighbouring communities.				
Impact Significance	**Negligible**	**Minor**	**Moderate**	**Major**	
	Based on the small impact magnitude and the high sensitivity, the impact significance is assessed to be moderate.				

6.4.4.4 Mitigation Measures

The embedded controls will need to be enhanced if the Project borehole has to be located within the radius of influence and a response is observed in any village wells during drilling and pump testing of the Project borehole.

The measures listed below will be implemented to mitigate the Project's groundwater impacts.

- Water storage solutions (e.g., tanks) will be utilised for water abstracted from the Project borehole and/or brought in by bowsers during the wet season for use during the dry season.
- Regular monitoring of affected village supplies will be conducted and Project abstraction will cease if the Project has a significant impact on the community boreholes.

6.4.4.5 Residual Impact Significance

With the implementation of the mitigation measures listed above, the residual impact significance is anticipated to be **Minor** (Table 6-14).

Table 6-14: Pre and Post Mitigation Groundwater Impacts.

Impact	Project Phase	Impact Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Groundwater Abstraction	Construction and operations	Moderate	Minor

6.4.5 Biodiversity: Loss of Habitats and Fauna Disturbance

6.4.5.1 Summary of Baseline Conditions

The habitats on the Project Site qualify as Modified Habitat based on definitions in IFC PS 6. In general, no plant or tree species of high ecological value are expected to be displaced or lost, and these habitats are therefore considered to have a low sensitivity. The baobabs trees discussed below are the only species to be removed that could be considered sensitive.

PS 6 states that where Modified Habitats occur, mitigation is required to address impacts to significant biodiversity values, and the client should minimize impacts on such biodiversity and implement mitigation measures as appropriate.

6.4.5.2 Potential Impacts: Construction

Construction of the proposed Project would require the removal of vegetation and would impact associated habitats. As discussed in the biodiversity baseline (Section 5.2), site habitats have long been transformed from their original state through many years of cultivation and livestock grazing that has led to extensive alteration of ecological processes. The Project Site still provides habitat to common species of the region, however, adapted to human-dominated landscapes, in particular the slightly less transformed Secondary Mixed Deciduous Woodland (2.9 ha/3.15% of the site) and Seasonal Wetland (3.8 ha/4.14% of the site).

As discussed in Section 5.2.2.4, on July 18, 2019, the Ministry of Lands conducted a detailed land and asset survey of the Project Site. The survey identified five species listed as protected under the Forestry (Amendment) Rules, 2012, as gazetted in Government Notice No. 23 (December 31, 2012). Of the five species, baobab trees (*Adansonia digitata*), of which two specimens were identified, were deemed irreplaceable and sensitive due to their age, cultural value, and keystone role within the ecosystem. The remaining species (Ghost Tree, Natal Mahogany, Peacock Flower, and African Sausage Tree) were not deemed as irreplaceable as they are relatively fast growing (reaching full maturity within 30-50 years) and do not have any specific cultural value apart from the provisioning ecosystem services they provide (see “Tree Use” in Table 5-5). These species are listed as protected due to their unsustainable use in Malawi.

The original Project design required removal of both baobab trees, as they were located in the solar panel layout. Due to their protected status and cultural value, JCM applied the mitigation hierarchy by conducting an alternative analysis to determine if the two baobab trees could be avoided/protected while still fulfilling Project objectives for electricity production. The alternative analysis indicated that one of the two trees could be avoided by moving panels to an alternate location within the Project Site. The alternative analysis determined that the other baobab tree could not be avoided without significantly diminishing the Project’s electricity production, as it is located in the centre of the solar panel layout (Appendix I). As a result, the Project will now only impact a single baobab tree.

6.4.5.3 Assessment of Impacts: Construction

Loss of habitat would be permanent, as lost habitat would not be restored. Replacement trees would be planted in adjacent areas, but this would not be a direct replacement of the lost habitat. The impact would be limited to the Solar Plant Site

(92 ha) and the transmission line wayleave (1.5 ha). The impact would be caused by site clearance, which would occur once during the initiation of construction. As a result, the magnitude of the potential impact is considered to be **Small**. The sensitivity of the impacted resource is considered to be **Low**, as the habitat is classified as modified. The impact significance is therefore assessed to be **Minor** (Table 6-15).

Table 6-15: Assessment of Loss of Habitat and Fauna Disturbance Impacts during Construction.

Impact	Loss of Habitat and Faunal Disturbance during Construction				
Impact Nature	Negative			Positive	
	The loss of habitat is considered negative.				
Impact Type	Direct			Indirect	
	The impact would be a direct result of Project activities (site clearance).				
Impact Duration	Temporary	Short Term	Long Term	Permanent	
	The impact duration would be permanent, as lost habitat would not be restored. Replacement trees would be planted in adjacent areas, but this would not be a direct replacement of the lost.				
Impact Extent	Limited	Local	Regional	Transboundary	
	The impact would be limited to the Project Site, an area of approximately 93.5 ha.				
Frequency	Remote	Rare	Occasional	Often	Constant
	Site clearance would occur once during the initiation of construction.				
Likelihood	Unlikely	Possible	Certain		
	The Project would require site clearance.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
	Despite the permanent loss of habitat, the natural vegetation to be cleared is limited and patchy because of cultivation and grazing usage, and the impact magnitude is therefore considered to be of small.				
Resource/ Receptor Vulnerability	Low	Medium	High		
	The habitat is classified as modified, which qualifies it as low sensitivity.				
	Negligible	**Minor**	**Moderate**	**Major**	

Impact	Loss of Habitat and Faunal Disturbance during Construction
Impact Significance	Based on the small impact magnitude and the low sensitivity, the impact significance is assessed to be minor.

6.4.5.4 Mitigation Measures

The measures listed below will be implemented to mitigate the Project's biodiversity impacts of loss of habitats and fauna disturbance.

- Provisions that prohibit staff and contractors from engaging in all forms of hunting in the Project Area will be included in the Worker Code of Conduct.
- Vegetation will be methodically cleared from the Project Site and excavations will be undertaken per designs to avoid unwarranted clearance of vegetation.
- If feasible, clearance of the 2.9 ha of Secondary Mixed Deciduous Woodland will be removed gradually from one side such that any resident wildlife is provided an opportunity to exit the site.
- Planning will be conducted in advance to determine the minimum feasible extent required. Predetermined areas will be clearly demarcated on the ground, fenced where appropriate, and enforcement measures will be taken to avoid footprint creep into surrounding areas.
- Rehabilitation of all disturbed areas (e.g., temporary access tracks and laydown areas) will be undertaken following construction. This will be done in such a way as to facilitate natural regeneration of vegetation.
- Five or more seedlings of the same species will be planted in adjacent areas for each protected tree that is cut down.

6.4.5.5 Residual Impact Significance

With the implementation of the mitigation measures listed above, the residual impact significance is anticipated to be **Negligible** (Table 6-16).

Table 6-16: Pre and Post Mitigation Loss of Habitat and Fauna Disturbance Impacts.

Impact	Project Phase	Impact Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Loss of Habitat and Fauna Disturbance	Construction	**Minor**	**Negligible**

6.4.6 Biodiversity: Risk of Increased Invasive Alien Plants

The Convention on Biological Diversity defines an invasive alien species as one that is established outside of its natural past or present distribution, and whose introduction

and/or spread threatens biological diversity.[47] The IUCN Red List of Threatened Species[48] rates the presence of invasive alien species globally as the second most significant threat to biodiversity,[49] and there is a growing global awareness of the problems associated with alien and invasive species. Alien species can be introduced either accidentally or intentionally. Although only a small percentage of alien species have the potential to become invasive, their impact is marked and usually is irreversible, displacing native species and leading to degradation of habitats.

6.4.6.1 Summary of Baseline Conditions

Given the predominantly agricultural usage of the Project Site, there has been ample opportunity for the introduction of invasive species. Accidental introduction of invasive species seeds with imported agricultural seeds is common. The baseline survey identified only two invasive species, however, on the list for Malawi on the Global Invasive Species Database (Table 6-17).[50] Invasive species in the Project Area are associated with Modified Habitats, which have low ecological sensitivity.

Table 6-17: Invasive and Alien Plants Identified on the Project Site.

Species Name	English / Local Name	Comment
Commelina baanghelensis	Tropical spiderwort	Common weed, typically occurring in disturbed land and is invasive in some cases.
Bidens pilosa	Black jack	Introduced annual herb, present as a result of soil disturbances, causes losses to agriculture and livestock.

6.4.6.1 Potential Impacts: Construction

Site clearance and soil disturbances create opportunities for invasive alien plants to establish. Extensive soil disturbance would occur during the construction phase, creating abundant potential for the establishment of invasive plants. Large infestations can develop, and if not controlled can serve as source populations for the spread into new areas.

Construction vehicles can accidentally gather invasive plant material and disperse seeds through normal movements. Construction equipment and vehicles, landscaping, or rehabilitation could potentially introduce invasive alien plants.

6.4.6.2 Assessment of Impacts: Construction

The risk of increased invasive alien plants would be long term, as invasive plants would gradually disappear. The impact would be limited to the Solar Plant Site (92 ha) and

[47] Convention for Biological Diversity, invasive species page. Available at: https://www.cbd.int/invasive/WhatareIAS.shtml

[48] IUCN Red List of Threatened Species. Available at http://www.iucnredlist.org/

[49] IUCN Website, invasive species page. Available at: https://www.iucn.org/theme/species/our-work/invasive-species

[50] http://issg.org/database/species/search.asp?sts=sss&st=sss&fr=1&sn=&rn=Malawi&hci=-1&ei=-1&lang=EN&x=27&y=6

the transmission line wayleave (1.5 ha). A limited number of invasive alien plants are already present due to the modified nature of the affected and surrounding habitats. As a result, the magnitude of the potential impact is considered to be **Small**. The sensitivity of the impacted resource is considered to be **Low**, as the habitat is classified as modified. The impact significance is therefore assessed to be **Minor** (Table 6-18)

Table 6-18: Assessment of Risk of Increased Invasive Alien Plants Impacts during Construction.

Impact	**Risk of Increased Invasive Alien Plants**				
Impact Nature	Negative			Positive	
	An increase in invasive alien plants is considered negative.				
Impact Type	Direct			Indirect	
	The impact would be a direct result of Project activities (clearance of vegetation, soil disturbances, and vehicle traffic).				
Impact Duration	Temporary	Short Term	Long Term	Permanent	
	The impact would be long term as invasive plants would gradually disappear.				
Impact Extent	Limited	Local	Regional	Transboundary	
	The impact would be limited to the Project Site, an area of approximately 93.5 ha.				
Frequency	Remote	Rare	Occasional	Often	Constant
	There would be ongoing risk of increased invasive alien plants.				
Likelihood	Unlikely	Possible	Certain		
	It is possible that Project activities would introduce invasive alien plants.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
	A limited number of invasive alien plants are already present due to the modified nature of the affected and surrounding habitats.				
Resource/ Receptor Vulnerability	Low	Medium	High		
	The habitat is classified as modified, which qualifies for a low sensitivity, and few of the species are highly invasive.				
Impact Significance	**Negligible**	**Minor**	**Moderate**	**Major**	
	Based on the small impact magnitude and the low sensitivity, the impact significance is assessed to be minor.				

6.4.6.3 Mitigation Measures

The measures listed below will be implemented to mitigate the Project's biodiversity impacts of increased invasive alien plants.

- Invasive plant species will be removed from areas controlled by the Project. Manual removal will be favoured over mechanised or chemical control measures.
- Invasive vegetative and/or seed bearing material that is removed through control measures will be contained in a cordoned off area, dried, and burnt on site to prevent the distribution of seeds.
- Vehicles and construction equipment will be washed on a regular basis and kept clean to minimise the distribution of seeds and invasive plant material.
- Source areas such as vehicle parking and construction camps will be kept clean of invasive plants to minimise the presence of seeds that can be dispersed unintentionally.
- Disturbed areas will be rehabilitated at the earliest opportunity to minimise the establishment of invasive plant species.
- Regular and ongoing monitoring of the presence of invasive plant species will be conducted within construction and rehabilitated sites and removal operations implemented according to the results.

6.4.6.4 Residual Impact Significance

With the implementation of the mitigation measures listed above, the residual impact significance is anticipated to be Negligible (Table 6-19).

Table 6-19: Pre and Post Mitigation Risk of Increased Invasive Alien Plants Impacts.

Impact	Project Phase	Impact Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Risk of Increased Invasive Alien Plants	Construction	**Minor**	**Negligible**

6.4.7 Biodiversity: Disruption of Ecosystem Services

6.4.7.1 Summary of Baseline Conditions

There is a wide diversity of ecosystem services present in the Project Area, many of which are underpinned by biodiversity and all of which are important to community well-being (Table 5-10). Three of these ecosystem services have been prioritised through an assessment of likelihood of impact by the Project, dependence of communities, and lack of available alternatives (i.e., replaceability), namely supporting, regulating, and provisioning.

6.4.7.2 Potential Impacts: Construction

Clearing of vegetation from the Project Site for the construction of the Project is likely to result in loss or reduction of biodiversity ecosystem services that occur at the Project Site. This may eventually result in loss of livelihoods and habitats for fauna, and localized flooding.

6.4.7.3 Assessment of Impacts: Construction

Disruption of ecosystem services would be long term, as biodiversity recovers slowly. The impact would be limited to the Project Site and neighbouring communities (where the people who depend on these ecosystem services live). The impact would be caused by land acquisition and site clearance, which would occur once during the initiation of construction. As a result, the magnitude of the potential impact is considered to be **Small**. The sensitivity of the impacted resource is considered to be **High**, as ecosystem services contribute to livelihoods. The impact significance is therefore assessed to be **Moderate** (Table 6-20).

Table 6-20: Assessment of Disruption of Ecosystem Services Impacts during Construction.

Impact	Disruption of Ecosystem Services during Construction				
Impact Nature	Negative			Positive	
	A disruption of ecosystem services is considered negative.				
Impact Type	Direct			Indirect	
	The impact would be a direct result of Project activities (i.e., land acquisition and clearance of vegetation).				
Impact Duration	Temporary	Short Term	Long Term	Permanent	
	The impact would be long term as biodiversity recovers slowly.				
Impact Extent	Limited	Local	Regional	Transboundary	
	The impact would be limited to the Project Site and neighbouring communities.				
Frequency	Remote	Rare	Occasional	Often	Constant
	Land acquisition and site clearance would occur once during the initiation of construction.				
Likelihood	Unlikely	Possible	Certain		
	The Project would require land acquisition and site clearance.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
	A limited diversity of ecosystem services have been identified.				

Impact	Disruption of Ecosystem Services during Construction			
Resource/ Receptor Vulnerability	Low	Medium	High	
	The sensitivity of ecosystem services is considered to be high as they contribute to livelihoods.			
Impact Significance	**Negligible**	**Minor**	**Moderate**	**Major**
	Considering the impact magnitude of change is small and the sensitivity is high, the overall significance is considered to be of *moderate* significance.			

6.4.7.4 Mitigation Measures

The measures listed below will be implemented to mitigate the Project's biodiversity impacts of disruption of ecosystem services.

- Rehabilitation of disturbed areas (e.g., temporary access tracks and laydown areas) will be undertaken following construction. This will be done in such a way as to facilitate natural regeneration of vegetation.
- Piles of woody vegetation cleared for construction activities will be made available to communities to access it for use as wood fuel or other purposes.
- Ongoing engagement will be maintained between the Project and local communities, with communities informed in advance of any vegetation clearing to allow pre-harvesting of resources such has wood fuel, mangoes, and building materials.

Mitigation measures for loss of livelihoods as a result of land acquisition are also applicable to this impact (Section 6.4.9.4).

6.4.7.5 Residual Impact Significance

With the implementation of the mitigation measures listed above, the residual impact significance is anticipated to be Negligible (Table 6-21).

Table 6-21: Pre and Post Mitigation Disruption of Ecosystem Services Impacts.

Impact	Project Phase	Impact Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Disruption of Ecosystem Services	Construction	**Moderate**	**Minor**

6.4.8 Landscape and Visual

This assessment identifies potential impacts to the existing visual landscape as a result of the Project. Impacts would occur during construction and operations and primarily relate to the presence of construction equipment, materials, and workers

during construction and the presence of solar panels and potential for solar reflection during operations.

6.4.8.1 Summary of Baseline Conditions

The Project Area is rural in nature and appearance, and most of the land that would be utilized for the Project Site is already cleared open fields dedicated to agricultural activities. There are settlements adjacent to the planned solar layout to the east and to the west.

6.4.8.2 Potential Impact: Construction and Operation

Temporary construction activities that would have an impact on the visual character of the landscape include the following:

- Clearance of vegetation (in particular clearance of trees and removal of crops);
- Presence of large construction vehicles and equipment on site;
- Fencing of works and restrictions to site access; and
- Construction of the plant.

Impacts during the operation phase include the colour change and a massing effect created by the PV panels covering a large area, limited early morning glare, and some security lights at night. The reflection from PV systems is generally low intensity, similar to the impact from a body of water. Solar glare can have the potential to be hazardous to pilots (typically when panels are located at airports), motorists (when panels are located adjacent to roads), and onlookers. There are no air strips near the Project Site, but the Project Site is located adjacent to a highway (M5).

Once constructed, the solar PV panels are estimated to be no higher than three metres above the ground, and the control room and warehouse building would be no higher than five metres above the ground.

6.4.8.3 Assessment of Impact: Construction

The visual impact of construction would be short term, occurring during construction (approximately 10 months). The impact would be restricted to the Project Area, impacting the seven neighbouring communities and adjacent highway. The impact would be constant during construction. The impact magnitude is therefore considered to be **Small**. The sensitivity of the receptors (neighbouring communities) is considered to be **High** due to their proximity and the significant nature of the visual impacts (heavy machinery and vehicles, construction activities). As a result, the impact significance is assessed to be **Moderate** (Table 6-22).

Table 6-22: Assessment of Landscape and Visual Impacts during Construction.

Impact	Landscape and Visual	
Impact Nature	Negative	Positive
	The change in visual character through on site presence during construction is considered negative.	

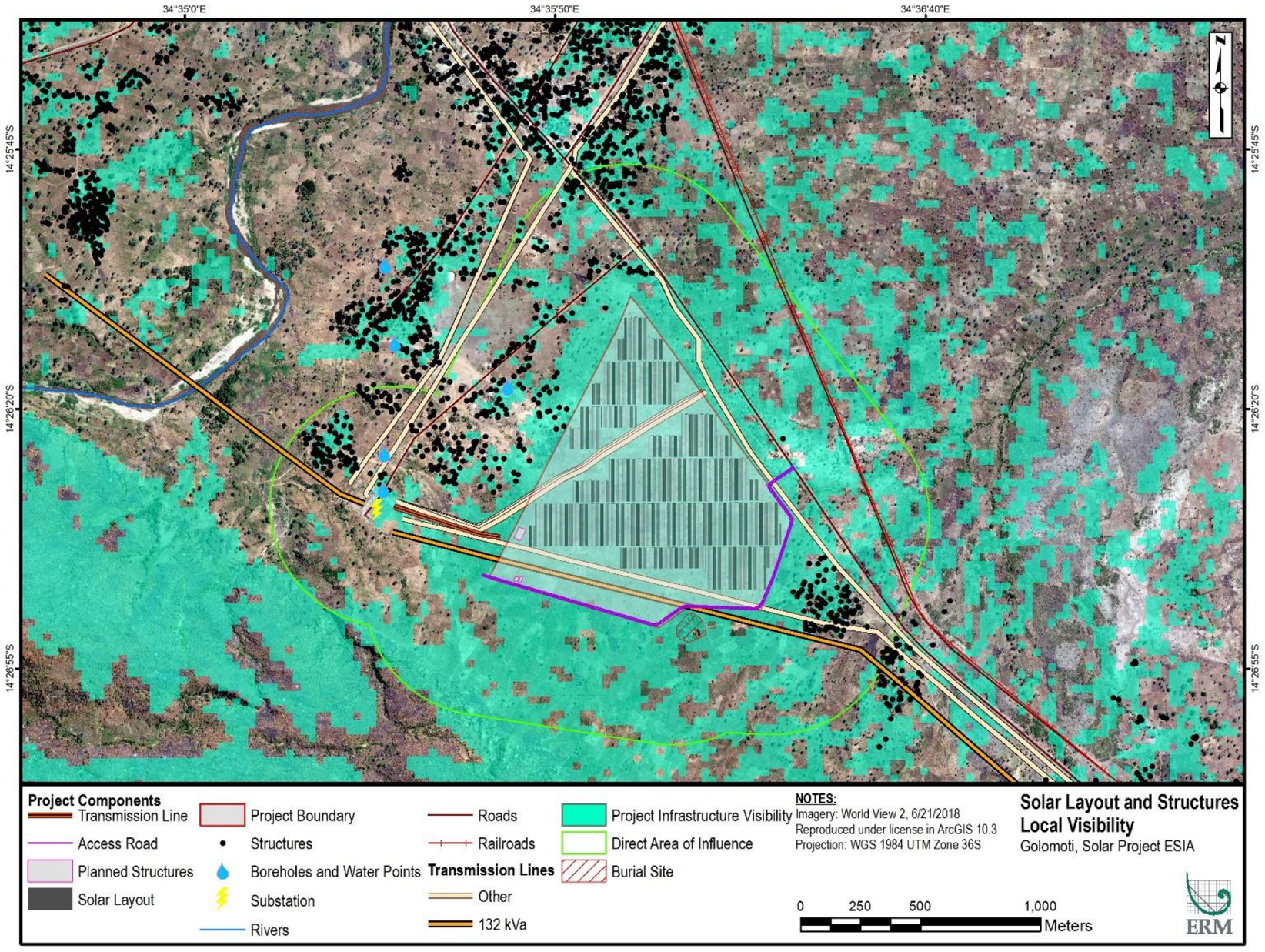
Impact	Landscape and Visual			
Impact Type	Direct		Indirect	
	The impact would be a direct result of Project activities (tree removal, presence of machinery and equipment).			
Impact Duration	Temporary	**Short Term**	Long Term	Permanent
	The impact would be short term, occurring during construction (approximately 10 months).			
Impact Extent	Limited	**Local**	Regional	Transboundary
	The impact would be restricted to the Project Area, impacting the seven neighbouring villages and adjacent highway.			
Frequency	Remote	Rare	Occasional	Often	**Constant**
	The impact would be constant during construction activities.				
Likelihood	Unlikely	Possible	**Certain**		
	The clearing of vegetation and installation of solar panels and other associated equipment is certain.				
Impact Magnitude	Positive	Negligible	**Small**	Medium	Large
	Based on the above, the impact magnitude is considered to be small.				
Resource/ Receptor Vulnerability	Low	Medium	**High**		
	The sensitivity of the receptors (neighbouring communities) is considered to be high due to their proximity (the closest being within 20 m of the site boundary.				
Impact Significance	**Negligible**	**Minor**	**Moderate**	**Major**
	Based on the small impact magnitude and the high sensitivity of receptors, the impact significance is assessed to be moderate.			

