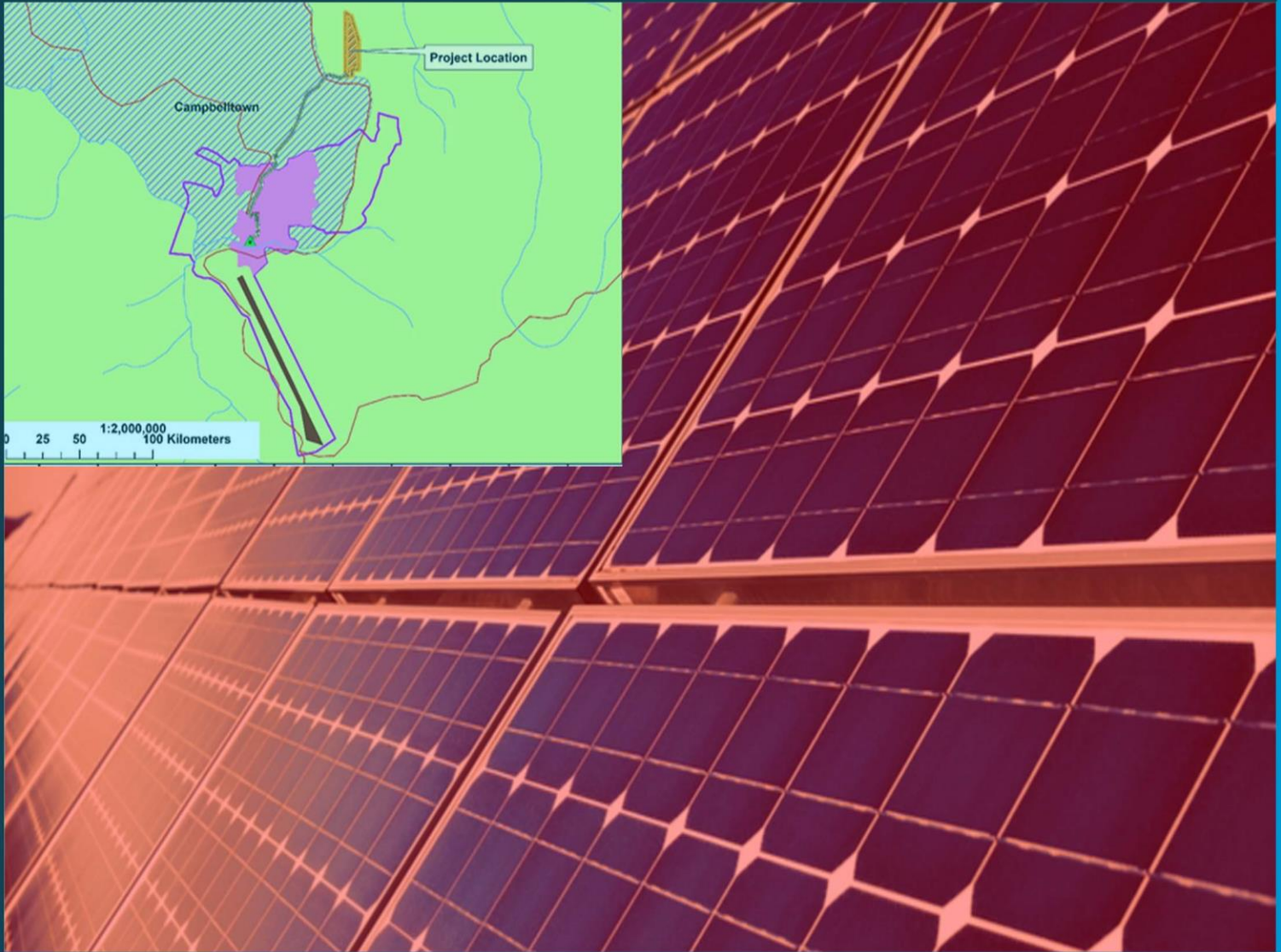
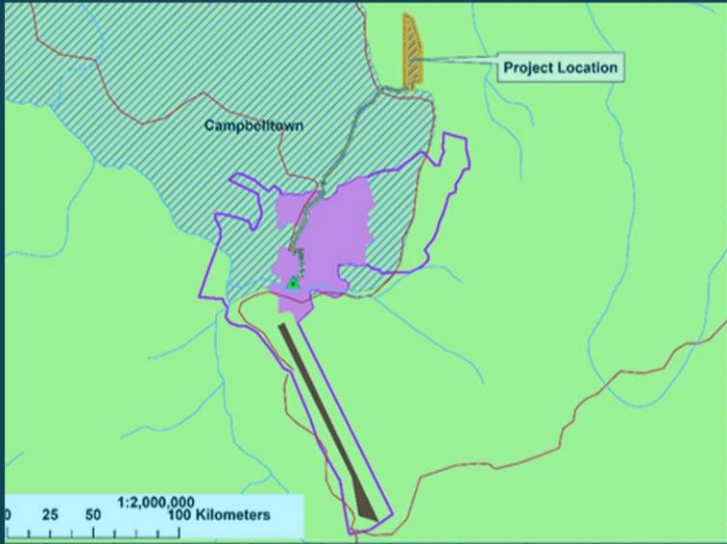


# ENVIRONMENTAL & SOCIAL ANALYSIS REPORT

## MAHDIA SOLAR FARM PROJECT



JANUARY 2022

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## ACRONYMS

AC	Alternating Current
AoI	Area of Influence
CESMP	Construction Environmental and Social Management Plan
CO	Carbon Monoxide
COD	Chemical Oxygen Demand
C-SERMS	Caribbean Sustainable Energy Roadmap and Strategy
DC	Direct Current
DO	Dissolved Oxygen
EBAs	Endemic Bird Areas
EMC	Environmental Management Consultants
EMDISDE	Energy Matrix Diversification and Institutional Strengthening of the Department of Energy
EMP	Environmental Management Plan
ENSO	El-Niño Southern Oscillation
ENSO	El-Nino Southern Oscillation
EPA	Environmental Protection Agency
EPC	Engineering, Procurement and Construction
ERP	Emergency Response Plan
ESAR	Environmental and Social Analysis Report
ESMP	Environmental and Social Management Plan
FPIC	Free, Prior and Informed Consent
GEA	Guyana Energy Agency
GFC	Guyana Forestry Commission
GIS	Geographical Information System
GLSC	Guyana Lands and Surveys Commission
GNBS	Guyana National Bureau of Standards



GoG	Government of Guyana
GW	Guyana Water Incorporated
HECI	Hinterland Electrification Company Inc.
HEP	Hinterland Electrification Programme
IAIA	International Association for Impact Assessment
IDB	Inter-American Development Bank
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
ITCZ	Inter-Tropical Convergence Zone
IUCN	International Union for the Conservation of Nature
kV	kilovolt
Kw	kilowatt
LCDS	Low Carbon Development Strategy
LCOE	Levelized Cost of Energy
MDG	Millennium Development Goal
MLGRD	Ministry of Local Government and Regional Development
MoPW	Ministry of Public Works
MPL	Mahdia Power and Light Company
MTR	Minimum Technical Requirements
MVA	Megavolt amperes
MW	Megawatt
NAP	National Action Plan
NBSAP	National Biodiversity Strategy and Action Plan
NDC	Neighbourhood Democratic Council
NDS	National Development Strategy
NEAP	National Environmental Action Plan
NFPA	National Fire Protection Association

NLUP	National Land Use Plan
NO <sub>2</sub>	Nitrogen Dioxide
OPM	Office of the Prime Minister
PAHO	Pan-American Health Organisation
PCU	Project Coordinating Unit
PEU	Project Execution Unit
PM	Particulate Matter
PPA	Power Purchase Agreements
PPE	Personal Protective Equipment
PRSP	Poverty Reduction Strategy Paper
PUC	Public Utilities Commission
PV	Photovoltaic
RDC	Regional Democratic Council
REDD+	Reducing Emissions from Deforestation and Forest Degradation
ROW	Right-of-Way
SO <sub>2</sub>	Sulphur Dioxide
TDS	Total Dissolved Solids
ToR	Terms of Reference
TSP	Total Suspended Particles
TSS	Total Suspended Solids
UAEP	Unserved Areas Electrification Programme
UNCBD	United Nations Convention on Biological Diversity
UNCCD	United Nations Convention to Combat Desertification
UNFCCC	United Nations Framework Convention on Climate Change
UV	Ultraviolet
USEPA	United States Environmental Protection Agency
VDC	Volts of Direct Current

VOCs	Volatile Organic Compounds
WHO	World Health Organisation

## 1.0 INTRODUCTION

### 1.1 Background

Electricity in Guyana is generated primarily from fossil fuels and the cost is one of the highest in the Caribbean. The vast majority of rural areas, especially in the interior of the country are unserved or underserved in terms of electricity supply. In an effort to address this, the Government of Guyana (GoG) is seeking to expand rural electrification through the use of micro-grids, solar photovoltaic systems with batteries, run-of-river and river dam hydro, and hybrid renewable energy systems.

The Energy Matrix Diversification Programme is one of the initiatives being pursued as part of efforts to address the energy diversification policy goals of the GoG. One of the components of this programme is to facilitate investing in sustainable and cleaner energy solutions to diversify the energy matrix in the hinterland while contributing to climate change mitigation. It is intended to finance investments in solar technology in three townships through the installation of photovoltaic (PV) tied mini-grid systems in Bartica, Region 7 (1.5 MW), Lethem, Region, 9 (1 MW), and Mahdia, Region 8 (0.65 MW), totaling 3.15 MW, as well as the implementation of storage capacity to manage intermittence of these sources. Overall, this component of the programme will provide a reliable source of electricity for the growing power supply needs of the townships which now relying on fossil fuel.

The GoG has received financing from the Inter-American Development Bank (IDB) to implement the Energy Matrix Diversification Programme. In accordance with the IDB's Operational Policy on Environment and Safeguards Compliance (OP-703), this operation is classified as Category "B" and it is anticipated that the programme will generate moderate environmental and social impacts that could be easily mitigated through the implementation of the required mitigation measures. The main anticipated impacts will be those associated with land use within or close to indigenous communities since these projects will also serve indigenous communities. The expansion of the substations and construction of the transmission line can likely result in impacts from the clearing and management of the right of way. The three townships have important presence of indigenous people who are among the beneficiaries of the projects.

In order to meet the requirements of the Bank's Environmental and Social Safeguard Policies, the GoG is required to prepare an Environmental and Social Analysis Report (ESAR) inclusive of an Environmental and Social Management Plan (ESMP) for the Mahdia project. This is a prerequisite for the engineering, procurement, construction, installation, commissioning and turn-key delivery of the Solar PV power plants, including battery energy storage systems. The Guyana Energy Agency (GEA), which is the implementing agency for the project, is responsible for the preparation of the ESAR. A Terms of Reference (ToR) was prepared to guide the preparation of the ESAR, as is outlined in Appendix A.

It should be noted that the project is already permitted by the Environmental Protection Agency (EPA) through the issuance of a Construction Permit in December 2020. An ESAR for the Energy Matrix Diversification Programme was prepared in 2018 and assessed all three locations in Bartica, Mahdia and Lethem. However, since the ESAR was prepared the proposed location of the solar power plant in Mahdia has changed. As a result, another ESAR, focusing exclusively on the development of the solar power plant in Mahdia and its associated activities was required to be prepared prior to the commencement of construction.

## 1.2 Objective and Scope of the ESAR<sup>1</sup>

The main objectives of the ESAR are to:

- Identify, predict and evaluate the economic, environmental and social impact of the development of a solar PV power plant and its associated activities at Mahdia.
- Provide information on the environmental consequences for decision making.
- Promote environmentally sound and sustainable development through the identification of appropriate alternatives and mitigation measures.

The Environmental and Social Analysis is to be carried out based on the inputs of and coordination with the GEA, and on information available in academic literature and on field visits and campaigns carried out. The focus of the ESAR is to identify and assess potential impacts envisaged from the construction and operation of the PV power plant and, for those adverse impacts which cannot be avoided, to identify appropriate mitigation actions.

Specifically, the ESAR seeks to:

- Determine the project Area of Influence (Aoi), including areas of direct and indirect influence.
- Present a description of the project including its location, scale, components, phases, benefits, etc.
- Assess the policy, regulatory and institutional framework for the project, including identifying the relevant national and international policies, legislation, standards and guidelines that define the implementation framework of the project, as well as the responsible institutions.
- Assemble relevant physical and biological baseline information on the project area including its geology, soils, hydrology, topography, climate, water quality, air quality, noise levels and terrestrial and aquatic flora and fauna (including an indication of possible endangered, rare or threatened species and species of commercial importance).
- Assemble relevant socioeconomic baseline information on the project area including communities, population, land use, economic activities, historical and archaeological sites, etc.
- Identify and engage with key project stakeholders, and present and address their feedback and concerns, including the communities closest to the site and the project beneficiary communities.
- Identify and assess the potential impacts of the project on the physical, biological and socioeconomic environment, distinguishing construction and post construction phase impacts, as well as cumulative impacts.
- Prepare an Environmental and Social Management Plan (ESMP) that identifies measures to prevent or reduce adverse impacts to acceptable levels for both the construction and operation phases of the project.
- Prepare an Implementation Framework for the ESMP, including outlining roles and responsibilities, Contractor plans, monitoring and reporting requirements, stakeholders' engagement, grievances mechanism, training, etc.

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<sup>1</sup> Adapted from Terms of Reference for the ESAR (Appendix A)

### 1.3 Approach

This ESAR was prepared by the consultant engaged by the GEA and guided by the Terms of Reference for the Consultancy, attached as Appendix A; the EPA issued Construction Permit for the project (attached as Appendix C); and EPA's Guidelines for preparing EMPs. The ESAR was prepared during the period February to April 2021 and was revised in July and November 2021. The consultant was assisted by a team with expertise in the conduct of environmental assessment. This team is presented in Appendix B.

Prior to the commencement of the ESAR preparation process the consultant sought to gain an in-depth understanding of the project and the project environment so as to determine the best methodology to be employed. The initiatives undertaken in this regard are outlined below:

- Meetings and discussions were held with key officials from the GEA to fully understand the project. Clarifications were also sought with the GEA on aspects of the ToR to ensure there is common understanding on the issues required to be addressed by the ESAR. These engagements with GEA personnel continued throughout the ESAR preparation process.
- Information was shared by the GEA on the project and these were reviewed, including the project's Technical Specifications, the Construction Permit issued by the EPA, previous Public Consultations Reports and the ESAR for the Energy Matrix Diversification Programme in 2018 among others.

These activities helped shape the methodology for the preparation of the ESAR.

### 1.4 Methodology

The ESAR preparation was done in phases. Early in the process a review of the national policies, strategies, plans and legislation, as well as international agreements was done to understand the regulatory and institutional framework within which the project will be developed and operate. Applicable IDB Environmental and Social Safeguard policies were also assessed.

Thereafter, the ESAR preparation was conducted in three main phases as follows:

Phase 1	Establishing the Baseline
Phase 2	Impact Identification and Analysis
Phase 3	Mitigation and Management Planning

The preparation of the ESAR utilised Geographical Information System (GIS) to provide spatial data and analyses to aid in the conduct of field exercises, analyses of the data, and presenting information in the ESAR. GIS encompassed two types of data: (1) primary data, which is data collected from field work; and (2) secondary data, which is data extracted from existing datasets/databases. This allowed a mixed-method approach whereby both primary and secondary spatial data contained qualitative and quantitative components. Digital data was available and stored in both raster and vector models (as raster data and vector data). GIS was utilized for all phases of the ESAR preparation.

Prior to the commencement of field activities, it was essential to have a clear understanding of the Aol of the project. The primary Aol of the project is defined as the footprint of the actual facility to be constructed. The secondary Aol is defined as the route to be followed for the establishment of the transmission line from the project site to interconnect with the existing transmission network. The Aol includes a fringe of land extending approximately 15 metres around the project components in all directions. A map of the Aol and potential impacts of the project relative to the Aol are presented in Chapter 6.



#### **1.4.1 Establishing the Baseline**

Collection of primary and secondary data on the physical, biological and ecological resources, and the socio-economic and cultural context of the project area formed an integral part of the ESAR and was done over the period February to March 2021.

Some amount of secondary data for the project environment exists at the level of Government institutions and in previous studies done such as the Environmental and Social Analysis Report for the Energy Matrix Diversification Programme. Weather data for Mahdia was sourced from the Hydrometeorological Department.

To complement the existing data, to address gaps, and ensure updated data is available and utilized for the purpose of the ESAR, baseline surveys were conducted to collect data at the project site. Surveys were done to collect baseline data for the following environmental components:

- Noise Levels
- Air Quality
- Surface Water Quality
- Biological Resources
- Socioeconomic Environment

The methodologies employed for the execution of the baseline surveys are presented in the section addressing the respective environmental components, and further details are included in the related appendices.

During this phase stakeholder engagements were also conducted to determine the concerns and recommendations of stakeholders so these can be addressed in the ESAR. Details on the stakeholder engagements are presented in Chapter Five, including the methodology employed and feedback provided.

#### **1.4.2 Impact Analysis**

After establishing the baseline conditions of the project area, the potential environmental and social impacts of the project activities during the construction and operational phases were assessed. This was done by establishing the potential interactions between the activities and the characteristics of the existing physical, biological and socio-economic environment and within the effective area of direct and indirect influence. The methodology employed for the impact identification and assessment is detailed in Chapter Six.

#### **1.4.3 Mitigation and Management Planning**

Mitigation and management planning were done to identify feasible and practical measures to reduce and mitigate the potential negative impacts as well as maximise the positive impacts. Procedures to be undertaken in the event of an emergency situation were examined, and a framework proposed to implement, monitor and assess the effectiveness of the mitigation measures recommended. Mechanisms to engage with project stakeholders and address grievances were also developed. An ESMP was prepared which outlines the measures to be implemented to prevent, manage and monitoring possible environmental and social impacts which may be derived from the project.

## 1.5 Organisation of the ESAR

The ESAR was organized in eleven (11) main sections as outlined below:

- **Chapter One** – This Chapter provides an introduction to the ESAR, including its scope and methodology employed.
- **Chapter Two** – This Chapter provides a detailed description of the project.
- **Chapter Three** – This Chapter provides a description of the national policies, strategies and plans relevant to the project, the various legislation with which the project will have to comply, and the regulatory bodies which will have oversight of the activities. The Chapter also describes the IDB's Environmental and Social Safeguards relevant to the project.
- **Chapter Four** – This Chapter provides a description of the project environment, including the physical, biological and socio-economic environment.
- **Chapter Five** – This Chapter documents the stakeholder engagement process, including identification of project stakeholders, methodology employed, and the feedback including concerns and recommendation from engagements with stakeholders.
- **Chapter Six** – This Chapter assesses the potential impacts of the project on the physical, biological and socio-economic environments. In addition, this section also outlines potential health and safety impacts of the project.
- **Chapter Seven** – This Chapter presents the ESMP, which outlines recommendations for the management of potential environmental and social issues relating to the project. Recommendations for health and safety and emergency response are also included.
- **Chapter Eight** – This Chapter presents an implementation framework for the ESMP outlined in Chapter 7.
- **Conclusion**
- **References**
- **Appendices**

## 1.6 Challenges Experienced

The following were the key challenges which were experienced in the completion of this ESAR:

- **Detailed Project Design Not Available** – Most of the potential impacts of the project relate to the construction phase. However, given that the project will be executed through an Engineering, Procurement, Construction (EPC) arrangement the detailed project design is still to be completed. In addition, the methodology to be employed by the contractor is not available to the consultant. This would have provided specific information including quantities and sourcing of construction materials, transport of materials to the site and storage, plans for workers, etc. This, however, has been addressed through the provision of guidelines and recommendations for a Construction Environmental and Social Management Plan (CESMP) to be prepared by the contractor.

- **COVID 19 Pandemic** – The entire ESAR preparation process was done during the COVID 19 pandemic. The implementation of the national restrictions including the curfew, requirements of practicing social distancing, limited travel options, as well as the need to ensure the safety of the consultant and stakeholders being engaged were all factors that collectively challenged the field work aspect of the process. Notwithstanding these challenges, all baseline surveys and stakeholder engagements were conducted with only minor adjustments to the methodology so as to ensure that all public health and safety measures were followed. As such, the pandemic did not compromise the quality and thoroughness of these activities.
- **Adjustment to Site Boundary** – During the ESAR preparation process GEA took the decision to adjust the project site boundary to exclude persons who were occupying portions of the original site so as to avoid any conflict. This resulted in a delay in the completion of the ESAR since the consultant had to await the new survey plan to adequately determine and assess the project impacts.

## 2.0 PROJECT DESCRIPTION

### 2.1 Background

The GoG has received financing from the IDB to implement a Programme titled *Energy Matrix Diversification and Institutional Strengthening of the Department of Energy (EMISDE)*<sup>2</sup>. The objective of the Programme is to support Guyana's evolving energy sector by: (i) investing in sustainable/cleaner energy solutions to diversify the energy matrix in the Hinterland while contributing to climate change mitigation; (ii) investing in the reinforcement of transmission infrastructure to improve reliability and stability of the Demerara-Berbice Interconnected System; and (iii) strengthening the Department of Energy to develop a regulatory framework, and improve institutional capacity and governance of the oil and gas sector. The Programme will achieve these objectives by the development of the following three components:

- **Component 1 – Renewable Energy Solutions for the Hinterland (USD\$8.6 million):** This Component entails the installation of solar photovoltaic (PV) plants in three hinterland townships of Bartica (Region 7), Mahdia (Region 8) and Lethem (Region 9) all of which currently rely exclusively on fossil fuel for electricity generation. The installation of a 1.5 megawatt (MW) solar plant within 3.03 hectares (7.5 acres) of land is planned in Bartica; 1 MW within 2.02 hectares (5 acres) of land is planned in Lethem, and 0.65 MW within 4.65 hectares (11.48 acres) of land is planned in Mahdia. The electrification of the Dagg Point community in Bartica and the titled indigenous village Campbelltown in Mahdia are also expected under this Component. The GEA is the executing agency for this Component and a dedicated Project Coordinating Unit (PCU) has been established to facilitate implementation.
- **Component 2 – Reinforcement of Transmission Infrastructure (USD\$9.95 million):** This Component entails reinforcements at three substations of Kingston, Old Sophia and 5 km single circuit overhead 69 kV transmission line between the Kingston and Sophia substations and installing reactive power compensation at New Sophia. The Guyana Power and Light Inc. (GPL) is the executing agency for this Component.
- **Component 3 – Institutional Strengthening and Governance of the Department of Energy (USD\$4.5 million):** This Component will finance the activities to strengthen the Department of Energy. In particular, it will finance capacity building initiatives and best practice organizational structure, including high level training and coaching of government staff and technical support for the development of the design of a new oil and gas legislative and regulatory framework. The GEA is also the executing agency for this Component.

This ESAR focuses on Component 1 of the Programme, specifically on activities related to the Engineering, Procurement, Construction (EPC) as well as the Installation, Commissioning and Turn-key Delivery of a solar PV power plant, including battery energy storage system for the hinterland town of Mahdia located in Region 8.

### 2.2 Rationale

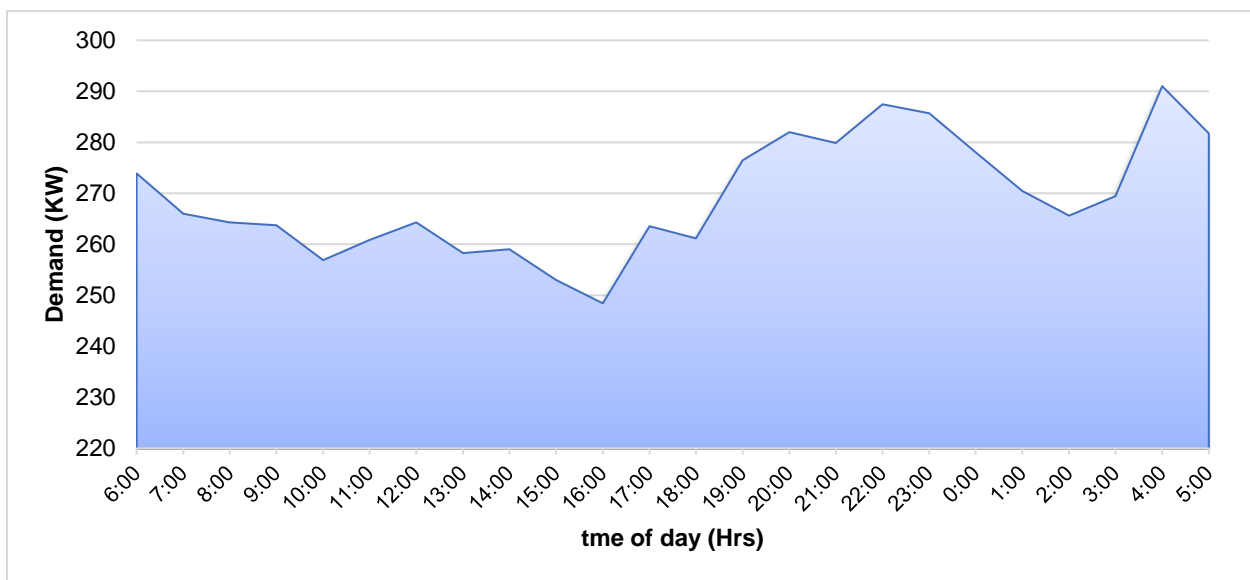
Guyana is almost entirely dependent on imported fossil fuels for its energy needs. The cost and reliability of electricity are also recognized as a major factor for profitability and efficiency in business operations. As such, the development of indigenous renewable energy resources is considered a priority and the GoG is pursuing the significantly increasing use of renewable energies to generate electricity. The transition of electricity generation to renewable sources will help to reduce fossil fuel

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<sup>2</sup> EMISDE Project documents are publicly available on the IDB's website: <https://www.iadb.org/en/project/GY-L1066>

consumption, increase energy security particularly for hinterland utilities and support the Government's developmental reorientation to a low carbon economy.

Mahdia is one of Guyana's newest townships and is supplied with electricity from the Mahdia Power and Light Inc. (MPL) for 24-hours on a daily basis. Currently, MPL's installed capacity is 1.455 MW provided by three diesel generator sets with capacities of 0.625 MW, 0.43 MW and 0.40 MW. Recently, one of these three generators malfunctioned leaving MPL with a two-generator installed capacity for the foreseeable future (EMC Personal Communication 08). Peak demand is 0.375 MW and typically occurs between 19:00 to 22:00 hrs. Figure 2-1 presents MPL's average hourly load profile. Electricity is generated at a cost of USD\$0.55 per kilowatt hour (kWh) or GYD\$ 115 per kWh. However, electricity is sold to residents at a subsidised rate of USD\$0.50 per kWh (GYD\$ 106.6 per kWh) requiring subventions from Government of approximately USD\$125,000 (GYD\$ 26.2 million) annually.<sup>3</sup> The Hinterland Electrification Company Inc. (HECI) is the operator of both MPL and the Mahdia Transmission and Distribution Grid.



**Figure 2-1: MPL's Average Hourly Load Profile**

Fuel accounts for approximately 65 to 69 percent of the MPL's total operational costs and is transported to Mahdia overland from Georgetown, a distance of approximately 203 kilometres. A significant section of the fuel transportation route is on unpaved roads which deteriorate during the rainy seasons and ultimately result in delays in deliveries and in some instances causing fuel shortages resulting in interruptions of electricity service.

## 2.3 Project Overview

The project comprises of an EPC and turn-key delivery of a 0.65-megawatt peak (MWp) solar PV power plant inclusive of a 2-hour battery energy storage system in Mahdia. The battery storage system (energy storage and battery inverter) will support the primary function of 'grid forming' and meet the demand of the Mahdia mini-grid during the periods for which solar energy is available. It is expected to be capable of providing rapid response when the intermittent source cannot meet the energy requirement of the consumers. The design of the solar power plant will allow for future expansion of

<sup>3</sup> Conversions of USD to GYD are based on an exchange rate of USD\$1 = GYD\$ 209.29

the solar PV system thereby increasing the solar PV capacity and upgrades the battery storage system with energy storage to provide solar energy during the night.

The electricity generated by the project will be integrated into the existing Mahdia Transmission and Distribution Grid. Accordingly, a new 13.8 kilovolt (kV) transmission line will be established for interconnecting the solar (PV) plant to the distribution grid at the 13.8kV busbar in the power plant. The transmission line will cover a distance of approximately 2 kilometers. Table 2-1 provides an overview of some of the key specifications of the solar power plant.

**Table 2-1: Key Specifications of the Solar Power Plant**

Location	Primelands, Mahdia, Region 8
Footprint	4.65 hectares (11.48 acres)
Rated Peak Capacity	0.65 MWp (with potential for expansion of an additional 1.3MWp)
Operational Hours	06:00 to 17:45 hrs
Battery Storage	Two-hour battery storage with at least two battery-subsystems
Sub-Stations	Two sub-systems with installed capacity of 0.325 MWp for each array
Electricity Generated/Year	925 MW/h
Distribution Network	Interconnection to the Mahdia Transmission and Distribution Grid via a 2 kilometer 13.8kV transmission line
CO <sub>2</sub> Savings	702.39 tons per year
Levelized Cost of Electricity (LCOE)	Simple LCOE to be estimated by EPC contractor
Design Life of Project	20 years
Cost Estimation	USD\$ 1,951,358

## 2.4 Project Life and Sustainability

The project is being installed with a life span of 20 years. The HECI and MPL will be the owner/operator once operational. Medium- to long-term sustainability of the project will be supported by the warranties for various equipment/project components as well as by training of HECI personnel.

## 2.5 Project Location

The proposed site for the 0.65 MWp solar power plant is located in Primelands, Mahdia in Region 8. The site is approximately 4.65 hectares (11.48 acres) and is located approximately 4 kilometres by road from MPL. The site can be accessed via the Mahdia Main Access Road. The location is shown in Figure 2-2.

During the ESAR preparation process, the site boundary was adjusted to exclude an individual occupying portions of the site so as to avoid any potential conflict. The boundaries of the project site as a result of the adjustment can be seen in Figure 2-3.

A 13.8 kilovolt (kV) transmission line will be established for interconnecting of the solar (PV) plant to the existing MPL distribution grid. In total, the transmission line will cover a distance of approximately 2 kilometers with about 0.94 kilometers passing through the titled indigenous village of Campbelltown. The route of the transmission line is shown in Figure 2-4.