6.4.8.4 Assessment of Impacts: Operations

The visual impact of operations would be the same as during construction, except that it would be long term (20 years). The impact magnitude is therefore considered to be **Medium**. Figure 6-3 shows that the solar panels would be visible from multiple Key Observation Points (KOPs) surrounding the Project. It should be noted that the solar panels that have been selected for the Project are designed to absorb as much solar radiation as possible and therefore solar reflection is minimized, which is considered to be an embedded control. The sensitivity of the KOPs and other receptors is considered to be **Medium**. As a result, the impact significance is assessed to be

Moderate. It is important to note that over time, the visual impact would decrease as receptors become accustomed to the Project (Table 6-23).

Figure 6-3: Viewshed of the Project in Relation to Surrounding Receptors.



Source: ERM, 2019.

Table 6-23: Assessment of Landscape and Visual Impacts during Operation.

Impact	Landscape and Visual				
Impact Nature	Negative			Positive	
	The change in visual character through on site presence during operation is considered negative.				
Impact Type	Direct			Indirect	
	The impact would be a direct result of Project activities (presence of solar panels).				
Impact Duration	Temporary	Short Term	Long Term	Permanent	
	The impact would be long term, occurring during operation (20 years).				
Impact Extent	Limited	Local	Regional	Transboundary	
	The impacts would be restricted to the Project Area, impacting the seven neighbouring villages and adjacent highway.				
Frequency	Remote	Rare	Occasional	Often	Constant
	The impact would be constant during the operation phase.				
Likelihood	Unlikely		Possible		Certain
	With the installation of the Project complete, the impact is certain.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
	Based on the above, the impact magnitude is considered to be medium.				
Resource/ Receptor Vulnerability	Low		Medium		High
	The sensitivity of receptors (neighbouring communities, KOPs) is considered medium as the landscape is largely modified as result of agricultural activities.				
Impact Significance	**Negligible**	**Minor**	**Moderate**	**Major**	
	Based on the medium impact magnitude and the medium sensitivity of receptors, the impact significance is assessed to be moderate.				

6.4.8.5 Mitigation Measures

Construction

The measures listed below will be implemented to mitigate the Project's landscape and visual impacts during construction.

- Ongoing rehabilitation of cleared areas will be conducted to minimize visual scarring. Maintenance clearing will be kept to a minimum and will not extend beyond the Project Site boundary.
- Excavated and cut and fill areas will be shaped and allowed to revegetate;
- No debris or waste materials will be left at work sites.
- Appropriate directional and intensity settings will be utilised for lighting.

Operations

The measures listed below will be implemented to mitigate the Project's landscape and visual impacts during operation.

- Rehabilitation of all disturbed areas (e.g., temporary access tracks and laydown areas) will be undertaken following construction. This should be done in such a way as to facilitate natural regeneration of vegetation.
- Ongoing engagement will be maintained between the Project and local communities with regards to potential solar reflection impacts.

6.4.8.6 Residual Impact Significance

With the implementation of the mitigation measures listed above, the residual impact significance is anticipated to be Minor during both construction and operation (Table 6-24).

Table 6-24: Pre and Post Mitigation Landscape and Visual Impacts.

Impact	Project Phase	Impact Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Landscape and Visual Changes	Construction	Moderate	Minor
Landscape and Visual Changes	Operation	Moderate	Minor

6.4.9 Land Acquisition and Displacement

This assessment identifies potential impacts from land acquisition for the Project. The land acquisition impact would occur during construction and would result in a loss of livelihoods (economic displacement) for affected people.

6.4.9.1 Summary of Baseline Conditions

The villages in the Project Area rely on subsistence farming for their household food consumption, with some households generating income from the sale of their crops. In addition, livestock rearing, particularly of poultry and goats, is common. Following crop harvests, livestock (goats and cattle) freely roam the Project Area to graze crop remnants.

Approximately 154 residents from six villages in Group Village Pitala are expected to be directly affected by the land acquisition for the Project (Table 6-25). Exact data on the size of each parcel to be acquired and assets contained thereon would be confirmed via the asset inventories currently in progress with the Ministry of Lands, but most agricultural plots on the Project Site are reported to be less than a hectare in size and are likely to be acquired in whole by the Project. It is important to note, however, that it is common for residents in the Project Area to have access/customary rights to more than one plot, many of which may fall outside the Project Site and can continue to be used uninterrupted for livelihood purposes.

Table 6-25: Approximate Number of PAPs per Village

Village	Approximate Number of PAPs
Nsamala	63
Ching'anipa	19
Chisaka	27
Kapesi	15
Kalumo	21
Chitseko	9
Total	**154**

Source: ERM, from household survey data.

In combination with small land plots, a lack of irrigation, and limited productivity due to soil conditions and adverse climate conditions some years, communities often suffer food shortages during the dry seasons, especially in January and February. In addition, malnutrition is a major cause of death among adults and children in Dedza District.

6.4.9.2 Potential Impacts: Construction

Land acquisition would trigger economic displacement of land users, affecting subsistence and income generating farming. Availability of spare agricultural land for sale or rent is reportedly scarce in the area. Of household survey respondents, 40% believed it would be possible to find more suitable land in the area, while 60% did not.

6.4.9.3 Assessment of Impacts: Construction

The impact of economic displacement caused by land acquisition would be long term, occurring during construction (approximately 10 months) and through operation (20

years). The impact would be local, experienced by the approximately 154 land users within six villages in Group Village Pitala. The impact would occur once during the land acquisition process prior to construction. Due to existing food shortages in the communities, the impact of land acquisition and economic displacement is likely to exacerbate food insecurity and malnutrition, and heighten poverty levels. As such, economic displacement could lead to further impoverishment if not well managed. As a result, the impact magnitude is considered to be **Large**. Land users are highly vulnerable due to their economic status and lack other income/livelihood streams that would allow them to adapt to diversify away from agriculture. In addition, given that available unoccupied agricultural land is scarce in the area, their land would not be easily replaced. As a result, the sensitivity of receptors (land users) is considered to be **High**. As a result, the impact significance is assessed to be **Major** (Table 6-26).

Table 6-26: Assessment of Economic Displacement Impacts during Construction.

Impact	**Economic Displacement**				
Impact Nature	Negative				Positive
	The impact is considered negative as it has the potential to create food insecurity, increased malnutrition, and impoverishment.				
Impact Type	Direct				Indirect
	The impact would be a direct result of Project activities (land acquisition).				
Impact Duration	Temporary	Short Term	Long Term		Permanent
	The impact would be long term, occurring during construction (approximately 10 months) and throughout operation (20 years).				
Impact Extent	Limited	Local	Regional		Transboundary
	The impact would be local, experienced by land users within six villages in Group Village Pitala				
Frequency	Remote	Rare	Occasional	Often	Constant
	The impact would occur once during the land acquisition process prior to construction.				
Likelihood	Unlikely		Possible		Certain
	Land acquisition would be certain.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
	Based on the above, the magnitude is considered to be large as the impact is expected to have a major impact on affected land users.				

Impact	Economic Displacement			
Resource/ Receptor Vulnerability	Low	Medium	High	
	Land users are highly vulnerable due to their economic status and lack other income/livelihood streams that would allow them to adapt to diversify away from agriculture. In addition, given that available unoccupied agricultural land is scarce in the area, their land would not be easily replaced.			
Impact Significance	**Negligible**	**Minor**	**Moderate**	**Major**
	Based on the large impact magnitude and the high sensitivity of receptors (land users), the impact significance is assessed to be major.			

6.4.9.4 Mitigation Measures

The measures listed below will be implemented to mitigate the Project's land acquisition and displacement impacts.

- A Livelihood Restoration Plan (LRP) will be developed, based on the one developed for the Salima project, that includes the following:
  - Identification of affected land users;
  - Census and asset inventory to assess compensation measures for those affected;
  - Assessment of eligibility and entitlements for those affected;
  - Identification of gender differentiated and sustainable livelihood improvement and/or restoration measures (e.g., financial literacy training, training on improved farming practices);
  - Provisional implementation budgets;
  - Roles and responsibilities, including details of an institutional structure/Livelihood Restoration Steering Committee;
  - Monitoring and evaluation requirements; and
  - Provisional implementation schedule.
- An inclusive and participatory consultation process will be followed that ensures the participation of women, men, youth, elderly, disabled, and other groups in the decision making process regarding replacement land and livelihood restoration programmes.

6.4.9.5 Residual Impact Significance

With the implementation of the mitigation measures listed above, the residual impact significance is anticipated to be Moderate (Table 6-27).

Table 6-27: Pre and Post Mitigation Economic Displacement Impacts.

Impact	Project Phase	Impact Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Economic Displacement	Construction	Major	Moderate

6.4.10 Walking Paths

This assessment identifies potential impacts to walking paths resulting from the land acquisition for the Project. Impacts would occur during construction and operation and result in a loss of access to the walking paths that currently traverse the Project Site.

6.4.10.1 Summary of Baseline Conditions

Villages in the Project Area have close ties to each other created over generations in which families have farmed the same fields and through marriages that have created bonds across villages. The villages frequently intermingle and gather for cultural and community events, such as weddings and funerals. There are a number of walking paths that transect the Solar Plant Site that would be impacted during construction and operation. Access to these walking paths would be restricted. The village of Thondoya to the east of the Project Site is home to many residents who are originally from villages in Group Village Pitala. The main walking path that connects Thondoya to the villages in Group Village Pitala, which traverses the Project Site, is a quicker and safer route to walk to visit family on the other side than is the main M5 road. Walking along M5 is approximately 1 km longer, depending on destination, and not as pedestrian friendly due to vehicular traffic.

6.4.10.2 Potential Impacts: Construction and Operation

During construction, safety fencing, security, and equipment would block access to several walking paths that transect the current agricultural fields. Once such fields are no longer utilized for agriculture, it is likely that they would no longer be needed by local villagers, with the exception of the pathway that is used to travel from Thondoya to the villages in Group Village Pitala. These impacts are expected to persist during operations.

6.4.10.3 Assessment of Impacts: Construction and Operation

Restricted access to walking paths would be long term, occurring during construction (approximately 10 months) and throughout operations (20 years). The impact would be restricted to the Project Area, impacting the seven neighbouring villages. The impact would be constant throughout construction and operation. The impact magnitude is considered to be **Small**, as the impact to the paths used to reach agricultural fields would no longer be needed, and the path from Thondoya to the villages in Group Village Pitala is the only one likely to be felt by community members. While not as desirable, walking along M5 is an alternative method to travel between these areas. The sensitivity of receptors (neighbouring community members) is considered to be **Medium** due to their reliance on community support networks. As a result, the impact significance is assessed to be **Minor** (Table 6-28).

Table 6-28: Assessment of Restricted Access to Walking Paths Impacts during Construction and Operation.

Impact	Restricted Access to Walking Paths	
Impact Nature	Negative	Positive
	Restricted access to walking paths is considered to be negative.	

Impact	Restricted Access to Walking Paths			
Impact Type	Direct		Indirect	
	The impact would be a direct result of Project activities (land acquisition and subsequent restriction of access).			
Impact Duration	Temporary	Short Term	Long Term	Permanent
	The impact would be long term, occurring during construction (approximately 10 months) and throughout operations (20 years).			
Impact Extent	Limited	Local	Regional	Transboundary
	The impact would be restricted to the Project Area, impacting the seven neighbouring villages.			
Frequency	Remote	Rare	Occasional	Often	Constant
	The impact would be constant throughout construction and operation.				
Likelihood	Unlikely	Possible	Certain	
	The Project would require acquisition of and restriction of access to the Project Site.			
Impact Magnitude	Positive	Negligible	Small	Medium	Large
	Based on the above, the magnitude is considered to be small, as the impact to the paths used to reach agricultural fields would no longer be needed, and the path from Thondoya to the villages in Group Village Pitala is the only one likely to be felt by community members.				
Resource/ Receptor Vulnerability	Low	Medium	High	
	The sensitivity of receptors (neighbouring community members) are considered to be medium due to their reliance on community support networks.			
Impact Significance	**Negligible**	**Minor**	**Moderate**	**Major**
	Based on the small impact magnitude and the medium sensitivity of receptors, the impact significance is assessed to be minor.			

6.4.10.4 Mitigation Measures

The measures listed below will be implemented during both construction and operation to mitigate the Project's impacts to walking paths.

- Consultation with take place with communities to assess the possibility/need for an alternative walking path that could connect settlements to minimize impacts related to access restrictions without compromising the design of the facility.

6.4.10.5 Residual Impact Significance

With the implementation of the mitigation measures listed above, the residual impact significance is anticipated to be **Negligible** during both construction and operation (Table 6-29).

Table 6-29: Pre and Post Mitigation Restricted Access to Walking Paths Impacts.

Impact	Project Phase	Impact Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Restricted Access to Walking Paths	Construction and Operation	Minor	Negligible

6.4.11 Vector Borne and Communicable Diseases

This assessment identifies potential impacts on communities in the Project Area of vector borne and/or communicable diseases. Due to a concentration of Project workers and construction activities, impacts would primarily occur during the construction phase and would result in increased health risks for communities in the Project Area.

6.4.11.1 Summary of Baseline Conditions

Malaria is the most prevalent illness experienced by men, women, and children in the Project Area. It is particularly prevalent during the rainy season, as pools of rainwater accumulate in low lying areas. Though hygiene improvements have been achieved in recent years in the communities, open defecation has not been completely eliminated and handwashing is generally limited to water only, in addition to somewhat precarious conditions of latrines, especially during the rainy season. Gastric illnesses such as diarrhoea, colds, and other illnesses can spread if proper sanitation and hygiene is not effectively managed. In addition, common cooking methods utilizing firewood and charcoal have negative health impacts on local families, especially women, often leading to respiratory infections.

6.4.11.2 Potential Impacts: Construction

Communicable diseases are caused by viral, bacterial, parasitic, and fungal pathogens that are airborne or that are transmitted through an infected person, animal, or environmental source. Communicable diseases include illnesses such as malaria, tuberculosis, measles, and bacterial infections such as colds and gastric infections (e.g., diarrhoea).

It is anticipated that during the construction period the workforce would comprise approximately 200 workers and that approximately 30-35% would be skilled workers coming from outside the local area that would be housed in a controlled camp on the worksite. The biggest risk associated with this impact is workers from outside the local

area being more susceptible to communicable diseases or bringing communicable diseases into the area that are currently not prevalent. In addition, in combination with community-worker interaction, inadequate hygiene and waste management controls at the construction site could also enable the increased transmission of communicable diseases.

In the event of an outbreak of an airborne (e.g., tuberculosis) or food-borne illness among workers, the home communities of the local workers and any of those visited by the Project workforce may become susceptible to these infectious diseases.

Moreover, due to the existing high prevalence of malaria, increased transmission due to Project activities is considered to be unlikely but could result if new breeding grounds for mosquitoes are created. This includes creation of wheel ruts from traffic or pools of water in and around land clearance or laydown areas.

Construction activities also have the potential to exacerbate existing high rates of respiratory infections due to dust emissions, which are common among women due to traditional cooking practices. This situation may be exacerbated during construction due to higher levels of dust emissions and also vehicle emissions. In addition, ground preparations and land clearance may create dust particles. Although dust suppression measures would be implemented, additional dust may be associated with any real (or perceived) increase in respiratory diseases.

6.4.11.3 Assessment of Impacts: Construction

A potential increase in vector borne and communicable diseases would be short term, occurring during construction (approximately 10 months). The impact would be restricted to the Project Area, impacting a small portion of neighbouring villages, where the majority of construction activities would occur. The impact would be possible throughout construction, but the greatest likelihood would occur occasionally during more intensive/shorter periods of peak construction. The impact magnitude is considered to be **Small**, as the workforce is not massive in number and would be composed mostly of locals. The sensitivity of receptors (workers and local community members) is considered to be **High,** as communities are vulnerable to an increase in vector borne and communicable diseases as present levels are already high and health indicators are generally low in the district. As a result, the impact significance is assessed to be **Moderate** (Table 6-30).

Table 6-30: Assessment of Vector Borne and Communicable Diseases Impacts during Construction.

Impact	Increase in Vector Borne and Communicable Diseases	
Impact Nature	Negative	Positive
	An increase in vector borne and communicable diseases would be negative.	
Impact Type	Direct	Indirect
	The impact would be a direct result of Project activities (the presence of construction equipment and activities in combination with the workforce, in particular community-worker interaction).	

Impact	Increase in Vector Borne and Communicable Diseases				
Impact Duration	Temporary	Short Term	Long Term	Permanent	
	The impact would be restricted to construction (approximately 10 months).				
Impact Extent	Limited	Local	Regional	Transboundary	
	The impact would likely only affect a small portion of neighbouring villages, where the majority of construction activities would occur.				
Frequency	Remote	Rare	Occasional	Often	Constant
	The impact would be present throughout construction, but is only predicted to occur occasionally during more intensive/shorter periods of peak construction.				
Likelihood	Unlikely	Possible	Certain		
	The impact is considered to be possible.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
	Based on the above, the impact magnitude is considered to be small, as the workforce is not massive in number and would be composed mostly of locals.				
Resource/ Receptor Vulnerability	Low	Medium	High		
	The sensitivity of receptors (workers and local community members) is considered to be high as communities are vulnerable to an increase in vector borne and communicable diseases as present levels are already high and health indicators are generally low in the district.				
Impact Significance	**Negligible**	**Minor**	**Moderate**	**Major**	
	Based on the small impact magnitude and the high sensitivity of receptors, the impact significance is assessed to be moderate.				

6.4.11.4 Mitigation Measures

The measures listed below will be implemented to mitigate the Project's vector borne and communicable disease impacts.

- Workforce training will be provided on communicable diseases, disease prevention, and treatment to raise awareness.
- Workers will be provided with appropriate gender considerate sanitary facilities that are properly designed to prevent contamination.
- A waste handling system will be developed that is sufficient to avoid the creation of new vector breeding grounds.

- Environmental controls will be established that reduce the presence of standing water on site during the site preparation to avoid the creation of new breeding grounds.
- Project areas, especially the camp, toilet, and eating facilities, will be kept clean and free from accumulation of wastes as well as supplied with clean potable water. This includes ensuring appropriate food preparation and monitoring measures are in place.
- There will be a first aid area on site to avoid adding pressure on local health facilities. Arrangements will be made with nearby hospitals and clinics, however, so sick Project workers who cannot be fully treated at the Project first aid area can be referred for treatment.
- Pre-employment screening measures will be developed to ensure that workers are fit for work, as well as to identify any pre-existing conditions. Individuals found to be suffering from communicable diseases will need to seek treatment prior to mobilisation to the Project Site. No one will be denied employment, however, on the basis of their health status as long as they are able to undertake the required duties (following treatment if relevant).
- A worker Code of Conduct will be established that includes guidelines on worker-worker interactions, worker-community interactions, and development of personal relationships with members of local communities.

6.4.11.5 Residual Impact Significance

With the implementation of the mitigation measures listed above, the residual impact significance is anticipated to be **Negligible** (Table 6-31).

Table 6-31: Pre and Post Mitigation Vector Borne and Communicable Diseases Impacts.

Impact	Project Phase	Impact Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Increase in Vector Borne and Communicable Diseases	Construction	Moderate	Negligible

6.4.12 STI/HIV Transmission

This assessment identifies potential impacts on communities in the Project Area of sexually transmitted infection (STI) and human immunodeficiency virus (HIV) transmission. Impacts would primarily occur in the construction phase and result in increased health risks for communities in the Project Area.