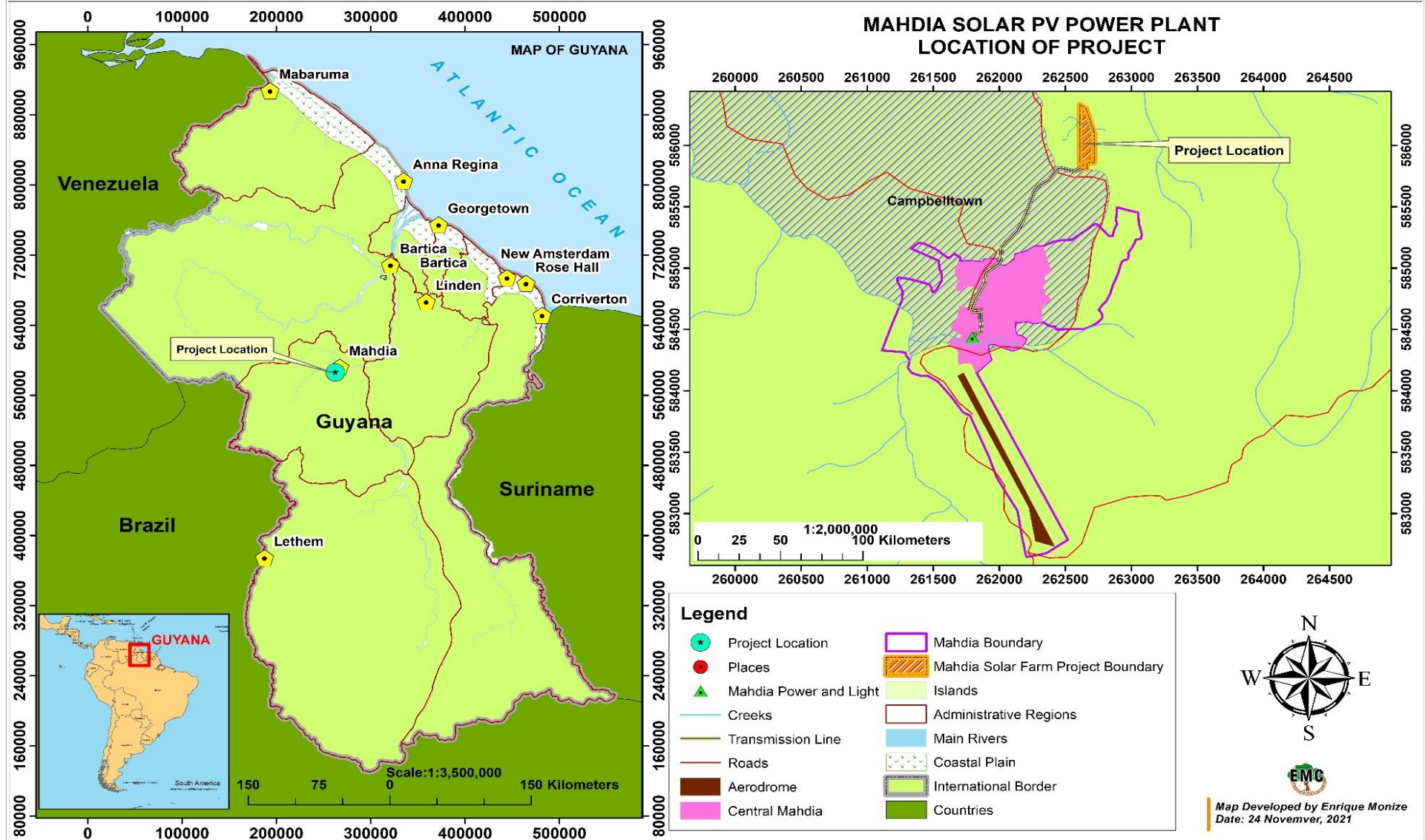


Figure 2-2: Location of the Mahdia Solar Power Plant and Transmission Line

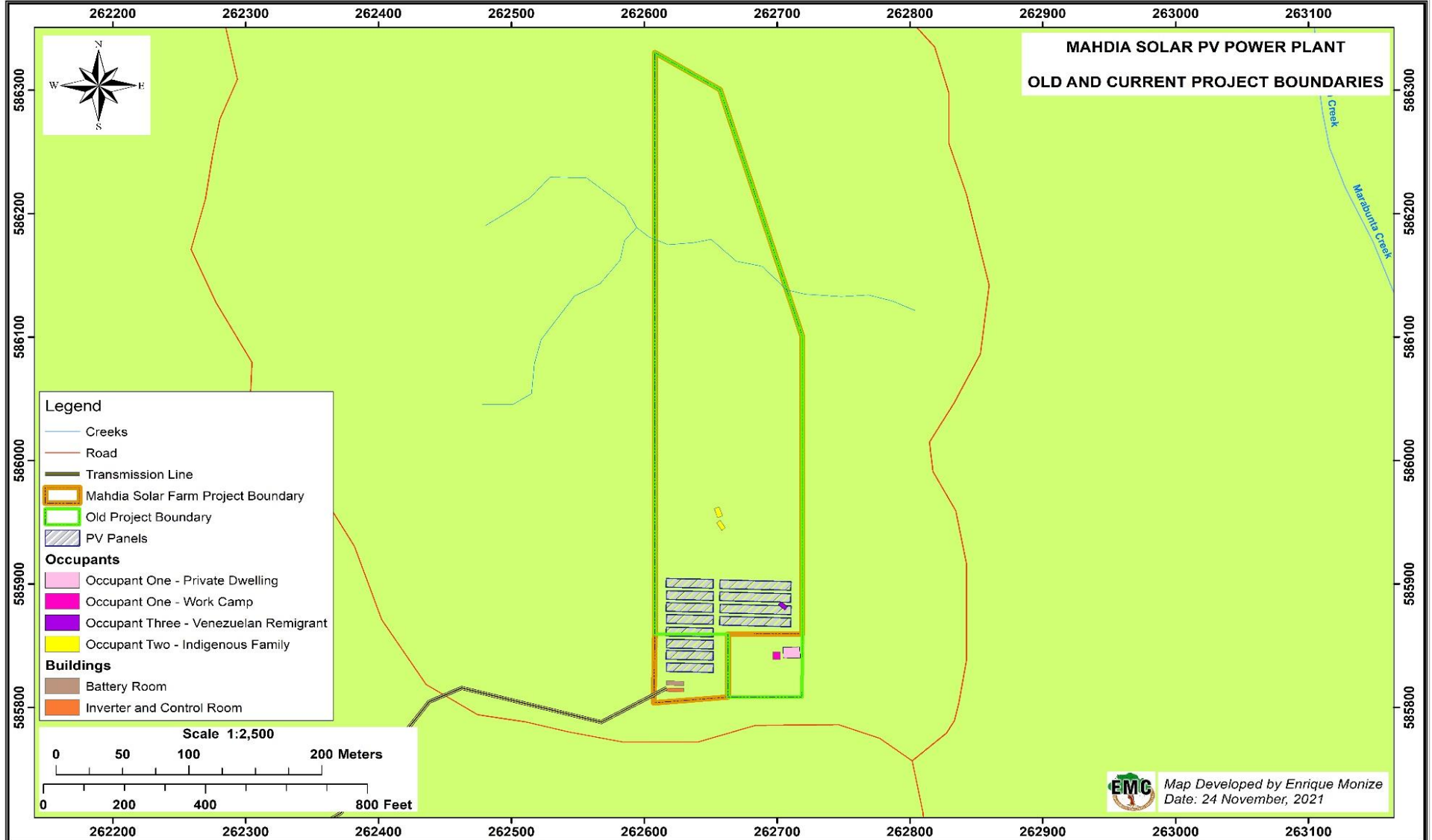


Figure 2-3: Adjustment to the Project Site Boundary

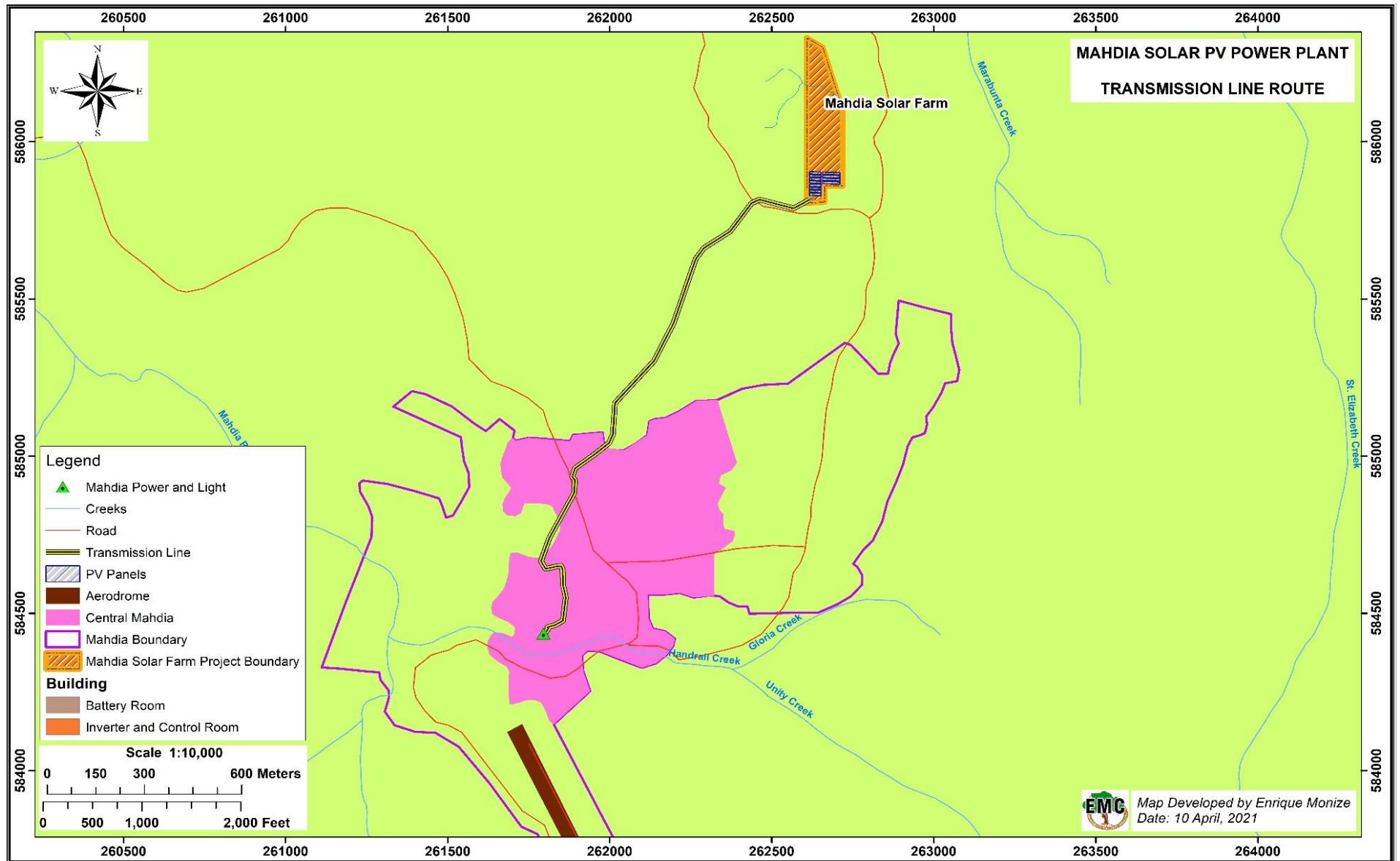


Figure 2-4: Route of Transmission Line from Mahdia Solar Power Plant to the MPL Facility

## 2.6 Project Components

The solar power plant will have the following components:

- **PV Modules**
- **PV Structure**
- **PV arrays**
- **Inverters**
- **Battery Station**
- **Transformer**
- **Interconnection, Control and Monitoring**

The proposed layout of the PV arrays, the housing facility for the batteries and inverters, and other Project buildings are presented in Figure 2-5. The layout caters for a possible expansion of the solar farm in the future.

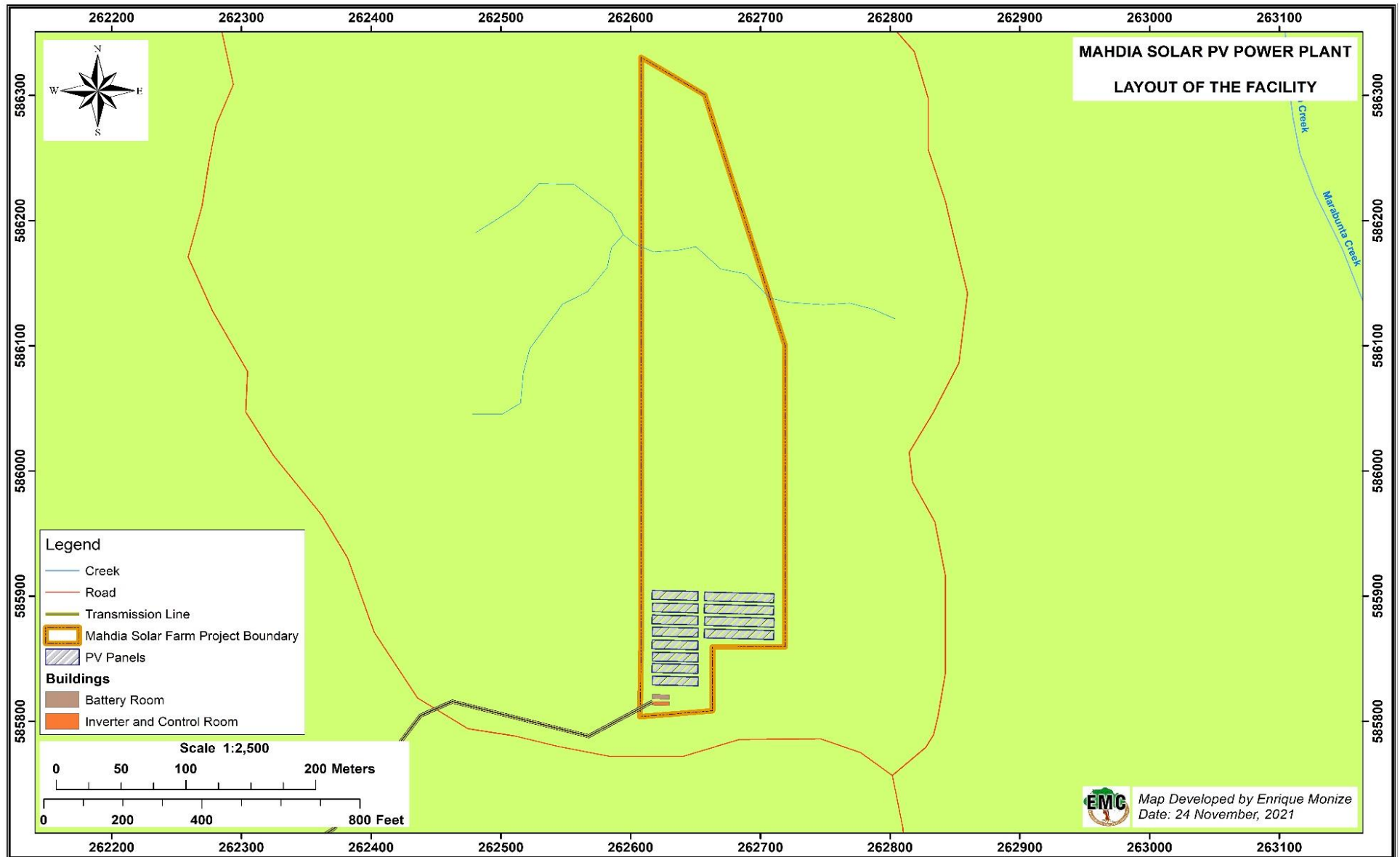


Figure 2-5: Proposed Layout of the Solar Power Plant/Facility



### **2.6.1 PV Modules**

The PV modules to be utilised by the project will be the Polycrystalline Silicon (Poly-Si) type with a minimum efficiency of 16 percent. However, alternative proven technology for PV module types may also be considered if it possesses higher energy efficiency, better reliability and improved durability, at equal or lower PV module cost as compared to the Poly-Si type. All of the PV modules will be framed. Frames will be aluminium or stainless steel which are electronically compatible with the structural material used for mounting the modules. All components will be designed to resist sand and dust deposits, wind, suction and uplift loading. Anti-reflective tempered glass cover will also be used as a protective shield for the active surface area of the module and should be chosen for high impact and thermal shock resistance. The service life of PV modules is expected to be 25 years with a minimum of ten years of the product warranty.

PV modules will have a minimum power output warranty of 90 percent of nominal peak power in year ten and 80 percent of nominal peak power in year twenty-five. PV modules must be tested and certified by an accredited certified agency. The modules must also satisfy all other relevant national and international standards. The PV module cables will have high-water resistance for outdoor installation, high durability and resistance to external influences, such as Ultraviolet (UV), ozone and temperature among other characteristics. The cables will also be halogen-free, flame resistant, self-extinguishing and with double insulation to prevent short circuit and earth fault. Each PV module will have a sealed junction box that contains a small replaceable cover for easy access for the replacement of the bypass diodes.

### **2.6.2 PV Structure**

The mounting structures for the solar PV modules will be made of corrosion resistant material which will be electronically compatible with the PV module's frame material. The design of the solar structure and foundations will take account of the existing soil conditions at the project site and will be capable of withstanding winds up to 160 kilometres per hour. The design of the mounting structure will also cater for thermal expansion and contraction of the structure without affecting the integrity of the modules. Foundation works for the solar PV structure will be in the form of strips, pads or a combination of both and allow for suitable fixations to secure mounting racks. The mounting structures will orient the PV modules in a southern direction with an inclination of between 8 to 10 degrees. The elevation of the structures from the ground to the lower tip of the PV modules will be approximately 1.2 to 1.5 meters (4 to 5 feet).

### **2.6.3 PV Arrays**

The PV array will maximize efficiency and reliability of the solar power plant. The minimum voltage of a string will be 1,000 volts of direct current (VDC). Each string must have a blocking diode to prevent reverse current flow. Each string must have string protection through fuse and disconnect switch. The PV arrays will have durable combiner boxes with built-in fuses and surge-protection. The positive and negative Direct Current (DC) cables will be laid separately and consisting of adequately sized single core copper cable each. All cables and connectors to be used for installation of the solar PV power plant will be able to withstand harsh environmental conditions for 25 years. All DC cables will be UV resistant, rodent proof and termite repellent.

### **2.6.4 PV and Battery Inverters**

Inverters will convert incoming DC power received from PV modules into Alternating Current (AC power) with suitable power quality. PV inverters will have integrated maximum power point tracking (MPPT) technology to maximize the energy output from the PV arrays. Each of the independent PV systems will have their synchronization provisions for parallel operation with the other inverters as well



as synchronization provisions for parallel operation with the diesel generators operated by MPL. Operation consumption of inverter at maximum load is expected to be lower than 0.5 percent of the nominal output power. Stand-by consumption of the inverter is expected to be lower than 0.1 percent of nominal power output. Inverters will have the capability for remote power off. PV inverters will be able to curtail the active power when demanded by energy management system. Inverters should have a minimum of ten years of product warranty.

#### **2.6.5 Battery Station**

The battery-based inverter and storage system for grid forming will allow maximum power output from the solar PV inverters into the grid. The battery system will provide a rapid response against the solar power output variations and will enable a smooth transition of the load provided by solar PV to the generators. Batteries will be the lithium-ion type. The Battery station should, under normal operating conditions, be able to serve for a period of eight years for the batteries or any other main component of the installation. The Battery station will have a minimum nominal power of 650kW. Battery storage will also be capable of providing a minimum of 350 kW for a duration of 2 hours. The batteries must have a minimum of eight years warranty.

#### **2.6.6 Transformers**

A pad-mounted step-up three-phase 60 Hz transformer will be installed at the solar power plant. The transformer will have a power rating of one Megavolt amperes (MVA) or above with a step-up voltage of 13.8 kV and low voltage input to match the output of the inverter along with all protection switchgear, circuit breakers, cables, etc. The transformer is expected to be the oil filled type and constructed of ventilated metal enclosure. The transformer will be rated for inverter source operation and the environment in which it will operate. Transformers will have all necessary protection features such as silica gel breather, Buchholz relay, pressure relief device, magnetic oil level gauge, oil temperature indicator and winding temperature indicator. Transformers will also be equipped with a no-load tap changer with high voltage taps capable of operating at 2.5 percent above and below the nominal voltage at full rating. Finally, the transformers will have a fused disconnect switch on the transformer high voltage side to isolate the transformer in case of an internal fault.

#### **2.6.7 Interconnection, Control and Monitoring**

An interconnection of medium voltage power, control and monitoring between the PV system and the existing grid and generators will be established. Each independent 0.325 MWp sub-system will also be equipped with synchronization provisions, to provide for parallel operation with the sub-system, the battery inverter and/or the generator sets in the diesel power station. Similarly, each diesel generator set in the diesel power station will be capable of synchronization with the PV plant and its sub-systems. Parallel operation of the new 0.650 MWp PV power plant with the existing generator sets must not result in abnormal operating conditions.

The 13.8 kV Medium Voltage switchgear will be located in the Control Room of the existing MPL diesel power station. The solar PV system control is intended to be integrated with the current generator sets control. This may require modifications or upgrades to the existing control system for the generator sets. During parallel operation of the solar PV and diesel Plants, the control system will be able to control the PV inverters output to maintain the diesel genset running at least 50 percent of its nominal power or the minimum specified gensets requirement. Each independent 0.325 MWp PV sub-system will be controlled from the local control panel. Disconnection and connecting of the PV sub-systems will also be possible from the MPL Control Room (both manually and automatically). After synchronization, the power and voltage control are to be supervised by the Operator in the Control Room. The electrical parameters of sub-system (inverter AC output voltage, current, power, frequency, etc.) is expected to be displayed on the local control panels. Additionally, a local system will be

provided with the possibility for real-time monitoring of all required PV sub-system parameters. The solar PV power plant can be remotely controlled from the Control Room and all required information with regard to the configuration of the system (circuit breaker positions, parameter value monitoring etc.) will be presented on a display.

The monitoring unit will be equipped with a suitable communication interface for remote monitoring. The monitoring unit will display the following data: solar irradiation on the inclined plane of the panels atmospheric and module temperature; in each DC string: voltage, current and power; in each inverter AC output voltage, current, power for each phase and frequency; for battery inverters AC input (battery charging): voltage, current and power; and point of interconnection: voltage, current and power. All the parameters will be logged on an hourly basis (average values) although more frequent logs may also be possible.

A system for protection against possible damage due to the abnormal operation or fault conditions, resulting either from internal equipment failure or wiring issues or from external natural causes, such as lightning will also be installed. The protection system will allow fast and safe clearing of the fault on the system to minimize any damages to the system as well as to prevent hazard to personnel. The protection system will be designed to, but will not be limited to, all the necessary protections against short-circuits, overloads, overvoltage, reverse power to solar array and lightning. A lightning arrester system will also be involved. A copper grounding system for all elements, with a voltage over 48 volts, will also be installed. All electrical components and structures will be grounded in accordance with the appropriate national and international standards. The grounding system will be informed by measurements of soil resistivity at the project site.

### 2.6.8 Transmission Line

A new 13.8kV transmission line will be installed to serve as the interconnection between the solar PV power plant and the 13.8kV busbar of the existing MPL distribution grid. The transmission line will cover a distance of approximately 2 kilometers with about 0.94 kilometers of the line being established in the titled indigenous village of Campbelltown. The transmission line will utilize existing MPL structures (including existing structures in Campbelltown) and new structures will only be installed as required. Table 2-2 presents indicative specifications of the transmission line.

**Table 2-2: Indicative Specifications of the Transmission Line**

Total Length	2 kilometers
Number of Structures	34
Structure Spacing	40 to 70 meters
Height of Structure	14 to 15 meters
Type of Structures	Wooden (Wallaba)
Voltage	13.8 kV
Classification of Line	Express Primary
No of Conductors	3 wire
Type of Conductor	Tulip (AAC) or equivalent size 336.4 MCM of bare conductor
Number of existing structures within transmission line route	21
Number of new structures within Campbelltown	12

### 2.6.9 Auxiliary Facilities

The following additional facilities and equipment will also be part of the Solar Power Plant:

- Security system, electrical fence and 24-hour on-site security access control.
- Lighting system along the entire fenced area.
- Fire detection system.
- Weather monitoring equipment (rainfall, wind speed/direction, solar irradiation, air moisture) will be located inside or in close proximity to the guard house.
- Suitable drainage system incorporating erosion control and storm water management.
- PV power facility monitoring equipment and associated telecommunication links will be located inside the guard house.
- Septic Systems.

### 2.7 Cost of Electricity and Main Consumers

A simple levelized cost of electricity (LCOE) will be estimated by the GEA based on information on cost breakdowns provided by the EPC contractor. The simple LCOE (USD/MWh) is equal to total expenditures over 20 years divided by total expected energy generated over 20 years (in MWh). The inputs for the calculation of the energy generated over twenty (20) years are: nominal power output of the solar farm, nominal efficiency of inverters, the minimum tolerance of the output power for the panels and the power output warranty of the PV panel. This information will be extracted from the PV panel power output warranty certificate. The inputs for the total expenditure are the EPC cost, battery bank replacement cost over 20 years, PV inverters cost replacement over 20 years and battery inverters cost over 20 years. The simple LCOE is only used for comparison purposes and it should not be seen as an accurate calculation of the cost of energy, as it will not include the actual operation and maintenance cost of the solar farm.

However, the final LCOE will be determined through consultations among the utility (HECI and MPL), the Public Utilities Commission (PUC) and the GoG.

The main consumer for the electricity would be the town of Mahdia and nearby communities including the indigenous community of Campbelltown.

### 2.8 Construction Phase

The construction of the solar power plant is expected to cover a period of 330 days. Some construction materials, such as lumber, may be easily available in Mahdia. However, other construction materials, equipment and project components will be transported to the site. For materials from Georgetown, road only or road and river transport are available options. Road only transport may be constrained by transport routes on laterite roads which may have limited axle load capacities.

The sequence of the construction program is expected to be as follows:

- Pre- construction site investigations, such as a geotechnical assessment to inform how the panels are mounted and secured.
- Detailed design and procurement of materials.
- Site establishment and preparation for construction, including fencing, earthworks, set out and construction of access roads and sediment and erosion controls. While extensive earthworks are not proposed, some land forming (including localised cut and fill areas) may be undertaken to achieve more consistent gradients beneath the array.
- Delivery of materials and equipment.
- Installation of the foundations (excavation and concrete footings) or driven piles.

- Installation of underground cabling (with an option for a short section of overhead cabling).
- Assembly of the panel frames and mounts.
- Installation of the PV panels.
- Installation of the inverters, battery transformer units, including pouring of concrete pads for transformer units.
- Installation of low voltage cabling and combiner boxes.
- Works to connect the Solar Farm to the existing Power Company. Substation (these occur within the switch room of the existing substation with no additional visible external substation infrastructure required).
- Commissioning of the Solar Power Plant.
- Removal of temporary construction facilities and completion of restoration work.

## 2.9 Commissioning and the Operational Phase

Commissioning involves the inspection and testing of the solar PV power plant after installation and certifying that it operates as expected and is installed in accordance with the engineering and design plans and complies with all the regulations and standards specified. At a minimum, commissioning will include:

- Complete integrity test of all equipment.
- Test and commissioning of the laid cables, according to International Electro technical Commission (IEC) standards.
- Electrical protection system commissioning, according to IEC standards.
- Perform values for Open-Circuit Voltage (Voc), and Close-Circuit Current (Imp) string testing
- Perform IV curve tracing.
- Perform thermal hotspot check with infrared images.

Once commissioned, the Mahdia Solar Power Plant is expected to work on a daily basis year-round for approximately 12 hours per day, based on an average of 5.29 peak sun hours, unless subject to scheduled maintenance. On an annual basis, 925MWh/Yr of generated electricity is expected.

## 2.10 Training and Technical Support

As part of the EPC, the contractor is expected to provide training of HECI staff on safety, best practice, operation and maintenance of the solar power plant. The training will be provided on-site by a certified engineer after commissioning of the installation. The contractor will also be expected to provide technical support for the whole solar PV system for a one-year period. Technical support is expected to include (but be not limited to): on-demand troubleshooting (if and when required), system performance monitoring; guidance on operation and maintenance procedures, and a follow-up visit by the contractor's technical personnel at the end of the one-year period. In addition, the contractor and HECI will agree on the plan for knowledge transfer to HECI staff when the period of technical support is finished and the HECI staff are fully trained in operation and maintenance of the entire solar PV system.

## 2.11 Project Employment

The project is expected to generate approximately 25 direct jobs (and part-time jobs requiring 71 man-months) during construction and 12 jobs during operation. The contractor will be required to hire local persons, including women, based on their experience and skills to support the construction phase. In addition, the project supports the Women's Economic Empowerment Programme through which approximately 200 women (in Bartica, Mahdia and Lethem) will be engaged in the productive use of electricity generated by the project. The potential areas for employment and the estimated number of

jobs and man-months required for each is outlined in Table 2-3. Additional opportunities for employment may be available during different phases of the project.

**Table 2-3: Potential Areas for Employment**

Construction Phase	Operational Phase
Laborers (31 man-months)	Operators (2)
Electricians (16 man-months)	Engineers (1)
Engineers (4)	Maintenance Personnel (1)
Masons (7 man-months)	Cleaners (2)
Carpenters (7 man-months)	Security (3)
Surveyors (1)	Electrician (1)
Security (6)	Drivers (1)
Drivers (2)	Health and Safety Personnel (1)
Cleaners (3)	
Caterers (3)	
Supervisors (2)	
Managers (1)	
Health and Safety Officers (1)	
Logistics Personnel (1)	
Accountants (1)	

## 2.12 Environmental Benefits of the Project

The operation of the solar power plant when compared to a diesel power plant will offset most of the fossil fuel that was previously used for the generation of electricity. A solar power plant, in general, is built for more than the projected lifetime. After the expected lifetime, a solar power plant will be typically rehabilitated for a fraction of the newly built cost. Given the continuous development of technology and price reductions for project components, it is reasonable to expect the solar power plant to continue to operate beyond the 20-year design life. The CO<sub>2</sub> savings shown in Table 2-4 below covers the projected lifetime of 20 years. However additional savings can be realised beyond this period if the solar power plant continues to operate.

**Table 2-4: CO<sub>2</sub> Savings from the Solar Power Plant**

<b>Saving/Year (MWh)</b>	925 MWh per year
<b>Savings/Year (tons CO<sub>2</sub>)</b>	Approximately 702.39 tons per year
<b>Savings/Lifetime (tons CO<sub>2</sub>)</b>	Approximately 14,047 tons

The project will allow for independence from fossil fuels. The reduction in diesel consumption will garner further benefits to air quality as the current diesel generation does not utilize filtration systems or other exhaust gas filter. As a result, power generated from diesel releases high concentrations of nitrogen oxides and fine dust particles into the atmosphere.

## 2.13 Social Benefits of the Project

The solar power plant is expected to have positive socio-economic benefits through the provision of an alternative source of electricity throughout the year to the town of Mahdia and surrounding villages. The project is estimated to complement the existing power generation system of Mahdia. The project, along with the MPL diesel power plant, should be able to satisfy the current energy demand for Mahdia, ensuring that the town has a reliable and stable source of electricity with redundant capacity.

## 2.14 Planning Permission and Regulatory Approvals

The MPL has secured permission from the Guyana Lands and Surveys Commission (GLSC) to occupy the lands in the project area for industrial purposes. A copy of the GLSC Permission to Occupy State Lands is attached in Appendix F.

The Mayor and Town Council of Mahdia has been engaged and has issued its 'No Objection' to the project. The Council also issued its 'No Objection' to the establishment of the transmission line route. Copy of these No Objections are included in Appendix F.

The Regional Democratic Council of Region 8 has provided a 'No Objection' to the project. A copy of this no Objection is included in Appendix F.

In 2020, the EPA, following an application from the HECL, issued a Construction Permit for the construction/installation of a solar photovoltaic system. The Construction Permit is valid for the period December 2020 to November 2021.

GEA has also obtained approval from the Campbelltown Village Council to establish a section of the transmission line on lands which falls within the village boundary. A Letter of Approval is attached in Appendix F.

### 3.0 POLICY, LEGISLATIVE AND INSTITUTIONAL FRAMEWORK

The 0.65 MW solar power plant to be established in Mahdia is required to be in compliance with Guyana’s national environmental and energy related policies, strategies, plans, legislation and institutional framework, and international treaties and conventions to which Guyana is signatory. These are outlined in Table 3-1 below.

**Table 3-1: Relevant Legislation, Policies and Strategies**

<b>Policies, Strategies, Plans</b>	Guyana National Energy Policy (1994)
	Low Carbon Development Strategy (2013)
	National Development Strategy (1997)
	Poverty Reduction Strategy Paper (2006)
	Hinterland Electrification Strategy (2007)
	Guyana Power Sector Policy and Implementation Plan (2010)
	Guyana Energy Agency Strategic Plan (2016)
	National Land Use Plan (2013)
	National Environmental Action Plan (2001)
	Nationally Determined Contribution (2016)
	National Biodiversity Strategy and Action Plan (2014)
	National Action Plan to Combat Land Degradation (2015)
<b>Legislation</b>	The Constitution of the Cooperative Republic of Guyana
	Environmental Protection Act (1996)
	Environmental Protection Air Quality Regulations (2000)
	Environmental Protection Water Quality Regulations (2000)
	Environmental Protection Noise Management Regulations (2000)
	Environmental Protection Hazardous Wastes Management Regulations (2000)
	Environmental Protection (Litter Enforcement) Regulations (2013)
	EPA Guidelines for Environmental Management Plans
	Guyana Energy Agency Act (1997)
	State Lands Act (1903)
	Guyana Lands and Surveys Act (2001)
	Local Democratic Organs Act (1980)
	Municipal and District Councils Act (1969)
	National Trust Act (1972)
	Public Health Ordinance (1934)
	Labour Act (1942)
	Occupational Health and Safety Act (1997)
<b>Other Policies</b>	IDB’s Operational Policies
<b>Institutional Framework</b>	Environmental Protection Agency (EPA)
	Office of the Prime Minister (OPM)
	Guyana Energy Agency (GEA)
	Hinterland Electrification Strategy Inc. (HECI) and Mahdia Power and Light Co. Inc. (MPL)
	Public Utilities Commission (PUC)
	Regional Democratic Council of Region 8 and Mahdia Town Council
	Guyana Lands and Surveys Commission
<b>International and Regional Framework</b>	Sustainable Development Goals
	United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Agreement
	CARICOM Energy Policy



<b>Other Codes and Guidelines</b>	Caribbean Sustainable Energy Road Map and Strategy
	GPL's National Grid Code
	NFPA's National Electrical Code
	Relevant Standards of the International Electrotechnical Commission
	Relevant Standards of the Institute of Electrical and Electronics Engineers

### 3.1 National Policies and Strategies

The importance of the environment and energy to national development is reflected in the prominence and priority of these areas in several development policy documents and strategies over the last twenty plus years.

#### 3.1.1 Low Carbon Development Strategy<sup>4</sup>

In June 2009, the GoG launched the Low Carbon Development Strategy (LCDS) with the aim of transforming Guyana's economy on to a low carbon, sustainable development trajectory, while simultaneously assisting in combating climate change. The broad goal of the LCDS was the transforming of the economy to deliver greater economic and social development by following a low carbon development path. A key aspect of the LCDS was a payment for forest climate services model developed between Guyana and Norway and based on Reducing Emissions from Deforestation and Forest Degradation (REDD+). The LCDS was updated in 2010 and 2013 to reflect progress achieved in REDD+ results and the transition to a low-carbon economy.

In its 2013 iteration, the LCDS identified several priorities that would be the focus of Guyana's transition to a low carbon economy including renewable energy initiatives. Two such initiatives of direct relevance to this project include the Amaila Falls Hydropower Project as the flagship project of the LCDS, and which was intended to deliver a steady source of clean, renewable energy that is affordable and reliable. The goal of the project was to eliminate at least 92 percent of Guyana's energy related greenhouse gas emissions. Although this project was put on hold in 2018, the Government has indicated that this project will be resuscitated. In addition, the LCDS made provisions for the Hinterland Electrification Programme (HEP) to support the energy needs of households who do not have access to the national electricity grid through solar powered home systems and investment in small-scale hydropower resources in the hinterland. Under this programme, the GoG provided and distributed 11,000 65-watt solar home systems to Amerindian hinterland and riverine communities. This programme is expected to continue with additional solar powered home systems for hinterland communities.

According to the Budget 2021, the LCDS will be revised with an expanded scope to include wider environmental services, integrated water resources management and climate resilience. The revised LCDS will also augment the opportunities for low-carbon economic diversification as well as the creation of jobs and opportunities utilising a non-carbon intensive pathway. In addition, payments valued USD\$ 135 million which were earned under the Guyana and Norway Partnership will be invested into several projects foremost of which will be in renewable energy.<sup>5</sup>

#### 3.1.2 Guyana National Energy Policy<sup>6</sup>

In 1994, a National Energy Policy was prepared with policy objectives that were intended to provide stable, reliable and economic supply of energy; reduce dependency on imported fuels; promote where possible the increased utilization of domestic resources; and ensure energy is used in an environmentally sound and sustainable manner. The Policy was intended to cover the period of 1994

<sup>4</sup> Government of Guyana, 2013. The Low Carbon Development Strategy. Pages 6 to 8.

<sup>5</sup> Ministry of Finance, 2021. A Path to Recovery, Economic Dynamism and Resilience. Budget 2020. Pages 18 to 19

<sup>6</sup> Government of Guyana, 1994. Energy Policy of Guyana. Pages 10 and 35.



to 2004. At the time of the Policy's publication, the high cost of solar PV system was recognized as a significant challenge to widespread uptake of solar power system as well as to development of large-scale solar farms. In 1994, only 21 solar PV systems were operational in Guyana with capacities ranging from 0.5 to 10 kilowatts (kW), and were being used by Health Centres in remote areas for lighting and refrigeration.