6.4.12.1 Summary of Baseline Conditions

Nationally, HIV/acquired immune deficiency syndrome (AIDS) is a leading cause of death among adults, and in Dedza District HIV/AIDs-related infections are a leading

causes of death in the under 5 aged population. Though contraceptives were reported to be available through a local health centre, during stakeholder engagement activities, many community members discussed early/unwanted pregnancies as an issue in the local area, highlighting inadequate use of contraceptives. Stakeholders, especially women and youth, expressed concern that rates of STIs, including HIV, could increase as a result of the Project attracting sex workers and/or worker-community sexual activity. In the women's FGD, participants mentioned that girls and women are at times enticed by men with money and other valuable things like cell phones in exchange for sex, which is another factor that contributes to increased risk of the spread of STIs, with a disproportionate impact on females.

6.4.12.2 Potential Impact: Construction

Increased income due to job opportunities for locals and the influx of non-local workers has the potential to create an increase in STI/HIV prevalence due to worker-community interactions, with young women seeking to exchange sexual favours for payment or valuables, and through other relationships with the workforce (expatriates or Malawians).

6.4.12.3 Assessment of Impacts: Construction

A potential increase in STI/HIV transmission would be short term, occurring during construction (approximately 10 months). The impact would be restricted to the Project Area, impacting neighbouring villages. The impact would be possible throughout construction, but the greatest likelihood would occur occasionally during more intensive/shorter periods of peak construction. The impact magnitude is considered to be **Small**, as the Project is not expected to create a significant increase in the population and the non-locals would be small in comparison to the local workforce. The sensitivity of receptors (workers and local community members) is considered to be **High.** At a national and district level, there is evidenced vulnerability of the population at large to the spread of STIs and especially illness and death cause by HIV and AIDS. Women in particular are disproportionately vulnerable due to the potential to be drawn to exchange sexual favours for monetary or other economic incentives. As a result, the impact significance is assessed to be **Moderate** (Table 6-32).

Table 6-32: Assessment of Increase in STI/HIV Transmission Impacts during Construction.

Impact	Increase in STI/HIV Transmission	
Impact Nature	Negative	Positive
	An increase in STI/HIV transmission would be negative.	
Impact Type	Direct	Indirect
	The impact would be indirect, as it can result as a follow on effect of an increase of people in the Project Area in combination with young women perceiving this increase as an economic opportunity.	

Impact	Increase in STI/HIV Transmission				
Impact Duration	Temporary	Short Term	Long Term	Permanent	
	The impact would be restricted to construction (approximately 10 months).				
Impact Extent	Limited	Local	Regional	Transboundary	
	The impact would likely only affect neighbouring communities.				
Frequency	Remote	Rare	Occasional	Often	Constant
	The impact would be present throughout construction, but is only predicted to occur occasionally or rarely during more intensive/shorter periods of peak construction.				
Likelihood	Unlikely	Possible	Certain		
	The impact in considered to be possible.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
	Based on the above, the impact magnitude is considered to be small, as the Project is not expected to create a significant increase in the population and the non-locals would be small in comparison to the local workforce.				
Resource/ Receptor Vulnerability	Low	Medium	High		
	The sensitivity of receptors (workers and local community members) is considered to be high, as there is evidenced vulnerability of the population at large to the spread of STIs and especially illness and death cause by HIV and AIDS. Women in particular are disproportionately vulnerable due to the potential to be drawn to exchange sexual favours for monetary or other economic incentives.				
Impact Significance	**Negligible**	**Minor**	**Moderate**	**Major**	
	Based on the small impact magnitude and the high sensitivity of receptors, the impact significance is assessed to be moderate.				

6.4.12.4 Mitigation Measures

The measures listed below will be implemented to mitigate the Project's STI/HIV transmission impacts.

- An STI/HIV Management Plan will be developed and implemented. The plan will include the following measures:
  - STI and HIV prevention training to all employees, through workshops, posters, and informal information sessions;

- Medical examinations to determine level of health; workers should also be encouraged to determine their HIV status;
- Supply of condoms at the construction site;
- Development of a Code of Conduct and/or rules for worker-community interaction and onsite behaviour; and
- Support to workers and affected communities to access treatment for STIs, particularly HIV/AIDS, through existing health facilities or NGO campaigns or programmes.

- A women's NGO that is addressing gender and GBV issues in Golomoti and in Project affected communities will be supported to raise awareness of such issues and to encourage prevention.
- Work camp control protocols, while respecting freedom of movement, will be put in place to limit the interactions between non-local workers and the local community
- GBV and sexual abuse will be monitored through general stakeholder engagement and grievance management.

6.4.12.5 Residual Impact Significance

With the implementation of the mitigation measures listed above, the residual impact significance is anticipated to be **Negligible** (Table 6-33).

Table 6-33: Pre and Post Mitigation STI/HIV Transmission Impacts.

Impact	Project Phase	Impact Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Increase in STI/HIV Transmission	Construction	Moderate	Negligible

6.4.13 Community Safety and Security

This assessment identifies potential impacts of the Project on community safety and security. Impacts would primarily occur in the construction phase and result in increased safety risks for communities in the Project Area.

6.4.13.1 Summary of Baseline Conditions

Villages in the Project Area are generally considered to be very safe, and there is no known past conflicts or significant safety or security issues. Security incidents in the Project Area are infrequent and limited to minor theft, including theft of livestock. Though not totally accustomed to major construction activity, the local communities do live near the trading centre and just off a main road, as well as in close proximity to the Golomoti Substation, so they are accustomed to vehicular traffic and possible related safety risks.

6.4.13.2 Potential Impacts: Construction and Operation

Project safety hazards may arise from the presence of construction equipment and activities, infrastructure, and traffic. The presence of such equipment and infrastructure may trigger risk/temptation of theft due to high levels of poverty in communities in the Project Area. Incidents may also arise as a result of worker-community interactions with security guards or other staff, influx, and perceptions that other people are benefitting from the Project more than others, especially PAPs receiving significant sums of money for their lands, causing tension among communities.

During operation, security risks are potentially associated with the presence of the Project including the Transmission Line, which could pose a threat to trespassers if they attempt to encroach on the solar farm to steal panels or attempt to connect to the Transmission Line.

6.4.13.3 Assessment of Impact: Construction

A potential decrease in community safety and security would be short term, occurring during construction (approximately 10 months). The impact would be restricted to the Project Area, impacting neighbouring villages. The impact would be present throughout construction, but incidents are likely to occur occasionally. Given the general safe current environment in the communities and nature of construction needs for a solar plant, the impact is unlikely. The impact magnitude is therefore considered to be **Small**. The sensitivity of receptors (local community members) is considered to be **Medium** for safety and security impacts**.** As a result, the impact significance is assessed to be **Minor** (Table 6-34).

Table 6-34: Assessment of Community Safety and Security Impacts during Construction.

Impact	**Decreased Community Safety and Security**				
Impact Nature	Negative		Positive		
	Decreased community safety and security would be negative.				
Impact Type	Direct		Indirect		
	The impact would be a direct result of Project activities (presence of equipment and infrastructure, traffic).				
Impact Duration	Temporary	Short Term	Long Term	Permanent	
	The impact would be short term, occurring during construction (approximately 10 months).				
Impact Extent	Limited	Local	Regional	Transboundary	
	The impact would likely only affect neighbouring communities.				
Frequency	Remote	Rare	Occasional	Often	Constant

Impact	Decreased Community Safety and Security				
	The impact would be present throughout construction, but incidents are likely to occur occasionally.				
Likelihood	Unlikely	Possible	Certain		
	Given the general safe current environment in the communities and nature of construction needs for a solar plant, the impact may occur but is unlikely.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
	Based on the above, the impact magnitude is considered to be small.				
Resource/ Receptor Vulnerability	Low	Medium	High		
	The sensitivity of receptors (local community members) is considered to be medium for safety and security impacts.				
Impact Significance	**Negligible**	**Minor**	**Moderate**	**Major**	
	Based on the small impact magnitude and the medium sensitivity of receptors, the impact significance is assessed to be minor.				

6.4.13.4 Assessment of Impacts: Operation

The impact would be the same as during construction, except that it would be indirect and long term (occurring throughout operations). The impact magnitude is therefore considered to be **Small**. The sensitivity of receptors (local community members) is considered to be **Medium** for safety and security impacts**.** As a result, the impact significance is assessed to be **Minor** (Table 6-35).

Table 6-35: Assessment of Community Safety and Security Impacts during Operation.

Impact	Decreased Community Safety and Security			
Impact Nature	Negative	Positive		
	Decreased community safety and security would be negative.			
Impact Type	Direct	Indirect		
	Security and safety risk are associated with the presence of the solar farm and the transmission lines, which may create temptations to trespass onto the site or attempt to connect to the transmission line. This impact would be indirect.			
	Temporary	Short Term	Long Term	Permanent

Impact	Decreased Community Safety and Security				
Impact Duration	The impact would be long term, occurring throughout operation (20 years).				
Impact Extent	Limited	Local	Regional	Transboundary	
	The impact would likely only affect neighbouring communities.				
Frequency	Remote	Rare	Occasional	Often	Constant
	The impact would be present throughout operation, but incidents are likely to occur occasionally or rarely.				
Likelihood	Unlikely	Possible	Certain		
	Given that there are not major security concerns at present in the community and that once constructed the site is geographically contained in a single area, safety and security impacts may occur but are unlikely.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
	Based on the above, the impact magnitude is considered to be small.				
Resource/ Receptor Vulnerability	Low	Medium	High		
	The sensitivity of receptors (local community members) is considered to be medium for safety and security impacts.				
Impact Significance	**Negligible**	**Minor**	**Moderate**	**Major**	
	Based on the small impact magnitude and the medium sensitivity of receptors, the impact significance is assessed to be minor.				

6.4.13.5 Mitigation Measures

Construction

The measures listed below will be implemented to mitigate the Project's community safety and security impacts during construction.

- Security personnel will be trained in safeguarding the community in high tension situations such as any type of protest or community conflicts. This will include training on human rights concepts and include information on local resources that could assist in such situations such as the GVH and TA.
- Security measures will be implemented to minimise safety risks and the possibility of theft in construction and storage areas.
- Clear and visible signage will be established in construction areas to warn the community of any risks and hazards and other engagement/communication efforts

will be employed to ensure community members are aware of safety risks, as needed.

- Security personnel will not carry firearms and will comply with Malawian laws and regulations as well as the requirements of the Voluntary Principles on Security and Human Rights. Security procedures will include selection of personnel based on a careful background screening and monitoring of performance.
- A community engagement programme will be established to provide information about safety hazards and raise awareness of how these are being managed. This includes visits to neighbouring communities and local schools.
- Community awareness will be raised regarding the Project's Community Grievance Mechanism to address community concerns and issues in a timely manner to avoid issues escalating. This will include the use of the CLO, who will be present around the Project Site before and during construction.

Operation

The measures listed below will be implemented to mitigate the Project's community safety and security impacts during operation.

- The solar farm will be fenced and have security personnel present at all times to avoid trespassers entering the site.
- Security personnel will not carry firearms and will comply with Malawian laws and regulations as well as the requirements of the Voluntary Principles on Security and Human Rights. Security procedures will include selection of personnel based on a careful background screening and monitoring of performance.
- Clear and visible signage will be established in hazardous areas to warn the community of any risks and hazards and engagement/communication efforts will be employed to ensure community members are aware of safety risks, as needed.

6.4.13.6 Residual Impact Significance

With the implementation of the mitigation measures listed above, the residual impact significance is anticipated to be **Negligible** during both construction and operation (Table 6-36).

Table 6-36: Pre and Post Mitigation Community Safety and Security Impacts.

Impact	Project Phase	Impact Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Decrease in Community Safety and Security	Construction	Minor	Negligible
Decrease in Community Safety and Security	Operation	Minor	Negligible

6.4.14 Labour and Working Conditions

This assessment identifies potential impacts on workers from the working conditions they will experience. Impacts would occur in the construction and the operation phase and result in increased health and safety risks for workers. Please note that occupational health and safety issues are also covered in this section.

6.4.14.1 Summary of Baseline Conditions

According to the 2018 Malawi Human Rights Country Report, the main human rights issues prevalent in the country include some labour-related issues, such as:

- Rights in relation to establishing unions and collective bargaining in the informal sector;
- Forced labour, including children subjected to domestic servitude and other forms of forced labour including rural/agricultural labour;
- Child labour, including worst forms, where children often receive low or no wages with as many as 38% of children aged 5-17 engaged in some form of child labour;
- Discrimination in employment and occupation with respect to gender and disability; and
- Acceptable conditions of work, including minimum wages, working hours, and occupational health and safety.[51]

Regardless of these issues, Malawi has ratified all eight of the core International Labour Organisation Conventions listed below.[52]

- C029 - Forced Labour Convention, 1930 (No. 29), 19 Nov 1999.
- C087 - Freedom of Association and Protection of the Right to Organise Convention, 1948 (No. 87), 19 Nov 1999.
- C098 - Right to Organise and Collective Bargaining Convention, 1949 (No. 98), 22 Mar 1965.
- C100 - Equal Remuneration Convention, 1951 (No. 100), 22 Mar 1965.
- C105 - Abolition of Forced Labour Convention, 1957 (No. 105), 19 Nov 1999.
- C111 - Discrimination (Employment and Occupation) Convention, 1958 (No. 111), 22 Mar 1965.
- C138 - Minimum Age Convention, 1973 (No. 138), Minimum age specified: 14 years, 19 Nov 1999.
- C182 - Worst Forms of Child Labour Convention, 1999 (No. 182), 19 Nov 1999.

Enforcement of labour laws and the ILO conventions is the biggest challenge in regard to labour and working conditions.

[51] US Department of State. Malawi Human Rights Report 2018. Available at https://www.state.gov/documents/organization/289227.pdf (accessed March 2019)

[52] International Labour Organisation. Available at https://www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:11200:0::NO::P11200_COUNTRY_ID:103101 (accessed July 2018)

6.4.14.2 Potential Impact: Construction and Operation

Issues regarding labour and working conditions in Malawi include long working hours, noncompliant wages, gender discrimination, and child labour. If not properly managed, these issues could affect the Project workforce, mainly during construction, and the local communities within the Project Area who are highly vulnerable due to low levels of education and high levels of poverty. In addition, workers have the ability to protest if they perceive working conditions to be unsatisfactory, which could create delays to the Project, reputational risk, and poor worker relationships.

Poor occupational health and safety can cause injuries and even fatalities if not managed, as well affect relationships with the workforce. During construction, activities may include intensive manual labour, the operation of heavy equipment and trucks, working at heights, working in confined spaces, construction traffic, use of electrical devices, handling of hazardous materials, and other hazardous activities. Due to the nature of the activities being undertaken during construction, worker health and safety is a key risk, with the potential for accidents that may result in injuries and fatalities as well as work stoppages. It is anticipated the portion of skilled workers coming from outside the local area for construction activities (approximately 30-35% of the construction phase workforce) will be housed in a controlled camp on the worksite, and thus there is a risk of poor worker accommodation standards.

Activities during operation and regular maintenance activities could include hazardous activities such as the operation of heavy equipment and trucks, working on electrical devices including high voltage, working at heights, maintenance of high pressure pipework and vessels, and handling of hazardous materials. During these activities, workers may be at risk for accidents and injury. Other non-hazardous routine maintenance activities will also be a part of operations phase such as vegetation management, cleaning of panels and site security.

6.4.14.3 Assessment of Impact: Construction

Potential poor labour and working conditions would be long term, and constant during construction (approximately 10 months). The impact would be restricted to the Project Site, impacting workers. The impact is possible, given the generally poor status of labour and working conditions in the country and given that hazardous activities are involved in the construction of the Project. The impact magnitude is considered to be **Small**, as the workforce will comprise approximately 200 people during construction. The sensitivity of receptors (workers) is considered to be **High**, given low levels of education, lack of formal wage-earning opportunities, and high levels of poverty, which could make potential workers prone to accepting poor labour and working conditions, especially the most vulnerable people in the community such as the very poor, women, and some children**.** Likewise, non-local workers housed in the work camp may feel limited in their ability to demand better housing conditions if these prove inadequate. As a result, the impact significance is assessed to be **Moderate** (Table 6-37).

Table 6-37: Assessment of Labour and Working Conditions Impacts during Construction.

Impact	Poor Labour and Working Conditions	
Impact Nature	Negative	Positive

Impact	Poor Labour and Working Conditions				
	Poor labour and working conditions are negative. Discrimination and non-compliant labour and working conditions have the ability to create delays to the Project, cause reputational risk, and create poor worker relations. In addition, poor occupational health and safety can cause injury or fatalities.				
Impact Type	Direct		Indirect		
	The impact would be a direct result of Project activities (presence of equipment and infrastructure, traffic).				
Impact Duration	Temporary	Short Term	Long Term	Permanent	
	The impact would be long term, occurring during construction (approximately 10 months).				
Impact Extent	Limited	Local	Regional	Transboundary	
	The impact would be restricted to the Project Site.				
Frequency	Remote	Rare	Occasional	Often	Constant
	The impact would be constant during the construction phase.				
Likelihood	Unlikely	Possible	Certain		
	The impact is possible, given the generally poor status of labour and working conditions in the country and given that hazardous activities are involved in the construction of the Project.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
	The impact magnitude is considered to be small, as the workforce would comprise approximately 200 people during construction.				
Resource/ Receptor Vulnerability	Low	Medium	High		
	The sensitivity of receptors (workers) is considered to be high, given low levels of education, lack of formal wage-earning opportunities, and high levels of poverty, which could make potential workers prone to accepting poor labour and working conditions, especially the most vulnerable people in the community such as the very poor, women, and some children. Likewise, non-local workers who may come from countries other than Malawi may be vulnerable to poor labour and working conditions due to their non-local status and limited ability to seek other employment.				
	Negligible	**Minor**	**Moderate**	**Major**	

Impact	Poor Labour and Working Conditions
Impact Significance	Based on the small impact magnitude and the high sensitivity of receptors, the impact significance is assessed to be moderate.

6.4.14.4 Assessment of Impacts: Operation

During the operations phase, the workforce will be greatly reduced to approximately 20 workers. These workers will be direct employees of JCM, and almost entirely skilled labourers. Regular operation and maintenance activities may still include some hazardous activities (high voltage electrical work, working at heights, etc.), but are less manual labour intensive and include general site maintenance tasks that are not high risk (such as vegetation management and the cleaning of panels). The impact magnitude is considered **Small** as the workforce is limited to just approximately 20 workers, and the work will become less frequent, as most will not need to be on site regularly. Receptor vulnerability is considered **Medium** given that these workers are skilled and directly employed by JCM they are expected to have reasonable levels of education and/ or technical training and employment opportunity, and thus less prone to accept poor labour and working conditions.

As a result, the impact significance is assessed to be **Minor** (Table 6-38).

Table 6-38: Assessment of Labour and Working Conditions Impacts during Operation.

Impact	Poor Labour and Working Conditions				
Impact Nature	Negative		Positive		
	Poor labour and working conditions are considered negative. Hazardous/risky operations activities can pose health and safety risks that can cause injury or fatalities.				
Impact Type	Direct		Indirect		
	The impact would be a direct result of Project operation activities (e.g. working on high-voltage electrical equipment)				
Impact Duration	Temporary	Short Term	Long Term	Permanent	
	The impact would be short term, given that operations activities will not be needed constantly during the 20 year operation period.				
Impact Extent	Limited	Local	Regional	Transboundary	
	The impact would be restricted to the Project Site.				
Frequency	Remote	Rare	Occasional	Often	Constant
	The impact would be often, or perhaps even occasional, given the need for workers and site maintenance is greatly reduced during operations				

Impact	Poor Labour and Working Conditions				
Likelihood	Unlikely	Possible	Certain		
	The impact is possible, given the generally poor status of labour and working conditions in the country and given that hazardous activities are still involved in the operation of the Project.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
	The impact magnitude is considered to be small, as the workforce would comprise approximately 20 workers during operation.				
Resource/ Receptor Vulnerability	Low	Medium	High		
	The sensitivity of receptors (workers) is considered to be medium, given that operations phase workers will be direct employees of JCM and generally will be skilled workers with some education and/or technical training and are likely to have the ability to pursue other economic opportunities if desired.				
Impact Significance	**Negligible**	**Minor**	**Moderate**	**Major**	
	Based on the small impact magnitude and the medium sensitivity of receptors, the impact significance is assessed to be moderate.				

6.4.14.5 Mitigation Measures

Construction

The measures listed below will be implemented to mitigate the Project's labour and working conditions impacts during construction.

- A Human Resources Policy will be developed, which will include a Labour and Employment Plan and Worker Grievance Mechanism. These will also be reflected in sub-contractor contracts. Key issues within Human Resources (HR) management and contracts will include:
  - Provision of clear and understandable information regarding rights under national labour and employment law, and any applicable collective agreements, including those related to hours of work, wages, overtime, and compensation;
  - Provision of reasonable working conditions and terms of employment;
  - Provision of adequate accommodation (if relevant);
  - Provision of employment, compensation/remuneration, and working conditions, including working hours, equal opportunity and fair treatment, and prohibition of discrimination;
  - Non-discrimination in all aspects of labour recruitment, management and exit;
  - Implementation of a Worker Grievance Mechanism for Project workers (including sub-contractors);

- Adoption and implementation of a sexual harassment policy; and
- Freedom of association.

- A Gender Development Plan will be prepared to promote gender equality in job opportunities and the elimination of gender-based violence, as well as to address other gender-related issues within the workforce and Project-affected communities.
- Contractors will be supported in adhering to labour and working conditions in compliance with Malawian labour laws and in alignment with IFC PS 2 through awareness training and information provision, as necessary.
- A fair and transparent worker Grievance Mechanism will be developed and implemented. It will be accessible to all workers, whether permanent or temporary, or directly or indirectly employed. The grievance mechanism will be open to the EPC Contractor and subcontractor workforce in the event that their grievance is not adequately resolved by their direct employer.
- The contractor and supplier selection process will ensure that performance with regards to worker management, worker rights, and health and safety as outlined in Malawian law and international standards will be managed and reported.
- Regular checks of contractors will be undertaken to ensure compliance with applicable labour laws.
- A health and safety programme will be developed that includes risk assessments (e.g., working at heights, confined space, machine guarding), work permit systems, and a H&S management system, in line with industry best practice, including worker performance safety tracking (safety observations) to assure worker safety. Workers will receive induction and regular training regarding this system.
- A hiring mechanism will be established to ensure no employee or job applicant is discriminated against on the basis of gender, marital status, nationality, ethnicity, age, religion, or sexual orientation.
- Workers (including contractors and subcontractors) will, as part of their induction, receive training on worker rights in compliance with Malawian legislation and in alignment with international standards.
- Workers (including contractors and subcontractors) will have contracts that clearly state the terms and conditions of their employment and their legal rights. Contracts will be verbally explained to workers in their native language when necessary for them to understand their rights. Contracts must be in place prior to workers leaving their home location, if applicable.
- Workers (including contractors and subcontractors) will have access to training on communicable diseases, STIs, and community interactions in general. This training will be developed in collaboration with local health institutions and local NGOs, if feasible.

Operation

The measures listed below will be implemented to mitigate the Project's labour and working conditions impacts during operation.

- The Human Resources Policy, Labour and Employment Plan, and Worker Grievance Mechanism developed for construction will continue to be implemented.
- The Gender Development Plan developed for construction will continue to be implemented during operation.
- Contractors will be supported in adhering to labour and working conditions in compliance with Malawian labour laws and in alignment with IFC PS 2 through awareness raising and information provision, as necessary.
- The Worker Grievance Mechanism developed for construction will continue to be implemented

6.4.14.6 Residual Impact Significance

With the implementation of the mitigation measures listed above, the residual impact significance is anticipated to be **Minor** during construction and negligible during operation (Table 6-39).

Table 6-39: Pre and Post Mitigation Labour and Working Conditions Impacts.

Impact	Project Phase	Impact Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Poor Labour and Working Conditions	Construction	Moderate	Minor
Poor Labour and Working Conditions	Operation	Minor	Negligible

6.4.15 Cultural Heritage

This assessment identifies potential Project impacts to cultural heritage. Based on the results of the cultural heritage baseline study, the Project would cause direct impacts to archaeological and living heritage resources. Construction and operation of the Project would also result in indirect impacts due to changes in the physical environment or “setting” of living heritage resources near the Project Site.

6.4.15.1 Summary of Baseline Conditions

The cultural heritage baseline study identified 26 individual cultural heritage resources within the Solar Plant Site: 22 archaeological finds, one historic school site, and three baobab trees. Seventeen of the 22 archaeological finds are interpreted as representing one, approximately 600 x 200 m archaeological site, with the remaining five isolated artefact finds likely associated with the site. The three baobab trees are locally significant living heritage resources due to their role in local traditions, oral history, folklore, and, in one case, a potential burial site. The M’Bisa cave site identified during the baseline study is located on the south side of the hills near the Project Area, but the Solar Plant Site would not be visible from the cave.

The cultural heritage resources identified during the baseline study that could be subject to direct or indirect Project impacts have been grouped into the following two

cultural heritage resources: the archaeological site and five associated isolated finds; and one of the three baobab tree living heritage sites.

The historic school house site is not considered in the impact assessment. Interviews with local stakeholders and the field survey determined that, while members of the local community remember using the site, they did not state it had any historical or cultural significance. During the field survey, the field team was able to locate the site but determined there were no structural remains of the former shelter.

The M'Bisa cave site is not considered in the impact assessment because through follow-up stakeholder engagement interviews ERM determined that the Project would not be visible from the cave site. A review of the Project layout and cultural heritage survey results determined that one of the baobab living heritage sites, the tree called Saimba Nluzu by the local population, is not located within the Solar Plant Site. As a result, ERM does not anticipate that the tree would be subject to direct impacts. Local tradition states that individuals should avoid this tree and if they pass by it they should remain quiet. Since the local population avoids the tree and does not use it for traditional activities or religious ceremonies/rituals, ERM does not anticipate that construction of the solar plant would indirectly impact the cultural value or use of the tree.

As discussed in Section 6.4.5.2, the original Project design required removal of two baobab trees, Mchiza Alendo and the unnamed tree with a possible burial. Due to their protected status and cultural value, JCM applied the mitigation hierarchy by conducting an alternative analysis to determine if the two baobab trees could be avoided/protected while still fulfilling Project objectives for electricity production. The alternative analysis indicated that one of the two trees, Mchiza Alendo, could be avoided by moving panels to an alternate location within the Project Site. The alternative analysis determined that the other baobab tree, the unnamed tree with a possible burial, could not be avoided without significantly diminishing the Project's electricity production, as it is located in the centre of the solar panel array (Appendix I). As a result, the Project will now only impact the unnamed baobab tree.

6.4.15.2 Potential Impacts: Construction

Construction of the proposed Project would require extensive ground disturbing activities within the Solar Plant Site. Examples of ground disturbing activities with the potential to impact the archaeological and living heritage resources in the Solar Plant Site include vegetation clearance, grading or levelling the site, excavation of cable trenches, ramming or drilling mounting structure frames, and other infrastructure and facility construction. These activities would likely result in the removal of one baobab tree living heritage site and the partial or complete destruction of the archaeological site and associated isolated finds.

Construction activities within the Solar Plant Site would also temporarily alter the setting of the cave site overlooking the Solar Plant Site by the introduction of new visual elements to the landscape (i.e., construction equipment and facilities) as well as increased noise from construction activities. These temporary, indirect impacts are considered relatively low to the impacts to the setting of the cave resource during Project operation.

6.4.15.3 Assessment of Impacts: Construction

Damage to Archaeological Resources

Damage to the archaeological site identified within the Solar Plant Site would be permanent. The impact would be restricted to a portion of the Solar Plant Site. The impact would occur once but result in the permanent loss of the resource. The impact would be certain, as ground-disturbing activities within the archaeological site would be required by construction. Due to the complete loss of the resource, the impact magnitude is considered to be **Large**. The archaeological resource is not a protected monument at the local or national level and, based on the number of similar Iron Age sites found across Malawi, meets the criteria for replicable cultural heritage under IFC PS 8.[53] The sensitivity of the resources is therefore considered to be **Low**. As a result, the impact significance is assessed to be **Moderate** (Table 6-40).

Table 6-40: Assessment of Damage to Archaeological Resources Impacts during Construction.

Impact	Damage to Archaeological Site				
Impact Nature	Negative			Positive	
	Partial to complete destruction of the archaeological site in the Solar Plant Site would be negative.				
Impact Type	Direct			Indirect	
	The impact would be a direct impact of construction activities (site clearance and other ground disturbing activities).				
Impact Duration	Temporary	Short Term	Long Term	Permanent	
	The impact would be permanent due to the removal of the archaeological site during construction.				
Impact Extent	Limited	Local	Regional	Transboundary	
	The Impact would be limited to the Solar Plant Site.				
Frequency	Remote	Rare	Occasional	Often	Constant
	The impacts would occur once but result in the permanent loss of all or part of the resource.				
Likelihood	Unlikely		Possible	Certain	

[53] "Replicable cultural heritage is defined as tangible forms of cultural heritage that can themselves be moved to another location or that can be replaced by a similar structure or natural features to which the cultural value can be transferred by appropriate measures. Archaeological or historical sites may be considered replicable where the particular eras and cultural values they represent are well represented by other sites and/or structures" (IFC Performance Standard 8, Footnote 3).

Impact	Damage to Archaeological Site				
	Ground disturbing activities within the 600 x 200 m area of the archaeological site would be required during construction.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
	Due to the complete loss of the resource, the impact magnitude would be large.				
Resource/ Receptor Vulnerability	Low	Medium	High		
	The archaeological resource is not a protected monument at the local or national level and, based on the number of similar Iron Age sites found across Malawi, meets the criteria for replicable cultural heritage under IFC PS 8. It does, however, meet the legal definition of a “monument” under the Monuments and Relic Act (1990) and could be eligible for local or national protection. If the site is intact it could contain valuable scientific information about the Iron Age in Malawi.				
Impact Significance	**Negligible**	**Minor**	**Moderate**	**Major**	
	Based on the large impact magnitude and the low sensitivity of the resource, the impact significance is assessed to be moderate.				

Loss of Baobab Tree

Damage to the baobab tree identified as cultural heritage within the Solar Plant Site would be permanent. The impact would be restricted to a small portion of the Solar Plant Site. The impact would occur once but result in the permanent loss of the resources. The impact would be certain, as vegetation removal within the Solar Plant Site would be required by construction. Due to the complete loss of the resource, the impact magnitude is considered to be **Large**. The baobab tree is not a protected monument at the local or national level and, based on the number of similar resources found across Malawi, meets the criteria for replicable cultural heritage under IFC PS 8. Stakeholder interviews do not suggest the tree is used on a regular basis for ritual or other traditional practices. The tree is part of local traditions, oral histories, and folklore and appears to serve as a historic site, a possible burial site, and a significant point within the local cultural landscape. The sensitivity of the resource is therefore considered to be **Medium**. As a result, the impact significance is assessed to be **Moderate** (Table 6-41).

Table 6-41: Assessment of Loss of Baobab Tree Impacts during Construction.

Impact	Loss of Baobab Tree	
Impact Nature	Negative	Positive
	Removal of the baobab tree living heritage resource would be negative.	

Impact	Loss of Baobab Tree			
Impact Type	Direct		Indirect	
	The impact would be a direct result of construction activities (site clearance).			
Impact Duration	Temporary	Short Term	Long Term	Permanent
	The impact would be permanent due to the removal of the baobab tree during vegetation removal.			
Impact Extent	Limited	Local	Regional	Transboundary
	The impact would be limited to the Solar Plant Site.			
Frequency	Remote	Rare	Occasional	Often	Constant
	The impact would occur once but result in the permanent loss of the baobab tree.				
Likelihood	Unlikely	Possible	Certain	
	Vegetation removal would require the removal of the baobab tree.			
Impact Magnitude	Positive	Negligible	Small	Medium	Large
	Due to the complete loss of the resource, the impact magnitude would be large.				
Resource/ Receptor Vulnerability	Low	Medium	High	
	The baobab tree is not a protected monument at the local or national level and, based on the number of similar resources found across Malawi, meets the criteria for replicable cultural heritage under IFC PS 8. Stakeholder interviews do not suggest the tree is used on a regular basis for ritual or other traditional practices. The tree is part of local traditions, oral histories, and folklore and appears to serve as a historic sites, a possible burial site, and a significant points within the local cultural landscape.			
Impact Significance	**Negligible**	**Minor**	**Moderate**	**Major**
	Based on the large impact magnitude and the medium sensitivity of the resource, the impact significance is assessed to be moderate.			

6.4.15.4 Mitigation Measures

The measures listed below will be implemented to mitigate the Project's cultural heritage impacts:

- Additional, limited archaeological excavations will be conducted within the boundaries of the archaeological site identified in the Solar Plant Site. The purpose

of these excavations will be to evaluate the integrity and potential significance of the site and to determine, in consultation with the MITC and the Chief Antiquities Officer, if additional archaeological excavations are warranted. Investigations at the site will be done in consultation with the MITC and Chief Antiquities Officer and with required government-issued permits and approvals.

- Additional stakeholder engagement will be conducted with the local community to develop a plan to transfer the cultural significance/value of the baobab tree living heritage site to another location, if feasible, or otherwise compensate for the loss of this resource.
- A Chance Find Procedure (CFP) will be developed and implemented. The CFP will set for the procedures to implement in the event that archaeological resources are encountered during ground disturbing activities. Workers will be trained in identifying chance finds and implementing the CFP.

6.4.15.5 Residual Impact Significance

With the implementation of the mitigation measures listed above, the residual impact significance is anticipated to be **Minor** for both the archaeological site and baobab tree (Table 6-42).

Table 6-42: Pre and Post Mitigation Cultural Heritage Impacts.

Impact	Project Phase	Impact Significance (Pre-mitigation)	Residual Impact Significance (Post-mitigation)
Damage to Archaeological Resources	Construction	**Moderate**	**Minor**
Loss of Baobab Tree	Construction	**Moderate**	**Minor**

6.4.16 Unplanned Events: Soil and Groundwater Impacts from Spill Events and Improper Disposal of Waste

6.4.16.1 Summary of Baseline Conditions

Baseline conditions are summarized for soils in Section 6.4.3.1 and for groundwater in Section 6.4.4.1.

6.4.16.2 Potential Impacts

Spills and improper disposal of waste have the potential to affect terrestrial environments and could lead to the deterioration of soil and groundwater quality. This could lead to impacts on flora and fauna and local community users.

During construction, there is the potential for spills of fuels and oils during construction activities, fuelling, maintenance of machinery and vehicles, and improper waste storage and disposal. Spills/improper disposal of waste could occur within the Project footprint resulting in soil and groundwater degradation.

During operation of the Project, there is the potential for improper waste storage and disposal (for example of broken panels).

6.4.16.3 Assessment of Impacts

Accidental Spills and Improper Disposal of Waste to Soils

The impact of spill events and improper disposal of waste to soils would be long term due to remediation time expected for contaminated soils. The impact would be limited to the Project Site. Spills are most likely to occur during refilling and transportation of substances. There would be no large-scale storage of fuels or chemicals on the Project Site. Large releases of hazardous materials would therefore be rare and it is considered unlikely that a spill of emergency scale would occur. Improper disposal of waste can occur throughout the construction phase if appropriate disposal measures are not put in place. The impact magnitude is therefore considered to be **Small**. The sensitivity of the resource is considered to be **High** due to the importance of soil quality in the agricultural economy of the Project Area and the low permeability of the clayey soils across the Project Site. As a result, the impact significance is assessed to be **Moderate** (Table 6-43).

Table 6-43: Assessment of Accidental Spills and Improper Disposal of Waste to Soils Impacts.

Impact	**Accidental Spills to Soils**				
Impact Nature	Negative		Positive		
	Accidental spills and improper disposal of waste to soils would negative.				
Impact Type	Direct		Indirect		
	The impact would be a direct result of Project activities (spillage during maintenance of machinery, improper storage of hazardous materials, spillage during transfers of fuel, improper disposal of waste).				
Impact Duration	Temporary	Short Term	Long Term	Permanent	
	The impact would be long term due to remediation time expected for contaminated soils.				
Impact Extent	Limited	Local	Regional	Transboundary	
	The impact would be limited to the Project Site.				
Frequency	Remote	Rare	Occasional	Often	Constant
	Not Applicable.				
Likelihood	Unlikely	Possible	Certain		

Impact	Accidental Spills to Soils				
	The impact is unanticipated and the likelihood is therefore small.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
	Based on the above, the impact magnitude is considered to be small.				
Resource/ Receptor Vulnerability	Low	Medium	High		
	The sensitivity of the resource is considered to be high due to the importance of soil quality in the agricultural economy of the Project Area and the low permeability of the clayey soils across the Project Site.				
Impact Significance	**Negligible**	**Minor**	**Moderate**	**Major**	
	Based on the small impact magnitude and the high sensitivity of the resource, the impact significance is assessed to be moderate.				

Accidental Spills and Improper Disposal of Waste to Groundwater

The impact of spill events and improper disposal of waste to groundwater would be long term due to remediation time expected for contaminated groundwater. The impact would be limited to the Project Area. Spills are most likely to occur during refilling and transportation of substances. There would be no large-scale storage of fuels or chemicals on the Project Site except for a 22,000 l Above-ground Storage Tank (AST). Large releases of hazardous materials would therefore be rare and it is considered unlikely that a spill would occur of emergency scale. Improper disposal of waste can occur throughout the construction phase if appropriate disposal measures are not put in place. Due to the larger impact extent (local vs. limited), the impact magnitude is considered to be **Medium**. The sensitivity of the resource is considered to be **High** due to the importance of groundwater to neighbouring communities. As a result, the impact significance is assessed to be **Major** (Table 6-44).

Table 6-44: Assessment of Accidental Spills and Improper Disposal of Waste to Groundwater Impacts.

Impact	Accidental Spills to Groundwater	
Impact Nature	Negative	Positive
	Accidental spills and improper disposal of waste to groundwater would negative.	
Impact Type	Direct	Indirect
	The impact would be a direct result of Project activities (spillage during maintenance of machinery, improper storage of hazardous materials, spillage during transfers of fuel, improper disposal of waste).	

Impact	Accidental Spills to Groundwater				
Impact Duration	Temporary	Short Term	**Long Term**	Permanent	
	The impact would be long term due to remediation time expected for contaminated groundwater.				
Impact Extent	Limited	**Local**	Regional	Transboundary	
	The impact would be limited to groundwater in the Project Area.				
Frequency	Remote	Rare	Occasional	Often	Constant
	Not Applicable.				
Likelihood	**Unlikely**	Possible	Certain		
	The impact is unanticipated and the likelihood is therefore small.				
Impact Magnitude	Positive	Negligible	Small	**Medium**	Large
	Based on the above, the impact magnitude is considered to be medium.				
Resource/ Receptor Vulnerability	Low	Medium	**High**		
	The sensitivity of the resource is considered to be high due to the importance of groundwater to neighbouring communities.				
Impact Significance	**Negligible**	**Minor**	**Moderate**	**Major**	
	Based on the medium impact magnitude and the high sensitivity of the resource, the impact significance is assessed to be major.				

6.4.16.4 Preventive Measures

The measures listed below will be implemented to prevent the Project's unanticipated soil and groundwater impacts from spill events and improper disposal of waste.

- A Hazardous Spill Response Plan will be developed and spill clean-up and response capability adequate for addressing spills for all phases of the Project will be maintained. Spills will be immediately contained and cleaned up. Contaminated areas will be remediated.
- A Waste Management Plan will be developed and implemented.
- Refuelling of equipment and vehicles will be carried out in a designated area (the AST) on hard standing ground to prevent seepage of any spills into the ground. Collection systems will be installed in these areas to manage any spills. Fuels will be collected and either reused or removed by a local contractor. Drip trays will be used when refuelling and servicing vehicles or equipment where there is no hard standing surface.

- Hazardous material storage will be on hard standing and impermeable surface and the storage facility will be bunded. The storage and handling of hazardous materials and fuels will be restricted to bunded areas of sufficient capacity to contain a release.

6.4.16.5 Residual Impact

With the implementation of the preventive measures listed above, the residual impact is reduced to acceptable levels.

6.4.17 Unplanned Events: Traffic Accidents

6.4.17.1 Summary of Baseline Conditions

Baseline conditions are presented in Section 2.6.

6.4.17.2 Potential Impacts

Increased traffic and presence of heavy vehicles on local roads as a result of Project development increases the risk of road traffic accidents involving members of the community. A significant number of trucks would be needed during construction to transport construction equipment (materials, sand, soil, waste) and solar PV components to and from the Project Site. Operational traffic movements would be very low.

6.4.17.3 Assessment of Impacts

The impact of vehicle accidents would be short term, occurring during construction (approximately 10 months). The impacts would be regional, as vehicle accidents could occur along construction and delivery routes. The increased traffic volumes as result of the Project would increase the risk of potential vehicle accidents. The likelihood is possible due to the increase in traffic volume and the current poor state of roads in the area, and the consequence of a potential accident is severe due to the potential for injuries or fatalities. The impact magnitude is therefore considered to be **Medium**. Considering the settlements along roads and the current uses of the roads, and the proximity of community activities and buildings to the roads, the sensitivity of receptors is considered to be **High**. As a result, the impact significance is assessed to be **Moderate** (Table 6-45).

Table 6-45: Assessment of Vehicle Accident Impacts during Construction.

Impact	Vehicle Accidents			
Impact Nature	Negative		Positive	
	Vehicle accidents would be negative.			
Impact Type	Direct		Indirect	
	The impact would be a direct result of Project activities (increased traffic).			
	Temporary	Short Term	Long Term	Permanent

Impact	Vehicle Accidents				
Impact Duration	The impact is short term, occurring during construction (approximately 10 months).				
Impact Extent	Limited	Local	Regional	Transboundary	
	The impact could occur along construction and delivery routes.				
Frequency	Remote	Rare	Occasional	Often	Constant
	Not Applicable.				
Likelihood	Unlikely	Possible	Certain		
	While unplanned, the likelihood is considered to be possible.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
	Based on the above, the impact magnitude is considered to be medium.				
Resource/ Receptor Vulnerability	Low	Medium	High		
	The sensitivity of the receptors (communities along the road network) is considered to be high.				
Impact Significance	**Negligible**	**Minor**	**Moderate**	**Major**	
	Based on the medium impact magnitude and the high sensitivity of the receptors, the impact significance is assessed to be major.				

6.4.17.4 Preventive Measures

The measures listed below will be implemented to prevent the Project's unanticipated traffic accidents.

- A Traffic Management Plan, driving codes of conduct, and enhanced driver safety awareness will be implemented.
- Traffic routes will be planned to limit road use by the Project during high traffic periods (including pedestrian traffic) and in sensitive areas such as near schools in order to reduce interaction with public road use.
- Local road conditions will be assessed and road maintenance discussed during Project construction to minimise traffic risks associated with roads deteriorated from Project activities.
- Collaboration with relevant local and regional governments will take place to ensure the roads used by Project vehicles are well maintained, and that potential problems or hazards are communicated to the relevant authority in a timely manner.
- Engagements with local communities and authorities will take place to inform them about plans and procedures.