The Policy aimed to increase utilization of national energy resources from 51.3 to 61.5 percent, and reduce dependence on imported petroleum products from 48.7 to 38.5 percent by 2004. In this regard, the Policy anticipated that renewable energy sources like hydropower, bagasse, solar, wood waste and rice-husk would be promoted as future energy sources and more efficient use of energy would be promoted to satisfy energy demand over a ten years period. As it regards solar power, the Policy encouraged the development of small solar power units for remote and isolated communities providing that they were a cost-effective option for power generation. The use of fixed convection and natural convection solar systems for the processing of agro-based and fisheries commodities was also encouraged.

### **3.1.3 National Development Strategy<sup>7</sup>**

In 1997, the National Development Strategy (NDS) was launched and outlined objectives and fundamental policy conditions for the country's development process over the next decade. In Volume 3 (Chapters 18 and 19) an overarching national policy framework and priorities for environmental management were developed. The environmental policies promoted the sustainable management of natural resources and the preservation of a healthy environment as an integral part of Guyana's development agenda. Environmental protection was framed as a proactive undertaking in which natural resources would be managed sustainably. The Strategy incorporated guidelines for management of these resources including fisheries and forests and prioritised avoiding contamination and cleaning up of pollution. The Strategy also covered the areas of liquid and solid waste management, coastal zone management, forest management, fisheries management, mining policies, Amerindian concerns, urban water supply, pesticide management, and protection of biodiversity, among others, as well as the institutional and legal aspects related to those issues. It also proposed the establishment of the EPA through the passage of the Environmental Protection Act.

In addition, Volume 5, Chapter 39 addressed the policy framework for the energy sector. Accordingly, some of the key policy objectives include ensuring that an adequate and dependable supply of electricity is available for the country's future economic development; reducing the dependency on imported petroleum products, where feasible; providing increased utilization of new and renewable domestic energy resources; using energy in an environmentally sound and sustainable manner and encouraging energy conservation practices through public awareness. The NDS recognized that although solar power represented a minimal contribution to energy potential in Guyana, there was significant potential to develop this resource over the long-term. The NDS reiterated the high-cost constraints previously highlighted by the National Energy Policy (1994) of large-scale deployment of solar power. However, the NDS anticipated that cost reductions of solar PV technology in the medium-to long-term could contribute to greater solar powered energy generation in Guyana particularly for widely dispersed communities in the interior. As such, among other targets for energy generation in the medium-term were the exploration of solar power applications in remote areas of Guyana. Further, long-term targets for the energy sectors includes larger scale deployment of solar power if it is a cost effective and sustainable option.

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<sup>7</sup> Government of Guyana, 1997. National Development Strategy. Volume 3: Chapter 18 and Volume 5: Chapter 39

### **3.1.4 Poverty Reduction Strategy Paper<sup>8</sup>**

In 2001, the GoG embarked on the development of a Poverty Reduction Strategy with support from the World Bank. The first Poverty Reduction Strategy Paper (PRSP) was aimed at generating economic growth, improving provision of social services, enhancing governance structures and progressing in a timely manner towards the achievement of the Millennium Development Goals (MDGs). The provision of access to electricity services to unserved rural coastal areas and communities in the hinterland interior were important areas of focus in the achievement of these objectives. Since the 2001 PRSP, Guyana has prepared three PRSP progress reports, one in 2004 and the other in 2005; and in 2008 prepared a second Poverty Reduction Strategy. A third was prepared in 2011 spurred on by changing economic and political developments that required a shift in strategy. This PRSP (2011 to 2015) focused achieving broad-based, low-carbon led job creation and economic growth and creating required infrastructure. One of the key pillars of the PRSP was the expansion and diversification of power supplies including making provision for sustainable institutional and financial schemes for hinterland electrification.

### **3.1.5 Hinterland Electrification Strategy<sup>9</sup>**

A study of possible energy sources in the hinterland and the identification of electrification projects that would provide the basis for a comprehensive hinterland electrification programme was undertaken as part of the Hinterland Project Preparation Component of the Unserved Areas Electrification Programme (UAEP). As such, a Hinterland Electrification Strategy was prepared in 2007. The goals of the Strategy were to establish some form of electrification in each village (starting with social services and communal buildings) and supplying the entire village with electricity including working in collaboration with private initiatives/ investors.

The Strategy classified hinterland villages into three groups based on their existing access to electricity, population size, number of Government services and utilities located in the villages as follows:

- **Group 1:** Villages with existing mini-grids, relatively high number of households, significant local government institutions and the prevalence of productive activities.
- **Group 2:** Villages with some potential for development, which have secondary schools, hospitals and other Government institutions.
- **Group 3:** Small villages with less than 1000 residents with primarily a subsistence economy. They have nursery and primary schools, small medical clinics and, usually, no other Government institutions.

With respect to solar power, the Strategy focuses on the installation of Solar Home Systems in all villages which were part of the Group 3 classification given their remoteness and low, dispersed demand for electricity. The Strategy indicated that the use of Solar Home Systems would facilitate the installation of individual, isolated systems and avoid the installation of an expanded transmission and distribution grid that would be costly due to long distribution lines to serve the characteristic dispersed housing arrangement in these communities. The Strategy identified four Group 3 villages as pilots for the implementation of the Solar Home Systems programme, Yarakita (Region 1); Capoey (Region 2); Kurukabaru (Region 8) and Muritaro (Region 10). The Strategy also highlighted the potential for installing solar home systems in peripheral areas of Group 2 villages. However, the potential for grid-tied solar projects was not examined by the Strategy.

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<sup>8</sup> Government of Guyana, 2001. Poverty Reduction Strategy Paper. Pages 1 to 5, 44

<sup>9</sup> Government of Guyana, 2007. Hinterland Electrification Strategy. Pages 5 and 10 to 11

### **3.1.6 Guyana Power Sector Policy and Implementation Plan<sup>10</sup>**

The Guyana Power Sector Policy and Implementation Strategy was prepared in 2010. The Policy and Implementation Strategy had among its objectives the supply of reliable power at the lowest possible sustainable costs with adequate energy security; utilization of local clean energy resources for electricity generation; development of efficient and environmentally sustainable energy production and consumption patterns; and increased households with access to electricity throughout Guyana. It also outlined nine strategic areas of focus for the power sector over the medium term (2010 to 2014) including the management and organization of the energy sector, regulating the sector, generation sources, national grid, distribution, hinterland electrification, cost recovery, self-generation of power and energy conservation. With respect to electricity generation, the Policy Implementation Strategy prioritized reducing the dependency on fossil fuel imports and increasing renewable energy sources, with emphasis on developing solar power as one of the clean sources of energy in a diversified grid. Moreover, the goal of electrification of hinterland communities is to contribute to socio-economic development of local populations.

The Policy and Implementation Strategy reiterated the focus of the Hinterland Electrification Strategy to develop Solar Home Systems. However, it expanded upon this goal by indicating that solar farms with potential for interconnection with the national grid will also be pursued. Further, the Implementation Strategy proposed that pilot programmes be used to determine the suitability of the various sources of renewable energy, including solar, to different hinterland areas. The Policy and Implementation Strategy also recommended the establishment of a permanent department within the Office of the Prime Minister for hinterland electrification and the periodic revision of the Hinterland Electrification Strategy.

### **3.1.7 Guyana Energy Agency Strategic Plan<sup>11</sup>**

The Strategic Plan for the GEA covering the period 2016 – 2020 outlines current initiatives in the energy sector and strategic objectives for the development of different sources of energy including a mix of renewable energy including hydropower, solar power and wind power. The Plan identifies significant strides which have been made with respect to solar power including:

- Installation of 1,750 home solar systems totaling 65,125 watts as well as solar systems in schools and other community buildings in 21 hinterland villages under the UAEP.
- Provision of 16,540 home solar systems to communities without grid access under the LCDS.
- Piloting grid-tied solar projects in 2011 and 2014.
- Distribution of 507 solar powered cooking stoves in five communities in Regions 1, 7, 8 and 9.

The strategic objectives for continuing to encourage the development and utilisation of sources of energy other than those sources presently in use; and to demonstrate, research and utilize solar photovoltaic technology as a source of renewable energy to meet energy needs where appropriate. In particular, the GEA will explore options for grid interconnection as a means of reducing investment in fossil-based generators and meeting incremental demand from renewable energy sources. Options for establishing Power Purchase Agreements (PPA) between the utilities and private power generators were also considered under the Plan.

### **3.1.8 National Land Use Plan<sup>12</sup>**

The National Land Use Plan (NLUP), which was prepared in 2013 provides a strategic framework to guide land development in Guyana and is guided by a number of national policies and strategies that

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10 Klass, V, 2010. Guyana Power Sector Policy and Implementation Strategy. Pages 3 and 11 to 14

11 Guyana Energy Agency 2016. Guyana Energy Agency Strategic Plan. Pages 26 to 27 and 42

12 Guyana Lands and Surveys Commission, 2013. National Land Use Plan. Pages 1, 5, 113 to 114, 119 and 139 to 140

have a direct relevance for land use and land management. The NLUP recognized the importance of land allocation to Guyana's development and also highlighted the challenges posed by multiple land uses. The NLUP is not prescriptive and does not zone areas of the country for particular land uses. However, it proposes development options for particular areas that can guide decision-making and attract investments.

The project is located in the White Sand Plateau and Central Guyana Area in which Mahdia is one of the main centres of population. According to the NLUP, development in inland Guyana will depend on several factors foremost of which is likely to be the existence of established urban centres or 'hotspots' and Mahdia was identified as one of the potential areas for growth. The principal development option for Mahdia is the mining of gold and associated minerals. For example, uranium and rare earths have been identified at scattered locations across Guyana and in proximity to Mahdia and kyanite has been observed on the Potaro River which is also in proximity to Mahdia. Additionally, there is potential for conversion of mined out areas to be converted to other land uses (such as aquaculture), for the development of other extractive industries (mainly logging) and to develop other services such as tourism. However, the transition of Mahdia and its environs to a multi-use area is significantly constrained by access. As a consequence, the NLUP highlights the importance of infrastructure developments in particular the upgrading of the Bartica – Potaro Road connecting to Mahdia and in the longer-term, connection to possible multi-national highways.

### **3.1.9 National Environmental Action Plan<sup>13</sup>**

A National Environmental Action Plan (NEAP) was first prepared in 1994 to identify the major environmental problems in Guyana and to formulate appropriate policies to address the causes and effects of the problems. A second NEAP was prepared and adopted in 2001. The second NEAP sets out the environmental management framework for Guyana in keeping with its commitment to international multilateral agreements. In addressing cross sectoral environmental issues related to land use, environmental health, integrated water resource management, and waste management, the NEAP committed to the implementation of several key actions. These include environmental education and public awareness, human resources development, institutional capacity building, inter-agency collaboration, public participation, information management and networking, acquisition of appropriate technology, and developing environmental legislation, and regulatory standards and controls. Importantly, it committed to executing environmental assessments for proposed development activities that may significantly affect the environment.

### **3.1.10 Nationally Determined Contribution<sup>14</sup>**

In 2016, Guyana submitted its Nationally Determined Contribution to the United Nations Framework Convention on Climate Change (UNFCCC) within the framework of the Paris Agreement. The Nationally Determined Contribution outlined contributions the GoG intended to implement to contribute to the global fight against climate change. The contributions were either unconditional contributions which could be implemented unilaterally or conditional contributions for which support was required. The energy sector was one of the two key sectors in which contributions were proposed. Unconditionally, Guyana indicated that options to facilitate the rapid expansion of a renewable energy supply will be examined with the goal of developing a mix of sources include wind, solar, biomass and hydropower to supply both the demand of the national grid and the energy requirements for towns and villages in Guyana's hinterland. Moreover, conditional on receiving adequate and timely financial support, Guyana would aim to develop 100 percent of its power supply from three renewable sources namely solar power, hydro power and wind energy.

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<sup>13</sup> Government of Guyana, 1994; 2001. National Environmental Action Plan.

<sup>14</sup> Government of Guyana, 2016. Guyana's Revised Intended Nationally Determined Contribution. Pages 10 to 11

### **3.1.11 National Biodiversity Strategy and Action Plan<sup>15</sup>**

In 2014, the National Biodiversity Strategy and Action Plan (NBSAP) was revised and updated to cover the period 2012 to 2020. This Plan sets out the vision, the roles, duties and obligations of the Government and its citizens and the actions to protect, conserve, use sustainably and share equitably the benefits arising from biodiversity. It provides the guidance and support actions for sustainable utilization and conservation of biodiversity, and sets out the national priorities and the strategic objectives to be achieved. The NBSAP also allows partners at all levels to better identify how they can contribute and support Guyana in meeting its national biodiversity vision while meeting at the same time, its obligations to the United Nations Convention on Biological Diversity (UNCBD). To this end, the Plan incorporates the goals of the UNCBD Strategic Plan for Biodiversity (2011-2020) and selected Aichi Targets. The NBSAP presented Guyana's vision for biodiversity as follows *"By 2030, biodiversity is sustainably utilized, managed and mainstreamed into all sectors contributing to the advancement of Guyana's bio-security, and socio-economic and low carbon development"*.

### **3.1.12 National Action Plan to Combat Land Degradation in Guyana**

In 2015, Guyana prepared an Aligned National Action Plan 2015-2025 that is consistent with the United Nations Convention to Combat Desertification (UNCCD) Strategic Plan 2008-2018. The Aligned National Action Plan (NAP) aims to ensure that agricultural, pasture, mining, forest, coastal and other land uses and resources are managed as sustainable, productive systems that maintain ecosystem productivity and ecological functions while contributing directly to the environmental protection, economic growth and social livelihood of the people of the country. The Aligned NAP provides consideration for the need for urgent efforts to integrate and strengthen existing national policies, strategies, action plans and the planning framework for conservation, promotion of sustainable land management and combating the exacerbated effects of degradation.

The Aligned NAP outlines the approach and roadmap towards continuing to enhance the way of managing land and resources in Guyana, and consists of and is governed by a set of overarching principles: achievement of sustainable development; land management governance and policy; education, training and awareness; knowledge, information and research; evaluation and monitoring; and partnership and financing. The Aligned NAP focuses on the primary sectors on which Guyana has depended and will depend upon in the future. In the mining areas, the focus is on reclamation of previously mined out areas while ensuring current mining practices include rehabilitation of mined out lands.

## **3.2 Legislation and Regulations**

There are several laws which guide the energy sector in Guyana. These include the Constitution of Guyana (1980) with amendments (2003); the Environmental Protection Act (1996) and Environmental Protection Regulations and the Guyana Energy Agency Act (1997). Additional legislation is also applicable to the project including the Occupational Safety and Health Act (1997) and the Acquisition of Lands for Public Purposes Act (1914) among others. These laws and regulations are discussed in the section below.

### **3.2.1 The Constitution of the Cooperative Republic of Guyana, 1980, and 2003 Reforms**

The Constitution of Guyana is the highest governing legal document and supreme law for the country. The importance of protection and management of the environment is also well recognized and given particular attention to environmental related principles. This is outlined as follows:

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<sup>15</sup> Environmental Protection Agency and Ministry of Natural Resources, 2014. Guyana's National Biodiversity Strategy and Action Plan (2012 to 2020)



- Article 25: “Every citizen must participate in activities to improve the environment and protect the health of the nation.”
- Article 36: “The wellbeing for the nation depends upon preserving clean air, fertile soils, pure water and the rich diversity of plants, animals.”
- Article 149J: (1) “Everyone has the right to an environment that is not harmful to his or her health or wellbeing.”
- Article 149(J): (2) “The State shall protect the environment, for the benefit of present and future generations, through reasonable legislative and other measures designed to:
  - Prevent pollution and ecological degradation.
  - Promote conservation.
  - Secure sustainable development and use of natural resources while promoting justifiable economic and social development.”

### 3.2.2 The Environment Protection Act (1996)

The Environmental Protection Act 1996 was the first comprehensive environmental legislation in Guyana. The Act, and the Environmental Protection Amendment Act 2005, establishes the basic institutional and regulatory framework within which all activities that may significantly impact on the natural, social, and cultural environments are assessed. The Act established the EPA and the goal of the Act is to “*provide for the management, conservation, protection and improvement of the environment, the prevention and/or control of pollution, the assessment of the impact of economic development on the environment, the sustainable use of natural resources and for matters incidental thereto connected therewith*”. The Act gives the EPA the mandate for the coordination of environmental management and outlines the legal process for undertaking sustainable and effective management of the natural environment.

Part V Section 19 (1) of the Act states that “*A person shall not (a) Undertake an activity that causes or is likely to cause pollution of the environment unless the person takes all reasonable and practicable measures to prevent or minimize any resulting adverse effect; (b) Discharge or cause or permit the entry into the environment of any contaminant in any amount, concentration or level in excess of that prescribed by the regulations or stipulated by an environmental authorization.*”

It is under the requirements of this Act that the Hinterland Electrification Company Inc. (HECI) applied for and was granted a Construction Permit covering the period December 2020 to November 2021.

#### 3.2.2.1 The Environment Protection Regulations (2000, 2013)

The Environmental Protection Act comprises several subsidiary Environmental Protection Regulations. Those of direct relevance to the Project are:

- The Environmental Protection Authorisations Regulations (2000)
- The Environmental Protection Air Quality Regulations (2000)
- The Environmental Protection Water Quality Regulations (2000)
- The Environmental Protection Noise Management Regulations (2000)
- The Environmental Protection Hazardous Wastes Management Regulations (2000)
- The Environmental Protection (Litter Enforcement) Regulations (2013)

These Regulations were developed to regulate and control the activities of development projects during construction and operation. The EPA has the responsibility to ensure the compliance of all new and existing activities with these Regulations by issuing the required authorizations and monitoring their operations.

### Environmental Protection (Authorisations) Regulations (2000)

These regulations outline the requirements for an environmental authorisation and the rules governing the issuance of such authorisation. Environment authorisations typically have specified conditions which with Permit Holders must comply so as to avoid, minimise, and mitigate environmental impacts. The EPA determines the types/categories of development that require environmental authorization.

### Environmental Protection Air Quality Regulations (2000)

In accordance with these Regulations any operation that emits any air contaminant in the construction, installation, operation, modification or extension of any facility related to industry, commerce, agriculture or any institution shall apply to the EPA for an environmental authorization at least ninety days before the date on which the emission is to commence. In accordance with the Regulations the EPA shall establish the desirable air pollution limits. Currently, there are no nationally determined or established air quality standards. However, the Agency is guided by and utilises air quality guidelines from the World Health Organisation (WHO), United States Environmental Protection Agency (USEPA) allowable limits and other reputable international organisations. Table 3-2 below shows the WHO Air Quality Guidelines.

**Table 3-2: WHO Air Quality Standards**

Element	Averaging Period	Acceptable Limit
Particulate Matter (PM 10)	24-hour	50 g/m <sup>3</sup>
Particulate Matter (PM 2.5)	24-hour	25 g/m <sup>3</sup>
Sulphur Dioxide	24-hour	20 g/m <sup>3</sup>
Ozone (O <sub>3</sub> )	8-hour	100ug/m <sup>3</sup>
Nitrogen Dioxide	1-hour	40ug/m <sup>3</sup>

### Environmental Protection Water Quality Regulations (2000)

These Regulations require an environmental authorization for construction, installation, operation, modification/extension of facilities that discharge effluents. Requirements and guidelines on the discharge of effluents and disposal of sludge are provided. The EPA and Guyana National Bureau of Standards (GNBS) have developed Interim Guidelines for Industrial Effluent Discharges into the Environment and these are currently being used by the EPA. The maximum allowable limits for parameters which are deemed relevant to the project are outlined in Table 3-3.

**Table 3-3: Parameters and Maximum Allowable Limits**

Parameters	Maximum Allowable Limits
pH	5.0 to 9.0
Temperature	<40°C
Dissolved Oxygen	5 mg/L
Total Suspended Solids (TSS)	<50 mg/L
Total Dissolved Solids (TDS)	<200 mg/L
Turbidity	<15 NTU
Oil and Grease	<10 mg/L

### Environmental Protection Noise Management Regulations (2000)

Under these Regulations operations that emit noise in the execution of various activities such as construction, transport, industry, commerce, and any institution are required to apply to the Agency for an environmental authorization. The EPA is responsible for the establishment of standards for

permissible noise levels in industry, construction, and other areas. The EPA may grant authorization for noise emission unconditionally or subject to conditions and may require environmental audit procedures. The GNBS and the EPA, together with other relevant agencies, developed standards for noise emissions into the environment as shown in Table 3-4. Construction activities are required to comply with the construction limits, as is stipulated in Condition 3.2 of the Construction Permit.

**Table 3-4: Decibel Limits for Various Types of Activities**

Type of Activity	Day-Time Limit (dB)	Night-Time Limit (dB)
Residential, Institutional, Educational	75	60
Industrial, Transportation	100	80
Commercial	80	65
Construction	90	75
Recreational	100 (18:00 to 01:00hrs)	75 (01:00 to 08:00hrs)

### **Environmental Protection Hazardous Waste Management Regulations (2000)**

These Regulations outline the rules and procedures for transport, storage, treatment, and disposal of hazardous wastes and are intended to ensure, through the environmental authorisation process, that all operations that generate, transport, treat, store and dispose of hazardous wastes are managed in a manner that protects human health and the environment. The Regulations allow for the provision of information on the types of facilities and quantity of hazardous waste generated, treatment standards and efforts to reduce the waste generated. These Regulations also apply to any activity that generates hazardous waste. Hazardous waste is defined, and a schedule of materials considered hazardous is provided in these regulations.

### **Environmental Protection Litter Enforcement Regulations (2013)**

These Regulations provide for the enforcement against litter offences. It is an offence under these Regulations to place litter in a public place, permit or cause another person to litter a public place or have litter on private premises that pose a health risk. The fine for an individual found littering in a public place is GYD \$50,000, while for body corporate it is GYD \$100,000. A fixed penalty of fifteen thousand dollars (GYD \$15,000) is offered to offenders who accept liability for the offence committed. Under the Litter Prevention Regulations, the Neighbourhood Democratic Councils (NDCs) and Regional Democratic Councils (RDCs) are to provide receptacles in public places. Further, every Council shall make appropriate provision for the prompt, efficient and regular emptying of the contents of the receptacles and the removal and disposal of those contents.

#### **3.2.2.2 Environmental Guidelines for the Preparation of an Environmental Management Plan**

The EPA has established Guidelines for the Preparation of Environmental Management Plans. An EMP seeks to identify and assessment potential impacts of project and provide methods and procedures for mitigating and monitoring impacts. According to the Guidelines, an EMP can be defined as *“an environmental management tool used to ensure that undue or reasonably avoidable adverse impacts of the construction, operation and decommissioning of a project are prevented, and that the positive benefits of the projects are enhanced”*. An EMP is recognised as a tool that can be used to provide assurance that developers make suitable provisions for counteracting negative impacts that occur through project implementation and operation, and contains environmental objectives/targets which the developer needs to accomplish in order to reduce or eliminate negative impacts.



The objectives of an EMP are to:

- Place the proposed or existing activity in the context of the local and regional environment.
- Adequately describe all components of the proposed/ existing activity, so that the Agency can consider approval of a well-defined project, and prescribe relevant and adequate Permit Conditions for the monitoring of the activity.
- Identify the environmental issues/risks associated with the proposed/existing activity.
- Provide the basis of the developer's environment management program, which shows that the environmental impacts resulting from the proposed/existing activity, including cumulative impacts, can be acceptably managed.
- Provide a document that clearly sets out the reasons why the proposed/existing activity should be considered environmentally acceptable.

### **3.2.3 Guyana Energy Agency Act (1997)**

The GEA Act 1997 (Act No. 31 of 1997) established the GEA. The GEA Act was amended in 2004, 2005, and 2011. The Act outlines the functions of the Agency and makes provisions for the Agency to exercise function under the Hydro- Electric Power Act. The GEA Act is supported by the Petroleum and Petroleum Products Regulations 2014.

### **3.2.4 State Lands Act (1903)**

The State Lands Act provides for the proper regulation of state lands, rivers and creeks. Under the Act, the President has the authority to grant leases of State lands of Guyana subject to any terms and conditions deemed necessary. Permission may be granted to occupy lands or to utilize the resources of those lands without giving the exclusive rights of occupancy. Accordingly, MPL has obtained permission from the GLSC to occupy the project site. A cadastral survey was completed and the lease is being processed.

### **3.2.5 Guyana Lands and Surveys Act (2001)**

The Guyana Lands and Surveys Act established the GLSC as a body corporate. The Act outlines the functions of the Commission with respect to land administration and management in Guyana (see Section 3.4.5 for some of the functions of the GLSC). It also makes provisions for the establishment of the Board, the management structure and staffing of the GLSC. The Act also makes financial provisions for the GLSC.

### **3.2.6 Local Democratic Organs Act (1980)**

The Local Democratic Organs Act makes provisions for the institution of a country-wide system of local government through the establishment of organs of local democratic power including RDCs. Under the Act, RDCs are empowered to administer all services required within its boundaries (services such as health, education, public works), coordinate the activities of the Local Democratic Councils and provide such cooperation and support as required, develop regional facilities, develop economic projects and execute works necessary for the development of the region.

### **3.2.7 Municipal and District Councils Act (1969)**

The Municipal and District Councils Act makes provisions for and empowers the municipalities of Georgetown, New Amsterdam and other areas in Guyana. The Act makes provisions for the municipality to let any land it owns. Town Councils are required to approve development activities within their jurisdiction, and provide services such as solid waste collection and disposal, sanitation,

drainage, and operation of markets among other services within their respective districts. The GEA has engaged the Mahdia Town Council on the project and received its No Objection in April 2020.

### **3.2.8 National Trust Act (1972)**

The National Trust Act provides for the preservation of monuments, sites, places, and objects of historic interest or national importance. The Act also establishes the National Trust of Guyana to promote the permanent preservation of buildings of national interest or architecture, archaeological, historic or artistic interest and places of national interest, importance or beauty. The Act requires that any cultural or archaeological chance finds, particularly during the construction phase, should be reported to the National Trust of Guyana. In such an event, the GEA and the National Trust of Guyana would need to work together to manage the resources found. If the National Trust of Guyana has reason to believe that the area contains a site of historic interest or national importance, it is in the power of the National Trust to enter the land for the purpose of excavation and assessment of the site and may restrict any works requiring construction or excavation at the site.

### **3.2.9 Public Health Ordinance (1934)**

The Public Health Ordinance makes provisions for promoting public health concerns in Guyana. The Ordinance makes provisions for central and decentralised and local administration of health including the prevention of infectious, epidemic, endemic and venereal diseases, as well as management of public health facilities and services. The Ordinance also makes provisions for regulating 'offensive trades', that is, a trade that damages the health of the persons engaged in the trade. The Ministry of Health has convened a committee for the management of offensive trades and this Committee is chaired by the Chief Medical Officer and is aimed at regulating activities that can damage the health of employees during their routine duties. The Government's COVID-19 measures introduce several social restrictions with which the Project must comply while they remain in effect. These were made under this Ordinance. A Public Health Bill has been drafted to supersede the Ordinance.

### **3.2.10 Labour Act (1942)**

The Labour Act specifies the conditions that an employer must observe in the contracting employees. Part V specifies that the entire wages of the employee must be paid as money and not otherwise. However, in occupations where it is customary to make partial payment of allowances in the form of food, toiletries, housing etc. these are acceptable and not considered illegal, if both the employer and employee are agreed on such terms. The Act is relevant to the entire Project lifetime so as to ensure that workers are not mistreated, are paid adequately in accordance with the Laws of Guyana, and have proper representation.

### **3.2.11 Occupational Health and Safety Act (1997)**

The Occupational Safety and Health Act defines the responsibilities of management and workers with respect to safety and health and applies to every workplace in Guyana. The Act makes provisions for the registration of industrial establishments, the establishment of an Occupational Safety and Health Authority, the establishment of a National Advisory Council on Occupational Safety and Health, the duties of employers, workers and other persons, treatments of accidents and occupational diseases, and occupational safety and health regulations. The Act authorises OH&S inspectors to enter and inspect workplaces.

Under this Act, the employer has a responsibility to establish a joint workplace safety committee consisting of four persons. When the workplace has more than 50 persons, the committee should consist of six persons of which at least half the numbers should be workers who do not exercise managerial functions and should be selected by the workers themselves. Employers also have duties

of providing protective equipment for workers, providing instructions and supervision to ensure the safety of workers, maintaining a medicine chest and establishing an occupational health service for workers. At a construction site, employers must ensure that the requirements of the Act are implemented and that the safety and health of workers are protected onsite.

### 3.2.12 Additional Legislation

Other pieces of legislation which may be applicable include:

- Prevention of Discrimination Act (1997)
- Employment of Young Persons and Children Act (1983)
- National Insurance and Social Security Act (1969)
- Energy Sector (Harmonization of Laws) Act (2002)
- Electricity Sector Reform Act (1999) with amendments in 2010
- Public Utilities Commission Act (1999) with amendments in 2010.

### 3.3 IDB Operational Policies

The IDB has in place environmental and social safeguards which are to be applied during all project execution. Safeguards are applied to ensure that project funds are engaged in a manner consistent with the Bank's institutional policies with respect to environmental and social management. According to the project documents, the project has triggered the IDB's Environment and Safeguards Compliance Policy (Operational Policy OP-703) and has been classified as Category "B" since impacts are anticipated to be mostly local and short-term for which effective mitigation measures are readily available. Table 3-5 outlines the policy directives of OP-703 and discusses their relevance to the project.

**Table 3-5: Policy Directives of OP-703 – Environmental and Safeguards Compliance**

Policy Directive	Aspect (if applicable)	Relevance to the Project
<b>B.1. Bank Policies</b>	OP-102: The Access to Information Policy.	The IDB to determine whether this ESAR contains information subject to the Access to Information Exceptions List. If it is not on the Exceptions List, the ESAR should be posted to the Bank's website.
	OP-710: The Involuntary Resettlement Policy	This Operational Policy will not be triggered by the project. Following site investigations which revealed overlaps between the project site and existing land uses, the GEA engaged with the GLSC to re-survey the proposed site so as to excise existing land uses and avoid land use conflicts.
	OP-704: The Natural and Unexpected Disasters Policy	This Policy is not expected to be triggered by the project.
	OP-761: Gender and Equality in Development	Gender safeguards outlined under this Operational Policy will not be triggered by the project. Although gender responsive considerations may be mainstreamed into the project as a whole, differential needs of men and

Policy Directive	Aspect (if applicable)	Relevance to the Project
		women are not a key consideration for this project given the broad base of potential beneficiaries as well as the existing implementation arrangements via MPL.
	OP-765: The Indigenous Peoples Policy	This Operational Policy will be triggered since the project will benefit indigenous peoples including the titled indigenous village of Campbelltown.
<b>B.2. Country laws and regulations</b>	Compliance with national environmental laws and regulations and with multilateral environmental agreements.	The project must comply with national legislation on environment and occupational health and safety as stated in the ESAR. In addition, the project will support Guyana in achieving obligations under multilateral agreements.
<b>B.3. Screening and Classification</b>	Classification of the risk level	The project has been classified a Category B Operation by the IDB because impacts are anticipated to be mostly local and short-term for which effective mitigation measures are readily available.
<b>B.4. Other Risk Factors</b>	Capacity of executing agency for environmental governance, high environmental and social risks, vulnerability to natural disasters.	Environmental and social risks associated with the project are assessed in this ESAR, and management and mitigation measures to address these risks are recommended.
<b>B5. Environmental Assessment Requirements</b>	Requirements for various types of environmental assessments including ESMPs.	Environmental analyses are required for Category B operations in both public and private sectors. An Environmental Analysis could include a description of the proposed investment plan; an evaluation of the legal and regulatory framework applicable to the investment plan; an assessment of the potential environmental and social impacts and risk of the proposed operations, works or activities included in the proposed investment plans; and proposed management plan, including mitigation and monitoring programs to address significant impacts and risks. This ESAR satisfies the requirements for an Environmental Analysis for this project.
<b>B.6 Consultation</b>	Consultations with parties who may be affected by the project.	Category B projects require at least one consultation with affected parties, preferably during the impact assessment in order to inform, gather comments, and adjust the assessment and the corresponding environmental and social management plan. Consultations should provide,

Policy Directive	Aspect (if applicable)	Relevance to the Project
		<p>at a minimum, information to affected parties and a dialogue regarding the project scope and proposed mitigation measures. Consultations with local stakeholders were conducted as part of the ESAR preparation process by the consultant in collaboration with the GEA. During the meetings with stakeholders, GEA representatives provided an overview of proposed project activities and stakeholders were provided with the opportunity to ask questions and share issues of concern.</p> <p>As part of this Operational Policy, the borrower should continue an applicable degree of information disclosure and consultation after IDB has provided approval for the project.</p>
<b>B.7. Supervision and Compliance</b>	Supervision of Construction and Operation Phase	The Bank will supervise and monitor the adequate implementation of the ESMP through the executing agency and supervisory consultants, as necessary. This may also involve an ex-post evaluation of performance on the designed indicators.
<b>B.8 Transboundary Impacts</b>	N/A	This Policy Directive is not applicable to the project.
<b>B9. Natural Habitats and Cultural Sites</b>	Degradation or of critical habitats, critical cultural sites and non-critical cultural sites.	This Policy Directive is not applicable to the project.
<b>B10. Hazardous Materials</b>	Production, use and disposal of hazardous substances	Small quantities of hazardous materials such as waste oil may be generated during the construction phase. During the operational phase, hazardous materials may include decommissioned batteries. Management measures will guide storage, transport and disposal.
<b>B.11. Pollution Prevention and Abatement</b>	Water, air, noise and waste pollution management	The project will implement management and mitigation measures for any adverse impacts on water quality, air quality, noise management, hazardous waste, and litter prevention.
<b>B.12 Projects Under Construction</b>	N/A	This Policy Directive is not applicable to the project.
<b>B. 13 Noninvestment Lending and</b>	N/A	This Policy Directive is not applicable to the project.

Policy Directive	Aspect (if applicable)	Relevance to the Project
<b>Flexible Lending Instruments</b>		
<b>B.14 Multiple Phase and Repeat Loans</b>	N/A	This Policy Directive is not applicable to the project.
<b>B.15 Co-financing Options</b>	N/A	This Policy Directive is not applicable to the project.
<b>B. 16 In-Country Systems</b>	Utilizing in-country systems to manage environmental and social impacts.	The IDB will decide whether the in-country safeguards systems will be used to manage potential environmental and social impacts from the project.
<b>B.17 Procurement</b>	Safeguards for procurement incorporated into loan agreements, operating regulations and bidding documents.	The applicability of this Policy Directive needs to be determined.

### 3.4 Institutional Framework

The Institutional arrangement for energy and environment straddles several Ministries of Government and Agencies. The key players that contribute to development and achievement of policy and legislative objectives relevant to energy and environment in Guyana are identified below.

#### 3.4.1 Environmental Protection Agency

The EPA oversees the effective management, conservation, protection and improvement of the environment and takes the necessary measures to ensure the prevention and control of pollution, assesses the impact of economic development on the environment and the sustainable use of natural resources. The Agency was established in 1996 by the Environmental Protection Act and is responsible for the enforcement of national environmental legislation and regulations as well as the development and implementation of environmental policies and standards. It also undertakes the inspection and enforcement of matters dealing with the environment, conservation and natural resources and administers the environmental permitting process in Guyana. The Agency is governed by a Board of Directors.

Under the Act, the EPA is mandated to *“take such steps as are necessary for the effective management of the natural environment so as to ensure conservation, protection and sustainable use of its natural resources”* (section 4 (1) (a)). The Act also provides for the EPA to have overall responsibility to ensure management of the natural environment to ensure conservation, protection and sustainable use of its natural resources; assess any developmental activity, which may cause an adverse effect on the natural environment before such activity commences; and coordinate and maintain a programme for the conservation of biological diversity and its sustainable use. The EPA is mandated to ensure that any project that may have a significant impact on the environment must acquire an Environmental Authorisation from the EPA. Projects are considered to have an environmental impact when they threaten the health, safety and natural life supporting systems of humans and other living things.



The EPA has granted a Construction Permit for the Project to the HECI for the construction of the solar farm. The EPA is expected to monitor the project's compliance with the terms and conditions of the Permit.

### **3.4.2 Office of the Prime Minister**

The Office of the Prime Minister (OPM) is established under Article 100 of the Constitution of the Cooperative Republic of Guyana. According to the Official Gazette,<sup>16</sup> the Office of the Prime Minister is responsible for matters related to energy, power generation, hinterland electrification and hydropower development among other responsibilities related to broadcasting, electronic data management, utilities, and information and communications. The OPM has principal policy-making and regulatory responsibility in the sector, including granting licenses to the public utilities and independent power producers and approval of development and expansion plans and operating standards and performance targets for the electricity sector.

Several key agencies in the energy and power generation sector fall under OPM's purview including the GEA, the HECI (including all of the satellite electricity companies including the Mahdia Power and Light Co. Inc.), the Public Utilities Commission, and the Guyana Power and Light. Two of these agencies, the GEA and HECI, will be directly responsible for the project during the design, construction and operational phases. The Public Utilities Commission will be involved in activities to set the prices at which electricity generated from the Project will be sold.

#### **3.4.2.1 Guyana Energy Agency**

The GEA falls under the purview of the Office of the Prime Minister. GEA's organization structure consists of a Board of Directors, Chief Executive Officer, Deputy Chief Executive Officer (unfilled), Secretariat and the following five Divisions: Energy & Energy Statistics Division, Legal & Licensing Division, Fuel Marking Division, Administration/Human Resource Division and Finance Division.

GEA's mission is to ensure the rational and efficient use of imported petroleum-based energy sources, while encouraging where economically feasible and environmentally acceptable, increased utilization of indigenous new and renewable sources of energy. The Act makes provisions for the core functions of the Agency, the following of which are relevant to the project:

- To advise and make recommendations to the Minister regarding any measures necessary to secure the efficient management of energy and the source of energy in the public interest and to develop and encourage the development and utilisation of sources of energy other than sources presently in use.
- To develop a national energy policy and secure its implementation.
- To carry out research into all sources of energy including those sources presently used in Guyana for the generation of energy, and securing more efficient utilisation of energy and sources of energy.
- To monitor the performance of the energy sector in Guyana, including the production, importation, distribution and utilisation of petroleum and petroleum products.
- To disseminate information relating to energy management, including energy conservation and the development and utilisation of alternative sources of energy.
- To study and keep under review matters relating to the exploration for, production, recovery, processing, transmission, transportation, distribution, sale, purchase, exchange and disposal of energy and sources of energy.

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<sup>16</sup> The Official Gazette (Extraordinary) of Guyana. September 2020. Subsidiary Legislation – Notice – The Constitutional Appointments.

- To report and recommend to the Minister measures the Agency considers necessary or in the public interest for the control, supervision, conservation, use and marketing and development of energy and sources of energy.
- To prepare studies and reports at the request of the Minister on any matter relating to energy or any source of energy, including research into alternative sources of energy, or the application of such research, and to recommend to the Minister the making of such arrangements as the Agency considers desirable for cooperation with governmental or other agencies in or outside Guyana in respect of matters relating to energy and sources of energy.
- To advise the Minister or assigned authority on matters relating to the administration and discharge of the functions of the Electricity Sector Reform Act 1999.

The GEA was integral in the conceptualization and development of the project and is the implementing agency responsible for coordination and oversight of the construction phase of the project.

#### **3.4.2.2 Hinterland Electrification Company Inc. and Mahdia Power and Light Co. Inc.**

The Hinterland Electrification Company Inc. (HECI) has its genesis in the Project Execution Unit (PEU) of the Office of the Prime Minister, Guyana. The HECI remains under the purview of the Office of the Prime Minister. The PEU was established in 2004 to manage the implementation of the UAEP which was implemented with support from the IDB. The main objectives of the UEAP were to expand existing coastal electricity grids to unserved areas within a feasible distance from the grids, and to examine ways in which hinterland areas could be provided with electricity in the most cost effective and sustainable manner. With regard to the latter, the PEU implemented several demonstration electricity projects in hinterland communities to test their viability for possible replication in other communities. The HECI's mission is to maintain the steady extension and upgrade of electricity supply systems across the hinterland, progressively improving operations and merging isolated services as appropriate.

HECI will be the owner of the Project when it is operational. HECI is a subsidiary of National Industrial and Commercial Investments Ltd. (NICIL) for holding of all satellite electricity companies<sup>17</sup> including the MPL who will be the operator of the Project. MPL will be responsible for the operation and maintenance of the solar farm and the transmission and distribution network that provides power to the principal beneficiary communities.

#### **3.4.3 Public Utilities Commission**

The Public Utilities Commission (PUC) is responsible for monitoring and enforcing operators' compliance with commitments to customers. These include commitments emanating from licenses and standard terms and conditions for operations, including operating standards and performance targets and development of expansion plans; the handling of consumers' complaints; and advising the OPM on these issues. The PUC also is responsible for confirming and approving tariffs charged by public suppliers.

#### **3.4.4 Regional Democratic Council of Region 8 and the Mahdia Town Council**

The two main regional and local democratic organs in Mahdia, the main beneficiary community, are the RDC of Region 8 and the Municipality of the township of Mahdia. These regional and local organs have already been engaged by the GEA and the GEA has been provided with a formal letter of No-Objection on the development of the Project. These entities have an important role to play as a key stakeholder to be engaged in the planning and implementation of the project. The Ministry of Local

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<sup>17</sup> Other satellite companies under the purview of HECI include: Linden Electricity Company Inc. (LECI), Kwakwani Utilities Inc. (KUI), Lethem Power Company Inc. (LMPC), Port Kaituma Power & Light Inc. (PKPL) and Matthew's Ridge Power & Light Inc. (MRPL).



Government and Regional Development (MLGRD) has responsibility for overseeing Local Government, which comprises the RDCs and the municipalities.

### **3.4.5 Guyana Lands and Surveys Commission**

The Guyana Lands and Surveys Commission (GLSC) is responsible for administering lands. According to the Guyana Lands and Surveys Act, the functions of the GLSC include:

- Having charge of and acting as guardian over all public lands, rivers and creeks of Guyana.
- Execute or cause to be executed geodetic, topographic, hydrographic and cadastral surveys in relation to the land and water resources
- Establish and maintain the national survey control system, set standards for the collection of photogrammetric data and specify the technical requirements for land surveys.
- Check, approve, record and where required, certify all land surveys carried out in Guyana.
- Provide access to land survey records and related information to any person, class or classes of persons.
- Receive and evaluate offers to purchase or let public lands and to issue grants, leases and permits to occupy such lands.
- Establish and liaise with all agencies involved in the registration and storage of records relating to public land in any tenure.
- Establish and liaise with all agencies to promote and monitor, in relation to public lands, the provision and maintenance of drainage and irrigation systems, access roads and other infrastructure.

The GLSC will be required to intervene to clarify whether the lands issued to the MPL for the project is in conflict with a lease which is being processed for residential purposes by a private citizen. The GLSC will be also required to play an active role in the settlement of any dispute regarding the land ownership. Ultimately the GEA will be responsible for the issuance of the lease for the land to be utilized for the project. The GLSC has issued a Permission to Occupy State Land to MPL for the project site.

## **3.5 International and Regional Framework**

### **3.5.1 Sustainable Development Goals**

The Sustainable Development Goals were adopted by all United Nations Member States in 2015 and outline a shared vision for sustainable development. There are 17 specific goals and associated targets for civil society, private sector, and governments to translate into national development plans and strategies towards achieving this shared vision. However, goals 7, 12, 13 and 17 are directly relevant to the Project:

- Goal 7: aimed to ensure affordable and clean energy. It speaks to international cooperation in access to energy, increased energy efficiency and the increased investments in and use of renewable energy towards more sustainable and inclusive communities and resilience to environmental issues such as climate change.
- Goal 12: addressed sustainable consumption and production and is focused on achieving sustainable use and management of natural resources, energy efficiency, sustainable infrastructure, environmentally sound waste management, and a better quality of life. Through sustainable consumption and production strategies and plans, countries aim to reduce future economic, environmental and social costs, strengthen economic competitiveness and reduction in poverty.
- Goal 13: addressed climate change and how affordable, scalable solutions can enable countries to leapfrog to cleaner, more resilient economies for example, through renewable

energy and a range of other measures to reduce emissions and increase adaptation efforts and move toward a low-carbon economy.

- Goal 17: underpins a successful sustainable development agenda through partnerships between government, the private sector and civil society at all levels. It emphasized that strong international partnerships are required to ensure countries achieve the SDGs.

### **3.5.2 United Nations Framework Convention on Climate Change and Paris Agreement**

The United Nations Framework Convention on Climate Change (UNFCCC) was entered into force in 1994 to achieve stabilization of greenhouse gas concentrations at a level that would prevent dangerous anthropogenic interference with the climate system. In 2015, Parties to the UNFCCC produced the Paris Agreement to combat climate change and to accelerate and intensify the actions and investments needed for a sustainable low carbon future. The Paris Agreement builds upon the Convention. Importantly, countries committed to a Nationally Determined Contribution to support reach the objectives of the Convention and the Paris Agreement. The provisions of Guyana's Nationally Determined Contribution are discussed in Section 3.1.10. The Mahdia Solar Farm Project is expected to contribute to achieving these targets.

Article 6 of the Paris Agreement allows countries to cooperate with each other to achieve the climate change mitigation targets outlined in their NDCs. The article facilitates direct bilateral cooperation between parties where emission reduction measures in one country may be transferred to another country to be counted in its Nationally Determined Contribution. Alternatively, Parties to the Paris Agreement may participate in a sustainable development mechanism which will be supervised by an independent body which will verify the results of emissions reductions measures. Non-market-based approaches for cooperating to achieve the Nationally Determined Contribution targets are also being developed under the Paris Agreement<sup>18</sup>. In the longer-term, there may be an opportunity in the future to cooperate with other countries on the basis of the emissions reductions which may be achieved by generating electricity from this project.

### **3.5.3 The CARICOM Energy Policy<sup>19</sup>**

The CARICOM Energy Policy aims to see a fundamental transformation of the energy sectors of Member States through the provision of secure and sustainable supplies of energy, whilst minimizing energy waste in all sectors, and ensuring all citizen have access to affordable and stable, modern, clean and reliable energy supplies, and to facilitate the growth of internationally competitive Regional industries towards achieving sustainable development of the Community. The policy charts 15 broad policy actions that encourages a new climate-compatible development path that harnesses diverse domestic renewable energy resources, minimizes environmental damage, and spurs social opportunity, economic growth, and innovation. With respect to renewable energy, the policy is to diversify the energy sources through the increased use of renewable energy.

#### **3.5.3.1 The Caribbean Sustainable Energy Road Map and Strategy**

In order to translate the policy actions of the CARICOM Energy Policy, the CARICOM Secretariat commissioned the Caribbean Sustainable Energy Roadmap and Strategy (C-SERMS), designed to build on existing efforts in the region and to provide CARICOM member states with a coherent strategy for transitioning to sustainable energy. C-SERMS provides the basis for a more targeted approach to advancing sustainable energy development under the regional policy and in so doing acts as a framework for articulating, monitoring and adjusting regional level strategies, and for securing commitments from Member States towards achievement of the targets that are established. C-SERMS suggests a regional target of 48 percent of installed power capacity by the year 2027. Regional

<sup>18</sup> UNFCCC, 2016. The Paris Agreement, Article 6.

<sup>19</sup> CARICOM, 2013. The CARICOM Energy Policy. Page 28.

renewable energy capacity shared targets include 20 percent by 2017, 28 percent by 2022, and 47 percent by 2027. C-SERMS also recommended a 33 percent reduction in energy intensity to be applied evenly across all member states

### 3.6 Other Codes and Guidelines

#### 3.6.1 GPL National Grid Code

The National Grid Code prepared by the GPL outlines the objectives of the general conditions to ensure, as far it is possible, that the various sections of the grid code work together for the benefit of GPL and all users and to provide a set of principles governing the status and development of the grid code and related issues as approved by regulatory authority. The GPL National Grid Code is comprised of five distinct Codes as follows:

- **Planning Code:** The Planning Code defines the criteria and procedures employed by GPL in evaluating the performance of its power system and the reinforcements necessary to maintain reliability. The overarching objective of the Planning Code is to set the minimum planning criteria that will be used as the basis for the expansion of the transmission network to reliably attend current and future loads while taking into account the need to minimize operating costs and capital investments.
- **Interconnection Code:** The Interconnection Code defines the requirements and processes that any Independent Power Producers or GPL Generation Projects must comply with to interconnect new (or modified) generation to the GPL System. The Interconnection Code objective is to ensure that the interconnection of the new (or modified) generation is accomplished in a manner that maintains the reliability of the GPL System and is in compliance with GPL Planning Code, the Minimum Technical Requirements and Operations Code. The Interconnection Code also aims for providing standardized and transparent bases for interconnecting new (or modified) generation to the GPL System, including required network upgrades and their cost allocation. The Interconnection Requirements also requires compliance with international standards including the NEC and IIEE discussed in Section 3.6.2 to 3.6.4 below.
- **Operational Code:** The Operational Code includes the criteria, procedures and information requirements necessary to execute the operational planning, the generation dispatch and coordination supervision and control of integrated operation of the GPL System. The Operational Code will also define the procedures for the reporting and information exchange between the different entities connected to the GPL System. The Operational Code takes into consideration that new generation will be added to the system in compliance with the Interconnection Code.
- **Minimum Technical Requirement Code:** The Minimum Technical Requirements (MTRs) Code defines the technical specifications and requirements that must be complied with by any new generation facility that will interconnect to the GPL System. This code is critical for Renewable Generation Facilities (RGFs), since there are specific technical requirements that are required to address RGFs inherent variability, uncertainty, and limited dispatchability. On the other hand, complying with the MTRs for conventional generation resources is normally less challenging. However, they must also comply with the MTRs.
- **Metering Code:** All active and reactive power entering or exiting the transmission system and distribution systems shall be metered using one or more metering systems. Electricity delivered to consumer premises shall also be metered. Hence, the Metering Code defines the regulations and technical aspects related to metering within the GPL System.

### **3.6.2 NFPA's National Electrical Code (NEC)20**

The National Fire Protection Association (NFPA) is a US-based global self-funded non-profit organization, established in 1896, devoted to eliminating death, injury, property and economic loss due to fire, electrical and related hazards. The NFPA publishes more than 300 consensus codes and standards intended to minimize the possibility and effects of fire and other risks. NFPA codes and standards, administered by more than 250 Technical Committees comprising approximately 8,000 volunteers, are adopted and used throughout the world. The NFPA 70: National Electrical Code (NEC) is one such code which is used by countries around the world as the benchmark for safe electrical design, installation, and inspection to protect people and property from electrical hazards. Solar PV installations must be compliant with the NEC, particularly, but not limited to, Article 690 and Article 705.

### **3.6.3 Relevant Standards of the International Electrotechnical Commission<sup>21</sup>**

The International Electrotechnical Commission (IEC) was founded in 1906 in the United Kingdom with the goal of making electrical and electronic technologies safer, more efficient and reliable. It is a global, not-for-profit membership organization, whose work underpins quality infrastructure and international trade in electrical and electronic goods. The IEC brings together more than 170 countries and provides a global, neutral and independent standardization platform. It administers four conformity assessment systems whose members certify that devices, systems, installations, services and people work as required. The IEC publishes International Standards which together with conformity assessment provide the technical framework that allows governments to build national quality infrastructure and companies of all sizes to buy and sell consistently safe and reliable products in most countries of the world. IEC International Standards serve as the basis for risk and quality management and are used in testing and certification to verify that manufacturer promises are kept. Relevant Standards of the IEC to which the project should comply include IEC61215, IEC61730, *IEC 61850 and IEC 61701 among others.*

### **3.6.4 Relevant Standards of the Institute of Electrical and Electronics Engineers**

The Institute of Electrical and Electronics Engineers (IEEE) is an association dedicated to advancing innovation and technological excellence to serve professionals involved in all aspects of the electrical, electronic, and computing fields and related areas of science and technology. IEEE's core purpose is to foster technological innovation and excellence for the benefit of humanity. Further, all interconnection equipment (inverters, charge controllers, etc.) must conform with the IEEE 1547 and be listed under the UL 1741 Standard. Additional relevant standards of the IEEE to which the project should comply includes IEEE C57.12.00, IEEE C57.12.34, IEEE C57.12.28, IEEE C57.12.29, IEEE C57.12.70, IEEE C57.12.80, IEEE C57.12.90 and IEEE C57.91 among others.

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20 NFPA, 2020. NFPA 70® - National Electrical Code®

21 IEC, 2021. Who We Are; What We Do.



#### 4.0 PROJECT ENVIRONMENT

The PV plant site is located along a gentle sloping hill. The landscape of the project area is made up of current and abandoned farmlands, as subsistence farming is practiced on a portion of the property and on adjacent lands. Vegetation consists of degraded forest characterized by secondary forest growth and successional vegetation species. Mining is prevalent in the wider project area. The alignment of the transmission line follows existing roads within both the Mahdia Township and the Campbelltown community.

A section of the alignment is shown in Figure 4-1 and the plant site can be observed in Figure 4-2.



**Figure 4-1: A Section of the Transmission Line Alignment**

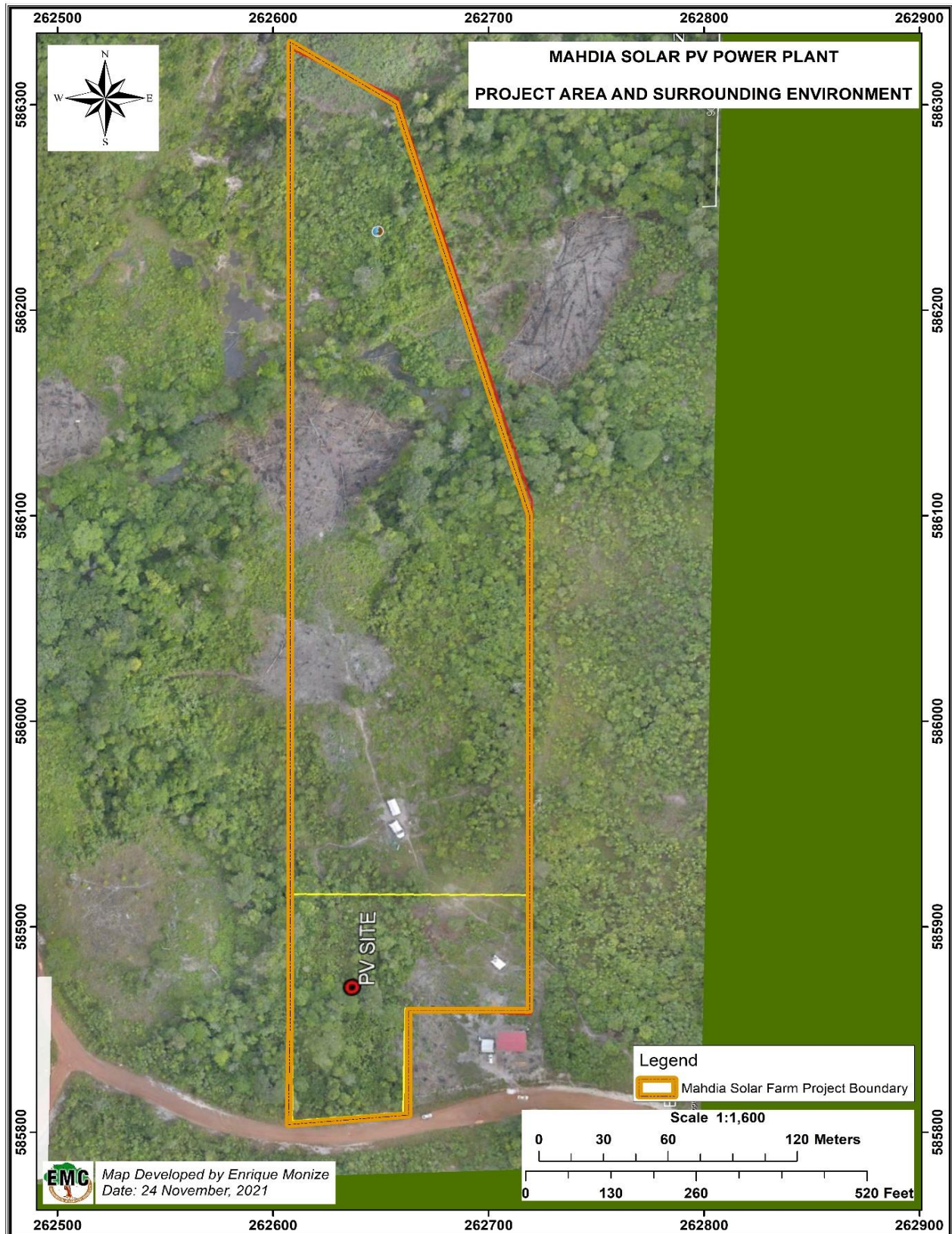


Figure 4-2: Project Area



## 4.1 Physical Environment

This section describes the geological, topographical, soil and hydrological conditions at the project site based on expert observations during field exercises and a review of relevant literature. It also presents the findings of baseline assessments of surface water quality, ambient air quality and ambient noise levels at sampling locations within and proximate to the Project site.

### 4.1.1 Geomorphology

Generally, the project site is located in the drainage basin of the Potaro River which flows eastwards approximately eight kilometres north of the site. Three mountains which bracket the site are the Ebini Mountains to the south-west, Eagle Mountain to the south and Lookout Mountains to the south-east. All of these mountains are the result of younger granitic intrusions and intrusions from the Avanavero suite of dykes. The Ebini Mountains are located on a series of granitic and Avanavero intrusion trending north-west to south-east. The Eagle and Lookout Mountains are both located on a series of north-east to south-west trending granitic and Avanavero intrusions. All areas to the north of the project site are relatively flat, gently undulating peneplains. There are several rivers and creeks all flowing north into the Potaro River with a dendritic drainage pattern.

The configuration of the surrounding mountains and the prevailing drainage patterns indicate that the project site is located in a very large and historic drainage basin which has been channelling surface flows from up in the higher elevations of the mountains into the Potaro River. This entire historic drainage basin is covered with a thick layer of fluvial white silica sands. The Potaro River itself is incised along a zone of weakness from a regional fault. The area has suffered several episodes of deformation which has caused lateral displacement along regional faults. The mountainous areas have fresh rock at or close to the surface but mostly there is a typical deeply weathered saprolite or laterite profile.

Specifically, the project site is located on a flat hill that is elongated in the north-south direction. A section of the site forms the western boundary for the catchment area of the Marabunta Creek. The areas in and around the Project site are mostly covered by white silica sands, and gravelly Regosols.

#### 4.1.1.1 Regional Geology

Guyana is located on the northeast coast of South America, and is entirely comprised of or underlain by rocks of the Precambrian Guiana Shield. The Guiana Shield lies between the Orinoco and Amazon Rivers and encompasses all or portions of neighbouring countries Suriname, French Guiana, Venezuela, Brazil and Columbia, aggregating to an area of 1.6 million square kilometres.

From oldest to youngest, the Guiana Shield and cover sequences comprise the following principal stratigraphic successions:

- The Imataca Complex, an Archaean complex composed of 3.4Ga - 2.7Ga protolith, on which are superimposed high grade metamorphic rocks of Trans-Amazonian age (2.2Ga - 2.0Ga) exposed in the Ciudad Bolivar Region of Venezuela.
- High grade granulites and gneisses of the Central Guyana Granulite Belt of Palaeoproterozoic age (2.4Ga - 2.3Ga).
- A widely developed Palaeoproterozoic granite-greenstone succession, which was deformed and metamorphosed during the Trans-Amazonian tectono-thermal event (2.2Ga - 2.0Ga). Rocks from the Trans-Amazonian age stretch across much of the northern third of the Shield, incorporating a succession of older gneissic granitoids, with the two principal occurrences in

Guyana referred to as the Bartica Gneiss and Kanuku Group. These gneissic complexes are considered equivalent to the Cape Coast Suite of West Africa and are enveloped by a less deformed succession of basic to acid volcanics, sediments and syntectonic granitoids. In Guyana, the greenstones are referred to as the Barama-Mazaruni Supergroup, in Venezuela the Pastora Supergroup, while in Suriname and French Guiana the term Maroni Supergroup is used. The greenstones are intruded by syntectonic granitoids (2.25Ga - 2.0Ga) equivalent to the Dixcove Suite of West Africa, providing an upper age limit for the Trans-Amazonian Orogeny, similar to that recorded for the Eburnean Orogeny of West Africa.

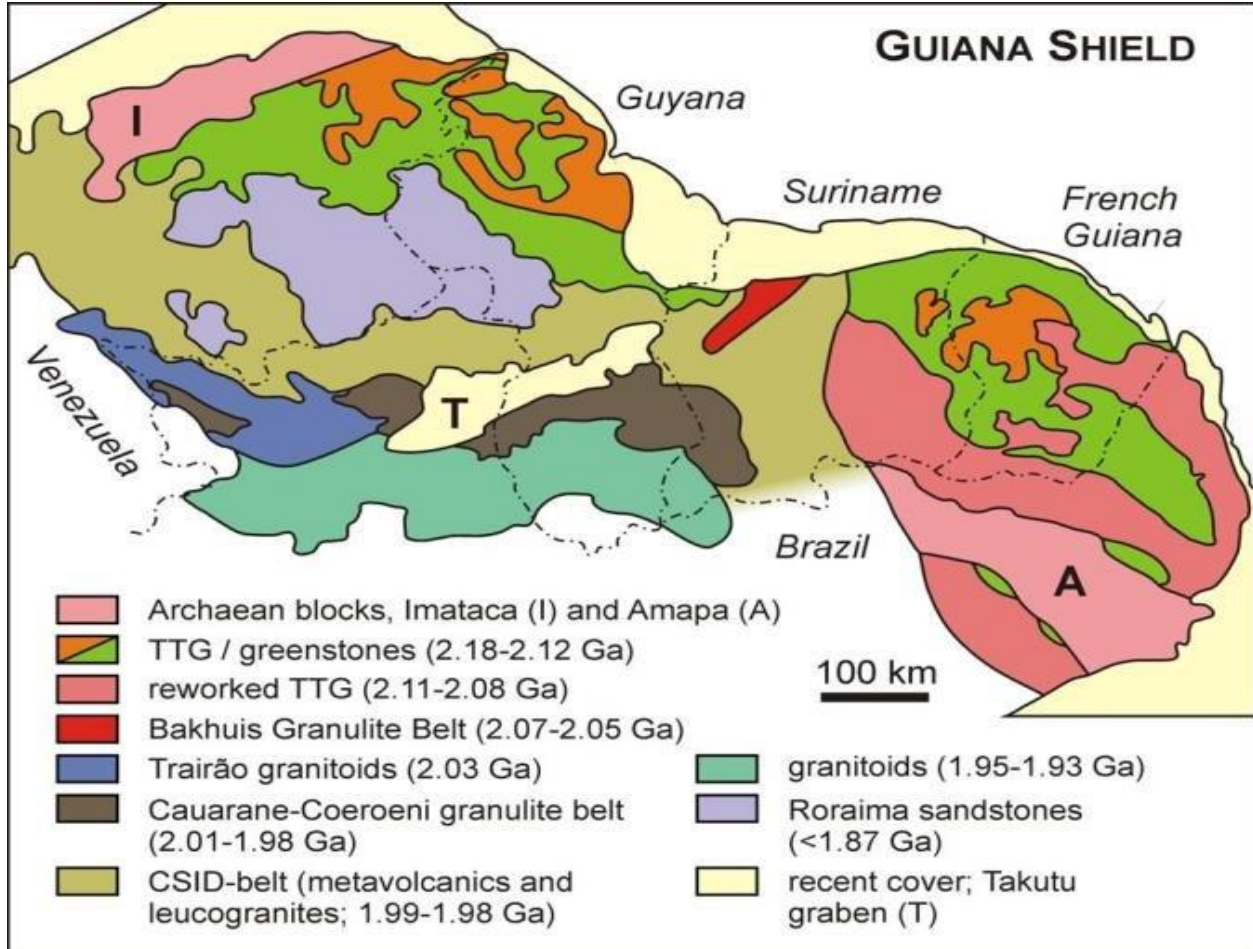
- The Uatuma Supergroup comprises a mostly undeformed and unmetamorphosed Mesoproterozoic (1.9Ga - 1.5Ga) sequence of supracrustals deposited above a major regional unconformity with the underlying Palaeoproterozoic basement. From oldest to youngest, these include 1,000 to 1,600 meters thick continental sandstones and conglomerates of the Muruwa Formation, and the 1,000 to 2,000 meters thick felsic volcanics, terrigenous sediments and sub-volcanic intrusives comprising the Iwokrama Formation.
- The Uatuma Supergroup is unconformably overlain by the topographically distinctive Roraima Group, which forms the Pakaraima Plateau bounded by a near vertical escarpment. The Roraima Group comprises a 1,000 to 3,600 meters thick sequence of relatively flat lying, unaltered, conglomerates and sandstones with subordinate siltstones and felsic volcanics. The age of the Roraima is constrained by the underlying basement and mafic intrusives to between 1.9Ga - 1.6Ga.
- Intruding the Roraima and Trans-Amazonian basement are dykes and sills of gabbro and dolerite of the Avanavero Suite. These intrusives are typically of substantial thickness and may extend laterally for hundreds of kilometres. The Avanavero Suite intrusives are undeformed and unmetamorphosed. Ages of the Avanavero suite have been determined by radiometric dating to 1.84Ga - 1.61Ga with the main cluster at 1.78 Ga.
- Other basic intrusives, younger than the Avanavero Suite, which cluster at ages of 1330, 1213, 907, 700-570 and 430-500 million years before present. These dykes are designated the PAPA dykes, an acronym standing for Post-Avanero Pre-Apatoe.
- Opening of the Atlantic during the Mesozoic resulted in the formation of intracratonic rifts within the Guiana Shield, which were filled with basaltic lavas and terrestrial sediments. In Guyana these Mesozoic rifts are represented by the Takutu Graben, an east-northeast trending rift structure, and the mostly offshore Guyana coastal basin.
- Associated with the opening of the Atlantic Rift was the emplacement of the dyke swarms known as the Apatoe Suite. Dykes of this suite are typically narrow, fine grained doleritic dykes of great strike extent, which predominantly trend north-northeast to east-northeast.
- Quaternary to Recent sediments of the Corentyne Group veneer much of the basement geology in northern Guyana. Clean shallow marine to estuarine quartz sands of the Berbice Formation (also referred to as the Mackenzie or White Sand Formation) are most prevalent, increasingly overlain by reducing fluvial clays of the Demerara Formation towards the northern coast.

The Guiana Shield has been correlated with the Leo-Man Shield of West Africa, and it is generally accepted that prior to the opening of the Atlantic during the Mesozoic the two shields formed a contiguous craton. The Archaean Imataca Complex can be correlated with the Archaean Liberian Province, the Central Guyana Granulite Belt with the Dimbroko Zone in Ivory Coast, the Barama-



Mazaruni greenstones with the Birimian greenstones and the Trans-Amazonian tectono-thermal event with the Eburnean Orogeny.