- Awareness campaigns will be implemented to address traffic and road safety in communities along the transportation corridor.
- Driver training will be provided to promote safe and responsible driving behaviour. The training will include contractors and subcontractors.

6.4.17.5 Residual Impact Assessment Conclusions

With the implementation of the preventive measures listed above, the residual impact is reduced to acceptable levels.

6.4.18 Cumulative Impacts

As described throughout this ESIA Report, the Project Site is relatively isolated and without nearby areas likely to be targeted for development. The Project Site is located approximately 150 km from Blantyre and 100 km from Lilongwe, which are the largest two cities in Malawi and where most future development is likely to be focused. It is located approximately 85 km from JCM's Salima Solar Project, which is currently under construction, and approximately 30 km from the district capital of Dedza. There are no known industrial or other projects that are in development or planned in the vicinity of the Project Site, or within the greater Project Area. As a result, our analysis foresees no impacts beyond those considered in this ESIA and therefore no cumulative impacts to consider.

7. PUBLIC CONSULTATION/STAKEHOLDER ENGAGEMENT

Public participation, also known as stakeholder engagement, is a two-way process of communication between a developer or project proponent and project stakeholders. Stakeholders include individuals or groups that may be impacted directly or indirectly by the project, influence project decisions, or have a specific interest in the project.

Stakeholder engagement for the Golomoti Project has been undertaken in line with the IFC Performance Standards, based on the key objectives of stakeholder engagement listed below.

- **Ensuring understanding**: Provide an inclusive and transparent process of culturally appropriate engagement and communication to ensure that stakeholders are well informed about the planned project.
- **Build relationships**: Through supporting open dialogue, engagement will help establish and maintain a productive relationship between the developer and project affected communities, as well as other key stakeholders.
- **Facilitate participation**: Ensure that all stakeholders participate in decision making regarding the project, regardless of gender, age, ethnicity, status, and other socio-economic factors so that they are not adversely impacted and access project benefits.
- **Engage vulnerable groups**: Identify and engage vulnerable groups to enable equal access to project information and a platform for them voice their concerns so that specific measures are included in project design.
- **Manage expectations**: It is important to ensure that the planned project does not create or allow unrealistic expectations to develop among stakeholders about potential benefits, such as employment or compensation. The engagement process will serve as a mechanism for understanding and managing expectations by disseminating the correct information in an accessible way.
- **Ensure compliance**: The process is designed to ensure compliance with both local regulatory requirements and international best practice.
- **Facilitate free, prior, and informed consultation**: Ensure engagement is free of external manipulation or coercion or intimidation, undertaken in a timely way so that stakeholders are informed prior to the development or implementation of the project, and ensure information is presented in an understandable and accessible way with consideration for literacy and language.

In order to facilitate the stakeholder engagement process for the Project, a Stakeholder Engagement Plan (SEP) has been developed, which provides a detailed engagement framework to minimise social risk and to enhance relationships between the developer and Project affected communities (Appendix H). The SEP is a “live” document and will be updated as the Project progresses.

7.1 NATIONAL AND INTERNATIONAL REQUIREMENTS

This section provides details of national legislative requirements and international best practice standards for stakeholder engagement.

7.1.1 National Requirements

The main stakeholder engagement requirements for development projects are detailed in the Environmental Management Act of 1996. It states that environmental impact assessment reports should be developed in accordance with the requirements set out in the act. The requirements include the following activities related to stakeholder engagement:

> The environmental impact assessment report shall be open for public inspection provided that no person shall be entitled to use any information contained therein for personal benefit except for the purposes of civil proceedings brought under this Act or under any written relating to the protection and management of the environment or the conservation or sustainable utilization of natural resources.
>
> Upon receiving the environmental impact assessment report, the Director shall invite written or oral comments from the public thereon, and where necessary may —
>
> (a) conduct public hearings at such place or places as the Director deems necessary for purposes of assessing public opinion thereon;
>
> (b) require the developer to redesign the project or to do such other thing as the Director considers desirable taking into account all the relevant environmental concerns highlighted in the environmental impact assessment report, any comments made by the public and the need to achieve the objectives of this Act…[54]

7.1.2 International Standards

This section describes international best practice for stakeholder engagement, as set forth in the IFC Performance Standards and the Equator Principles.

7.1.2.1 IFC Performance Standards

The IFC defines the objective of stakeholder engagement as being "the basis for building strong, constructive, and responsive relationships that are essential for the successful management of a project's environmental and social impacts."[55] The IFC Performance Standards include specific guidance on conducting stakeholder engagement both during the planning phase and throughout the project lifecycle. Stakeholder engagement requirements are primarily contained in Performance Standard (PS) 1 (Assessment and Management of Environmental and Social Risks and Impacts) and covers the following key topics:

- Stakeholder Engagement;
- Disclosure of Relevant Project Information;
- Informed Consultation and Participation;
- External Communications;

[54] The Government of Malawi, Environmental Management Act 1996, Part V, paragraphs 25 and 26. Available at https://www.malawilii.org/mw/legislation/act/1996/6 (Accessed March 2019).

[55] IFC Performance Standard 1: Environmental and Social Risks and Impacts, paragraph 25. Available at http://www.ifc.org/wps/wcm/connect/115482804a0255db96fbffd1a5d13d27/PS_English_2012_Full-Document.pdf?MOD=AJPERES (accessed March 2019)

- Grievance Mechanism for Affected Stakeholders; and
- On-going Reporting to Affected Stakeholders.

PS 5 (Land Acquisition and Involuntary Resettlement) is also applicable to the Project, given the planned land acquisition. PS 5 promotes the concept of negotiated settlements to avoid expropriation and the forcible removal of people or land use activities. It also includes requirements regarding community engagement to ensure that affected communities are informed and participate in decision-making processes related to land acquisition.[56]

7.1.2.2 Equator Principles

The most relevant principles in relation to stakeholder engagement are:

- Principle 2: Environmental and Social Assessment;
- Principle 5: Stakeholder Engagement;
- Principle 6: Grievance Mechanism; and
- Principle 10: Reporting and Transparency.

In addition, it should be noted that Principle 3 requires projects located in "Non-Designated" countries, which includes Malawi, to align with the IFC Performance Standards.

7.2 STAKEHOLDER IDENTIFICATION AND MAPPING

A stakeholder is defined in the IFC Performance Standards as:

> persons or groups who are directly or indirectly affected by a project, as well as those who may have interests in a project and/or the ability to influence its outcome, either positively or negatively. Stakeholders may include locally affected communities or individuals and their formal and informal representatives, national or local government authorities, politicians, religious leaders, civil society organizations and groups with special interests, the academic community, or other businesses.[57]

The purpose of the stakeholder identification process for the Project has therefore been to establish which individuals or groups, including vulnerable groups, may be directly or indirectly affected (positively or negatively) by the Project or have an interest in it.

Stakeholder identification has taken into account:

- The direct and indirect AoI of the Project, as described in Section 6.2.1, which are the geographical areas over which the Project may cause direct and indirect impacts (both positive and negative), respectively, over its lifetime, and therefore are the localities within which people and businesses could be affected; and

[56] IFC Performance Standard 5: Land Acquisition and Involuntary Resettlement Paragraph 10. Available at http://www.ifc.org/wps/wcm/connect/115482804a0255db96fbffd1a5d13d27/PS_English_2012_Full-Document.pdf?MOD=AJPERES (accessed March 2019)

[57] IFC (2007) Stakeholder Engagement: A Good Practice Handbook for Companies Doing Business in Emerging Markets, page 20. Available at: https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/publications/publications_handbook_stakeholderengagement__wci__1319577185063 (Accessed March 2019)

- The nature of the impacts that could arise and therefore the types of government bodies, Non-Governmental Organisations (NGOs), academic and research institutions, and other bodies that may have an interest in these issues.

The aim of stakeholder mapping has been to understand stakeholder needs and expectations for engagement and consultation in order to tailor engagement to each type of stakeholder. Stakeholders have been categorized and mapped according to their interest, influence, and how they are likely to be affected by the Project.

A list of stakeholders identified to date based on the above methodology is provided in Table 7-1. This list is not exhaustive and will be updated as the Project progresses.

7.3 STAKEHOLDER ENGAGEMENT ACTIVITIES

This section overviews stakeholder engagement activities regarding the Project that have been carried out to date with a special focus on those activities undertaken that are relevant to the ESIA development. A chronological summary overview of meetings held and feedback from stakeholders, where relevant, is included in Appendix G.

7.3.1 Initial Stakeholder Engagement Activities

Initial engagement involved meetings between JCM representatives and Regional and District Lands Officers to gather information on the land acquisition and compensation process in Malawi, and in relation to the Project. In addition, meetings were held with community leaders and representatives of the land compensation beneficiaries. These early stage meetings were generally focused on developing working relationships between JCM and key local stakeholders who could facilitate positive ties with the community and guide JCM on local priorities and concerns *vis a vis* the Project. The local communities elected their own Project Committee early on in the process to represent them, especially with regard to the land acquisition process. The Project Committee is made up of approximately 16 community members and has been very active since its inception.

7.3.2 Grievance Mechanism

An effective grievance mechanism allows stakeholders to lodge complaints and/or concerns at no cost, without fear of retribution, and with the assurance of a timely response. JCM's Grievance Redress Framework serves as the foundation from which a Project-level Grievance Redress Committee was formed. The formal grievance mechanism and procedures are described in the SEP included as Appendix H. To summarize, the process includes:

- Identification of the grievance through reporting channels;
- Recording of the grievance;
- Assessment to determine priority and significance;
- Acknowledgement of receipt;
- Eligibility determination;
- Investigation culminating in corrective action when necessary;
- Communication on course of action and timeframe;
- Implementation of corrective action and resolution; and Close-out.

Table 7-1: Project Stakeholders.

Stakeholder Category	Stakeholder	Connection to the Project
National Regulatory Bodies - National bodies are of primary importance in terms of establishing policy, granting permits and other approvals for the Project and monitoring enforcing compliance.	Environmental Affairs Department (EAD)	The Project must comply with the Environmental and Social Impact Assessment (ESIA) requirements and to develop environmental management and monitoring plans. The Department is responsible for issuing the Environmental Certificate after an ESIA has been approved.
	Electricity Supply Corporation (ESCOM)	ESCOM is responsible for the procurement, transmission and distribution of electricity to consumers. If the affected communities are to benefit from the electricity by way of community investment, ESCOM may have to play a part in the modalities for household connections. Additionally, the Project can draw on ESCOM's experience in relation to land acquisition for electricity related projects.
	Ministry of Lands, Housing, and Urban Development/Department of Lands	The ministry, through the Department of Lands, is a key stakeholder in the Project due to the management of land issues in Malawi. The department is the final approving authority for land acquisition related matters. It represents the Ministry of Lands, Housing and Urban Development on all matters to do with compensation and resettlement. As such the department has the authority to issue a land lease / registration certificate to JCM. The Ministry also provides land and housing management services to the general public. It draws its mandate from various statutes and policy instruments such as the Land Act.
	Electricity Generation Company of Malawi (EGENCO)	EGENCO is currently the sole generator of electricity in Malawi. The contribution of the Project to the alleviation energy problems will greatly assist EGENCO.

Stakeholder Category	Stakeholder	Connection to the Project
	Malawi Energy Regulatory Authority (MERA)	MERA is the overall regulatory authority for energy in Malawi.
National Government Ministries	Ministry of Gender and Social Welfare	The Ministry of Gender and Social Welfare has an interest in the social welfare of the people throughout the country. Therefore, they will be interested in how the Project is managing impacts on vulnerable groups, including women.
	Ministry of Education, Science and Technology	The Ministry of Education, Science, and Technology would be interested in any access related constraints resulting from the Project as well as any skills training and education related community investment that the Project may support.
	Ministry of Local Government and Rural Development	The Ministry of Local Government and Rural Development provides a link between the central and local governments in Malawi and would thus be interested in ensuring district authorities and other local authorities effectivity participate in the development and authorization of the project according to their legal mandates.
	Finance, Economic Planning and Development Department	Formulates economic fiscal policy and manages financial material resources for the Government for Malawi in order to realize balanced and sustainable economic growth to reduce poverty.
	Natural Resources, Energy and Mining Department	The ministry oversees sustainable development, management and utilisation of energy, minerals and monitoring geo-hazards for socio economic development.
	District Commissioner (DC)	The DC is the overarching local authority for all the development projects in the district. The DC also has the authority to issue the project planning Permit (on behalf of the Department of Physical Planning).

Stakeholder Category	Stakeholder	Connection to the Project
		Additionally, the DC oversees the compensation process for all projects within the District, including payment of compensation and monitoring related activities. The DC's office works hand in hand with the Community Development Officer on matters related to social aspects including community mobilisation and sensitisation on such projects.
	Ministry of Irrigation and Water Development / Water Department	The Water Department is responsible for provision of water supply services including piped rural water supply schemes and boreholes. The Department must be engaged in relation to water use by the Project and any water-related CSR projects resulting from the Project. A water abstraction permit will be required from the Water Resources Authority if the Project requires a borehole or abstraction of surface water for construction and/or operational purposes.
	Ministry of Labour	The Ministry of Labour issues the Workplace Registration Certificate as mandated by the Occupational Safety Health and Welfare Act. It is also responsible for monitoring of workers' health and safety during construction and operation.
Community level– including the GV Pitala and in particular the following villages with PAPs whose customary land will be acquired by the Project: ■ Ching'anipa ■ Kalumo ■ Nsamala	Project affected communities, including residents in surrounding villages and land users	Households and communities that will be directly or indirectly affected by the proposed Project activities. This includes people living in the affected land either by direct land take or by social and environmental impacts.
	Chiefs/Traditional authorities Group Village Heads/Village Heads	Local community leaders act as representatives of their local community. Meeting with Traditional Authorities will follow local practices and be held prior to any wider communication in order to respect the political and social structure.

Stakeholder Category	Stakeholder	Connection to the Project
■ Kapesi ■ Chisaka ■ Chitseko		
Vulnerable groups	May include: ■ Women headed households ■ Children headed households ■ Elderly, physically or mentally disabled ■ Youth ■ Low-income household	Vulnerable groups may be disproportionately affected by the proposed Project by virtue of socio-economic status or physical abilities and are therefore less resilient to change. A vulnerability assessment will be required for the Project to identify specific vulnerabilities in the Project Area.
Civil society groups	Community based organisations (CBOs) and cooperatives	Organisations that may be impacted by the Project or that the Project can work with on livelihood development activities. CBOs identified as stakeholders include two Village Savings and Loans groups, Youth Network, and Water Council Network. See Appendix G for more details.
Non-Governmental Organisation(NGO)/ Institutions/ Academic	Includes international, national and local NGOs covering biodiversity/ conservation, human rights, gender and child related issues	NGO and academic institutions are able to influence the success of projects through advocacy and negative media attention. The Project will identify and engage relevant NGOs and institutions to keep them informed about the Project. They may also act as a partner in implementing livelihood or community investment programmes. NGOs identified as stakeholders includes Total Land Care, Water for All, and the Golomoti AIDS Support Organization. See Appendix G for more details.
Commerce and Industry	Local businesses / potential suppliers and contractors	Will be interested in procurement opportunities in relation to the Project. They may also create cumulative impacts. As such the

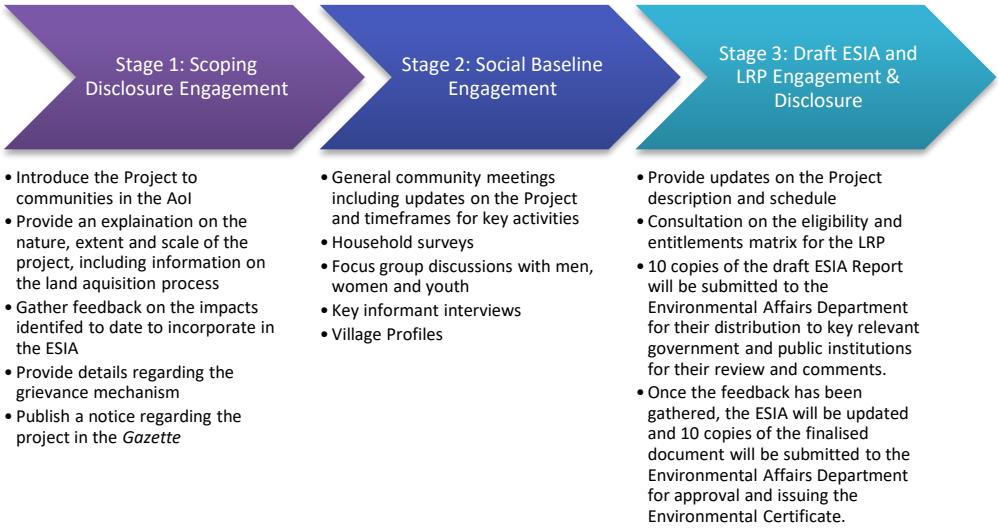
Stakeholder Category	Stakeholder	Connection to the Project
		Project is required to identify industries in the local area and aim to collaborate with them where appropriate.

As part of the general stakeholder engagement activities, and in advance of social baseline activities commencing (Stage 2 described below), an open community meeting was held on March 22, 2019 that was broadly attended by community members residing in the Project Area. During this meeting, JCM explained the purpose, process, and composition of a Project Grievance Redress Committee. Emphasis was placed on ensuring the committee had diverse membership representative of the community, including females, youth, and vulnerable groups. Community members in attendance then selected the representatives to form the committee. Ten total members (3 females and 7 males) were nominated to the committee, including a representative from JCM and community members from different villages, including some who could represent different perspectives in the communities (i.e., youth, religious, and disabled representatives). The committee members have received initial training from JCM on how to identify and record a grievance. Training will be reinforced before Project construction begins.

7.3.3 ESIA Stakeholder Engagement Process

In order to avoid stakeholder fatigue, there are three main stages of engagement that form the ESIA process. These include engaging on scoping and presenting the Project and gathering feedback from communities in the Project Area. A third stage of engagement will be undertaken on drafts of the ESIA and the Livelihood Restoration Plan (LRP), which will include consultation on the identified impacts and associated mitigation measures that have been proposed. This engagement process is presented in Figure 7-1.

Figure 7-1: ESIA Engagement.



Source: ERM, 2019.

Stage 1 and 2 of the engagement process has been undertaken and details regarding these are provided below. At the time of writing the ESIA, Stage 3 was pending.

7.3.3.1 Stage 1: Scoping and Disclosure Engagement

ERM undertook a site visit in December 2018 and conducted meetings with stakeholders in Lilongwe and in the Project Area as part of its scoping exercise for the ESIA. In particular, ERM participated along with JCM in a community meeting that included GVH Pitala, seven village headmen, the Village Development Committee, and Project Committee representatives, as well as other community members. The team took advantage of this opportunity to explain the Project, listen to community expectations and concerns, and answer questions, which helped to inform the scoping results described in Section 6.2. See Appendix G for additional details.

In addition, as part of its December 2018 visit, ERM and JCM met with other key stakeholders, including those listed below.

- **Environmental Affairs Department (EAD):** Given that the EAD is the entity responsible for the ESIA process, the meeting focused on potential impacts and mitigations for the planned solar Project, requirements for the ESIA document, and how monitoring and inspections are conducted after the license is granted.
- **Ministry of Lands:** Given that the Ministry of Lands will facilitate the land acquisition process for the Project, the meeting focused on predominant land tenure regimes in Malawi and security thereof, the asset inventory process, market valuation approach, and other legislative requirements.
- **Electricity Supply Corporation of Malawi (ESCOM):** This meeting focused on technical aspects of the Project including the preliminary site layout, transmission, and physical interconnection requirements.

7.3.3.2 Stage 2: Social Baseline Engagement

Stage 2 was carried out between March and June 2019, including a site visit by ERM in June 2019. Activities included general community engagements, household surveys, social baseline participatory discussions, and meetings with district-level authorities, and generally built on dynamic and ongoing engagement between JCM and Project stakeholders. These activities are described in detail in Section 5.3.1, and the outputs are described throughout Section 5.3.

All meetings have been documented, including meeting registrations, photos, and discussion summaries to keep track of stakeholder feedback and concerns. Information gathered from stakeholder feedback has informed the baseline and impact assessment included in this ESIA and will also help to inform the organisation of future engagements and support monitoring and evaluation requirements, as detailed in the SEP.

8. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

This chapter presents the Environmental and Social Management Plan (ESMP) for the construction and operation of the Project. The ESMP specifies the management and mitigation measures to which JCM is committed and shows how they will mobilise organisational capacity and resources to implement these measures. The objective is to make sure that there are appropriate mitigation measures in place and that the responsible individuals consistently follow them.

The ESMP briefly describes the other E&S management plans that will be developed and implemented for the Project by the EPC Contractor and JCM. It then presents the management procedures (i.e., mitigation measures) that will be implemented during construction and operation, organized by the potential impacts as described in Section 6.4 of the ESIA. Each management procedure includes a schedule for implementation, estimated budget, and institution and/or person responsible for implementation. The ESMP then presents an E&S Monitoring Plan, also organized by the potential impacts as described in Section 6.4 of the ESIA. The ESMP then describes how the ESMP will be implemented, including a description of the Project's E&S organization, roles and responsibilities, training and awareness, communication, documentation, and management of change. The ESMP concludes with a description of procedures for monitoring and review, including inspections, monitoring, audits, corrective actions, and reporting.