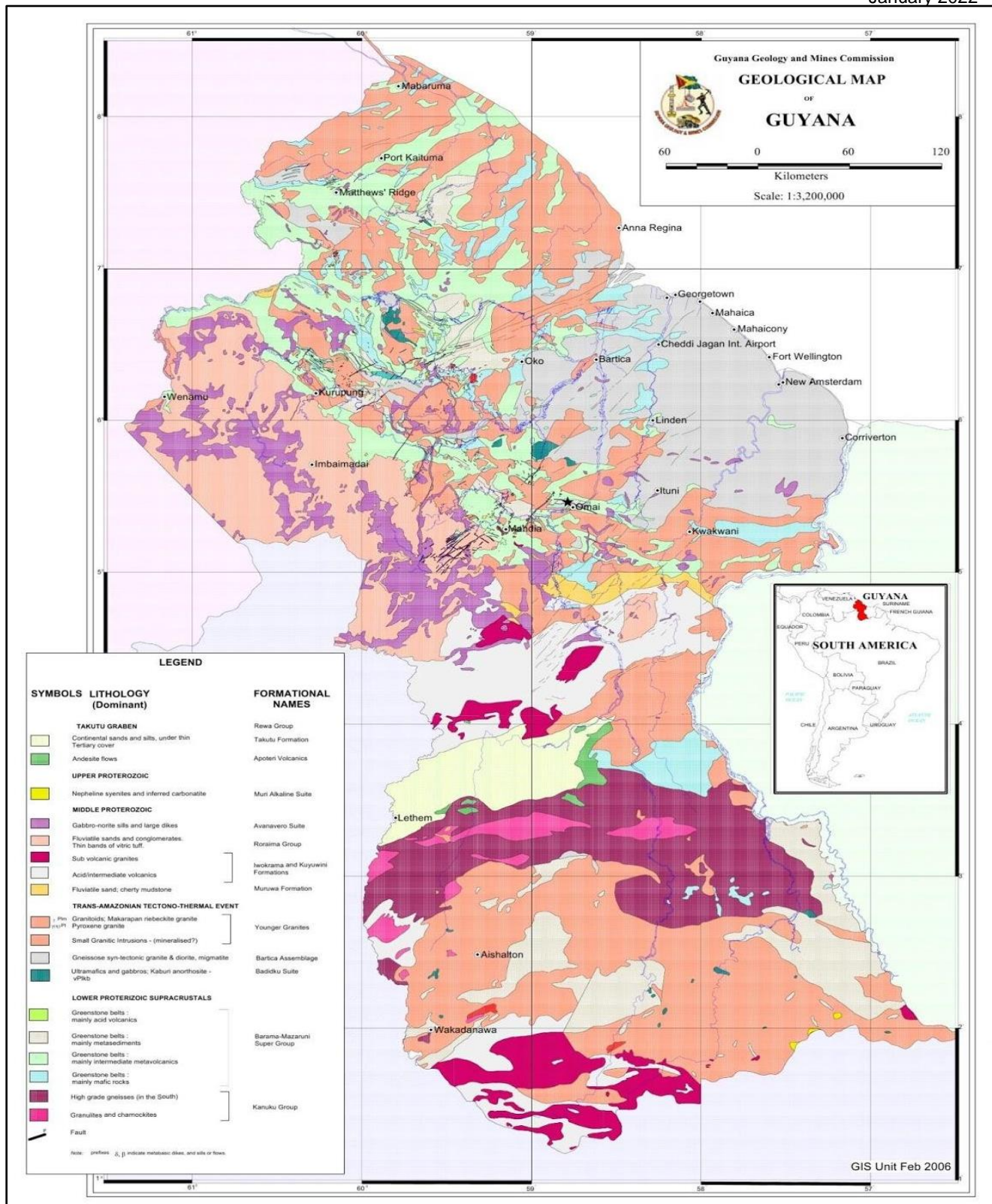
The project is located in the Archean-Proterozoic Guiana Shield in northeast South America. The Guiana Shield is a palaeo-Proterozoic granite-greenstone terrane and is considered to be the extension of the West-African palaeo-Proterozoic Birimian Supergroup terrane. The Guiana Shield is largely composed of the Barama-Mazaruni Supergroup, a metasedimentary/greenstone terrain intercalated with Archean-Proterozoic gneisses that are intruded by Trans-Amazonian granites, as well as mafic and ultramafic rocks<sup>22</sup>. The geology of the Guyana Shield is shown in Figure 4-3, while the regional geology of Guyana is shown in Figure 4-4.



Source: Patadien, Raysree & de Roever, Emond. 2019. The K3 Copper Deposit in the Bakhuis Granulite Belt, W Suriname.

**Figure 4-3: Simplified Regional Geology of the Guiana Shield**

<sup>22</sup> McConnell R.B., Williams E. 1970. Distribution and Provisional Correlation of the Precambrian of the Guiana Shield. In: Guiana Geol. Conf., 8, Georgetown, Guiana. Proceedings: 1-20



Source: Guyana Geology and Mines Commission (2006)

Figure 4-4: Regional Geology of Guyana

#### 4.1.1.2 Local Geology

The project site is dominated by one geological group called the Barama-Mazaruni Super Group. The name Barama-Mazaruni Super Group is a “bag” term that refers to the greenstone basement of Guyana north of the Takutu Graben. Several belts and smaller areas of greenstones occur, separated by areas of Bartica Assemblage gneisses and Younger Granites. Stratigraphic details are in some areas, with specific formation names that relate to sequences separated by local unconformities. However, correlation between areas is challenging. In general, the Barama Group is sediment dominated, and the Mazaruni Group volcanic dominated, though a similar stratigraphic sequence occurs in both, suggesting they may be lateral equivalents.<sup>23</sup>

The area has been extensively studied by geologists from Golden Star Resources and the findings of these studies inform the following description. The geological assemblage ranges from the predominantly volcanic and intrusive “basement” rocks of the Proterozoic Barama-Mazaruni Super Group to the recent alluvium of the “Proto-Mahdia”. Proto-Mahdia is the name given to the gold-bearing palaeo-alluvial channel of probable Late Tertiary age, precursor to the present-day Mahdia River. The channel runs over a Proterozoic volcano-sedimentary sequence intruded by felsic plutons. The palaeo-channel explored by Golden Star Resources extends north-south for about eight kilometres, averaging ten metres in thickness and three hundred metres in width. It is believed to have evolved in a north-south graben-like valley. The channel was eroded through Roraima Formation sandstones to reach the Proterozoic volcanics and plutons, where it became controlled by bedrock geology and structure. Late in the Tertiary, the Proto-Mahdia is thought to have flowed into the White Sand Sea, formed by regional crustal subsidence. This event caused the capture of the Proto-Mahdia by the present Mahdia River, and deposition of an extensive mantle of marine sand over most of the region (Berbice Formation). Following rejuvenation of the valley, deep tropical weathering of palaeo-alluvium and bedrock occurred, with partial erosion of the palaeo-channel. The Proto-Mahdia alluvium is made up of three major sedimentary facies: clay, clayey sand and gravel. From south to north there is a gradual passage from coarser to finer sediments, with the gravel usually concentrating in the bottom of the channel. During its evolution the channel appears to have received slump debris from the left bank. The Proto-Mahdia alluvium is extensively weathered with local development of a thick lateritic profile.<sup>24</sup>

Within a few kilometres of the project site, particularly in the bracketing mountainous areas to the south-west, south and south-east, there are several younger intrusions belonging to the younger granites, granitoids and gabbro-notite dykes of the Avanavero suite. These intrusions were influential in the resulting topography, stratigraphy, and drainage patterns.

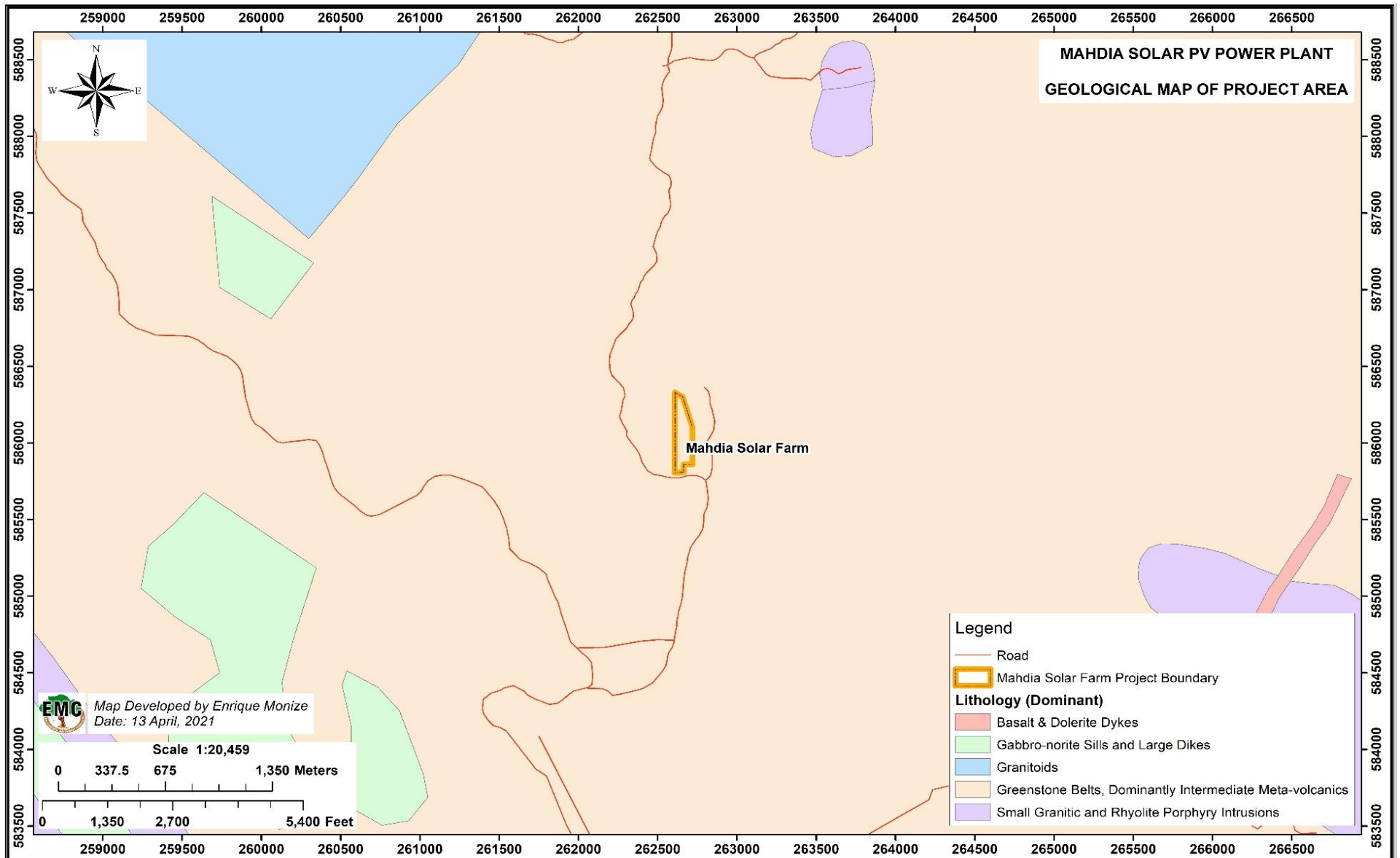
No faults or dykes were observed at the project site during the field visits. Moreover, there is no documented evidence of faults or dykes within approximately three kilometres of the project site. There are no apparent lithological boundaries within a three-kilometer radius of the project site. Lithological contacts in the wider project area zones of weaknesses that would have allowed the rivers to develop drainage as they eroded faster than the bordering topographic highs that are underlain by the younger and more weather resistant material. Figure 4-5 presents a map of the local geology around the project area.

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<sup>23</sup> Heesterman, L. 2019. Stratigraphy of Guyana Greenstone Belts.

<sup>24</sup> Heesterman, L et al. 2000. A Summary of Geochemistry of Land Dredges in the Mahdia Area, Potaro District.





**Figure 4-5: Local Geology of the Project Area**

#### **4.1.2 Topography**

The project site is located at the top of the flattened 61-meter contour and down its slope an elongated hill is created in a north-south orientation. This hill forms the western boundary of the Marabunta Creek catchment. There is only one contour within the project site which is a gentle slope from the top of the hill along the southern boundary of the site and progresses to the northern boundary of the project site. This hillside along the northern boundary is a part of the catchment of the Marabunta Creek. Figure 4-6 presents a topographical map of the project area.

The area is drained by a dendritic network of moderately incised small streams and creeks which all flow approximately north south. These all feed ultimately into the Potaro River located to the north of the project area. In the wider area there are a series of elongated hills with a general north-south orientation. The high elevations to the south in the mountainous areas carry relatively sharp and steep slopes as a result of the hard lateritic cover and fresh rock which resists mass movement. The lower elevations are mostly floodplains and are dominated by fluvial and alluvial terrains. The channel of the Potaro River is generally below its 46-meter contour. Mining has changed the topography of the landscape in the lower Potaro River. Deep pits and depressions remain post-mining, causing an alteration of river channels and flood plains.

The transmission line alignment is generally flat (Figure 4-6), with a few gentle sloping hills.

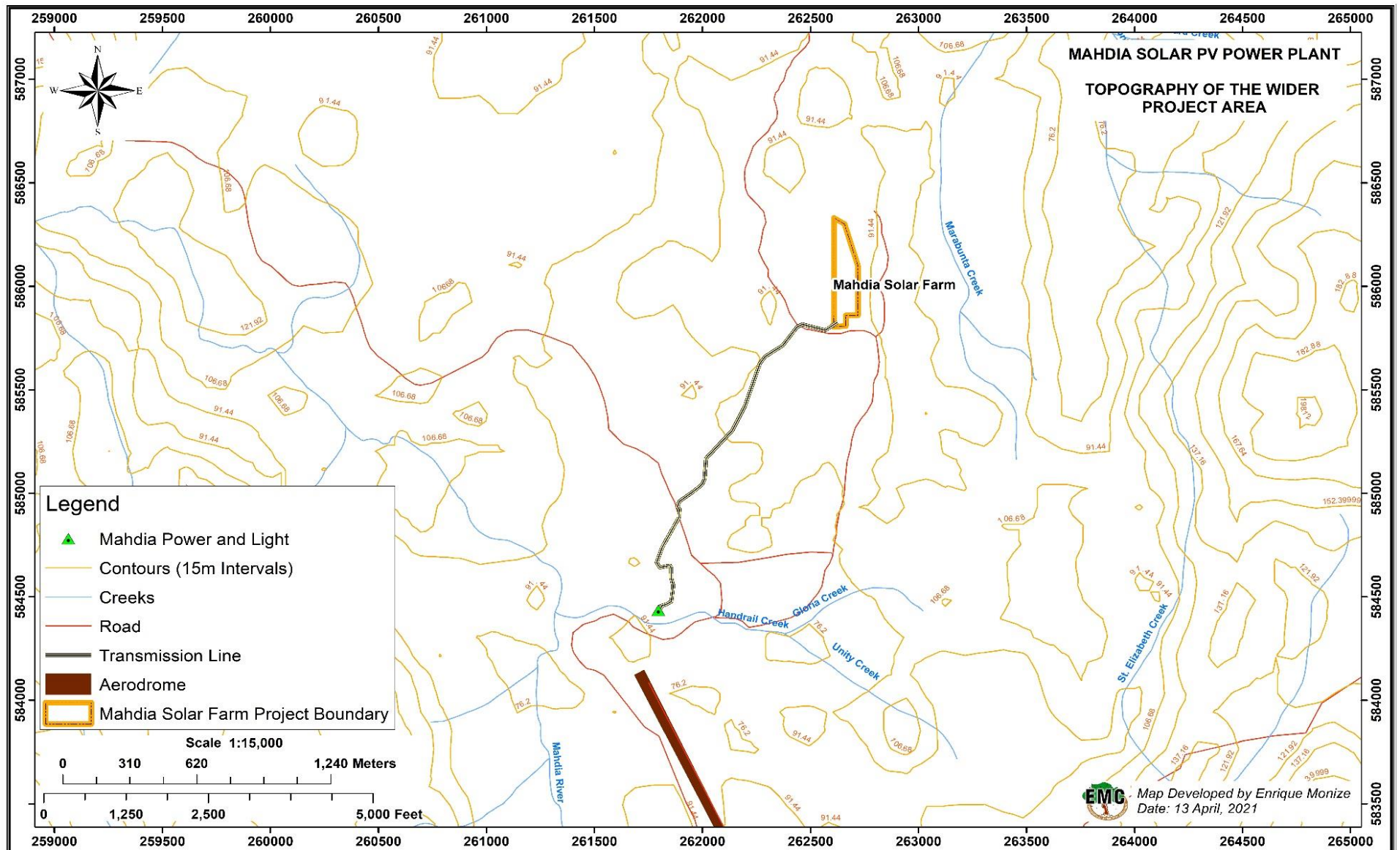


Figure 4-6: Topography of the Project Area

### 4.1.3 Soils

The plant site and the transmission line alignment are located on soils characterised by the White Sand Plateau and Older Pediplains. Generally, these soils have been developed on old deltaic and continental deposits with some inclusions developed on crystalline rocks. The majority are red-yellow latosols and sandy regosols with steep, gravelly and truncated phases.<sup>25</sup>

The entirety of the project site, inclusive of the transmission line alignment, is located on only one of the mapping units for this soil type namely, *4c - Regosols, laterite gravel phase, including red yellow latosols, forest and savannah phases (Kandiodults with Kandiodults, Eutrochrepts)*. This mapping unit describes soils containing large amounts of laterite gravels. They occur east of the Pakaraima Mountains, north of the Siparuni River and in the Ebini Hills between the Mazaruni and Potaro Rivers. They are also extensive in the northern Rupununi savannas forming the higher ground between the alluvial plain and the Kanuku Mountains. The soils are generally very shallow (though occasionally deep), very gravelly (greater than 70 percent gravels) and vary from darker coloured gravelly sandy clay loam under forest to lighter coloured gravelly clay loams on the savannas, both of very low fertility. The main limitations are the high gravel content resulting in low water holding capacity and low fertility. These soils have a land capability classification of III which means that they are considered poor agricultural soils.<sup>4</sup> The key characteristics of the 4c mapping unit are presented in Table 4-1 below.

**Table 4-1: Characteristics of 4c - Gravelly Regosols Soils**

Soil Class*	Texture	Depth	Drainage	Fertility	Erosion Hazard	Land Capability	Limitations
Kandiodults, Eutrochrepts	gC-L	Very Shallow	Well	Very Low	Slight to Moderate	III	Fertility, Gravels

\*According to the soil units and capability identified by the United Nations Food and Agriculture Organisation (FAO) as presented in the National Land Use Plan.

A map of the soil types in the project area is presented in Figure 4-7.

<sup>25</sup> Guyana Lands and Surveys Commission, 2013. National Land Use Plan. Pages 38 and 42 to 43



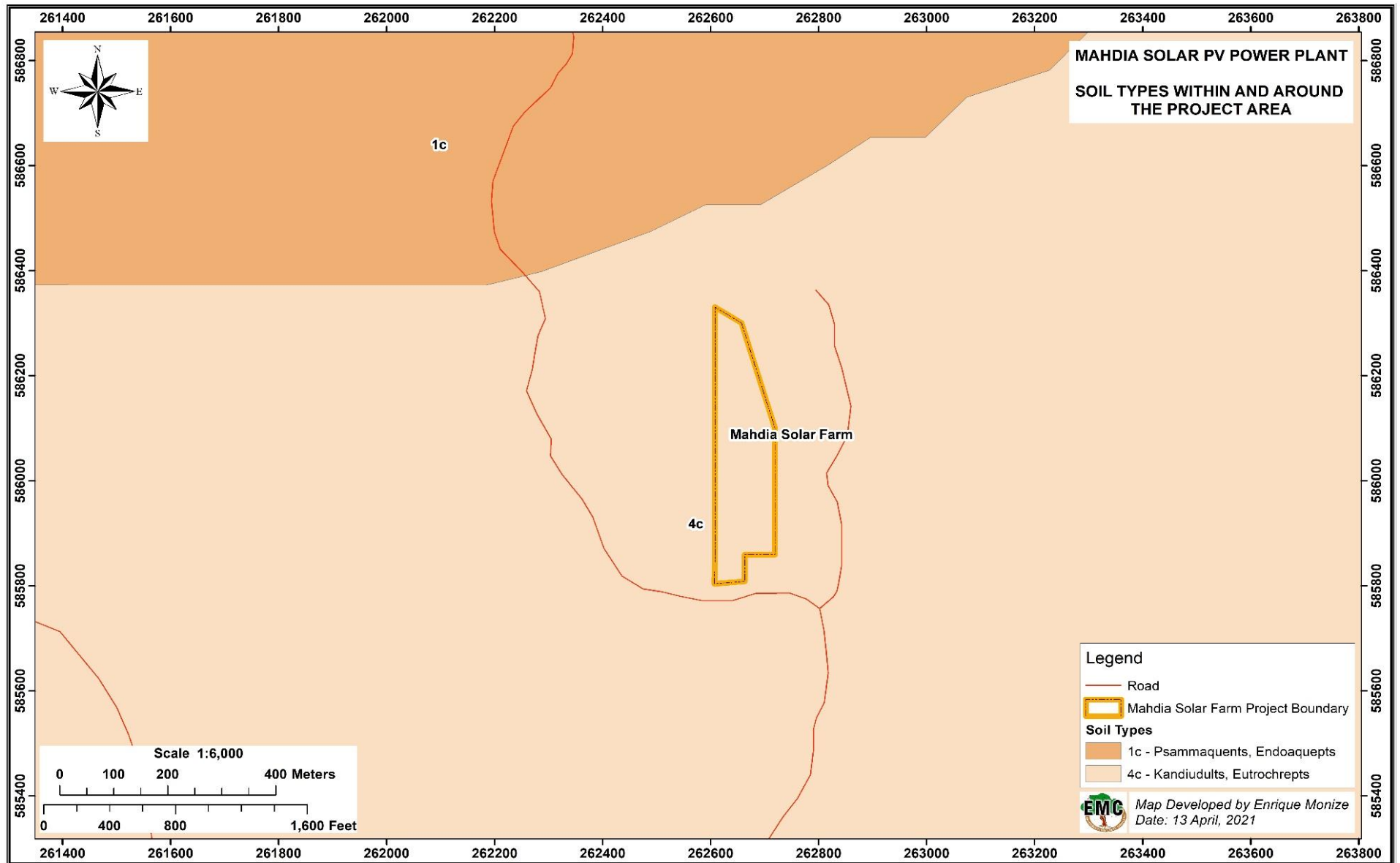


Figure 4-7: Soils Types in the Project Area

#### 4.1.4 Hydrology

Within the boundaries of the project site there is only one small seasonal waterway (Figure 4-8 [Left]) and that flows into a tributary of the Marabunta Creek (Figure 4-8 [Right]) to the east of the site. This small drainage primarily has flows during and immediately following rains. The Marabunta Creek continues along the northern boundary of the site and continues to flow north where it joins the Small Konawak River approximately 1.6 kilometres to the north-east of the site. Immediately upstream of the confluence of the Marabunta Creek with the Small Konawak River are the St. Elizabeth Creek and Santa Barbara Creek. These all continue to flow to the north. The Small Konawak River continues in a northerly into the Konawak River. In the wider project area, there are a several small streams and seasonal runoffs that flow from the topographic highs and into this catchment which leads to the Konawak River. The Konawak River continues to flow north and then ultimately flows into the Potaro River approximately 8 kilometres north-east of the project site.



**Figure 4-8: Small Seasonal Waterway in the Project Site (Left) and a Tributary of the Marabunta Creek (Right)**

The rivers are incised along historical drainages, in places the Proto-Mahdia was exposed and incorporated into the present flows. The creeks are small and generally fewer than 6 meters wide. The rivers are typically about 12 meters wide. The project site borders the Mahdia and the Proto-Mahdia Rivers, where the Marabunta Creek and other flows have re-established themselves in and close to the historic Proto-Mahdia flow. The three mountains to the south-east, south and south-west represent the headwaters for all major flows in the area. Due to the drainage gradient and large catchment the Mahdia and Potaro Rivers experience large, rapid changes to flow rate and height.

Figure 4-9 shows the drainage network of the project site.

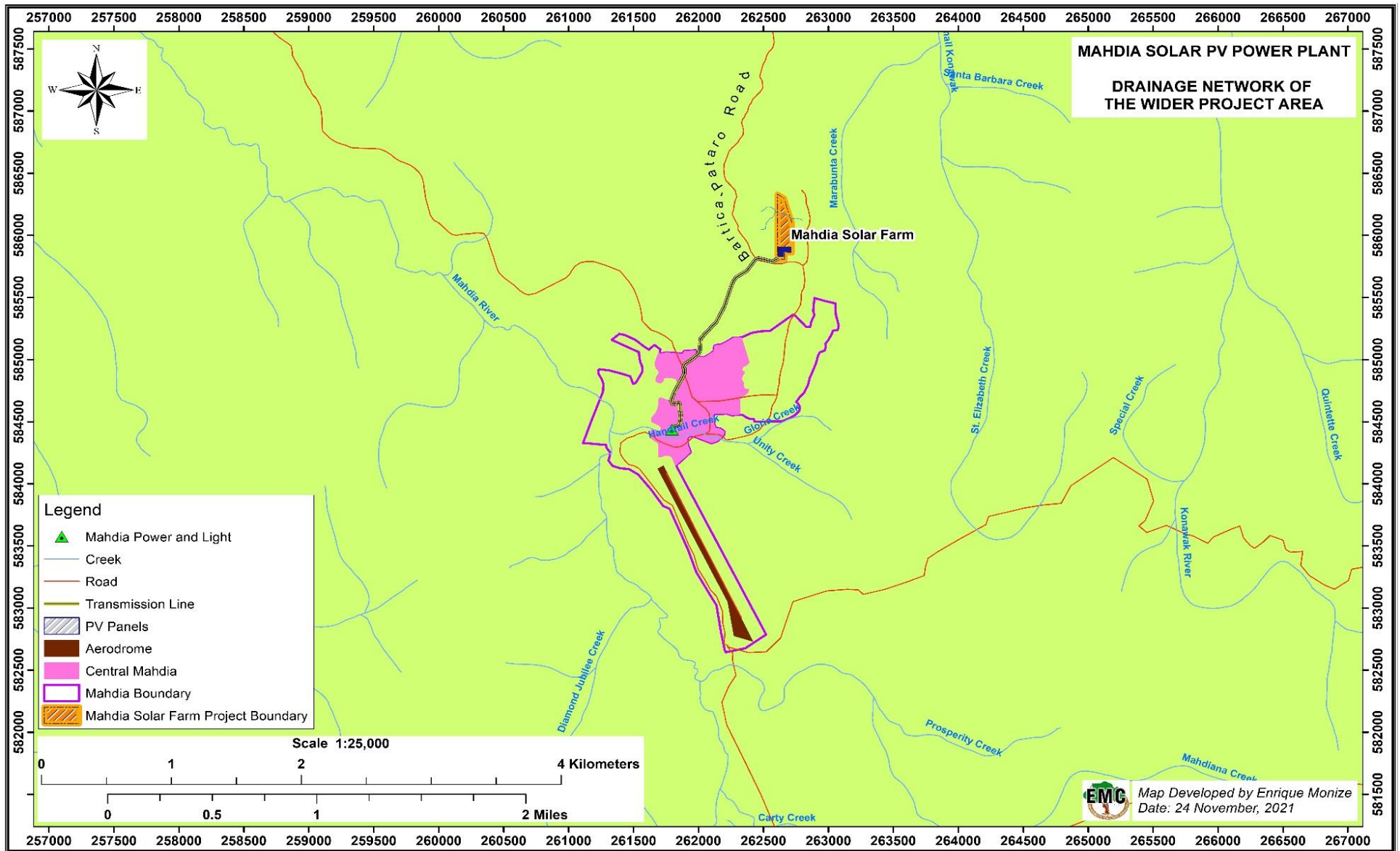


Figure 4-9: Drainage Network of the Project Site

#### 4.1.5 Climate

##### 4.1.5.1 National Climate Profile

Guyana is classified as a tropical rainforest country. It is located north of the equatorial line and is characterized by warm temperatures all year round. The weather is influenced by the Inter-Tropical Convergence Zone (ITCZ) which is a belt of low pressure that circles the earth at the equator. This zone is at a convergence point for trade winds of the Northern and Southern Hemispheres. This creates a zone of rain-bearing clouds and causes a great amount of precipitation. There are two different seasons observed in Guyana which are the wet and dry seasons. These two seasons are further divided into the primary and secondary seasons. During the mid-April to the end of July Guyana experiences a primary wet season. The secondary wet season would then occur from mid-November to January. The intervening periods are the primary and secondary dry seasons respectively. There is precipitation during all seasons. However, during the wet season this is more intense. On average annual rainfall ranges between 1,600 to 3,000 millimeters with spatial variation of rainfall across the country.<sup>26</sup>

Ambient temperatures in Guyana range between a low of 16 degrees Celsius and a high of 34 degrees Celsius. Temperatures would seldomly exceed these ranges. However, at higher altitudes in Guyana it is normal to experience lower temperatures. Wind speeds on Guyana's coastal regions ranges between 4.4 and 13.5 kilometres per hour. Wind speed would decrease at inland locations.

Guyana's climate is also influenced by the El-Niño Southern Oscillation (ENSO). During El Niño phenomena, precipitation is lessened and air temperatures are warmer. From 1997 to 1998 and 2015, El Niño episodes triggered extreme drought events in Guyana. By contrast, La Niña episodes are accompanied by wetter conditions and cooler temperatures and have been linked to flood events in Guyana. ENSO varies on an inter-annual basis in Guyana but its occurrence has been non-linear.<sup>27</sup>

##### 4.1.5.2 Climate Profile of the Project Site

In order to present specific information regarding the climatic conditions at the project locations, data on monthly rainfall was collected from the Ministry of Agriculture, Hydrometeorological Department. The Department operates a weather station in Mahdia, Region 8 approximately 1.7 kilometres away from the project site. However, the station only collects precipitation data.

Rainfall data were collected for the period July 2016 to February 2021. However, there was a gap from between January to April of 2017. Due to this gap monthly averages were used to compute data. The trends seen were consistent with patterns established in Guyana's Second National Communication to the UNFCCC for the bimodal patterns of seasonality with distinct wet and dry seasons. The primary wet season occurs from May to July while the secondary wet season occurs from November to January. The primary and secondary dry season occurs from August to October and February to April respectively.

Figure 4-10 shows the monthly mean levels of precipitation observed for the periods for which data is available. Precipitation throughout the year largely adhered to the expected seasonality with distinct wet and dry seasons. Higher levels of precipitation were observed in the primary and secondary wet seasons as compared to the dry seasons. For the periods assessed, the greatest precipitation occurred in the primary wet season, extending over the period May to July, and the highest total

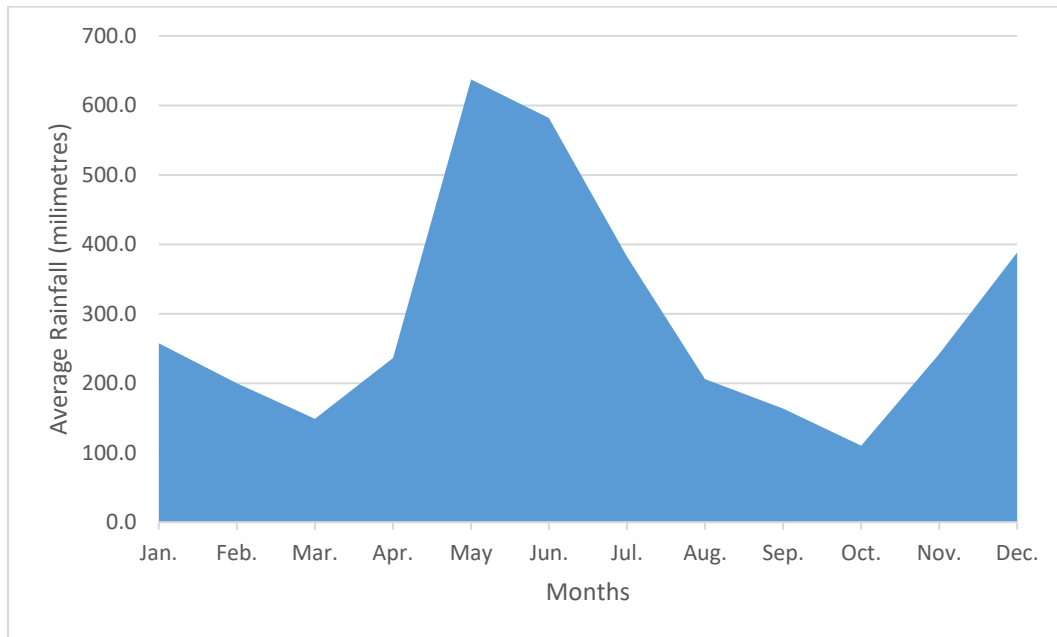
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<sup>26</sup> Government of Guyana, 2012. Second National Communication to the United Nations Framework Convention to Climate Change; Page 53

<sup>27</sup> Government of Guyana, 2012. Second National Communication to the United Nations Framework Convention to Climate Change; Page 177



monthly rainfall occurred in May. By contrast, the secondary dry season, occurring from August to October, was the driest period, with the lowest average monthly rainfall occurring in October.



**Figure 4-10: Mean Monthly Rainfall in Mahdia**

There were no sunshine or cloud-related data collected by the Ministry of Agriculture, Hydrometeorological Department in Mahdia. However, there is an established positive relationship between rainfall and cloud cover while a negative relationship exists with sunshine and cloud cover<sup>28</sup>. As such, cloud cover during the wet seasons can affect the productivity of the solar panels during the primary and secondary wet seasons.

Due to the relative closeness to the equator of Guyana, there is also a minute variance of sunrise and sunset with there being on average 12-hour period of sunshine with a variance of plus or minus 25 minutes. Since Guyana is in the northern hemisphere the longest day of sunshine is typically experienced on June 20 with an average of 12 hours and 26 minutes of sunlight. Moreover, the shortest day is generally experienced on December 21 with an average of 11 hours and 49 minutes of daylight.

The period of the greatest incidence of shortwave solar radiation would be experienced at the project site will be between February and April at 6.1-kilowatt hours. Shortwave solar radiation is greatest on March 27 with an average of 6.3-kilowatt hours. The period of the year with the lowest solar radiation is experienced during the primary wet season from May to July with solar radiation averaging below 5.4-kilowatt hours. Generally, solar radiation is expected to be lowest on May 30 with an average of 5.1-kilowatt hours.

#### **4.1.6 Surface Water Quality**

To gain a better understanding of the water quality within and around the project site, water quality sampling and analyses were conducted.

<sup>28</sup> Rokonzaman, Md, Rahman, M.M. 2017. Effect of Cloud Coverage on Sunshine, Humidity, Rainfall and Temperature for Different Weather Stations in Bangladesh: A Panel Analysis.

#### 4.1.6.1 Methodology

Water quality analysis was conducted for the two surface water bodies within and around the project site namely the small seasonal flow ravine and the tributary of the Marabunta Creek. Two sets of samples were collected for each sampling location as follows:

- The first set of samples were analyzed *in-situ* for pH, Temperature, Turbidity, Total Suspended Solids (TSS), Dissolved Oxygen (DO), Total Dissolved Solids (TDS) and Conductivity.
- The second set of samples were sent to the Guyana Sugar Corporation Inc. (GUYSUCO) Laboratory for analyses and was tested for Sulphates, Nitrates, Oil and Grease and Chemical Oxygen Demand (COD).