8.1 ESMP OBJECTIVES

The objectives of the ESMP are to:

- Ensure compliance with Malawian E&S laws and regulations and ESIA commitments, as well as alignment with international standards;
- Ensure that mitigation measures and commitments made by JCM and identified in the ESIA are taken into account during the construction and operation phases; and
- Establish an E&S monitoring program so that the ESMP can be updated and improved as the Project progresses in order to ensure continuous improvement.

8.2 MANAGEMENT PLANS

8.2.1 Contractor E&S Management Plans

JCM is currently constructing a solar power plant similar to the proposed Project at Salima in Malawi. The EPC contractor for the Salima project is SUMEC. JCM required SUMEC to develop a Construction Environmental and Social Management Plan (CESMP) for the Salima project. JCM reviewed the CESMP to ensure that it aligns with their corporate policies, complies with Malawian laws and regulations, complies with the project's ESIA commitments, and aligns with international standards. JCM has approved the CESMP and it is being implemented by SUMEC for the Salima project.

JCM intends to leverage its experience on the Salima project in regards to the E&S management of the proposed Project. To this end, JCM proposes to utilize the CESMP developed for the Salima project, with minor modifications. The CESMP for the Salima project has, and thus the CESMP for the proposed Project will have, procedures for:

- Soil management;

- Biodiversity management;
- Water management;
- Waste and wastewater management;
- Air quality management;
- Noise management;
- Visual management;
- Heritage resources management;
- Hazardous materials management;
- Traffic management;
- Security management;
- Community health, safety, and security;
- Human resources management; and
- Worker accommodation management.

The mitigation measures specified in the Salima CESMP capture and build upon the mitigation measures in the Salima ESMP described in the Salima ESIA, focusing on those that are the responsibility of the EPC Contractor.

JCM also required SUMEC to develop a Construction Health & Safety Management Plan (CHSMP) for the Salima project. JCM proposes to utilize the Salima CHSMP, with minor modifications, for the Project.

8.2.2 Other E&S Management Plans

Additional E&S management plans will be developed and implemented by JCM to support the implementation of this ESMP. These plans will focus on social management, as the CESMP and CHSMP to be developed by the EPC Contractor will focus on any environmental management procedures beyond those that are captured in this ESMP. The timing of the development of these plans may be staged, ensuring that the appropriate focus and level of detail is provided for construction and operational activities. The social management plans to be developed and implemented by JCM for this Project include:

- Livelihood Restoration Plan;
- STI/HIV Management Plan;
- Human Resources Policy (including a Labour and Employment Plan and Worker Grievance Mechanism);
- Gender Development Plan;
- Transportation Management Plan;
- Community Investment Plan; and
- Stakeholder Engagement Plan (including a Community Grievance Mechanism).

Each of these plans will be a modified version of the social management plans developed for the Salima project. The Golomoti plans will have the same objectives and cover the same set of activities as the Salima plans, but will be modified to meet

the unique characteristics of the Golomoti Project. JCM will also seek to improve the plans for Golomoti based on lessons learned from the implementation of the Salima plans. The draft Stakeholder Engagement Plan has been completed and is included as Appendix E of this ESIA. The plan is considered a draft because it is a living document and will be updated as needed throughout the life of the Project.

8.3 MANAGEMENT PROCEDURES

The E&S management procedures presented in this section constitute mitigation measures to avoid, minimise, or compensate for the risks and impacts that have been identified in the ESIA. The management procedures for construction are presented in Table 8-1, and the management procedures for operations are presented in Table 8-2. Management procedures related to decommissioning are discussed in Section 8.3.2.

Table 8-1: Construction Environmental and Social Management Plan.

Ref	Potential Impact Managed/Enhanced	Objective	Mitigation / Avoidance/Enhancement Measures	Schedule for Implementation	Estimated Budget (USD)	Institutional Responsibility
Positive Impacts						
8.1	Employment ■ Employment opportunities and the need for the supply of goods and services has the potential to create jobs for local communities and improve income levels	Provide opportunities to local communities to enhance income levels and skills/ employability, and improve quality of life	1. A recruitment strategy will be established and implemented for staff required before and during construction to enable the community to access job opportunities. 2. Although recruits will require a basic level of skills prior to recruitment, training opportunities and internships will be provided to males and females in local communities in order to enhance their skills, increasing employability and career development opportunities at a later stage. 3. A Gender Development Plan will be developed and implemented to promote gender equality in job opportunities as well as to support the mitigation of gender-based violence and other gender-related issues within the workforce and externally (e.g., in Project-affected communities). 4. Goods and services required for construction and operation will be sourced in Dedza District as much as possible. If a good or service is not available in Dedza District, it will be sourced in Lilongwe and at a national level prior to sourcing outside of Malawi.	Before and during construction	USD 10,000 for review of recruitment performance (1-3) Part of EPC Contractor's bid (4)	JCM Project Manager (1-3) EPC Contractor (4) Quarterly Reports of EPC and JCM activities will be prepared by JCM's EHS Manager
Adverse Impacts						
9.1	Air Quality ■ Site preparation, construction activities, equipment and material, and worker transportation will generate fugitive dust emissions, which could act as a nuisance for nearby sensitive receptors	Minimise deterioration of ambient air quality from construction activities	1. Removal of vegetation and soil cover will be restricted to that which is necessary for the Project. 2. Land clearance will be sequential and the smallest possible area for working will be exposed where ground and earthworks are undertaken. 3. Stripping of topsoil will not be conducted earlier than required (i.e., the Project will maintain vegetation cover for as long as possible) in order to prevent the erosion (wind and water) of organic matter, clay, and silt. 4. A speed limit of 30 kph on unpaved surfaces will be enforced and national speed limits on public roads will not be exceeded. 5. Transported materials will be covered with tarpaulins to prevent fugitive dust. 6. Surface binding agents will be utilized on exposed open earthworks, when feasible. 7. Exposed ground and earthworks will be covered as much as possible with sheeting, shade cloth, or tarpaulin where wind generated dust occurs. 8. Stockpiles stored longer than six weeks will be vegetated or covered with sheeting, shade cloth, or tarpaulin to reduce soil loss from wind or storm water runoff. 9. Stockpiles will be located as far away from receptors as possible and will be covered with sheeting, shade cloth, or tarpaulin. 10. Wind breaks will be erected around key construction activities and, if possible, in the vicinity of potentially dusty works to minimize impacts to the nearby temporary residential accommodation and permanent residential receptors.	Regularly throughout construction	Part of EPC Contractor's bid (1-12) Part of CLO responsibilities (13)	EPC Contractor (1-12) JCM CLO (13) Quarterly Reports of EPC and JCM activities will be prepared by JCM's EHS Manager

Ref	Potential Impact Managed/Enhanced	Objective	Mitigation / Avoidance/Enhancement Measures	Schedule for Implementation	Estimated Budget (USD)	Institutional Responsibility
			11. Construction vehicles will be regularly maintained to minimise exhaust emissions. 12. Vehicles will be switched off when not in use, unless impractical for safety reasons (e.g., maintenance of air conditioning). 13. Complaints received from local community members through the Community Grievance Mechanism will be reported to the CLO.			
9.2	Noise ■ Site preparation, construction activities, equipment and material, and worker transportation will generate noise emissions, which could act as a nuisance for nearby sensitive receptors	Maintain noise levels within required limits of 55 dBA during the day time (07:00- 22:00) and 45 dBA during the night time (22.00 – 07.00)	1. Machines and equipment will be maintained in good working condition and inspected regularly. 2. Equipment and vehicles will be selected in accordance with best available techniques for noise reduction. 3. Vehicle movements within and around the site will be minimised as much as possible. 4. Local screening/site hoardings will be utilised to screen noise where appropriate. 5. Complaints received from local community members through the Community Grievance Mechanism will be reported to the CLO.	Regularly throughout construction phase	Part of EPC Contractor's bid (1-4) Part of CLO responsibilities (5)	EPC Contractor (1-4) JCM CLO (5) Quarterly Reports of EPC and JCM activities will be prepared by JCM's EHS Manager
9.3	Soil ■ Loss of arable soils and reduced soil quality	Avoid soil erosion and the consequent loss of soil quality and quantity	1. Mitigation measures 1-10 for air emissions (Ref. 9.1) are applicable to this impact. 2. Erosion control measures such as intercept drains and toe berms will be constructed where necessary. 3. Access roads will be well drained in order to limit soil erosion.	Regularly throughout construction phase	Part of EPC Contractor's bid (1-3)	EPC Contractor (1-3) Quarterly Reports of EPC activities will be prepared by JCM's EHS Manager
9.4	Groundwater ■ Some of the water to be utilized by the Project during construction is anticipated to be derived from groundwater, which may have an effect on other water users	Prevent the contamination of surface and groundwater and avoid loss of water availability to other water users	1. Water storage solutions (e.g., tanks) will be utilised for water abstracted from the Project borehole and/or brought in by bowsers during the wet season for use during the dry season. 2. Regular monitoring of affected village supplies will be conducted and Project abstraction will cease if the Project has a significant impact on the community boreholes.	Regularly throughout construction phase	Part of the Project's design costs (1) USD 15,000 for monitoring and assessment programme (2)	JCM (1-2) Quarterly Reports of JCM activities will be prepared by JCM's EHS Manager
9.5	Biodiversity ■ Loss of habitats and fauna disturbance ■ Risk of increased invasive alien plants	Minimise impacts on terrestrial flora, fauna, and avifauna during construction	*Loss of Habitats and Fauna Disturbance* 1. Provisions that prohibit staff and contractors from engaging in all forms of hunting and from clearing/utilising plant species in the Project Area will be included in the Worker Code of Conduct.	Prior to and regularly throughout construction phase	USD 1000 for Code of Conduct (1)	JCM (1) and JCM CLO (15) EPC Contractor (2-14)

Ref	Potential Impact Managed/Enhanced	Objective	Mitigation / Avoidance/Enhancement Measures	Schedule for Implementation	Estimated Budget (USD)	Institutional Responsibility
	▪ Disruption of ecosystem services		2. Vegetation will be methodically cleared from the Project Site and excavations will be undertaken per designs to avoid unwarranted clearance of vegetation. 3. If feasible, clearance of the 2.9 ha of Secondary Mixed Deciduous Woodland will be removed gradually from one side such that any resident wildlife is provided an opportunity to exit the site. 4. Planning will be conducted in advance to determine the minimum feasible extent required. Predetermined areas will be clearly demarcated on the ground, fenced where appropriate, and enforcement measures will be taken to avoid footprint creep into surrounding areas. 5. Rehabilitation of disturbed areas (e.g., temporary access tracks and laydown areas) will be undertaken following construction. This will be done in such a way as to facilitate natural regeneration of vegetation. 6. Five or more seedlings of the same species will be planted in adjacent areas for each protected tree that is cut down. *Risk of Increased Invasive Alien Plants* 7. Invasive plant species will be removed from areas controlled by the Project. Manual removal will be favoured over mechanised or chemical control measures. 8. Invasive vegetative and/or seed bearing material that is removed through control measures will be contained in a cordoned off area, dried, and burnt on site to prevent the distribution of seeds. 9. Vehicles and construction equipment will be washed on a regular basis and kept clean to minimise the distribution of seeds and invasive plant material. 10. Source areas such as vehicle parking and construction camps will be kept clean of invasive plants to minimise the presence of seeds that can be dispersed unintentionally. 11. Disturbed areas will be rehabilitated at the earliest opportunity to minimise the establishment of invasive plant species. 12. Regular and ongoing monitoring of the presence of invasive plant species will be conducted within construction and rehabilitated sites and removal operations implemented according to the results. *Disruption of Ecosystem Services* 13. Rehabilitation of disturbed areas (e.g., temporary access tracks and laydown areas) will be undertaken following construction. This will be done in such a way as to facilitate natural regeneration of vegetation. 14. Piles of woody vegetation cleared for construction activities will be made available to communities to access it for use as wood fuel or other purposes. 15. Ongoing engagement will be maintained between the Project and local communities, with communities informed in advance of any vegetation clearing to allow pre-harvesting of resources such as wood fuel, mangoes, and building materials.		Part of EPC Contractor's bid (2-14) Part of CLO responsibilities (15)	Quarterly Reports of EPC and JCM activities will be prepared by JCM's EHS Manager

Ref	Potential Impact Managed/Enhanced	Objective	Mitigation / Avoidance/Enhancement Measures	Schedule for Implementation	Estimated Budget (USD)	Institutional Responsibility
9.6	Landscape and Visual ■ Impact on the visual character of the landscape	Minimise the visual impact on surrounding sensitive receptors	1. Ongoing rehabilitation of cleared areas will be conducted to minimise visual scarring. Maintenance clearing will be kept to a minimum and will not extend beyond the Project Site boundary. 2. Excavated and cut and fill areas will be shaped and allowed to revegetate. 3. No debris or waste materials will be left at work sites. 4. Appropriate directional and intensity settings will be utilised for lighting.	Regularly throughout the construction phase	Part of EPC Contractor's bid (1-4)	EPC Contractor (1-4) Quarterly Reports of EPC activities will be prepared by JCM's EHS Manager
9.7	Land Acquisition and Displacement ■ Economic displacement, in particular of subsistence farmers and land for livestock grazing	Avoid and minimise displacement as well as mitigate negative impacts and enhance positive impacts	1. A Livelihood Restoration Plan (LRP) will be developed, based on the one developed for the Salima project, that includes the following; a. Identification of affected land users; b. Census and asset inventory to assess compensation measures for those affected; c. Assessment of eligibility and entitlements for those affected; d. Identification of gender differentiated and sustainable livelihood improvement and/or restoration measures (e.g., financial literacy training, training on improved farming practices); e. Provisional implementation budgets; f. Roles and responsibilities, including details of an institutional structure/Livelihood Restoration Steering Committee; g. Monitoring and evaluation requirements; and h. Provisional implementation schedule. 2. An inclusive and participatory consultation process will be followed that ensures the participation of women, men, youth, elderly, disabled, and other groups in the decision making process regarding replacement land and livelihood restoration programmes.	August 2019	USD 60,000 for LRP development LRP implementation to be determined	JCM (1-2) Quarterly Reports of JCM activities will be prepared by JCM's EHS Manager
9.8	Walking Paths ■ The presence of construction equipment and activities during construction may block pathways that provide access to communities and farmland	Minimise restrictions to existing pathways transecting the Project Site	1. Consultation will take place with communities to assess the possibility/need for an alternative walking path that could connect settlements to minimise impacts related to access restrictions without compromising the design of the facility.	Prior to and regularly throughout the construction phase	Part of CLO responsibilities	JCM CLO Quarterly Reports of JCM activities will be prepared by JCM's EHS Manager
9.9	Vector Borne and Communicable Diseases ■ Construction equipment and activities have the	Avoid increasing the prevalence of vector borne and	1. Workforce training will be provided on communicable diseases, disease prevention, and treatment to raise awareness. 2. Workers will be provided with appropriate gender considerate sanitary facilities that are properly designed to prevent contamination.	Prior to and regularly throughout the	Part of EPC Contractor's bid (1-7)	EPC Contractor (1-7)

Ref	Potential Impact Managed/Enhanced	Objective	Mitigation / Avoidance/Enhancement Measures	Schedule for Implementation	Estimated Budget (USD)	Institutional Responsibility
	potential to create dust emissions and create breeding grounds for vector borne illnesses affecting communities living in villages adjacent to the Project Site ■ The presence of the workforce during construction in combination with poor sanitary conditions has the potential to increase communicable diseases	communicable diseases	3. A waste handling system will be developed that is sufficient to avoid the creation of new vector breeding grounds. 4. Environmental controls will be established that reduce the presence of standing water on site during site preparation to avoid the creation of new breeding grounds. 5. Project areas, especially the camp, toilet, and eating facilities, will be kept clean and free from accumulation of wastes as well as supplied with clean potable water. This includes ensuring appropriate food preparation and monitoring measures are in place. 6. There will be a first aid area on site to avoid adding pressure on local health facilities. Arrangements will be made with nearby hospitals and clinics, however, so sick Project workers who cannot be fully treated at the Project first aid area can be referred for treatment. 7. Pre-employment screening measures will be developed and implemented to ensure that workers are fit for work, as well as to identify any pre-existing conditions. Individuals found to be suffering from communicable diseases will need to seek treatment prior to mobilisation to the Project Site. No one will be denied employment, however, on the basis of their health status as long as they are able to undertake the required duties (following treatment if relevant). 8. A worker Code of Conduct will be established that includes guidelines on worker-worker interactions, worker-community interactions, and development of personal relationships with members of local communities.	construction phase	USD 2000 for Code of Conduct (8)	JCM (8) Quarterly Reports of EPC and JCM activities will be prepared by JCM's EHS Manager
9.10	STI/HIV Transmission ■ Increase in STI/HI transmission and GBV due to worker-community interaction	Avoid Project-related increase in STI/HIV transmission and GBV	1. An STI/HIV Management Plan will be developed and implemented. The plan will include the following measures: a. STI and HIV prevention training to all employees, through workshops, posters, and informal information sessions; b. Medical examinations to determine level of health; workers should also be encouraged to determine their HIV status; c. Supply of condoms at the construction site; d. Development of a Code of Conduct and/or rules for worker-community interaction and onsite behaviour; and e. Support to workers and affected communities to access treatment for STIs, particularly HIV/AIDS, through existing health facilities or NGO campaigns or programmes. 2. A women's NGO that is addressing gender and GBV issues in Golomoti and in Project affected communities will be supported to raise awareness of such issues and to encourage prevention. 3. GBV and sexual abuse will be monitored through general stakeholder engagement and grievance management. 4. Work camp control protocols, while respecting freedom of movement, will be put in place to limit the interactions between non-local workers and the local community.	Prior to and regularly throughout the construction phase	USD 6,000 for STI/HIV Management Plan (1) USD 10,000 for support for NGO (2) Part of CLO responsibilities (3) Part of EPC Contractor's bid (4)	JCM (1-2) and JCM CLO (3) EPC Contractor (4) Quarterly Reports of JCM activities will be prepared by JCM's EHS Manager

Ref	Potential Impact Managed/Enhanced	Objective	Mitigation / Avoidance/Enhancement Measures	Schedule for Implementation	Estimated Budget (USD)	Institutional Responsibility
9.11	Community Safety and Security ■ Security risk of petty crime, increased GBV, and perceptions that people in the communities are benefitting more than others creating tensions ■ Worker-community interactions, including the presence of security, may pose a threat to the community	Avoid risks associated with safety and security	1. Security personnel will be trained in safeguarding the community in high tension situations such as any type of protest or community conflicts. This will include training on human rights concepts and include information on local resources that could assist in such situations such as the GVH and TA. 2. Security measures will be implemented to minimise safety risks and the possibility of theft in construction and storage areas. 3. Clear and visible signage will be established in construction areas to warn the community of any risks and hazards and other engagement/communication efforts will be employed to ensure community members are aware of safety risks, as needed. 4. Security personnel will not carry firearms and will comply with Malawian laws and regulations as well as the requirements of the Voluntary Principles on Security and Human Rights. Security procedures will include selection of personnel based on a careful background screening and monitoring of performance. 5. A community engagement programme will be established to provide information about safety hazards and raise awareness of how these are being managed. This includes visits to neighbouring communities and local schools. 6. Community awareness will be raised regarding the Project's Community Grievance Mechanism to address community concerns and issues in a timely manner to avoid issues escalating. This will include the use of the CLO, who will be present around the Project Site before and during construction.	Prior to and regularly throughout the construction phase	Part of EPC Contractor's bid (1-3) Part of CLO responsibilities (4-6)	EPC Contractor (1-3) JCM CLO (4-6) Quarterly Reports of EPC and JCM activities will be prepared by JCM's EHS Manager
9.12	Labour and Working Conditions ■ The workforce may be subject to poor labour and working conditions	Prevent poor labour and working conditions	1. A Human Resources Policy will be developed, which will include a Labour and Employment Plan and Worker Grievance Mechanism. These will also be reflected in sub-contractor contracts. Key issues within Human Resource (HR) management and contracts will include: a. Provision of clear and understandable information regarding rights under national labour and employment law, and any applicable collective agreements, including those related to hours of work, wages, overtime, and compensation; b. Provision of reasonable working conditions and terms of employment; c. Provision of adequate accommodation (if relevant); d. Provision of employment, compensation/remuneration, and working conditions, including working hours, equal opportunity and fair treatment, and prohibition of discrimination; e. Non-discrimination in all aspects of labour recruitment, management, and exit; f. Provision of adequate welfare facilities on site; g. Implementation of a Worker Grievance Mechanism for Project workers (including sub-contractors); h. Adoption and implementation of a sexual harassment policy; and i. Freedom of association.	Policies and plans will be developed prior to construction (1-2) Other measures regularly throughout the construction phase (3-12)	USD 2000 for HR Policy (1) USD 7000 for Gender Development Plan (2) Part of CLO responsibilities (4) Part of EPC Contractor's bid (5-12)	JCM (1-3) and JCM CLO (4) EPC Contractor (5-12) Quarterly Reports of EPC and JCM activities will be prepared by JCM's EHS Manager