Sample collection and in-situ analysis can be seen in Figure 4-11 and 4-12.

The instruments utilized to conduct the water quality analyses onsite are described below:

- **pH, TDS, Conductivity, DO** – These parameters were analysed by a Hach HQ40D Multimeter - Portable two-channel multimeters for pH, conductivity, Total Dissolved Solids and Dissolved Oxygen. The digital meter/electrode system combines reliability, flexibility and ease of use. Interchangeable Intellical electrodes are recognized automatically and store all relevant data. Rugged, nearly indestructible outdoor versions with multiple cable lengths enable measurements even at previously inaccessible locations. The degree of accuracy for the parameters are pH ( $\pm 0.02$  pH), TDS (0.001, 0.01, 0.1 mg/L), Electrical Conductivity (0.01  $\mu\text{S}/\text{cm}$ ), DO ( $\pm 0.1$  from 0 to 8 mg/L  $\pm 0.2$  for greater than 8 mg/L).
- **TSS** - TSS Portable Hand-held Turbidity, Suspended Solids, and Sludge Blanket Level Instrument. The Hach TSS Portable Hand-held Turbidity, Suspended Solids, and Sludge Blanket Level Instrument's unique multi-beam alternating light method with infrared diode system gives it a broad measuring range for both turbidity and suspended solids in one portable handheld instrument. It stores up to four different calibration curves for suspended solids and one for turbidity. There is no need for constant re-calibration for different locations. The accuracy of the measurement for the TSS is  $< 4\% \pm 0.001$  g/L.
- **Turbidity** - Hach's Portable Turbidimeter, the 2100Q, provides ease of use and accuracy. With an intuitive user interface, the 2100Q makes it easy to take measurements and perform calibration and verification. This device is calibrated before every field visit. It has a degree of accuracy of  $\pm 2\%$ .

A description of each sampling location, the date, time and weather condition at the time of sampling is presented in Table 4-2. The locations sampled can be seen in Figure 4-13.

**Table 4-2: Description of Surface Water Sample Locations and other Sampling Details**

Sample ID	Location	GPS Point	Time (hrs)	Date	Weather
SW1	Small Seasonal Flow	05°17'42.09" N 59°08'34.12" W	09:23	March 11, 2021	Sunny
SW2	Tributary of Marabunta Creek	05°17'54.1" N 59°08'29.3" W	09:29		Sunny



**Figure 4-11: Water Sample Collection at the Small Seasonal Flow (Left) and the Marabunta Creek Tributary (Right)**



**Figure 4-12: *In-Situ* Analysis of Surface Water Samples**



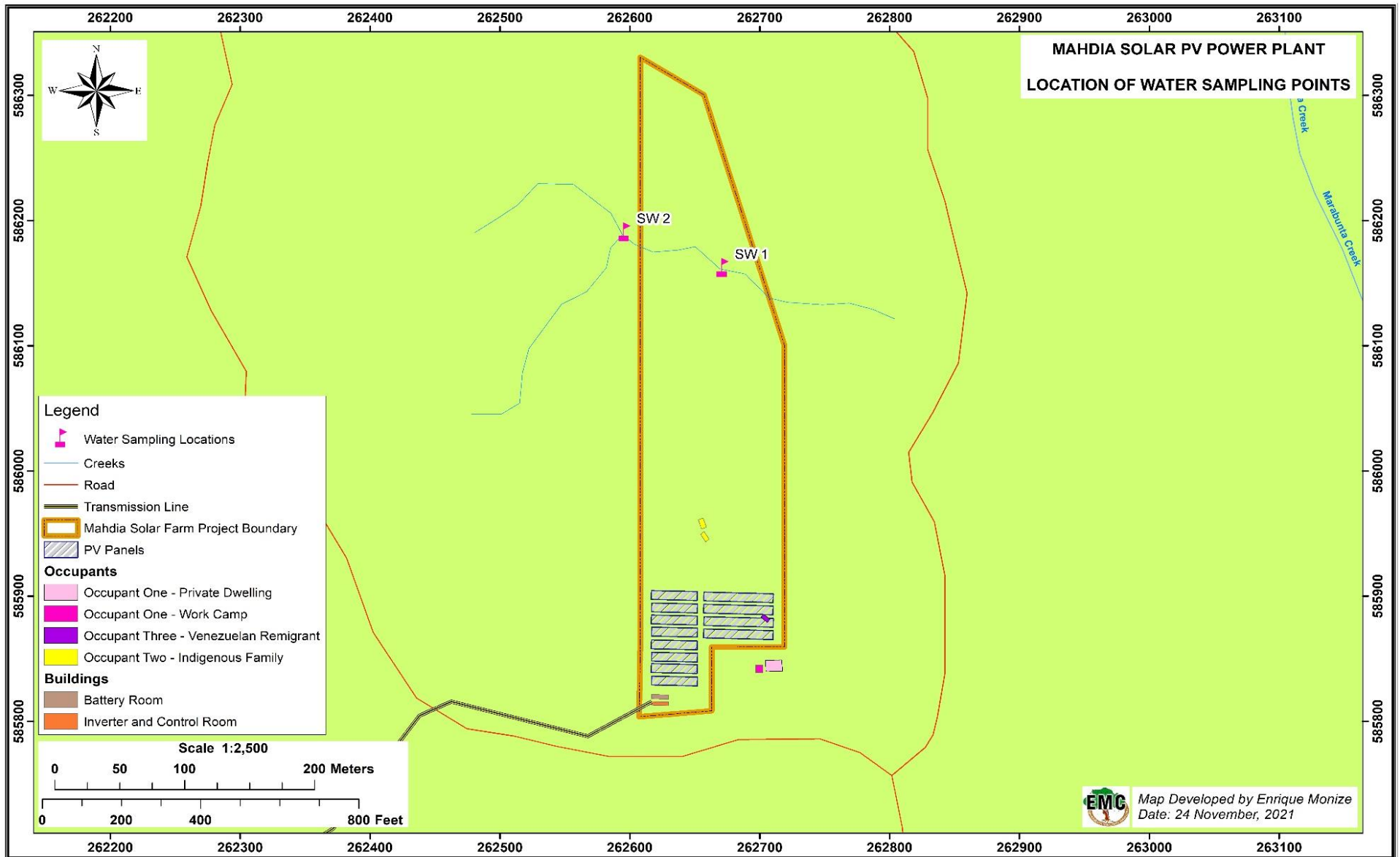


Figure 4-13: Sampling Locations for Surface Water Quality Analysis

#### 4.1.6.2 Results

The results for the water quality analysis were compared to the limits prescribed in the GNBS Interim Guidelines for Industrial Effluent Discharge into the Environment for pH, temperature, TSS, COD, and Oil and Grease. Turbidity levels were compared with the limit prescribed in the Mining (Amendment) Regulation 2005<sup>29</sup>. The prescribed levels of TDS were within the limits of the National Recommended Water Quality Criteria – Human Health Criteria Table of the United States Environmental Protection Agency<sup>30</sup>. The laboratory analyses report is attached as Appendix E. The results of the water quality analyses are presented in Table 4-3.

**Table 4-3: Results of Water Quality Analyses**

Sample Locations	Parameters								
	pH 5.0–9.0	Temp (°C) <40	DO (mg/L) >4	ECw (µs/cm)	TDS (mg/L) 250	TSS (mg/L) 50	Turbidity (NTU) <50	Oil and Grease (mg/L) <10	COD (mg/L) 250
SW 1	5.66	27.9	5.43	12.92	5.64	5.0	3.21	ND	5
SW 2	5.68	26.9	5.02	14.25	6.32	4.0	2.63	ND	ND

ND – Not Detected

The results of the water quality analyses indicates that the water quality for both sampling locations can be considered good, with no indication of contamination.

#### 4.1.7 Ambient Noise Levels

In order to determine the baseline noise level measurement of decibel levels were conducted at various locations within and adjacent to the project site.

##### 4.1.7.1 Methodology

Decibel levels were measured at two points. The first sampling location was taken within the project site downhill of the slope along the eastern boundary. The other sampling point was located in close proximity to the southern boundary adjacent to the Bartica-Potaro Road. A description and coordinates of each of the noise measurement locations is provided in Table 4-4. The noise measurement locations can also be seen in Figure 4-15.

**Table 4-4: Noise Level Measurement Locations**

Location ID	Locations	Co-ordinates
N1	Northern Boundary (Downhill)	05°17'52.4" N 59°08'28.8" W
N2	Southern Boundary (Adjacent to the Road)	05°17'46.9" N 59°08'29.1" W

The measurements were done using a Reed Instrument R 8080 meter. This is a quick responding triple range sound level meter with backlit display, analog bargraph and built-in memory to data log up to 64,000 points. This data logging sound level meter has the ability to record samples on internal memory and keep track of registered readings with a time and date stamp. The R8080 features user

<sup>29</sup> The Mining (Amendment) Regulations 2005 is the only national guideline to specify a limit for turbidity.

<sup>30</sup> United States Environmental Protection Agency. 1986. National Recommended Water Quality Criteria – Human Health Criteria Table.

selectable sampling rates and the option to track live measurements via the included PC interface software. The meter has a  $\pm 1.5$  dB degree of accuracy with real-time logging of data which can be transferred onto an excel data sheet for further analysis.

For the noise measurement the windscreen was installed on the microphone of the meter and the meter was then turned on in accordance with the manufacturer's guidelines. Thereafter, noise measurement readings were conducted for 15 minutes at each sampling point. The maximum and minimum readings obtained were recorded on data sheets along with the locations ID, coordinates, time, date, weather conditions and any other observations for each sample point. Noise measurement at one of the sampling points can be seen in Figure 4-14.



**Figure 4-14: Noise Levels Measurement at Northern Boundary (Left) and Outside Southern Boundary (Right)**

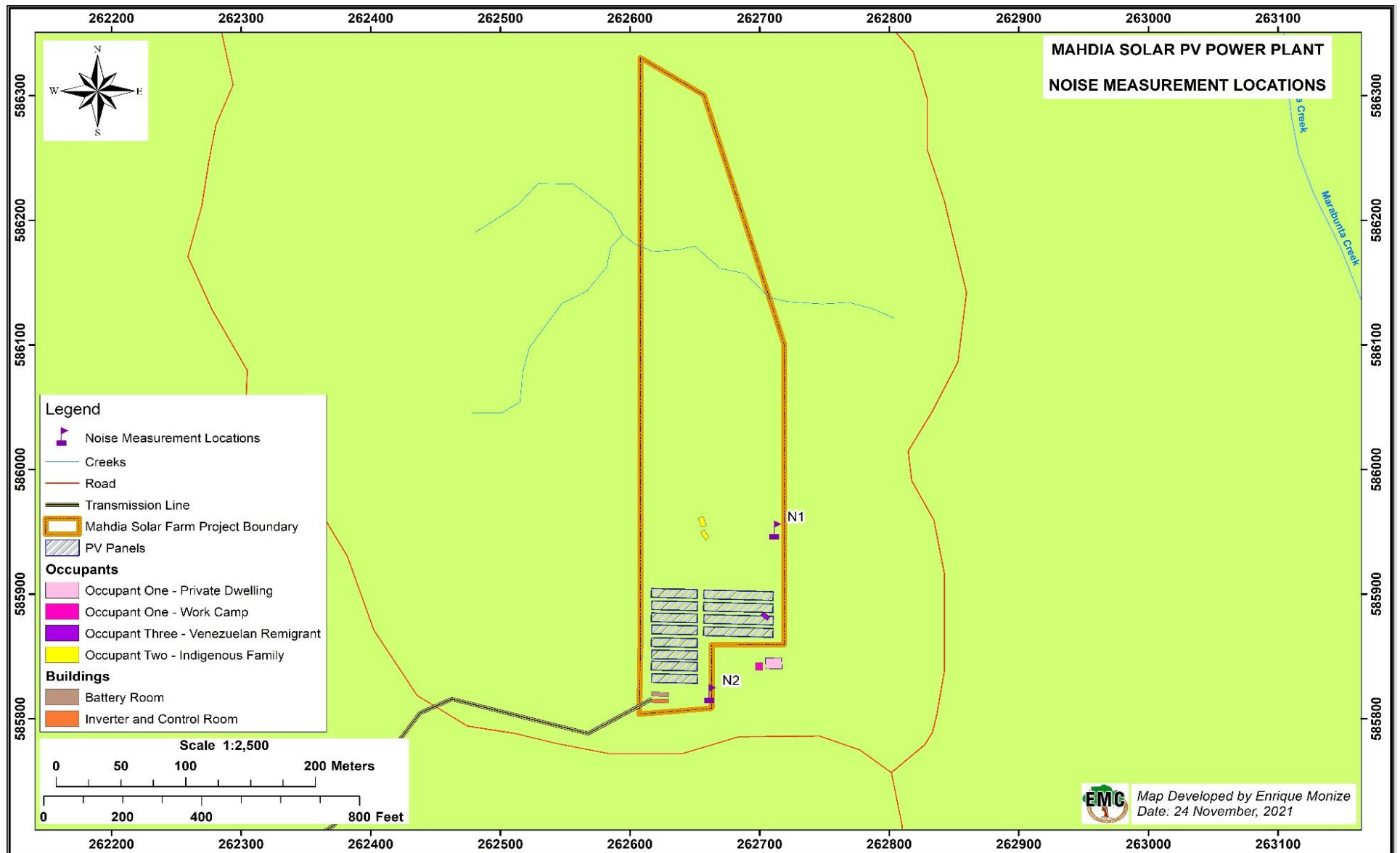


Figure 4-15: Noise Measurement Locations

#### 4.1.7.2 Results

The results of the ambient noise level measurements for the two sampling locations are presented in Table 4-5.

**Table 4-5: Results of Noise Level Measurements**

Location ID	Description	Date	Time (hrs)		Weather Conditions	Reading (dB)	
			Start	End		Max	Min
N1	Eastern Boundary (Downhill)	March 11, 2021	09:30	09:45	Sunny	59.2	41.9
N2	Southern Boundary (Adjacent to the Road)		10:52	11:07	Sunny	51.3	40.9

There were various influences of noise. The anthropogenic influence of noise from vehicular traffic was observed when the assessment was conducted at both sampling locations but more particularly at the southern boundary of the site. Moreover, during the measurement of N1, construction works were ongoing at a private dwelling located along the southern boundary of the project site. However, during measurement of N2, the construction works had stopped and this accounts for the lower readings at N2. Generally, the ambient noise level at the project site is low.

#### 4.1.8 Ambient Air Quality

Baseline ambient air quality was also measured within the Project area. Particulate Matter (PM) levels along with the level of various gases such as Sulphur Dioxide (SO<sub>2</sub>), Nitrogen Dioxide (NO<sub>2</sub>), Carbon Monoxide (CO) and Volatile Organic Compounds (VOCs) were measured at the project area to confirm the existing air quality.

##### 4.1.8.1 Methodology

Ambient air quality was measured at two locations within the project site. A description and coordinates of each of the air quality measurement location is provided in Table 4-6. The air quality measurement locations can also be seen in Figure 4-16.

**Table 4-6: Air Quality Assessment Locations and Other Details**

Location ID	Locations	Coordinates	Time (hrs)	Date	Weather Condition
AQ1	Within the central area of the property	05°19'51.5" N 59°08'29.0" W	08:40	March 11, 2021	Sunny
AQ2	Close to the southern boundary of the property	05°17'35.1" N 59°08'33.8" W	10:06		Sunny



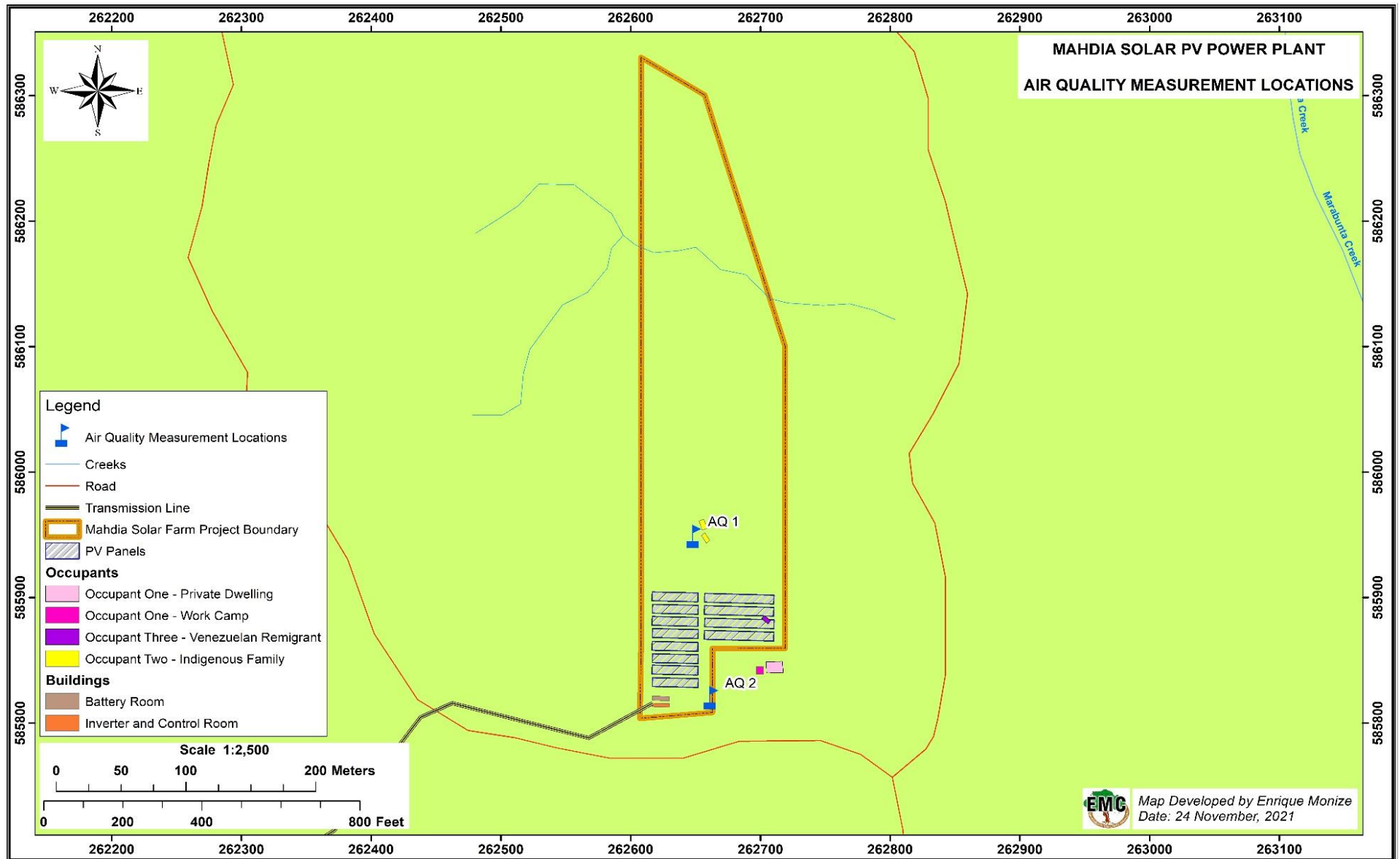


Figure 4-16: Ambient Air Quality Measurement Locations

### Methodology for Measuring Particulate Matter

Particulate Matter and Total Suspended Particles (TSP) were recorded using an Aerocet 831 Aerosol Mass Monitoring Meter. The Aerocet 831 is a completely portable, full-featured, battery-operated, handheld mass monitor which measures five mass ranges (PM<sub>1</sub>, PM<sub>2.5</sub>, PM<sub>4</sub>, PM<sub>10</sub> and TSP). The meter has a  $\pm 10$  % degree of accuracy with real-time logging of data which can be downloaded into MS Excel for further analysis.

At each sampling site, suitable locations for setting up the meter were determined based on several key considerations which included unrestricted and safe access, unrestricted airflow, no obstructions and avoiding topographic hollows where air circulation is restricted. The meter was turned on following the manufacturer's guidelines, after which sampling was conducted for one hour at each site. The data obtained were recorded on data sheets along with the location ID, coordinates, time, date, weather conditions and any other observations for each sample point. Sampling was conducted for one hour at each of the sample points.

### Methodology for Measuring Gases

SO<sub>2</sub>, NO<sub>2</sub>, CO and VOCs were measured using the Aeroqual Series 500 Portable Air Quality Monitor. This air quality monitor and sensors enable accurate real-time surveying of common outdoor air pollutants, and is typically used for short- and long-term air quality studies and carrying out checks on pollution "hot spots". The device has a  $\pm 0.2$  % degree of accuracy with real-time logging of data which can be downloaded into MS Excel for further analysis.

For the exercise, the sensor heads of the gas to be monitored were inserted into the meter on an alternating basis. For each measurement, sensor heads were allowed to warm up for three minutes as per the manufacturer's guidelines after which sampling was conducted for 15 minutes. The locations used were the same for the PM and TSP readings. This gave a more comprehensive overview of the conditions in the specific localities.

Figure 4-17 shows ambient air quality measurement being conducted at the project site.



**Figure 4-17: Ambient Air Quality Measurement at the Project Site**



#### 4.1.8.2 Results

##### Particulate Matter

The measurements for the PM<sub>2.5</sub> and PM<sub>10</sub> were compared to the limits from the Environmental Protection Agency of Victoria, Australia which categorizes emissions with 1-hour mean measurements as follows:

- Good: PM<sub>2.5</sub> levels lower than 27 µg/m<sup>3</sup>; PM<sub>10</sub> lower than 40 µg/m<sup>3</sup>.
- Moderate: PM<sub>2.5</sub> levels between 27 to 62 µg/m<sup>3</sup>; PM<sub>10</sub> levels are between 40 to 80 µg/m<sup>3</sup>.
- Poor: PM<sub>2.5</sub> levels between 62 to 97 µg/m<sup>3</sup>; PM<sub>10</sub> levels are between 80 to 120 µg/m<sup>3</sup>.
- Very Poor: PM<sub>2.5</sub> levels between 97 to 370 µg/m<sup>3</sup>; PM<sub>10</sub> levels are between 120 to 240 µg/m<sup>3</sup>.
- Hazardous: PM<sub>2.5</sub> levels greater than 370 µg/m<sup>3</sup>; PM<sub>10</sub> greater than 240 µg/m<sup>3</sup>.

The results of the air quality baseline assessment for particulate matter are presented in Table 4-7.

**Table 4-7: Results of PM and TSP Assessment**

Locations	Results (µg/m <sup>3</sup> )		
	PM <sub>2.5</sub>	PM <sub>10</sub>	TSP
AQ1	24.8	113.6	121.2
AQ2	20.7	50.8	114.8

Based on the results of the assessment, PM<sub>2.5</sub> levels were well within the prescribed limits for “good” air quality. However, with respect to PM<sub>10</sub>, air quality at AQ1 can be considered “poor” while at AQ2 the measurements indicate “moderate” air quality. Generally, all measurements were higher for AQ1 which is upwind of the project site. However, this area also had a denser vegetation cover which may have influenced higher values particularly for large particulates such as PM<sub>10</sub> and TSP. The values for PM<sub>2.5</sub> were higher in areas with forest cover and this is consistent with findings of a positive correlation between canopy cover and high values of PM<sub>2.5</sub> due to materials falling from the canopy (Liu et.al in 2015<sup>31</sup>).

##### Gases

The results of the air quality baseline assessment for gases are presented in Table 4-8 below. These values were compared to permissible limits established by the World Health Organization Air Quality Guidelines<sup>32</sup> for SO<sub>2</sub> and NO<sub>2</sub> and the Air Quality Index from the Environmental Protection Agency of Victoria, Australia for CO. There are no established permissible limits for VOCs. These limits are as follows:

- SO<sub>2</sub>: 0.5 mg/m<sup>3</sup> (10-minute mean)
- NO<sub>2</sub>: 0.2 mg/m<sup>3</sup> (1-hour mean)
- CO: < 34.46 mg/m<sup>3</sup> is an indicator of good air quality (1-hour mean)

<sup>31</sup> Liu, Xuhui; Yu, Xinxiao; Zhang, Zhenming. 2015. "PM<sub>2.5</sub> Concentration Differences between Various Forest Types and Its Correlation with Forest Structure" Atmosphere 6, no. 11: 1801-1815.

<sup>32</sup> World Health Organization, 2005. WHO Air Quality Guidelines for Particulate Matter, Ozone, Nitrogen Dioxide and Sulfur Dioxide. Pages 16 and 18.

**Table 4-8: Results of Gaseous Assessment**

Location ID	Time (hrs)	Date	Weather Condition	Results (mg/m <sup>3</sup> )			
				VOCs	SO <sub>2</sub>	NO <sub>2</sub>	CO
AQ1	09:11	March 11, 2021	Sunny	661.7	0.0	0.045	0.0
AQ2	10:36		Sunny	302.1	0.0	0.063	4.4

SO<sub>2</sub> was not detected at either sampling locations. CO was not detected at AQ1 and was within the good air quality range at AQ2. NO<sub>2</sub> was within the levels for good air quality both sampling points. These results were expected for an area covered with secondary vegetation where there are no industrial act2 Biological Environment

The objective of the biodiversity baseline assessment was to determine whether there are sensitive species and areas of biological interest within the project development landscape. The mechanism utilized to conduct this assessment consisted of the review of available information on the project area of influence (Aol)<sup>33</sup>, including a field assessment conducted during March 10 to 11, 2021 (Figure 4-18).



**Figure 4-18: Consultant's Team Conducting Biological Surveys of Vegetation Bordering the Northern Boundary of the Plant Site**

The baseline data compiled considered biodiversity at three levels of scale: global and regional biogeographic provinces; landscapes and ecosystems; and habitats and species. Using the data compiled, an assessment was conducted to determine the presence of threatened species, as defined in the IUCN Red List, endemic and migratory species, and areas of recognized global, national or local importance to biodiversity within the Aol.

#### **4.2.1 Biogeographic Provinces**

Four main geographical regions can be distinguished within Guyana. These are:

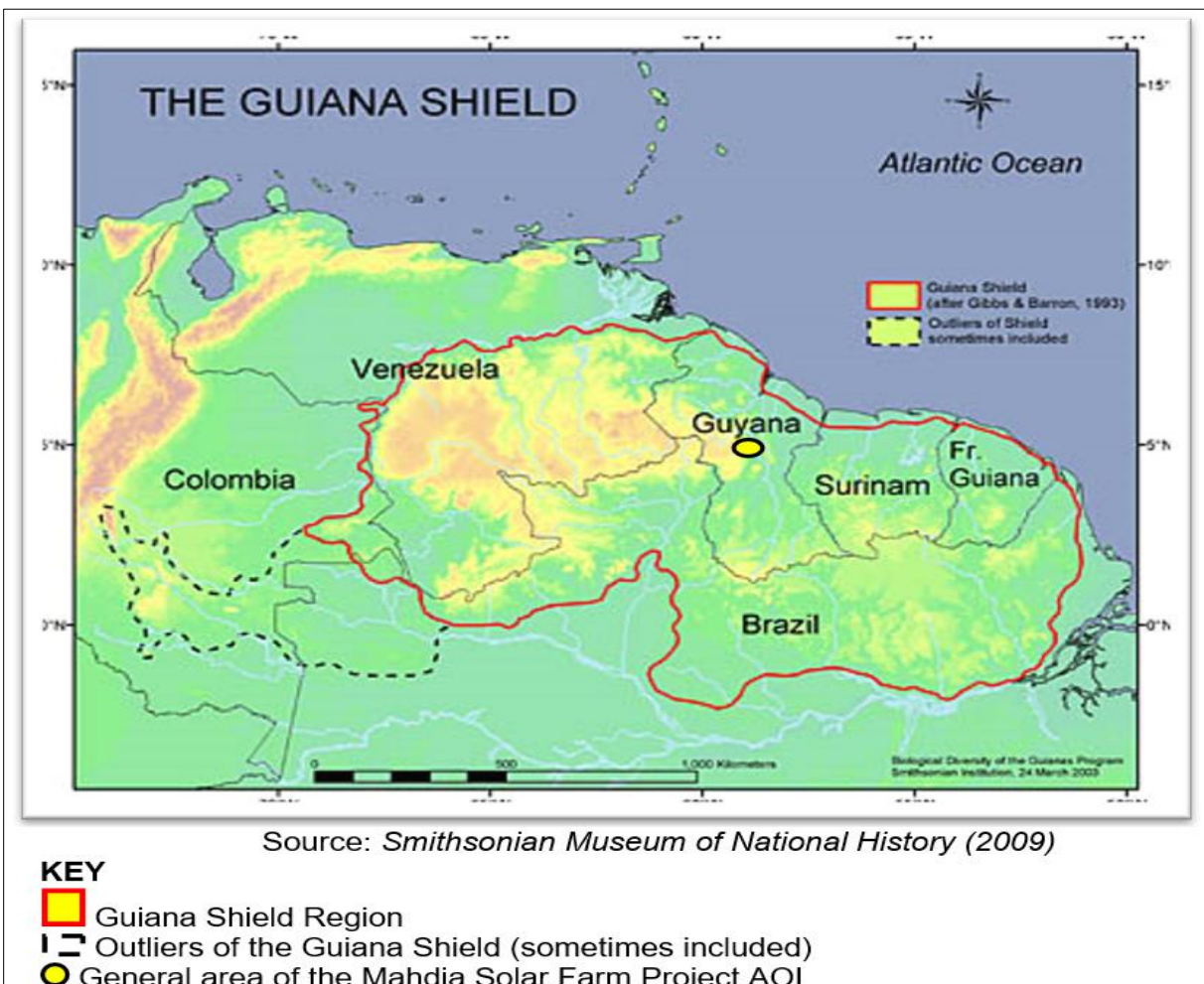
- The northern coastal belt, consisting of low-lying alluvium with a varying width up to a maximum of 65 kilometres inland (in the east).

<sup>33</sup> The Area of Influence (Aol) includes all areas in which the Project may generate social and environmental impacts. The Aol for this Project is discussed in Chapters 1 and 6.

- The lowland region of undulating land covering most of the northern and central parts of the country, generally with an elevation below 150 meters.
- The Pakaraima Mountain region in the west, an elevated table land of sandstone escarpments between 300 and 1,200 meters in elevation.
- The southern uplands consisting of a vast area mostly over 150 meters in elevation covered with undulating forest land.

The project is situated in the Potaro – Siparuni District, Region 8 in the tropical lowland region of central Guyana as described in the second division above. This low-lying area is considered part of the Guiana Shield Region as defined by regional studies by Hollowell and Reynolds (2005)<sup>34</sup>.

The Guiana Shield is situated in north-eastern South America. It includes the large mountain systems that form the watershed between the Amazon and Orinoco Rivers. The Guiana Shield accounts for more than 25 percent of tropical forests remaining in the world. Its diverse landscapes have been recognized for their biological endemism, unique ecosystems, pristine forests, and cultural diversity. Figure 4-19 depicts the general location of the project in Guyana and in relation to the Guiana Shield Region.



**Figure 4-19: General Location of the Project in Relation to the Guiana Shield Region**

<sup>34</sup> Hollowell, T., and R. P. Reynolds, eds. 2005. Checklist of the Terrestrial Vertebrates of the Guiana Shield. Bulletin of the Biological Society of Washington, no. 13.

The lowlands of the Guiana Shield are biogeographically distinct from the Guiana Shield highlands which include the tepui formations characterized by relatively high levels of endemism. Biogeographically the lowlands of the Guiana Shield are much more closely related to the forested lowlands of the Amazon Basin and are often included under broader definitions of Amazonia due to their overriding similarities. The lowland rainforest on brown sandy soils, loams or laterites is the major vegetation type of the Amazon valley and the Guiana Shield<sup>35</sup>.

The vertebrate faunal diversity of the Guianan lowland is comprised largely of widespread species found across the lowland humid forests of the Amazon Basin and the watersheds of the Guiana Shield. In contrast, Guianan vertebrate endemics are generally restricted to the highlands of the Guiana Shield, especially at elevations greater than 1,500 meters or to the savanna and dry forest ecosystems.<sup>36</sup>

#### **4.2.2 Landscapes and Ecosystems**

The landscape of the Potaro-Siparuni district is dominated by dense forests which are interlocked among aquatic environments in the form of rivers and creeks. Forest ecosystems along the rivers and in the creek valleys are seasonally flooded and provide habitats for aquatic biota during the wet season. The valley slopes, hillslopes, and ridgetops support forests vegetation tolerant to non-seasonally flooded forest conditions. The ecosystems support a large diversity of widespread humid forest fauna typical of the neo-tropics, the Guiana Shield and Amazonia lowlands, and the lowlands forest regions of Guyana.

The project area lies within the lower Potaro River, cradled between the Eagle and Ituni Mountains. The lower Potaro River is primarily known for its mineral resources and consists of active small and medium scale gold mining. Mining and its impact on the landscape can be seen in lower portion of the Potaro River, and the smaller creeks and streams flowing through the area, and the Konawaruk River. Mining has changed the topography of the landscape in the lower Potaro River causing deep pits and depressions that alter river channels and flood plains. The quality of the water and freshwater habitats of the lower Potaro River has over the years been continuously degraded due to discharges from mining activities within the district, where high levels of turbidity and changes in hydrology are evident.

The Potaro River along with the Siparuni, Mazaruni, Cuyuni and Rupununi Rivers comprise the Essequibo freshwater eco-region within north-eastern South America. The Essequibo freshwater eco-region is approximately 158,634.9 square kilometres and includes the entire Essequibo River basin in Guyana and part of southeastern Venezuela where it drains the eastern margin of the Guiana Shield and low country south of the Orinoco Delta. The Potaro-Siparuni basin occupies approximately 25,800 square kilometres, entirely within Guyana where enormous quantities of fresh water are available year-round. Kaieteur Falls is located on the Potaro River.