Ref	Potential Impact Managed/Enhanced	Objective	Mitigation / Avoidance/Enhancement Measures	Schedule for Implementation	Estimated Budget (USD)	Institutional Responsibility
			2. A Gender Development Plan will be prepared to promote gender equality in job opportunities and the elimination of gender-based violence, as well as to address other gender-related issues within the workforce and Project-affected communities. 3. Contractors will be supported in adhering to labour and working conditions in compliance with Malawian labour laws and in alignment with IFC PS 2 through awareness raising and information provision, as necessary. 4. A fair and transparent Worker Grievance Mechanism will be developed and implemented. It will be accessible to all workers, whether permanent or temporary, or directly or indirectly employed. The mechanism will be open to the EPC Contractor and subcontractor workers in the event that their grievance is not adequately resolved by their direct employer. 5. The contractor and supplier selection process will ensure that performance with regards to worker management, worker rights, and health and safety as outlined in Malawian law and international standards will be managed and reported. 6. Regular checks of contractors will be undertaken to ensure compliance with applicable labour laws. 7. A health and safety programme will be developed that includes risk assessments (e.g., working at heights, confined space, machine guarding), work permit systems, and a H&S management system, in line with industry best practice, including worker performance safety tracking (safety observations). Workers will receive induction and regular training regarding this system. 8. A hiring mechanism will be established to ensure no employee or job applicant is discriminated against on the basis gender, marital status, nationality, ethnicity, age, religion, or sexual orientation. 9. Workers (including contractors and subcontractors) will, as part of their induction, receive training on worker rights in compliance with Malawian legislation and in alignment with international standards. 10. Workers (including contractors and subcontractors) will have contracts that clearly state the terms and conditions of their employment and their legal rights. Contracts will be verbally explained to workers in their native language when necessary for them to understand their rights. Contracts must be in place prior to workers leaving their home location, if applicable. 11. Workers (including contractors and subcontractor) will have access to training on communicable diseases, STIs, and community interactions in general. This training will be developed in collaboration with local health institutions and local NGOs, if feasible.			
9.13	Cultural Heritage ■ Removal of living heritage (e.g., sacred trees) and damage to archaeological sites by	Minimise impacts to cultural heritage	1. Additional, limited archaeological excavations will be conducted within the boundaries of the archaeological site identified in the Solar Plant Site. The purpose of these excavations will be to evaluate the integrity and significance of the site and to determine, in consultation with the MITC and Chief Antiquities Officer, if additional archaeological excavations are warranted. Investigations at the site will be done in consultation with the MITC and Chief	Prior to and regularly throughout the construction phase	USD 10,000 (1) Part of CLO's responsibilities (2)	JCM (1 & 3) and JCM CLO (2)

Ref	Potential Impact Managed/Enhanced	Objective	Mitigation / Avoidance/Enhancement Measures	Schedule for Implementation	Estimated Budget (USD)	Institutional Responsibility
	ground-disturbing activities		Antiquities Officer and with required government-issued permits and approvals. 2. Additional stakeholder engagement will be conducted with the local community to develop a plan to transfer the cultural significance/value of the baobab tree living heritage site to another location, if feasible, or otherwise compensate for the loss of this resource. 3. A Chance Find Procedure (CFP) will be developed and implemented. The CFP will set forth the procedures to implement in the event that archaeological resources are encountered during ground disturbing activities. Workers will be trained in identifying chance finds and implementing the CFP.		USD 1000 (3)	
9.14	Unplanned Events ■ Spills leading to soil and groundwater contamination ■ Traffic accidents	Minimise the impact of unplanned spills and reduce the risk of traffic accidents impacting community health and safety	1. A Hazardous Spill Response Plan will be developed and spill clean-up and response capability adequate for addressing spills for all phases of the Project will be maintained. Spills will be immediately contained and cleaned up. Contaminated areas will be remediated. 2. A Waste Management Plan will be developed and implemented. 3. Refuelling of equipment and vehicles will be carried out in a designated area (the AST) on hard standing ground to prevent seepage of any spills into the ground. Collection systems will be installed in these areas to manage any spills. Fuels will be collected and either reused or removed by a local contractor. Drip trays will be used when refuelling and servicing vehicles or equipment where there is no hard standing surface. 4. Hazardous material storage will be on hard standing and impermeable surfaces and the storage facility will be bunded. The storage and handling of hazardous materials and fuels will be restricted to bunded areas of sufficient capacity to contain a release. 5. A Traffic Management Plan, driving codes of conduct, and enhanced driver safety awareness will be developed and implemented. 6. Traffic routes will be planned to limit road use by the Project during high traffic periods (including pedestrian traffic) and in sensitive areas such as near schools in order to reduce interaction with public road use. 7. Local road conditions will be assessed and road maintenance discussed during Project construction to minimise traffic risks associated with roads deteriorated from Project activities. 8. Collaboration with relevant local and regional governments will take place to ensure the roads used by Project vehicles are well maintained, and that potential problems or hazards are communicated to the relevant authority in a timely manner. 9. Engagement with local communities and authorities will take place to inform them about plans and procedures. 10. Awareness campaigns will be implemented to address traffic and road safety in communities along the transportation corridor. 11. Driver training will be provided to promote safe and responsible driving behaviour. The training will include contractors and subcontractors.	Plans will be developed prior to construction (1-2 & 5) Other measures regularly throughout the construction phase (3-4 & 6-11)	Part of EPC Contractor's bid (1-4 & 11) USD 7000 for Traffic Management Plan (5) Part of the Project's design costs (6-8) Part of CLO responsibilities (9-10)	EPC Contractor (1-4 & 11) JCM (5-8) and JCM CLO (9-10) Quarterly Reports of EPC and JCM activities will be prepared by JCM's EHS Manager

Table 8-2: Operational Environmental and Social Management Plan.

Ref	Potential Impact Managed/Enhanced	Objective	Mitigation/Enhancement Measures	Schedule for Implementation	Estimated Budget (USD)	Institutional Responsibility
Positive Impacts						
8.1	Economy ■ Generation of electricity	Not applicable				
Adverse Impacts						
9.4	Groundwater ■ Some of the water to be utilized by the Project during operation is anticipated to be derived from groundwater, which may have an effect on other waters users	Prevent the contamination of surface and groundwater and avoid loss of water availability to other water users	1. Regular monitoring of affected village supplies will be conducted and Project abstraction will cease if the Project has a significant impact on the community boreholes. 2. Water storage solutions (e.g., tanks) will be utilized for water pumped during the wet season for use during the dry season.	Regularly throughout operations	Ongoing monitoring costs to be confirmed	JCM Project Manager
9.6	Landscape and Visual ■ Impact from solar reflection	Minimise the visual impact on surrounding sensitive receptors	1. Rehabilitation of disturbed areas (e.g., temporary access tracks and laydown areas) will be undertaken following construction. This will be done in such a way as to facilitate natural regeneration of vegetation. 2. Ongoing engagement will be maintained between the Project and local communities with regards to potential solar reflection impacts.	Regularly throughout operations	No additional costs required	JCM Project Manager
9.8	Walking Paths ■ The presence of a fenced solar site may block pathways that provide access to communities and farmland	Minimise restrictions to existing pathways transecting the Project Site	1. Consultation will take place with communities to assess the possibility/need for an alternative walking path that could connect settlements to minimise impacts related to access restrictions without compromising the design of the facility.	Regularly throughout operations	Part of JCM's operational costs	JCM Project Manager and CLO
9.11	Community Safety and Security ■ Safety hazards may arise from trespassers into the solar plant and those that illegally try to connect to the transmission line	Avoid incidents related to trespassers and opportunists attempting to steal panels or illegally connect to the transmission line	1. The solar farm will be fenced and have security personnel present at all times to avoid trespassers entering the site. 2. Security personnel will not carry firearms and will comply with Malawian laws and regulations as well as the requirements of the Voluntary Principles on Security and Human Rights. Security procedures will include selection of personnel based on a careful background screening and monitoring of performance. 3. Clear and visible signage will be established in hazardous areas to warn the community of any risks and hazards and engagement/communication efforts will be employed to ensure community members are aware of safety risks, as needed.	Regularly throughout operations	Part of JCM's operational costs	JCM Project Manager (1-3) and CLO (3)

Ref	Potential Impact Managed/Enhanced	Objective	Mitigation/Enhancement Measures	Schedule for Implementation	Estimated Budget (USD)	Institutional Responsibility
9.12	Labour and Working Conditions ■ The workforce may be subject to poor labour and working conditions	Prevent poor labour and working conditions	1. The Human Resources Policy, Labour and Employment Plan, and Worker Grievance Mechanism developed for construction will continue to be implemented. 2. The Gender Development Plan developed for construction will continue to be implemented during operation. 3. Contractors will be supported in adhering to labour and working conditions in compliance with Malawian labour laws and in alignment with IFC PS 2 through awareness raising and information provision, as necessary. 4. The Worker Grievance Mechanism developed for construction will continue to be implemented.	Regularly throughout operations	Part of JCM's operational costs	JCM Project Manager
9.14	Unplanned Events ■ Spills leading to soil and groundwater contamination	Minimise the impact of unplanned spills	1. The Hazardous Spill Response Plan developed for construction will continue to be implemented and spill clean-up and response capability adequate for addressing spills for all phases of the Project will be maintained. Spills will be immediately contained and cleaned up. Contaminated areas will be remediated. 2. The Waste Management Plan developed for construction will continue to be implemented. 3. Hazardous material storage will be on hard standing and impermeable surfaces and the storage facility will be bunded. The storage and handling of hazardous materials and fuels will be restricted to bunded areas of sufficient capacity to contain a release.	Regularly throughout operations	Part of JCM's operational costs	JCM Project Manager

8.3.2 Decommissioning

A detailed decommissioning and rehabilitation plan will be developed prior to decommissioning the solar plant and associated infrastructure. This plan will include management of socio-economic aspects such as employment loss, removal, re-use and recycling of materials, and vegetative rehabilitation to prevent erosion.

The decommissioning activities will be similar to construction activities and therefore recommendations outlined to manage construction phase impacts will be adhered to during decommissioning. Management actions will focus on the rehabilitation of disturbed areas and the removal of infrastructure.

It is important to note that JCM and ESCOM may agree to trigger a clause in the PPA that would extend the term beyond 20 years. It is therefore possible the plant will operate beyond the 20 year term of the current PPA. Land leases for the Project are expected to be for 50 years.

8.4 MONITORING PLAN

JCM will undertake environmental and social monitoring during the construction and operation phases. The monitoring commitments are presented in Table 8-3 and Table 8-4.

Table 8-3: Construction Environmental and Social Monitoring Plan.

Ref	Potential Impact Managed/Enhanced	Objective	Monitoring Indicator	Monitoring Frequency	Estimated Budget (USD)	Institutional Responsibility
Positive Impacts						
8.1	Employment and the Economy ■ Employment opportunities and the need for the supply of goods and services has the potential to create jobs for local communities and improve income levels	Provide opportunities to local communities to enhance income levels and skills/employability, and improve quality of life	1. Number of males and females employed from Project affected communities 2. Number of males and females employed from Dedza District 3. Review of economic trends through baseline monitoring (community level and district level – in Dedza) 4. Number/type/location of suppliers of goods and services	Quarterly reporting by JCM	USD 10,000 for review of recruitment performance (1-3) Part of EPC Contractor's bid (4)	JCM Project Manager (1-3) EPC Contractor (4) Quarterly Reports of EPC and JCM activities will be prepared by JCM's EHS Manager District Commissioner will review JCM's Quarterly Reports
Adverse Impacts						
9.1	Air Pollution ■ Site preparation, construction activities, equipment and material, and worker transportation will generate fugitive dust emissions, which could act as a nuisance for nearby sensitive receptors	Minimise deterioration of ambient air quality from construction activities	1. Weekly visual inspection logs 2. Audit reports 3. Grievances logged	Weekly visual inspection Quarterly audit reporting by JCM	Part of EPC Contractor's bid (1) Part of EHS Manager (2) and CLO (3) responsibilities	EPC Contractor (1) JCM EHS Manager (2) and CLO (3) Quarterly Reports of EPC and JCM activities will be prepared by JCM's EHS Manager District Environmental Officer will review JCM's Quarterly Reports
9.2	Noise Pollution ■ Site preparation, construction activities, equipment and material, and worker transportation will generate noise emissions, which could act as a nuisance for nearby sensitive receptors	Maintain noise levels within required limits of 55 dBA during the day time (07:00-22:00) and 45 dBA during the night time (22.00 – 07.00)	1. Equipment/vehicle inspection logs 2. Equipment/vehicle manuals 3. Audit reports 4. Grievances logged	Weekly visual inspection Quarterly audit reporting by JCM	Part of EPC Contractor's bid (1-2) Part of EHS Manager (3) and CLO (4) responsibilities	EPC Contractor (1-2) JCM EHS Manager (3) and CLO (4) Quarterly Reports of EPC and JCM activities will be prepared by JCM's EHS Manager District Environmental Officer will review JCM's Quarterly Reports
9.3	Soil ■ Loss of arable soils and reduced soil quality	Avoid soil erosion and the consequent loss of soil quality and quantity	1. Weekly visual inspection logs 2. Audit reports 3. Grievances logged	Weekly visual inspection	Part of EPC Contractor's bid (1)	EPC Contractor (1) JCM EHS Manager (2) and CLO (3)

Ref	Potential Impact Managed/Enhanced	Objective	Monitoring Indicator	Monitoring Frequency	Estimated Budget (USD)	Institutional Responsibility
				Quarterly audit reporting by JCM	Part of EHS Manager (2) and CLO (3) responsibilities	Quarterly Reports of EPC and JCM activities will be prepared by JCM's EHS Manager District Environmental Officer will review JCM's Quarterly Reports
9.4	Groundwater ■ Some of the water to be utilized by the project during construction is anticipated to be derived from groundwater, which may have an effect on other water users	Prevent the contamination of surface and groundwater and avoid loss of water availability to other water users	1. Monitoring reports 2. Evidence of water storage solutions 3. Grievances logged	Quarterly reporting by JCM	USD 15,000 for monitoring and assessment programme (1-2) Part of CLO responsibilities (3)	JCM Project Manager (1-2) and CLO (3) Quarterly Reports of JCM activities will be prepared by JCM's EHS Manager EAD will review JCM's Quarterly Reports
9.5	Biodiversity ■ Loss of habitats and fauna disturbance ■ Loss of threatened flora ■ Risks of Increased Invasive plant species ■ Disruption of ecosystem services	Minimise impacts on terrestrial flora, fauna, and avifauna	1. Weekly visual inspection logs (including photographic evidence) 2. Audit reports 3. Grievances logged	Quarterly audit reporting by JCM	Part of EPC Contractor's bid (1) Part of EHS Manager (2) and CLO (3) responsibilities	EPC Contractor (1) JCM EHS Manager (2) and CLO (3) Quarterly Reports of EPC and JCM activities will be prepared by JCM's EHS Manager District Environmental Officer will review JCM's Quarterly Reports
9.6	Landscape and Visual ■ Impact on the visual character of the landscape	Minimise the visual impact on surrounding sensitive receptors	1. Weekly visual inspection logs (including photographic evidence) 2. Audit reports 3. Grievances logged	Quarterly audit reporting by JCM	Part of EPC Contractor's bid (1) Part of EHS Manager (2) and CLO (3) responsibilities	EPC Contractor (1) JCM EHS Manager (2) and CLO (3) Quarterly Reports of EPC and JCM activities will be prepared by JCM's EHS Manager District Environmental Officer will review JCM's Quarterly Reports
9.7	Land Acquisition and Displacement	Avoid and minimise displacement as well as a mitigate negative	1. Monitoring Plan within the Livelihood Restoration Plan (LRP)	Quarterly reporting by JCM	USD 60,000 for LRP development; LRP	JCM is responsible for the development and implementation of the LRP.

Ref	Potential Impact Managed/Enhanced	Objective	Monitoring Indicator	Monitoring Frequency	Estimated Budget (USD)	Institutional Responsibility
	▪ Economic displacement, in particular of subsistence farmers and land for livestock grazing	impacts and enhance positive impacts			implementation to be determined	Quarterly Reports of JCM activities will be prepared by JCM's EHS Manager District Commissioner will review JCM's Quarterly Reports
9.8	Access Restrictions ▪ The presence of construction equipment and activities during construction may block pathways that provide access to communities and farmland	Minimise restrictions to existing pathways transecting the Project Site	1. Meeting minutes with affected communities to determine and avoid access restrictions 2. Grievances logged	Quarterly reporting by JCM	Part of CLO responsibilities (1-2)	JCM CLO (1-2) Quarterly Reports of JCM activities will be prepared by JCM's EHS Manager District Lands Officer will review JCM's Quarterly Reports
9.9	Vector Borne and Communicable Diseases ▪ Construction equipment and activities have the potential to create dust emissions and create breeding grounds for vector borne illnesses affecting communities living in villages adjacent to the Project Site ▪ The presence of the workforce during construction in combination with poor sanitary conditions has the potential to increase communicable diseases	Avoid increasing the prevalence of vector borne and communicable diseases	1. Incident Records 2. Worker Code of Conduct 3. Grievances logged	Quarterly reporting by JCM	Part of EPC Contractor's bid (1-2) USD 2000 to develop Code of Conduct (3) Part of CLO responsibilities (4)	EPC Contractor (1-2) JCM (3) and JCM CLO (4) Quarterly Reports of EPC and JCM activities will be prepared by JCM's EHS Manager District Health Officer with support from the officers from the Ministry of Gender will review JCM's Quarterly Reports
9.10	STI/HIV Transmission ▪ Increase in STI/HI transmission and GBV due to worker-community interaction	Avoid Project-related increase in STI/HIV transmission and GBV	1. Health worker outreach reports and number of people targeted by providers 2. Number of condoms distributed 3. Assessment of NGOs addressing GBV and other gender issues 4. Impact monitoring of selected NGO 5. Grievances logged	Quarterly reporting by JCM	USD 6000 for STI/HIV Management Plan (1-3) USD 10,000 for support for NGO (4-5) Part of CLO responsibilities (6)	JCM (1-6) Quarterly Reports of JCM activities will be prepared by JCM's EHS Manager District Health Officer with support from the officers from the Ministry of Gender will review JCM's Quarterly Reports

Ref	Potential Impact Managed/Enhanced	Objective	Monitoring Indicator	Monitoring Frequency	Estimated Budget (USD)	Institutional Responsibility
9.11	Community Safety and Security ■ Security risk of petty crime, increased GBV, and perceptions that people in the communities are benefitting more than others creating tensions ■ Worker-community interactions, including the presence of security, may pose a threat to the community	Avoid risks associated with safety and security	1. Incident records 2. Meeting minutes from community engagement, including registers, photos and communication materials 3. Grievances logged	Quarterly reporting by JCM	Part of EPC Contractor's bid (1) Part of CLO responsibilities (2-3)	EPC Contractor (1) JCM CLO (2-3) Quarterly Reports of EPC and JCM activities will be prepared by JCM's EHS Manager District Health Officer with support from the officers from the Ministry of Gender will review JCM's Quarterly Reports
9.12	Labour and Working Conditions ■ The workforce may be subject to poor labour and working conditions	Prevent poor labour and working conditions	1. Incident records 2. Health and safety training records 3. STI training records 4. Recruitment statistics 5. EPC/contractor contracts 6. Gender Development Plan 7. Worker grievances logged	Quarterly reporting by JCM	Part of EPC Contractor's bid (1-4) USD 2000 for HR Policy (5) USD 7000 for Gender Development Plan (6) Part of CLO responsibilities (7)	EPC Contractor (1-4) JCM (5-6) and JCM CLO (7) Quarterly Reports of EPC and JCM activities will be prepared by JCM's EHS Manager District Commissioner will review JCM's Quarterly Reports
9.13	Cultural Heritage ■ Removal of living heritage (e.g., sacred trees) and damage to archaeological sites by ground-disturbing activities	Minimise impacts to cultural heritage	1. Chance find records 2. Audit reports	Quarterly reporting by JCM	Part of Project's design costs (1) Part of EHS Manager responsibilities (2)	JCM (1) and JCM EHS Manager (2)
9.14	Unplanned Events ■ Spills leading to soil and groundwater contamination ■ Traffic accidents	Minimise the impact of unplanned spills and reduce the risk of traffic accidents impacting community health and safety	1. Weekly visual inspection logs (including photographic evidence) including of hazardous material and waste containment and clean up kits 2. Incident records 3. Waste Management Plan 4. Hazardous Spill Response Plan 5. Driving training records 6. Audit reports 7. Grievances logged	Quarterly reporting by JCM	USD 7000 for Transportation Management Plan Part of EPC Contractor's bid (1-5) Part of EHS Manager (6) and CLO (7) responsibilities	EPC Contractor (1-5) JCM EHS Manager (6) and CLO (7) Quarterly Reports of EPC and JCM activities will be prepared by JCM's EHS Manager EAD and District Commissioner will review JCM's Quarterly Reports

Table 8-4: Operational Environmental and Social Monitoring Plan.

Ref	Potential Impact Managed/Enhanced	Objective	Monitoring Indicator	Monitoring Frequency	Estimated Budget (USD)	Institutional Responsibility
Positive Impacts						
8.1	Economy ■ Generation of electricity	Not applicable				
Adverse Impacts						
9.4	Groundwater ■ Some of the water supply to be utilized by the Project during operation is anticipated to be derived from groundwater, which may have an effect on other waters users	Prevent the contamination of surface and groundwater and avoid loss of water availability to other water users	1. Monitoring reports 2. Evidence of water storage solutions 3. Grievances logged	Bi-annual Audit Reports by JCM	Ongoing monitoring costs to be confirmed	JCM Project Manager (1-3) EAD will review JCM's Bi-annual Audit Reports
9.6	Landscape and Visual ■ Impact from solar reflection	Minimise the visual impact on surrounding sensitive receptors	1. Audit reports 2. Grievances logged	Bi-annual Audit Reports by JCM	Part of JCM's operational costs	JCM Project Manager (1) and CLO (2) EAD will review JCM's Bi-annual Audit Reports
9.8	Access Restrictions ■ The presence of a fenced solar site may block pathways that provide access to communities and farmland	Minimise restrictions to existing pathways transecting the Project Site	1. Meeting minutes with affected communities to determine and avoid access restrictions 2. Grievances logged	Bi-annual Audit Reports by JCM	Part of JCM's operational costs	JCM Project Manager (1) and CLO (2) District Commissioner will review JCM's Bi-annual Audit Reports
9.11	Community Safety and Security ■ Safety hazards may arise from trespassers into the solar plant and those that illegally try to connect to the transmission line.	Avoid incidents related to trespassers and opportunists attempting to steal panels or illegally connect to the transmission line	1. Incident records 2. Signage in hazardous locations 3. Community engagement records, including registers, photos, and communication materials 4. Grievances logged	Bi-annual Audit Reports by JCM	Part of JCM's operational costs	JCM Project Manager (1-2) and CLO (3-4) District Commissioner will review JCM's Bi-annual Audit Report
9.12	Labour and Working Conditions ■ The workforce may be subject to poor labour and working conditions	Prevent poor labour and working conditions	1. Incident records 2. Health and safety training records 3. Worker grievances logged	Bi-annual Audit Reports by JCM	Part of JCM's operational costs	JCM Project Manager (1-2) and CLO (3) District Commissioner will review JCM's Bi-annual Audit Reports
9.14	Unplanned Events	Minimise the impact of unplanned spills	1. Annual review of plans 2. Incident records	Bi-annual Audit Reports by JCM	Part of JCM's operational costs	JCM Project Manager (1-2)

Ref	Potential Impact Managed/Enhanced	Objective	Monitoring Indicator	Monitoring Frequency	Estimated Budget (USD)	Institutional Responsibility
	▪ Spills leading to soil and groundwater contamination					EAD will review JCM's Bi-annual Audit Reports

8.5 IMPLEMENTATION

The Project is committed to providing resources and establishing the systems and components essential for the implementation and control of the ESMP. These include appropriate human resources with specialised skills, training programmes, communication procedures, documentation control, and a management of change procedure.

8.5.1 Organisation

JCM is ultimately responsible for the management and supervision of Project activities and will have principal responsibility for implementing this ESMP and its mitigation measures. During construction, the Project will delegate some responsibility to the EPC Contractor. JCM will be responsible for operation but may engage contractors for certain operational aspects and in these cases, contractors would be delegated some responsibility for environmental and social performance. As a contractual requirement, the contractors will be required to demonstrate compliance of their activities with the ESMP. This includes providing resources to ensure compliance of subcontractors and a process for emergency stop-work orders in response to monitoring triggers. JCM will manage its contractors to ensure that this ESMP is implemented and monitored effectively through contractual mechanisms and regular direct oversight.

8.5.2 Roles and Responsibilities

The roles and responsibilities of the team responsible for implementing this ESMP are listed in Table 8-5. Supervision of contractor activities will be the responsibility of the Project Manager. The Project's Construction Manager and EHS Manager will be placed locally at the Project Site to supervise contractors and subcontractors during construction, while the Project's Operations Manager and EHS Manager will supervise personnel and contractors during operational activities. The CLO will be responsible for engagement with stakeholders, including local communities, to obtain and maintain the Project's social license to operate, which is crucial for the success of the Project.

Table 8-5: ESMP Implementation Roles and Responsibilities.

Position	Responsibility
Project Manager	Responsible for technical aspects of the Project, including contractor and subcontractor supervision during construction.
EHS Manager	Responsible for ensuring that the Project, including contractors and subcontractors, complies with applicable Malawian environment, social, health and safety, and labour laws and regulations, as well as ESIA commitments, including implementation of the mitigation measures set forth in the ESMP. Also responsible for ensuring that the Project aligns with applicable international standards.
Community Liaison Officer (CLO)	Responsible for engaging with local communities, government regulators, and other stakeholders on behalf of the Project. Also responsible for implementing EHS awareness and education programmes with communities.
EPC Contractor	Responsible for subcontractor technical and EHS performance and compliance.

8.5.3 Training and Awareness

The Project will identify, plan, monitor, and record training needs for personnel whose work may have a significant adverse impact on the environment or social conditions. The Project recognises that it is important that all employees are aware of the Project's environmental and social commitments, potential impacts of their activities, and roles and responsibilities in complying with this ESMP.

Key staff will be appropriately trained in key areas of EHS management and operational control with core skills and competencies being validated on an on-going basis. The identification of training and awareness requirements and expediting of identified training/awareness events will be the responsibility of the EHS Manager. This will be achieved through a formal training process. Employee training will include, as applicable to each employee's responsibilities, awareness and competency with respect to:

- E&S impacts that could potentially arise from their activities;
- Legal requirements for E&S performance;
- Necessity of complying with ESIA and ESMP commitments in order to avoid or reduce E&S impacts;
- Activity-specific training on waste management practices, documentation systems, and community interactions; and
- Roles and responsibilities to achieve compliance, including management of change and emergency response.

The EHS Manager is responsible for coordinating training, maintaining employee training records, and ensuring that training needs are monitored and reviewed on a regular basis. The EHS Manager will also periodically verify that staff are performing competently through discussion and observation.

Employees responsible for performing site inspections will receive additional training, drawing on external resources as necessary. Training will be coordinated by the EHS Manager prior to commissioning of the facilities. Upon completion of training and once deemed competent by management, staff will be ready to train other people.

JCM will also require that contractors and subcontractors institute training programmes for their personnel. Each contractor and subcontractor is responsible for providing EHS awareness training for personnel working on the Project Site. Contractors and subcontractors are also responsible for identification of any additional training requirements to maintain required competency levels.

8.5.4 Communication

The Project will maintain a formal procedure for communications with regulatory authorities and local communities. The EHS Manager will be responsible for communication of EHS issues with regulatory authorities, as required. The Project Manager will be kept informed of such communications and pertinent information arising from these communications will be communicated to contractors and subcontractors through the EHS Manager.

The CLO will be responsible for disseminating information and coordinating communications with local communities and other stakeholders through the course of the Project. The Project will implement a Community Grievance Mechanism whereby

community members can raise any issues of concern. Grievances may be verbal or written and are usually either specific claims for damages/injury or complaints or suggestions about the way that the Project is being implemented. When a grievance has been brought to the attention of the Project team, it will be logged and evaluated. The person or group filing the grievance is required to present grounds for making a complaint or claiming loss so that a proper and informed evaluation can be made.

When a complaint or claim is considered to be valid, steps will be taken to address the issue or reach agreement on compensation for the loss. In all cases, the decision made and the reason for the decision will be communicated to relevant stakeholders and recorded. When there remains disagreement on the outcome, an arbitration procedure may be required to be overseen by a third party (e.g., government official). Local community stakeholders will be informed on how to access and utilize the Community Grievance Mechanism.

8.5.5 Documentation

The Project will control EHS documentation, including management plans, associated procedures, checklists, forms, and reports through a formal procedure. All records will be kept on site and will be backed up at offsite locations (including secure cloud storage facilities). Records will be kept in both hard copy and electronic formats. All records will be archived for the life of the Project.

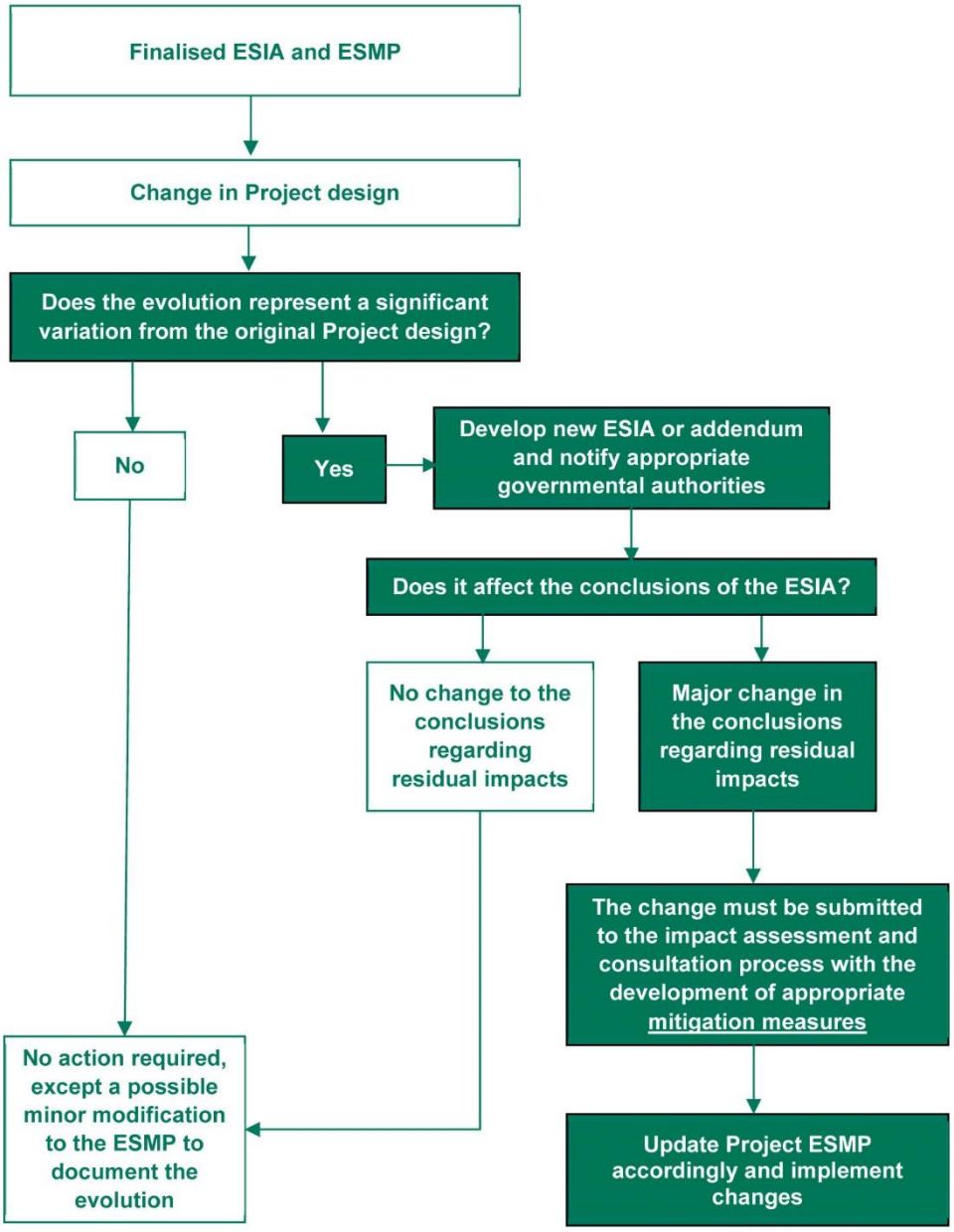
The EHS Manager will be responsible for maintaining a master list of applicable EHS documents and making sure that this list is communicated to appropriate parties. The EHS Manager will be responsible for providing notice to the appropriate parties of changes or revisions to documents, for issuing revised copies, and for checking that the information is appropriately communicated within the parties' organisations.

Contractors and subcontractors will be required to develop a system for maintaining and controlling their own EHS documentation and to describe these systems in their respective EHS plans.

8.5.6 Management of Change

Gaps and uncertainties inevitably remain in terms of information regarding the proposed Project and the ESIA process at the time of writing this report. As a result, JCM will implement a clear and transparent Management of Change Procedure in order to take gaps and uncertainties into account as they arise. Uncertainties remaining about the timetable and logistics for the Project must be addressed in a structured and transparent manner. The decision tree that JCM proposes to follow in order to manage these uncertainties is depicted in Figure 8-1.

Figure 8-1: Management of Change Decision Tree.



Source: ERM

8.6 MONITORING AND REVIEW

The Project's monitoring and review program will include inspections, monitoring, audits, corrective actions, and reporting. The objective of the program is to assess the effectiveness of the implementation of the ESMP.

8.6.1 Inspections

Internal EHS inspections will be conducted weekly on an ad hoc basis and formally at least once every six months. During construction, inspections will be conducted by the EPC Contractor and JCM, as specified in Table 8-3. The results of inspections will be reported to the EHS Manager, who will recommend actions to the Project Manager to address non-compliances and improve performance. During operations, inspections

will be carried out by the Project Manager and designated staff as specified in Table 8-4.

The Project will also facilitate any external inspections by governmental regulators. The results of these inspections will be reported to the EHS Manager and the Project Manager. The EHS Manager will be responsible for responding to any observations during these external inspections, and the Project Manager will be responsible for ensuring that contractors and subcontractors implement any required corrective actions.

8.6.2 Monitoring

Monitoring will be conducted to ensure compliance with ESIA and ESMP commitments, including the mitigation measures listed in Table 8-1 and Table 8-2. Monitoring parameters are listed in Table 8-3 and Table 8-4. The results of monitoring will be documented in Quarterly Reports or as otherwise specified in Table 8-3 and Table 8-4.

In addition, lenders may require monitoring of the Project's compliance with the E&S requirements specified in loan agreements and general alignment with lender E&S standards.

8.6.3 Audits

Beyond the routine inspection and monitoring activities, audits will be carried out internally by the Project to ensure compliance with regulatory requirements. Audits will also cover contractor self-reported monitoring and inspection activities. Audits will be performed by qualified staff, and the results will be reported to the EHS Manager and Project Manager.

Audit will include an assessment of compliance with ESIA and ESMP requirements, and will minimally include:

- Completeness of EHS documentation, including planning documents and inspection records;
- Compliance with monitoring requirements;
- Efficacy of activities to address non-conformances with monitoring requirements; and
- Training activities and record keeping.

There will also be a cycle of audits into specific areas or activities of the Project. The frequency of audits will be risk-based and will vary with the stage of the Project, and will depend on the results of previous audits.

8.6.4 Corrective Actions

The Project will implement a formal non-compliance and corrective action tracking procedure for investigating the causes of, and identifying corrective actions to, accidents or E&S non-compliances. This will ensure coordinated action between JCM and its contractors and subcontractors. The EHS Manager will be responsible for keeping records of corrective actions and for overseeing the modification of E&S procedures and/or training programs to avoid repetition of non-compliances. The Project Manager will be responsible for ensuring that contractors and subcontractors implement corrective actions.

8.6.5 Reporting

If required, the Project will provide appropriate documentation of EHS related activities, including internal inspection records, training records, and reports, to governmental authorities. Contractors and subcontractors will be required to provide EHS performance reporting to the Project on a regular basis through weekly and monthly reports. These will be used as inputs to the above. Quarterly and annual monitoring reports will be provided to government authorities as requested.

9. CONCLUSION AND RECOMMENDATIONS

This report presents the results of an Environmental and Social Impact Assessment (ESIA) of the Golomoti Solar Project. Environmental Resources Management (ERM) conducted the ESIA and prepared this ESIA Report as part of a larger Feasibility Study being conducted by Power Engineers. Power Engineers is conducting the Feasibility Study under a grant from the United States Trade and Development Agency (USTDA). This ESIA Report is designed to comply with Malawian laws and regulations, specifically the Environmental Management Act of 1996 and the Environmental Affairs Department (EAD) Guidelines for Environmental Impact Assessment (www.sdnp.org.mw/enviro/eia). It is also designed to align with international lender standards, specifically the International Finance Corporation (IFC) Performance Standards on Environmental and Social Sustainability (2012). This is because: 1) the ESIA is being funded by the USTDA; and 2) the Project proponent is committed to aligning with the IFC Performance Standards in its Environmental and Social (E&S) Policy. Baseline studies for the ESIA were conducted by Geoconsult Limited (Geoconsult) and Water Waste and Environment Consultants (WWEC), both based in Lilongwe, under subcontract to Power Engineers and ERM, respectively.

The Project proponent is Golomoti JCM Solar Corporation Limited (JCM). Project sponsors include JCM Power, InfraCo Africa, and the Project's development partner is Matswani Capital (PTY). JCM Power is an independent power producer (IPP) dedicated to accelerating social, economic, and environmental sustainability in growth markets through the development, construction, and operation of renewable energy facilities and high voltage direct current (HVDC) transmission lines. InfraCo Africa seeks to alleviate poverty by mobilising private sector expertise and finance to develop infrastructure projects in sub-Saharan Africa.

9.1 IMPACT SUMMARY

The potential impacts assessed in this ESIA Report were determined based on the results of a scoping exercise, which is described in Section 6.2.

Positive impacts are expected through the generation of electricity and job creation. The generation of 20 MW of power will lead to a 7.4% increase in the generation capacity of Malawi, representing a significant benefit to the macro economy of the country. The employment of approximately 200 people is anticipated for the construction phase, and approximately 20 people for the operation phase.

The only potential impact assessed to be major was economic displacement. Potential impacts assessed to be moderate are dust emissions, noise emissions, soil erosion, groundwater abstraction, disruption of ecosystem services, landscape and visual changes, increase in vector borne and communicable diseases, increase in STI/HIV transmission, poor labour and working conditions, damage to archaeological resources, and loss of baobab tree.

Unplanned events identified as a result of scoping are spills and improper disposal of waste to soils and groundwater, as well as traffic accidents. The impact significance (pre-mitigation) of spills was assessed to be major for both construction and operation, and the impact significance of traffic accidents was assessed to be major for construction.

9.2 CONCLUSION

Positive impacts are expected through the generation of electricity and job creation. The generation of 20 MW of power will lead to a 7.4% increase in the generation capacity of Malawi, representing a significant benefit to the macro economy of the country. The employment of approximately 200 people is anticipated for the construction phase, and approximately 20 people for the operation phase. Enhancement measures have been included in the ESMP (Section 8) to maximise the positive impacts. Regarding potential negative impacts, management and mitigation measures have been included in the ESMP to reduce the impacts identified by the ESIA process. There are no residual impacts of major significance.

Economic displacement is the only residual impact of moderate significance. Land Acquisition will be undertaken in close coordination with the Ministry of Lands. No physical displacement is anticipated. A Livelihood Restoration Plan (LRP) is being developed in parallel with the ESIA. The plan will evaluate the extent and scale of displacement impacts and address engagement related to land acquisition, eligibility and entitlements for affected persons, and implementation, monitoring, and evaluation requirements.

Unplanned events identified during scoping include spills and improper disposal of waste to soils and groundwater, as well as traffic accidents. Preventive measures have been included in the ESMP to reduce their likelihood and impact. With these measures in place, the likelihood and risk of unplanned events would be significantly reduced.

9.3 RECOMMENDATIONS

JCM is committed to working with the local community and authorities during the construction and operation of the Project and will maintain open dialogue as part of their ongoing stakeholder engagement activities. JCM is also committed to implementing the management procedures (i.e., enhancement, management, mitigation, and preventive measures) detailed in Table 8-1 (construction) and Table 8-2 (operation) of the ESMP, as well as the monitoring procedures detailed in Table 8-3 (construction) and Table 8-4 (operation) of the ESMP. As a result, it is recommended the Project be approved and proceed as planned.

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APPENDIX A ENVIRONMENTAL AFFAIRS DEPARTMENT TERMS OF REFERENCE

December 14, 2018

APPENDIX B HYDROLOGY AND FLOOD RISK ASSESSMENT (GEOCONSULT)

April 2019

APPENDIX C GEOTECHNICAL STUDY (GEOCONSULT)

July 2019

APPENDIX D HOUSEHOLD SURVEY REPORT (WWEC)

May 2019

APPENDIX E BIODIVERSTIY BASELINE REPORT (WWEC)

April 2019

APPENDIX F CULTURAL HERITAGE BASELINE REPORT (WWEC)

April 2019

APPENDIX G LIST OF STAKEHOLDER ENGAGEMENT ACTIVITIES

July 2019

APPENDIX H STAKEHOLDER ENGAGEMENT PLAN

February 2019

APPENDIX I TECHNICAL MEMO: GOLOMOTI PROTECTED TREES

October 7, 2019

APPENDIX J ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT TEAM

The core team members involved in the development of the ESIA Report and their qualifications and roles are listed in the table below.

Name	Organization	Qualifications / Experience	ESIA Role
Emlen Myers	ERM	PhD, Anthropology / >35 years	Partner in Charge / Senior ESIA Expert
Greg Lockard	ERM	PhD, Anthropology / >20 years	Project Manager / Senior ESIA Expert
Reed Huppman	ERM	MSc, Fluvial Geomorphology, Plant Ecology, and Environmental Engineering / >30 years	Biodiversity Specialist / Senior Technical Review
Ashley Morse	ERM	Master in International Affairs / 10 years	Social Specialist
Kara Westerfield	ERM	MS, Natural Resources & Environmental Sustainability / 10 years	Environmental Specialist
Justin Bedard	ERM	MA, Archaeological Studies / 15 years	Cultural Heritage Specialist
Kent Kafatia	WWEC	Registered Engineer / >25 years	In-Country Project Manager for Baseline Studies

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