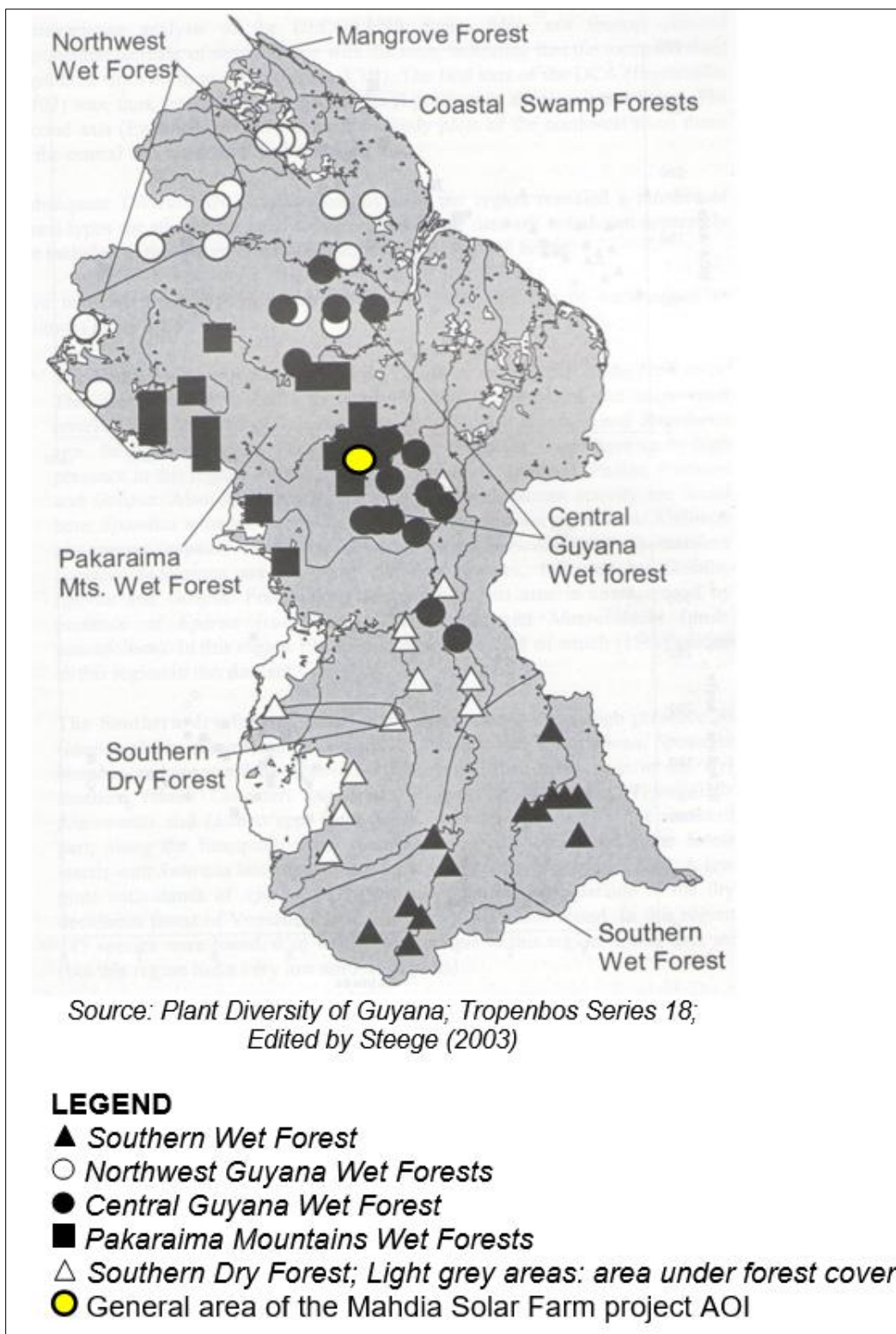
The project AOI falls within the divide of the wet forest regions of central Guyana and the Pakaraima Mountains as defined by Steege (2003). Figure 4-20 shows the project area within the national forest regions of Guyana.

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<sup>35</sup> Steege, H. ter., 2003. Plant Ecology, in Conservation Priorities of the Guayana Shield, 2002 Consensus. Conservation International, Centre for Applied Biodiversity Science.

<sup>36</sup> Hollowell, T., and R. P. Reynolds, eds. 2005. Checklist of the Terrestrial Vertebrates of the Guiana Shield. Bulletin of the Biological Society of Washington, no. 13.





**Figure 4-20: General Location of the Project Area in Relation to the National Forest Regions**

According to Steege (2000), the central Guyana wet forest is characterized by high abundance of commercial and often (near) endemic species such as *Swatzia leiocalycina*, *Chlorocadium rodiei*,

*Mora excelsa*, *Mora gonggripjii*, *Alexa imperatricis*, *Alexa leiopetala* and *Clathrotopis spp.* Forest in this region are often dominated by one of the above species except for *Alexa* and *Clathrotopis spp.* *Eschweilera spp.* and *Licania spp.* which are common, but not dominant, in all forests of the region. *Mora excelsa* dominated forest is commonly found along the rivers often in association with *Carapa spp.* Swamps with *Pterocarpus* and *Tabebuia insignis* are not uncommon in creek heads. Extensive forest stands dominated by *Eperua falcata* and *E. grandiflora* with *Swartzia leiocalycina* are found on the white sand soils of this region (the latter one also occurring on the lighter brown sands). *Vouacapoua macropetala*, a near endemic of this region is commonly found on lateric soils in a small area south-west of Great Falls, Demerara River.

The Pakaraima Mountains wet forest is characterized by high presence of *Dicymbe altsonii* and *D. corymbosa* (species almost absent in other regions), *Chamaecrista adiantifolia*, *Chamaecrista apocoutia*, *Ormosia coutinhoi*, the latter three are sand specialists and *Eschweilera potaroensis*, an endemic of this region. Other species with high presence are *Pentaclethra macroloba*, *Tapirira obtuse*, *Eperua spp.* and *Carapa spp.* Forest types in the region include those highly dominated by *Dicymbe altsonii* and *D. corymbosa* (not together) with *Eperua falcata*, *Chlorocardium rodiei* and *Eschweilera potaroensis*, and by *Eschweilera corrugate*, *Mora gonggripjii* and *Swartzia leiocalycina*. Forest along rivers is often dominated by *Mora excelsa*, *Carapa spp.*, *Pentaclethra macroloba* and *Alexa imperatricis*. White sands in the region are dominated by *Eperua spp.* and by a combination of *Aldina* and *Terminalia*. In the western part of this region forest stands with *Pithecellobium/Elizabetha sp* and *Chrysophyllum sanguinolentum* occur.

The landscape of the project area is made up of degraded forest characterized by secondary forest growth and successional vegetation species. Moreover, given the degraded nature of the vegetation, no area within the footprint of the project location would be considered forested based on the definition of forests adopted by the Guyana Forestry Commission (GFC) of an area which has land coverage of 1-hectare, 30 percent crown cover and mature stand height of 5 meters. Also, none of the areas contiguous with the project site are considered to be forested. As a consequence of the historic and current human activities, the primary ecological functions of the project area have been substantially modified and as a result, the habitats and biodiversity components are largely modified natural habitats. The degraded vegetation cover of the project area can be observed in Figure 4-21.



**Figure 4-21: Degraded Vegetation of the Project Area**

#### **4.2.3 Habitats and Species**

The forest ecosystems of the Potaro-Siparuni district support a large diversity of widespread humid forest fauna typical of the neotropics, the Guiana Shield and Amazonia lowlands, and the lowland forest regions of Guyana. Biodiversity baseline information referenced in this assessment was sourced, in part, from the Environmental and Social Analysis Report for the Diversification of the



Energy Matrix and Energy Security Project (GY-L1066)<sup>37</sup> hereafter referred to as the ESAR 2018. Additionally, the biodiversity of the Guyana Shield Region has been recently studied resulting in checklists for vascular plants<sup>38</sup>, fish, and terrestrial vertebrates<sup>39</sup>. These data provide a valuable baseline on species richness and endemism relevant to this assessment.

According to the vegetation map of Guyana after Huber et al., (1995), shown in Figure 4-23, the habitat types which would have been characteristic of the Project area are associated with the central wet forest region. These include tall evergreen non-flooded low-land (10 to 400 meters) mixed forests – *Eschweilera*, *Licania*, *Chlorocardium*, *Catostemma* (20 to 50 meters tall).

Well beyond the project site, degraded forests give way to a mature intact stand characteristic of the Potaro - Siparuni district. Within this wider project area Cato stemma there are: tall, evergreen, flooded riparian lowland (Mora) mixed forest that prevails along the low-lying valleys of the rivers between 0 to 400 meters are. The habitat types associated with the Pakaraima Mountains wet forest region are also found within the wider area and consist of tall/medium, evergreen, pre-and base-montane forest (100 to 500 meters) – *Eschweilera*, *Dicymbe*, *Eperua* (24 to 36 m tall), and the tall/medium, evergreen, lower montane sclerophyllous forest (400 to 800 meters) – *Eperua*, *Eperua-Dimorphandra*, *Eperua-Cassia*. The vegetation types characteristic of the wider project area, inclusive of the area of the transmission line alignment, can also be seen in Figure 4-22.

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<sup>37</sup> Environmental and Engineering Solutions. 2018. Environmental and Social Analysis Report. Diversification of the Energy Matrix and Energy Security Project (GY-L1066). Solar Photovoltaic (PV) Farms in Mahdia, Lethem and Bartica.

<sup>38</sup> Funk, V.A., and P.E. Berry. In press. Guiana Shield. Chapter 10.4 in Plant Conservation: a natural history approach. Smithsonian Institution Press.

<sup>39</sup> Hollowell, T., and R. P. Reynolds, eds. 2005. Checklist of the Terrestrial Vertebrates of the Guiana Shield. Bulletin of the Biological Society of Washington, no. 13.

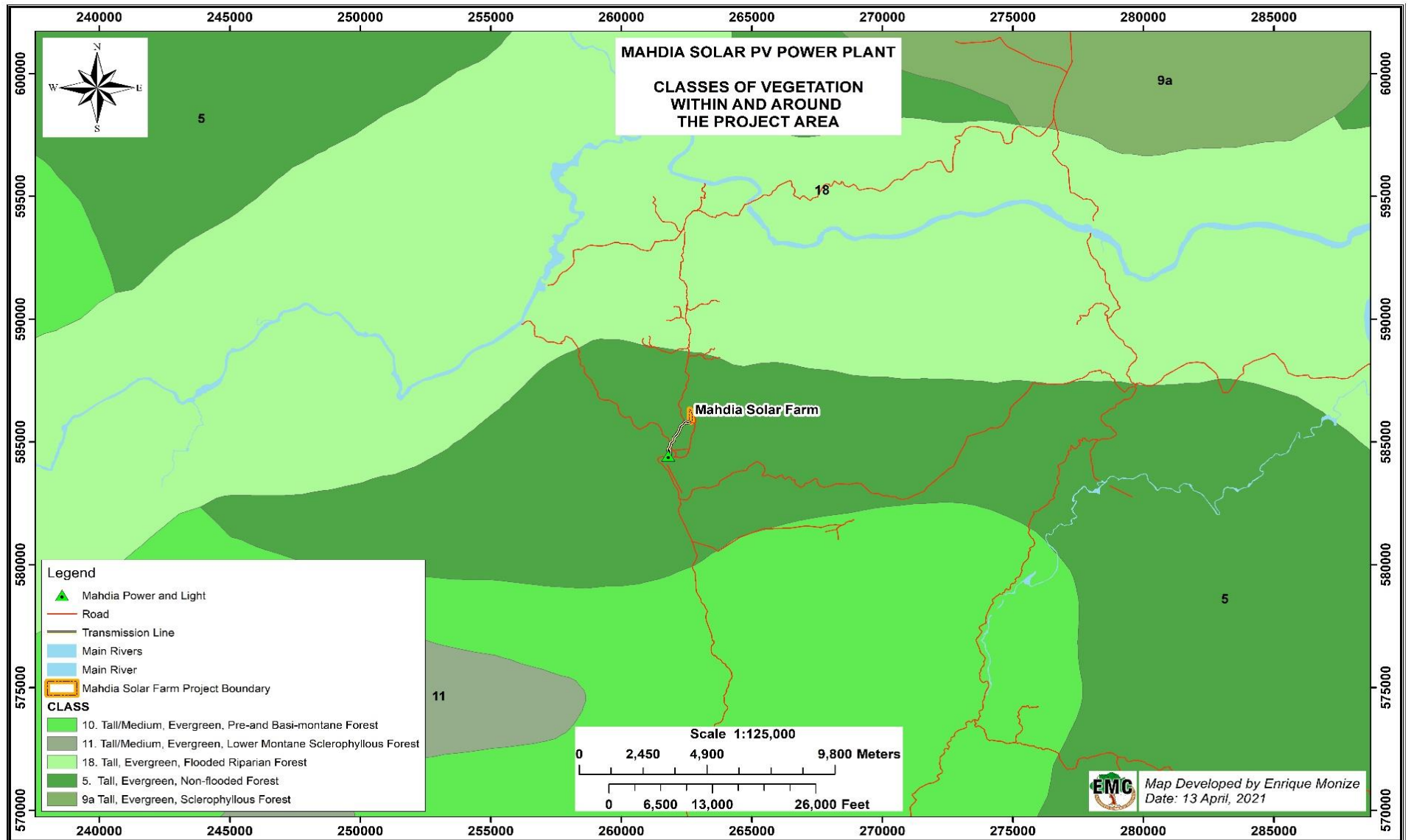


Figure 4-22: Vegetation Types Characteristic of the Project Area

The floral assessment of March 10 to 12, 2021 was conducted within the project site at Mahdia. Linear survey transects were established within the proposed site and seedlings, trees, and epiphytes within a five-meter radius at every 25-meter interval of the linear transect were recorded. The site contained mostly successional vegetation with mixed remnant forest vegetation existing on the fringes of the site. A domestic farm of cassava, sweet potatoes, sugar cane and other subsistence crops also existed on the site. Although a few commercial species were recorded during the floral assessment, none had achieved maturity of a 35-centimeter diameter at breast height (DBH). None of these species are considered to be Endangered, Threatened or Protected floral species. Plant species recorded within the proposed site are presented in Table 4-9. The types of vegetation found in the project site can be seen in Figure 4-23.

**Table 4-9: Plant Species Recorded During Baseline Floral Assessment**

Common Name	Scientific Name	Family Name
Avocado	<i>Persea americana</i>	Lauraceae
Baby semitoo	<i>Passiflora foetida</i> L.	Passifloraceae
Bird seed	<i>Miconia cf. ruficalyx</i>	Melastomataceae
Bisi-bisi-grass	<i>Eleochariselegans</i>	Poaceae
Black Kakaralli (Common)	<i>Eschweilera sagotina</i>	Lecythidaceae
Black sage	<i>Cordia curassavica</i>	Boraginaceae
Black Wattle	<i>Acacia mangium</i>	Fabaceae
Black Yari Yair	<i>Guatteria punctata</i>	Annonaceae
Blood wood	<i>Vismia</i> sp.	Guttiferae
Carrion Crow Bush	<i>Senna alata</i> (L.)	Fabaceae
Cassava	<i>Manihot esculenta</i>	Spurges
Cattail	<i>Typha latifolia</i>	Typhaceae
Common sorrel	<i>Rumex acetosa</i>	Polygonaceae
Conga Pong/Cecropia	<i>Cecropia angulata</i>	Cecropiaceae
Fern	<i>Pityrogramma</i> spp.	Adiantaceae
Greenheart*	<i>Chlorocardium rodiei</i>	Lauraceae
Hold-me-back	<i>Desmoncus orthacanthos</i>	Areacaceae
Iron weed	<i>Vernonia</i> spp.	Asteraceae
Jamoon	<i>Syzygium cumini</i>	Myrtle
Kabukalli*	<i>Goupia glabra</i>	Celastraceae
Kamadan	<i>Posoqueria loniflora</i>	Rubiaceae
Kautaballi*	<i>Licania alba</i>	Chrysobalanaceae
Matchwood	<i>Scherfflera morototoni</i>	Araliaceae
Mora	<i>Mora excelsa</i>	Caesalpiniaceae
Nibi	<i>Heteropsis flexuosa</i>	Areacaceae
Papaya	<i>C. papaya</i>	Caricaceae
Pepper	<i>Capsicum frutescens</i>	Nightshade
Shame Bush	<i>Mimosa pudica</i> L.	Fabaceae
Sour grass	<i>Paspalum conjugatum</i>	Poaceae

Common Name	Scientific Name	Family Name
Sugar Cane	<i>Saccharum officinarum</i>	Poaceae
Sweet Fig Banana	<i>Musa acuminata</i>	Musaceae
Sweet Potato	<i>Ipomoea batatas</i>	Convolvulaceae
Tatabu*	<i>Diploptropis purpurea</i>	Leguminosae - Papil
Trysil	<i>Pentaclethra macroloba</i>	Leguminosae-Mimos
Understorey palm	<i>Bactris spp</i>	Areacaceae
Wallaba	<i>Eperua falcatae</i>	Caesalpionioiceae
White Yari Caesalpinaceae	<i>Duguetia pauciflora</i>	Annonaceae
Wild Coffe	<i>Psychotria</i>	Madder
Yellow Guinea Yam	<i>Dioscorea cayenensis</i>	Dioscoreaceae
Yuriballi	<i>Trichilia Sp.</i>	Meliaceae



**Figure 4-23: Secondary Growth Vegetation on the Project Site (Left) and Remnants of Tall Evergreen Lowland on beyond the Northern Boundary Bordering the Marabunta Creek Access Road (Right)**

A review of the biodiversity baseline information conducted in the ESAR 2018 documented the following species within the landscape of Mahdia: Psittids such as orange-winged parrots (*Amazona amazonica*), yellow crowned amazon (*Amazona ochrocephala*) and red-shouldered macaw (*Diopsittaca nobilis*); toucans (*Ramphastos sp.*; Family: Ramphastidae); blue-grey tanagers (*Thraupis episcopus*; Family: Thraupidae); and woodpeckers (Family: Picidae). Widely distributed species of reptiles such as *Ameiva ameiva* (Family: Teiidae) and *Anolis sp.* (Family: Polychrotidae); and small mammal species such as common opossums and bats are associated with the general area.

An area immediately south of central Mahdia recorded 32 species of non-volant mammals, based on physical evidence, including scat and tracks, and interviews. Red-rumped Agouti (*Dasyprocta leporina*), Paca/ Labba (*Agouti paca*), Red howler monkey (*Alouatta seniculus*) and Black Spider Monkey (*Ateles paniscus*; IUCN - Vulnerable) were the most common sightings; felids including Jaguar (*Panthera onca*), Jaguarundi (*Herpailurus yagouaroundi*), Ocelot (*Leopardus pardalis*), Margay (*Leopardus wiedii*) and Puma (*Puma concolor*); and other species such as Common Opossum (*Didelphis marsupialis*), Tyra (*Eira Barbara*) and deer (*Mazama sp*) were also recorded.

#### 4.2.3.1 Sensitive Species

The following sections provide an assessment of the biodiversity baseline data compiled to determine whether there are sensitive species, that is, threatened species as defined by the International Union for the Conservation of Nature (IUCN) Red List; endemic or restricted range species; and migratory species within the Project area.

##### **Threatened Species**

The IUCN Red List of Threatened Species Version 2020-1 was used to conduct this assessment. The globally threatened categories are species listed as Vulnerable (VU), Endangered (EN) or Critically Endangered (CE).<sup>40</sup>

##### **Mammals**

There are no known Critically Endangered mammals occurring in Guyana. The only Endangered mammal that occurs in Guyana is the Giant River Otter (*Pteronura brasiliensis*). *P. brasiliensis* is considered Endangered due to an ongoing population reduction as a result of habitat loss. The Marabunta Creek which flows east of the project site does not meet the preferred habitat criteria for Giant River Otters such as slow flowing clear black water creeks and rivers with low sloping banks, good forest cover, access to food particularly rivers with low levels of human activity<sup>41</sup>. Historical and ongoing high levels of human activities within the project development landscape of the township of Mahdia and its immediate environ have modified the primary ecological functions and species composition of habitats, resulting in habitat loss and species displacement which may have previously existed therein. In Guyana, these habitat conditions for Giant River Otters are met in the interior rivers, particularly the Rupununi River<sup>42</sup> where they exist in reasonable numbers.

The ESAR 2018 reveals the occurrence of the Guiana spider monkey *Ateles pansicus*, listed as Vulnerable by the IUCN Red List, in an area immediately south of Mahdia. The Guiana Spider Monkey, *Ateles pansicus*, occurs in primary high forest, and seldom found in edge or degraded forest. In Guyana, it is known from the far south and from the east of the Essequibo River. *Ateles pansicus* is vulnerable due to habitat loss caused by expanding agriculture, ranching, mining, hydroelectric and associated road construction, which contributes to heavy hunting pressure. There is no known record or sightings of the Guiana spider monkey at the project site.

##### **Birds**

There are 16 threatened bird species that are known to occur in Guyana<sup>43</sup>. Of these, two species are listed as Critically Endangered:

- Hoary-throated spintail (*Synallaxis kollari*): known to occur in the upper Rio Branco in north Roraima of Brazil and adjacent Guyana in seasonally flooded riverine forest with an understorey of dense thickets and vines - suitable habitat is restricted to within 0.5 square kilometres of the rivers.
- Rio Branco Antbird (*Cercomacra carbonaria*): limited to middle sections of the Rio Branco and some of its tributaries in Roraima, extreme north Brazil, and adjacent Guyana. It ranges from

<sup>40</sup> The Red List was accessed on March 19, 2021.

<sup>41</sup> Duplaix, N. 1980. Observations of the ecology and behaviour of the giant river otter *Pteronura brasiliensis* in Suriname. *Revue d'Ecologie (La Terre et La Vie)* 34: 495-620.

<sup>42</sup> Duplaix, N., (2004) Guyana Giant Otter Project, 2002-2004 Research Results. Report to the Oceanic Society, San Francisco, CA. 40 pages

<sup>43</sup> BirdLife International (2020) Country profile: Guyana.



Caracarai in the south, along the Rio Branco and Rio Takutu to the Ireng River in Guyana, less than two kilometres from its confluence with the Rio Takutu.

Three species are listed as Endangered:

- Sun Parakeet (*Aratinga solstitialis*): restricted to dry, semi-deciduous forests on the slopes of north and north-eastern Roraima).
- Great-billed Seed-finch (*Sporophila maximiliani*): occurs in riparian thickets, freshwater marshes/wetlands, second-growth scrub and shrubland/grassland savanna habitats).
- Red Siskin (*Spinus cucullatus*): known to occur in southwestern Guyana between 100 to 1,500 meters moving semi-nomadically and altitudinally (seasonally and daily) between moist evergreen forest, dry deciduous woodland and associated edge habitats, shrubby grassland and pastures).

None of the EN or CR birds that are known to occur in Guyana are known to occur within the project area.

#### Herpetofauna – Reptiles and Amphibians

There are no Endangered or Critically Endangered amphibians known to occur in Guyana. *Echinosauro sulcarostrum*, listed as Endangered, is the only terrestrial/freshwater non-avian vertebrate listed for Guyana, the others are marine species that are not known to occur within the project area. *Echinosauro sulcarostrum*, a semi-aquatic/riparian Gymnophthalmid lizard species known to occur on the Atlantic versant of the Guiana Shield, was first described by Donnelly *et al.* (1998)<sup>44</sup> in 1992 at Baramita, Northwest District, at elevation 100 meters. *E. sulcarostrum* species is also known from Mount Wokomung, Guyana. This species likely occurs between the Baramita and Mount Wokomung localities, and probably more widely as this recently described species is very poorly known. *E. sulcarostrum* was also recently encountered in Matthew's Ridge during biodiversity surveys conducted in 2012 and 2020. The Matthew's Ridge record represents a third known locality. *E. sulcarostrum* is listed as Endangered because the extent of occurrence is approximately 1,250 square kilometres, the species is (previously) known from two locations, and the habitat at one location is subject to ongoing decline in quantity and quality as a result of gold mining activities. *E. sulcarostrum* is not known to occur within the project area.

#### Plants

The only Endangered or Critically Endangered plant species occurring in Guyana are: *Trichilia surumuensis* (Endangered), *Aniba rosiodora* (Endangered), *Virola surinamensis* (Endangered), and *Vouacapoua americana* (Critically Endangered). *Trichilia surumuensis* is an understorey species restricted to the Roraima highlands of Brazil and Guyana; the *Aniba rosiodora* is native to northern South America and the genus *Aniba* occurs widely in Wallaba forest and in mixed forest on white and brown sand in Guyana. *Virola surinamensis* is widely distributed and are abundant to frequent in marsh forest, Mora forest and swamp forest in Guyana. The genus *Vouacapoua* is locally common in mixed forest in the near interior growing in reefs on rocky hills or sandy clay, and in swamp forests on alluvial flats in southeastern Guyana.

*Vouacapoua Americana*, *Aniba rosiodora*, and *Virola surinamensis* are timber species that are not commercially targeted in Guyana and are widespread within their ranges Guyana. *Aniba rosiodora* (Endangered), *Virola surinamensis* (Endangered), and *Vouacapoua americana* (Critically Endangered), are known to occur within the lowland marsh and mora forest of the Potaro-Siparuni

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<sup>44</sup> Donnelly, M *et al.*, 1998. *Field Checklist of reptiles and amphibians of Iwokrama Forest*. Iwokrama International Centre. Georgetown. Guyana

district. However, these species were not encountered at the project site during the floral assessment conducted in March 2021.

#### Summary of Sensitive Species Occurrences on the Project Area

Historical and ongoing human activities within the project development landscape have modified the primary ecological functions and species composition of habitats, resulting in habitat loss and species displacement. Biodiversity resident within the project landscape is therefore habituated to the constantly changing and human-influenced environments. Consequently, project activities are not expected to significantly transform existing habitats and or affect the long-term survivability of species present within the project landscape.

#### **4.2.3.2 Endemic or Restricted Range Species**

The project site is located within the lowland forest ecosystems typical of the lowland forest habitats of the national forest regions and is part of the lowland forests of the Guyana Shield Region and the Amazon Basin. Even though these lowland forested areas may have heterogeneity in the nature of soils, they are present across the lowland forests of the national forest regions and therefore do not have significant transitional habitats that may have potential importance for key evolutionary processes such as speciation. Moreover, while there are several terrestrial vertebrate species that are broadly endemic to the Guiana Shield region, none of the Guiana Shield endemics or the Guyana lowland endemics have ranges that can be considered restricted.

Unlike the Guiana Shield Highlands centres of endemism occurring at elevations of 1,500 meters or more, the lowland forest habitats are characterized by biota that is widespread throughout the Guiana Shield and Amazonia lowlands. As a result, there are no ecological features/functions or ecosystem services characteristic of the project site that are not replicated across the Guianas and Amazonia lowlands. Moreover, project development activities are not expected to significantly transform existing habitats and or affect the long-term survivability of sensitive species with ranges that includes the project site.

#### **4.2.3.3 Migratory Species**

The lowlands in which the project site is located are not known to be critical habitats for migratory terrestrial species. Unlike the Atlantic Coastline of the North West District of Guyana (Shell Beach Protect Area), which supports the nesting and foraging grounds of migratory sea turtles and birds such as the Scarlet Ibis (*Eudocimus ruber*), the project landscape does not include any significant habitat areas known to assemble migratory terrestrial species.

#### **4.2.4 Areas of Biological Interest**

Areas of recognized global, national or local importance to biodiversity within Guyana were considered in this assessment to determine whether the project landscape is identified as a priority area for conservation interest. This includes consideration of legally protected areas, World Heritage Sites, Ramsar Sites, Important Bird Areas, Key Biodiversity Areas, Community reserves, and natural reserves.

The project site has not been identified by the GoG as a priority for conservation interest. The conservation initiatives in Guyana are largely focused on the larger forested landscapes of central and southern Guyana or in the Rupununi Savannas region. Currently, the conservation priority sites identified by the GoG include the legally protected areas of the Kanuku Mountains, the Shell Beach Protected Area, the Kaieteur National Park, the Iwokrama Rainforest Reserve, and the Community Owned Conservation Area at Konashen, and other areas of biological interest not legally protected

including the Guyana Forestry Commission (GFC) Moraballi and Mabura Reserves, the Orinduik Falls and Roraima Mountains. None of the legally protected areas and other areas of biological interest are located near the project area (Figure 4-24).

There are no recognized areas of global importance to biodiversity within the landscape of the project. There are no Zero Extinction Sites, proposed or listed Ramsar Wetland Sites within Guyana or officially designated areas in Guyana identified as Important Bird Areas (IBAs). However, Birdlife International has identified two Endemic Bird Areas (EBAs) within Guyana; the Rio Branco Gallery Forest of Brazil and Guyana; and the tepuis (or table-mountains) scattered throughout Bolívar and Amazonas states of southern Venezuela (south of the Orinoco river), penetrating as far as west-central Guyana and northern Brazil. None of the two EBAs identified in Guyana are located within the project area.

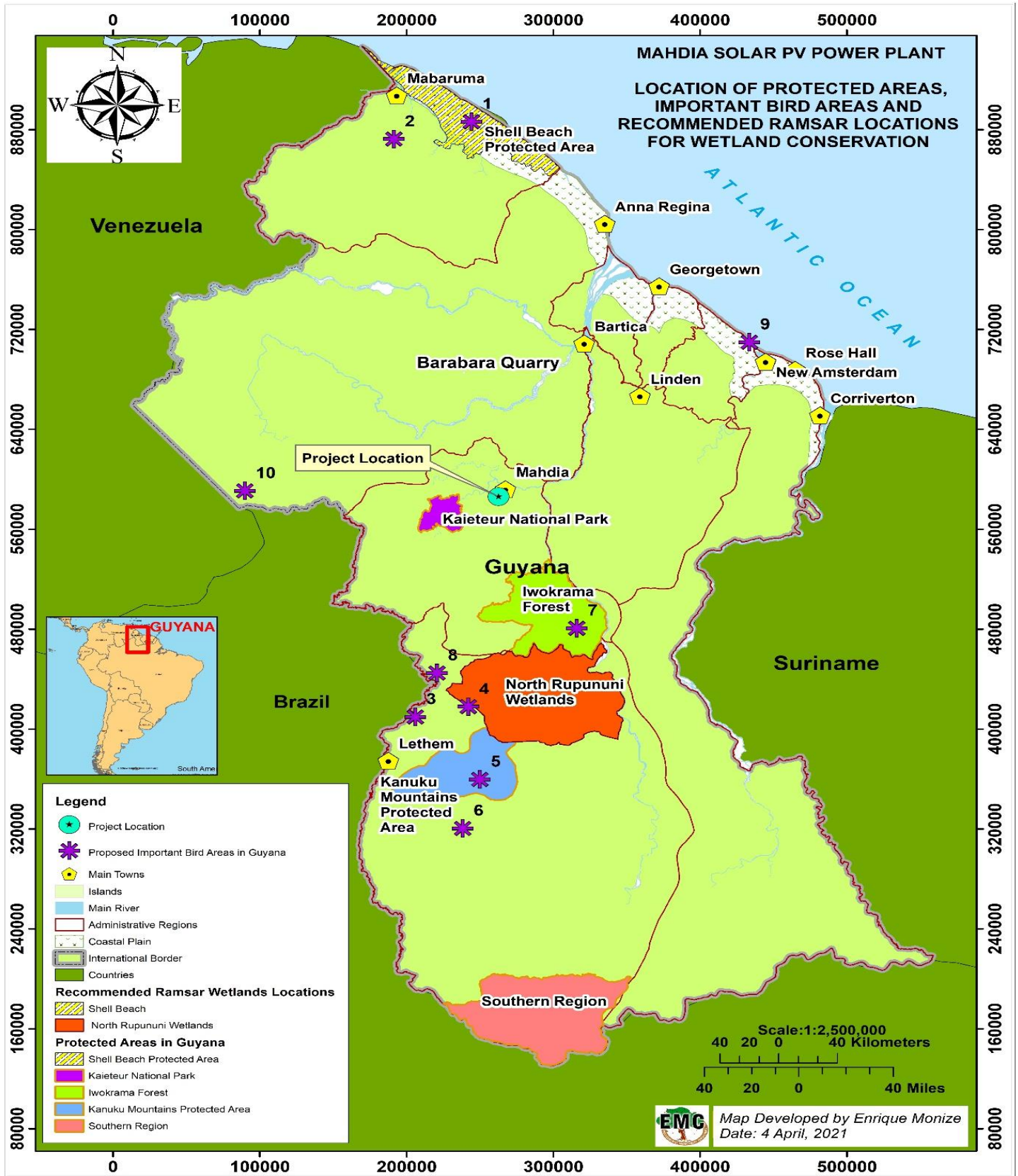


Figure 4-24: Areas of Biological Interest in Relation to the Project Site

### 4.3 Socio-Economic Environment

The site for the Mahdia Solar PV Power Plant is located within Mahdia, a small town located in Administrative Region # 8 (Potaro-Siparuni). Mahdia is the only town located in Region 8 and thus is considered the administrative and business hub of the Region. It is widely known to support the small and medium scale mining activities that occur within the boundaries of the township, in neighbouring indigenous villages and surrounding areas.

#### 4.3.1 Access to the Project Site

The project site in the Mahdia township is accessible by the following main routes:

- By air via scheduled flights offered by private carriers for passengers and cargo on Sundays, Mondays, Wednesdays and Fridays from the Eugene F. Correia International Airport in Ogle, East Coast Demerara and the Mahdia Airstrip. Passenger and cargo flights may also be chartered. Travel to the project site from the airstrip is overland via a network of concrete roads in central Mahdia and laterite roads on the outskirts. The Mahdia Airstrip can be seen in Figure 4-25.
- Overland from capital city of Georgetown located approximately 500 kilometres away, via the Linden-Lethem Road using the junction to Mahdia located in Mabura<sup>45</sup>.
- Overland from the township of Bartica located approximately 175 kilometers via the Bartica-Potaro Road, across the Denham Suspension/Garraway Stream Bridge.<sup>46</sup> The Bartica-Potaro Road is located along the southern boundary of the project site and is a laterite capped road.

Plans are underway to upgrade the Mahdia airstrip, develop new roads, and repair damaged ones (Consultant Personal Communication 03 and 04). The central and commercial areas of Mahdia have a widely used internal road network which was recently upgraded from laterite to concrete structures, including bridges, reinforced concrete pavements, and a network of drains and culverts (Figure 4-26).



**Figure 4-25: Mahdia Airstrip**



**Figure 4-26: One of the Concrete Streets in Central Mahdia**

<sup>45</sup> Stabroek News, 2013. Mahdia. (Article by D. Sutherland)

<sup>46</sup> Allicock, D. 2012. The 1933 Denham Suspension Bridge of Guyana's Hinterland



### 4.3.2 Land Use

#### 4.3.2.1 Land Uses at the Plant Site

In October, 2019, MPL received permission from the GLSC to occupy state lands for industrial purposes. By December 2020, during a site visit, the GEA team observed that the first occupant (Occupant one) had commenced the construction of a private residence within the boundaries of the land for the proposed project site. The GEA reported the occupation and construction to the Mahdia Police Station and the Police advised the occupant to discontinue works on the project site, until matters were resolved (Figure 4-27 [Left]). During the site visit to collect baseline data for the preparation of this ESAR over the period March 10 to 21, 2021, construction activities had advanced beyond foundational stages and is progressing as a two-storeyed building to be used as a private dwelling (Figure 4-27 [Right]). During the site visit, construction activities were also ongoing. The occupant was in possession of a receipt for an application for land in the vicinity and this receipt was used to obtain permission from the Mahdia Mayor and Town Council to commence construction (Consultant Personal Communication 01 and 03).



**Figure 4-27: Foundation and Work Camp of Private Dwelling on Previous Project Location in December 2020 (Left) and March 2021 (Right)**

Site investigations during the period March 10 to 12, 2021 found that there were two other occupants within the project site:

- **Occupant Two:** A small-scale female subsistence farmer of indigenous descent who has cultivated the land surrounding the project site for over 18 years but has not formally applied for ownership of the land. Occupant Two obtained permission to conduct agricultural activities on the project site from an individual who had permission from the Guyana Geology and Mines Commission (GGMC) to mine in the area. No rents were paid by the Occupant for this area. Crops cultivated are cassava, plantain, eddo, turmeric, fruit trees like coconut and lemon, sugar cane, bora, ochro, pumpkin, bananas, green-leafed vegetables, and makes several cassava by-products including farine, cassava bread, cassava water and cassareep.

Occupant Two is the sole breadwinner for her family and the farm also supports her extended family. There is a temporary campsite within the project boundary where cassava by-products are made, for resting during the day and where a watchman stays at night. During the visit, a new camp area was being constructed to avoid the slippery conditions experienced during rainy seasons. Shifting cultivation is the method of farming used and at the time of the site visit, five different areas were under cultivation. Only one of these five areas was located within

the project boundary. The occupant sells most of the crops in Mahdia but has not estimated revenues or profits.

Occupant Two relies on rainwater for drinking and other purposes, but also periodically utilises the small seasonal flow located within the project site. This stream usually dries up during the dry season. She also has access to water provided by Guyana Water Inc. from a water source five minutes away. She was reluctant to relocate because the farm is located within walking distance of her residence and markets in Mahdia and she does not have access to alternative means of transportation. However, if relocation is inevitable, Occupant Two expects to be fairly compensated including being compensation for the labour require for land clearing.

One of the areas under cultivation, the temporary dwellings and some cassava products made by Occupant Two can be seen in Figures 4-28 to 4-30.

- **Occupant Three:** A remigrant from Venezuela who has established temporary dwellings and a kitchen garden within the project site. Occupant Three has been residing at this location for approximately one year. The private dwelling can be observed in Figure 4-31.



**Figure 4-28: Existing Temporary Dwelling (Left) and New Temporary Dwelling Being Established (Right)**



**Figure 4-29: Cassava Bread (Left) and Cassareep (Right) Made for Sale by Occupant Two**





**Figure 4-30: One of the Areas Cultivated by Occupant Two**



**Figure 4-31: Occupant Three's Dwelling and Kitchen Garden**

Following the site visit on March 10 to 12, the GEA and MPL further engaged the GLSC on land tenure at project location and a decision was taken to re-survey the area so as to excise all overlapping land uses from the Lease to be issued to the Project. The new Survey Plan for the project site was issued on April 09, 2021. The plan, shown in Figure 4-32, indicates that the areas where Occupant 1 structures are located now falls outside of the project boundary. As a consequence, there are no overlapping lands with this Occupant who is in the process of constructing a private residence. A Letter of Agreement was signed between the GEA and Occupant 1 that acknowledges the boundaries of the project site based on the resurvey. The Occupant signed with the letter with informed consent after having consulted a lawyer. A copy of the Letter of Agreement can be seen in Appendix G.

However, after the re-survey a portion of one of Occupant 2 farms and her dwelling still overlapped onto the site. The occupant had five active farming areas and uses the shifting cultivation method of farming. The farm which overlaps onto the Project site is approaching harvesting time and the occupant practices shifting cultivation and does not replant in the same area for more than one harvest cycle (Consultant Personal Communication 07). It should be noted that, although Occupant 2's farm camp structure – for temporary/periodical use associated with the farming activities – and a section of her farmlands fall within the project site boundary, these do not encroach on the actual project footprint. During consultations in March 2021, the occupant would have expressed willingness to discontinue farming activities, and to relocate the farm camp structure within the project site boundary. This position was reiterated during July when the GEA further engaged the occupant and updated her on the project. In August, Occupant 2 signed a Letter of Consent to discontinue farming at the project site boundary when the current harvest cycle is completed. The Letter was signed after having been read aloud to Occupant 2 by GEA representatives in the presence of three members of her family. Another Letter of Consent was signed by the Occupant to allow for the removal of the structures on the project site. Consequently, Occupant 2 would have requested compensation to cover costs of relocation, involving clearing new lands and constructing another temporary farm camp structure. Additional details on the Letters of Consent signed by Occupant 2 are presented in Appendix G. Occupant 2 was again engaged and updated on the project in November (see Appendix D for notes on engagement). The GEA is currently working with Occupant 2 to source the land for her to be relocated.

By mid-August, Occupant 3 had voluntarily relocated from the site and therefore, there were no subsequent consultations on land use in the area.

The locations of the occupants in relation to the project site can be observed in Figure 4-32.

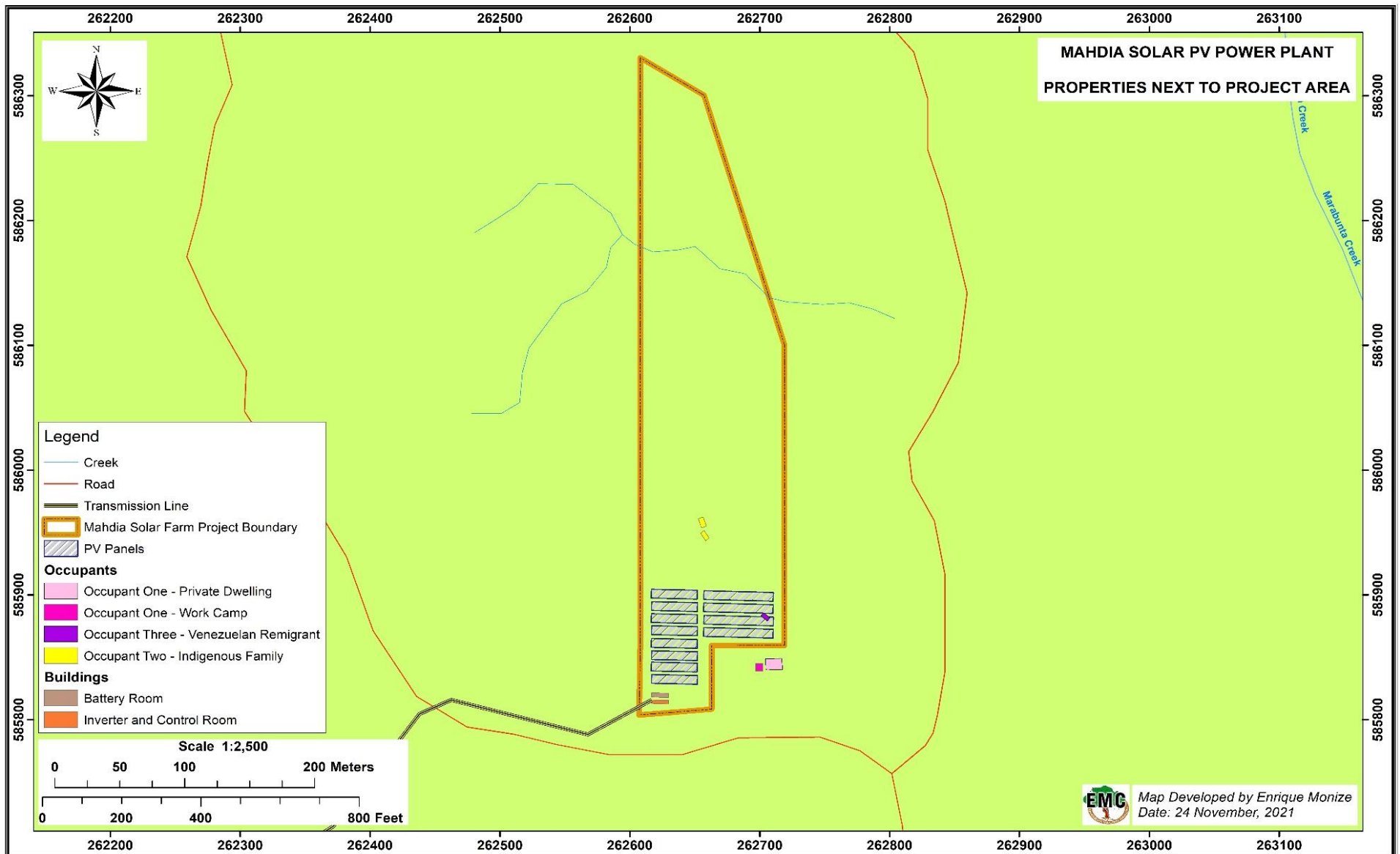


Figure 4-32: Revised Project Site Plan Showing Location of Occupants



#### 4.3.2.2 Land Uses around the Plant Site

Land uses in the environs of the project site is shown in Figure 4-33. These include an area to the south-west of the project site which was allocated by the GLSC to an individual and which is expected to be used for residential purposes. During the site visit, a mining camp was being established to the north-west of the project site and mining activities may commence in this location in the near-term. This mining site is separated from the project site by the Marabunta Creek Access Road and a vegetative buffer. Within a two-kilometre north-east of the project site are several mined out areas and an active small-scale mining operation (Figure 4-34).



**Figure 4-33: Land Uses Immediately around the Project Site**



**Figure 4-34: Small-Scale Mining Operation within a Two-Kilometer Radius of the Project Site**



#### 4.3.2.3 Land Uses along the Transmission Line Route

A 2-kilometer transmission line will be installed within areas that fall within the boundaries of Central Mahdia and the titled indigenous village of Campbelltown. The transmission line will utilize existing structures where available but will require the installation of new structures. All of the new structures will be located within the boundaries of Campbelltown. For the section located in Central Mahdia, no new structures will have to be constructed.

Figure 4-35 show the existing transmission line located in proximity to existing residential and commercial structures in Campbelltown while Figure 4-36 shows a section of the route which has existing structures and will also require new installations. Figure 4-37 shows the current status of some sections of the transmission line alignment. No displacement/resettlement will be required for the establishment of the transmission line.

Figure 4-38 presents the land uses in the wider project area.



**Figure 4-35: Existing Transmission Structures in Campbelltown**



**Figure 4-36: Existing Transmission Line Structures and Section of the Route Where New Structures Will Be Erected (Red Arrow Points to Transmission Poles)**

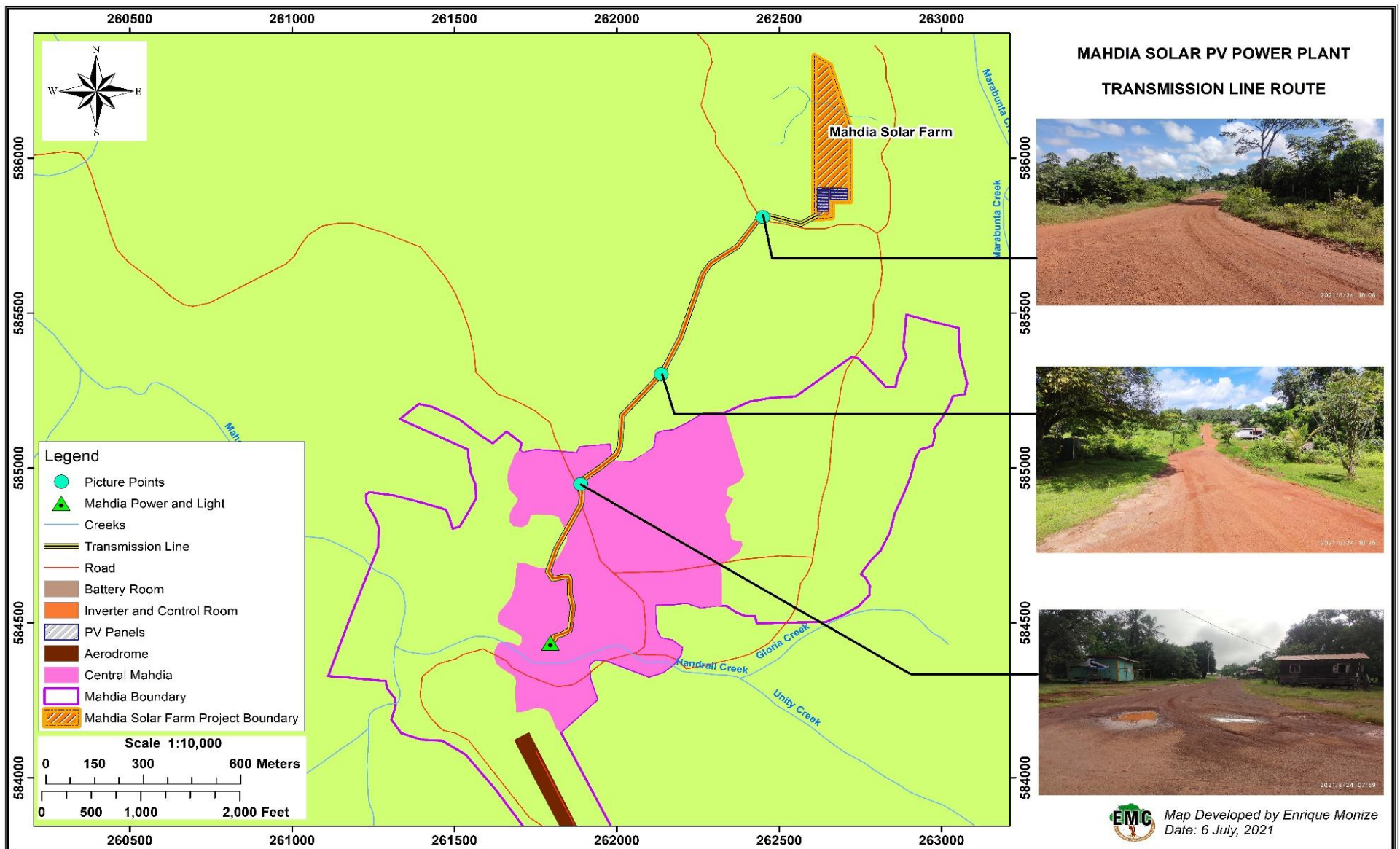


Figure 4-37: Sections of the Transmission Line Route



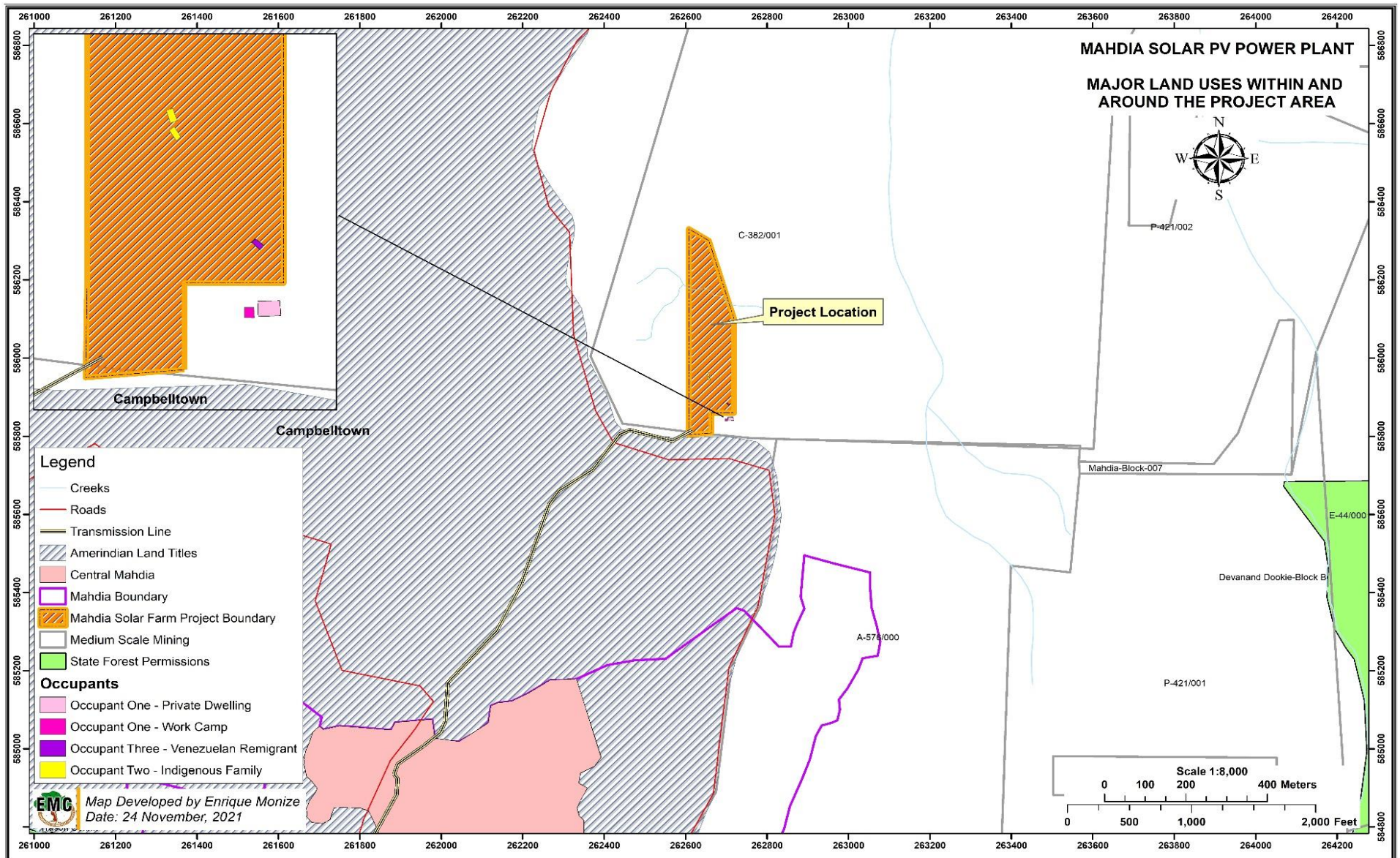


Figure 4-38: Land Uses in Surrounding Areas

### 4.3.3 Communities

The main beneficiary of the electricity generated by the Mahdia Solar PV Power Plant is the township of Mahdia. Mahdia town is expected to experience an increased power generation capacity and the creation of redundant supply to the existing MPL grid from which they are currently electrified. On the other hand, the titled indigenous village of Campbelltown is considered as the minor beneficiary. Campbelltown, of a lesser extent, is expected to experience a slightly improved electricity service, due to the relatively small population and number of structures connected to the grid.

#### 4.3.3.1 Mahdia

Mahdia is the only township located in Administrative Region # 8, Potaro-Siparuni. Mahdia is the main administrative and commercial hub. The town is located in the Potaro Mining District (Mining District 2) and is known widely for its gold and diamond mining activities. The Mahdia Solar Farm Project falls within the jurisdiction of the Mahdia township.

Mahdia was established in 1884 by emancipated Africans from Berbice and the East Coast Demerara searching for gold<sup>47</sup>. Following its discovery, the British Guiana Consolidated Goldfields mining company in then British Guiana expanded exploration and instituted Colonial Administrative offices in the community. Mahdia was principally accessible by waterways until the Denham Suspension Bridge's construction over the Garraway stream in the 1930s which links it to Bartica. Overland accessibility was also improved with the establishment of the Linden-Lethem road and subsequently the Mabura to Mahdia road. Mahdia was officially declared a town in October 2018 as part of the Government's vision to establish a town in each of the ten development regions<sup>48</sup>. The boundaries of the Mahdia township exclude the titled indigenous community of Campbelltown.

#### **Population and Demographics**

Mahdia has population to 2,563 people (Bureau of Statistics, 2012). Local authorities estimate that the population has doubled to over 5,000 people due to increased migration for mining opportunities and increased births (Consultant Personal Communication 03 and 04). Mahdia's population is 58 percent male and 42 percent female.

According to the findings of the Census, 58 percent of Mahdia's population are between the ages of 20 to 59. Moreover, 22 percent are between 0 to 9, 17 percent who are pre-teens, and teens between 10 to 19 (Figure 4-40[Left]).

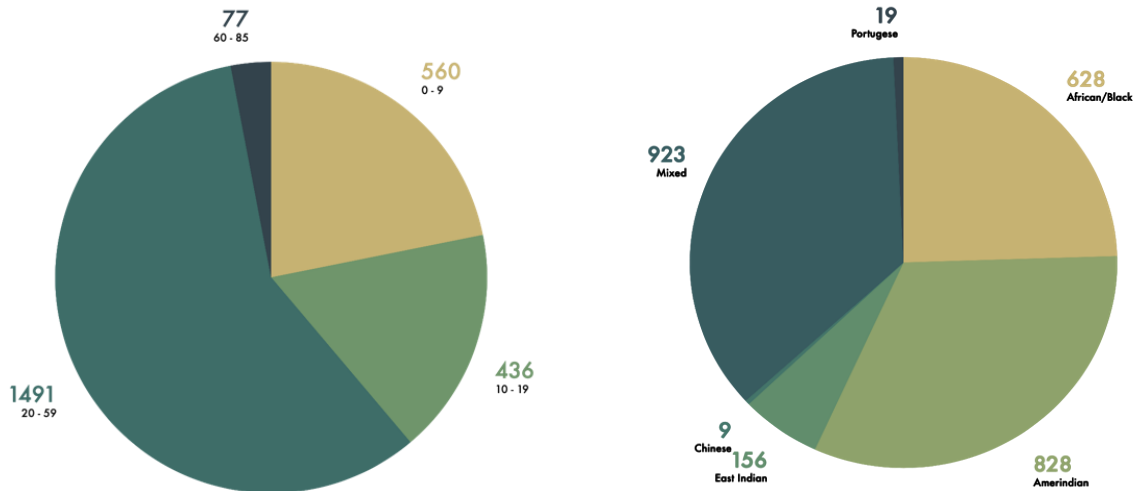
Mahdia is a multi-ethnic and multi-racial town with a mixed population of Amerindians, Coast Landers (residents from Guyana's coast), and Islanders (immigrants and descendants from Caribbean Islands). According to the findings of Census, 36 percent of the Mahdia's population is Mixed-Race, 32 percent of Amerindian descent, and 25 percent of African Descent, as seen in Figure 4-39 (Right).

Mahdia is a multi-religious town with practicing Christians, Muslims, Rastafarians, Hindus, and Bahai devotees.

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<sup>47</sup> GxMedia, 2019. Mahdia: The History You Didn't Know.

<sup>48</sup> Guyana Chronicle, 2018. Mahdia Declared a Town.



**Figure 4-39: Population of Mahdia by Age (Left) and by Ethnicity (Right)**

### Livelihoods

Mining is the economic activity in Mahdia. Over 90 percent of Mahdia's population directly or indirectly depends on mining for their livelihoods and are either engaged in gold and diamond mining or commerce in complementary sectors such as retail, transport, logistics, and hospitality<sup>49</sup>. Estimates from local authorities indicate that approximately 75 percent of Mahdia's population are directly engaged in mining activities and the remaining 25 percent are employed in private businesses and the commerce which supports the mining sector. A small percentage of Mahdia's population also works in the public sector (Consultant Personal Communication 03).

The business and commercial area in central Mahdia include businesses such as gas stations, supermarkets, hardware stores, restaurants, hotels, and other wholesale and retail enterprises which line the streets of the town's commercial center. Over the last few years, rapid development has taken place due to the mining boom and increased gold prices. Although most of the food consumed in Mahdia is imported from Georgetown, some residents practice small-scale domestic and commercial farming (Consultant Personal Communication 03 and 04).



**Figure 4-40: Supermarket (Left) and Commercial Shopping Centre (Right) in Central Mahdia**

<sup>49</sup> Hilson, G., Laing, T. 2017. Gold mining, indigenous land claims and conflict in Guyana's hinterland. *Journal of Rural Studies*, 50, 172-187.



## **Health**

The Mahdia District Hospital is the primary government health care facility providing services in Mahdia and Region 8. The hospital is staffed and equipped to manage fever, malaria, and other minor sicknesses. It currently does not offer emergency services or treat complicated cases. Plans are underway to rehabilitate the hospital's Accident and Emergency (A&E) department, provide emergency care, and treat complicated medical cases, reducing referrals to Georgetown Public Hospital Corporation (GPHC)<sup>50</sup>.

The most common disease in Mahdia is malaria (Consultant Personal Communication 03 and 04). According to the RDC, the Region to date has managed the COVID-19 pandemic well, with only eight cases being recorded at the height of the pandemic in 2020. There were no current cases as of March 11, 2021. In addition, COVID-19 vaccines have arrived in the Region and immunization is ongoing (Consultant Personal Communication 04).

## **Infrastructure**

Key Government headquarters and facilities are located in Mahdia including the Regional Democratic Council of Region 8 (RDC), Mahdia Mayor and Town Council, District Hospital, Police Station, Post Office, and Fire Station (Consultant Personal Communication 03 and 04). There is a field office of the GGMC in the township. However, other natural resources regulating agencies such as the GFC and the GLSC do not have field offices in Mahdia. Construction of the new Mahdia Magistrates Court is ongoing, and plans are underway for a new housing development near the Mahdia airstrip (Consultant Personal Communication 03).

Educational facilities in Mahdia include the Mahdia nursery, primary, and secondary schools. Religious buildings include four churches and a mosque. Mahdia is connected to GTT and Digicel cellular services and wireless internet and has an established radio station, Radio Mahdia 95.1<sup>51</sup>. There is no landline telephone service in Guyana. There are no commercial banks in the township.

There are no recreational facilities in Mahdia. The lawns of Mahdia Monument are used by young persons to play football and cricket in the evening. Residents also have access to recreation facilities in Campbelltown such as the football field. The Town Council is developing an area for recreational activities and events (Consultant Personal Communication 03).



**Figure 4-41: Mahdia Secondary School**

<sup>50</sup> Department of Public Information. 2021. Mahdia District Hospital A&E to undergo renovations

<sup>51</sup> Guyana Chronicle, 2017. Radio Mahdia 95.1FM Hits the Air.

## **Electricity**

MPL supplies electricity in Mahdia 24 hours daily. MPL is supported through Government subvention and rates accrued from the customers who pay more than GYD\$ 100/kWh, assumed to be the highest rate in the hinterland. MPL's baseload is 140 kW per day, with a peak demand of 280 kW. Fuel is transported overland to MPL from Georgetown every fortnight at the cost of GYD\$ 450,000 per tanker load. The company stores at least 50,000 liters of fuel, equal to a six-week supply of fuel, as a contingency to prevent interruption of electricity service in case of delays (Consultant Personal Communication 05 and 08).

In December 2020, MPL completed expansion of the secondary transmission and distribution network. In addition, in 2021, MPL recently added approximately 0.5 kilometres of transmission lines in the vicinity of Pepper Hill. MPL plans to expand its electricity transmission and distribution network, and build its technical capacity, to meet the forecasted rise in load demand from Mahdia. Expansion of services including to provide electricity to a greater number of households in the titled indigenous village of Campbelltown (Consultant Personal Communication 08). Mining camps located within the township and on its outskirts typically use private generators for electricity (Consultant Personal Communication 03).



**Figure 4-42: MPL Diesel Power Plant (Left) and Section of Transmission and Distribution System in Mahdia (Right)**

## **Water Supply**

Guyana Water Incorporated (GWI) provides water in Mahdia and its main source is the Salbora Creek which is located in proximity to the Mahdia Airstrip (Consultant Personal Communication 04). Surrounding communities source their water mainly from rainwater harvesting, but water is also sourced from nearby rivers, and creeks (Consultant Personal Communication 03). Community members shared concerns of surface water contamination by effluent discharged from mining activities that have rendered flows from most creeks in the Mahdia township unsafe for consumption (Consultant Personal Communication 03, 04, and 06). Visible contamination of creeks within the Mahdia township was observed during the site visit conducted in March 2021 (Figure 4-43). Illegal mining was also reported to have adversely impacted the GWI's distribution pipelines and as a consequence, adversely impacted the reliability of GWI's service and the quality of water provided by the utility<sup>52</sup>.

<sup>52</sup> Stabroek News. 2018. Miners continue to destroy GWI pipelines at Mahdia.



**Figure 4-43: Visible Contamination of Surface Water Flows in Creeks in the Mahdia Township**

### **Sanitation**

The Mahdia Mayor and Town Council is responsible for the collection and disposal of waste in the township. The Council's garbage collection trailer collects solid waste from resident and business premises twice a week, at a fee. The households that do not utilize the waste collection services burn or bury their garbage. Mahdia has no sewage treatment facility and untreated sewage is stored in septic tanks. There is no municipal dumpsite in the township. The current dumpsite was established by the RDC but a resident has mining rights to this area. The Mayor and Town Council is in the process of identifying an alternative location for the dumpsite (Consultant Personal Communication 03 and 04).

### **Local Governance**

Several government entities, including the Town Council and the RDC, are located in Mahdia. The RDC is the highest Local Government Organ in each region. It is responsible for the Region's overall management and administration and the coordination of all Local Democratic Organs activities within its boundaries. The RDC is also tasked with identifying economic projects that contribute to the Region's growth and development. The RDC headquarters is located in Mahdia and led by the Regional Chairman and Councillors who are elected into office every five years. The Regional Executive Officer is the Accounting Officer of the Region and functions as the Clerk.

After obtaining township status in 2018, Mahdia became Guyana's tenth town. This allows for a Mayor, Deputy Mayor, Councillors, and a Town Clerk, who serves as the Administrator. The Council is responsible for infrastructure, child welfare, and solid waste management, among other services. The Bartica Municipality receives an annual subvention from the Ministry of Local Government and Regional Development per budgetary allocations approved by Parliament to fund development projects. However, the collection of rates and taxes is the primary revenue source for the Council.

### **Crime**

The crime rate in Mahdia is relatively low. Petty crimes are reported in the backdam, but not a high number (Consultant Personal Communication 03 and 04).

#### **4.3.3.2 Campbelltown**

Campbelltown is a titled indigenous village located north of Mahdia. The village has two satellite communities namely Princeville and Muruwa. It was established in the 1940s and named after Stephen

Campbell, the first Amerindian Member of Parliament in Guyana<sup>53</sup>. Campbelltown became a titled village in 2006.

### **Demographics**

Based on recent surveys by the Village Council, Campbelltown and Princeville have a combined total population of 1,200 people with 224 households. Only 87 persons are residents of Muruwa. Local Authorities indicate that the village population is on the rise and is attributed it to increased births and diaspora returning. Most Campbelltown residents are from the Patamona tribe, and the rest from the Macushi, Wapishana, Akawaio, and Arawak tribes, with a few Brazilian settlers who have assimilated into the village (Consultant Personal Communication 06).

### **Access**

This community is accessible by road from Mahdia. The concreted roads located in central Mahdia end at entrance to the village and all roads in the village are laterite capped. There is a security outpost and toll booth at the entrance to the village. Visitors are charged GYD\$300 to enter the village with a vehicle.

The main forms of transport in and outside of Campbelltown are walking, cycling, and driving. A taxi ride within Campbelltown costs around GYD\$1,000, to Mahdia GYD\$2,000, and to Princeville up to GYD\$ 5,000. Travel to Muruwa requires an ATV and costs of rental are approximately GYD\$ 100,000 to 120,000 for a one-way trip from Muruwa to Campbelltown.

### **Livelihoods**

The main economic activity in Campbelltown is mining<sup>54</sup>. Residents also practice small-scale subsistence and commercial farming, fishing, and hunting<sup>55</sup>. Small-scale/subsistence farming and hunting are practiced by some households to meet domestic needs. Some residents also fish for subsistence and walk for up to four days to access the Potaro River, one of the boundaries of the Village, for this purpose (Consultant Personal Communication 06). The main foods consumed in Campbelltown are rice, flour, sugar, and cassava, all purchased from Mahdia or sourced from small-scale farmers.

Some of Campbelltown's residents are employed at the Regional Office, schools, and stores in Mahdia, while others work as guides, labourers, and drivers in the mining sector<sup>56</sup>. The Village Improvement Plan, which includes a Land Use Plan, guides Campbelltown's development and investments (Consultant Personal Communication 06).

### **Electricity and Energy**

Only some households in Campbelltown receive electricity from the MPL grid. According to the Village Council, MPL had explained that there is not enough generation capacity or an existing transmission and distribution system to provide power to all the homes in Campbelltown. Campbelltown's satellite villages of Princeville and Muruwa are not connected to the electric grid. The Village Council has been requesting MPL to expand the provision of electricity for more than two years, including an expansion of service to Princeville (Consultant Personal Communication 06). Currently, all of the village

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<sup>53</sup> Camacho-Nassar, C. 2016. Mid-Term Evaluation of the Amerindian Land Titling Project in Guyana.

<sup>54</sup> Hilson, G., Laing, T. 2017. Gold mining, indigenous land claims and conflict in Guyana's hinterland. *Journal of Rural Studies*, 50, 172-187.

<sup>55</sup> Stabroek News. 2019. Campbelltown. (Article by D. Sutherland)

<sup>56</sup> Stabroek News. 2020. Campbelltown Revisited. (Article by J Dhanraj)

infrastructure operated by the Village Council in Campbelltown and buildings which offer Government services such as the health centre are electrified.

Most households use a combination of gas, firewood, and coal for cooking.

### **Health**

Residents of Campbelltown use the Mahdia District Hospital for treatment. There are Health Post for use by residents of Muruwa but it is not staffed or equipped. The remote/isolated nature of this community make it challenging to find health workers to be stationed there. The Village Council ensured that there is adherence to the recommended health and safety guidelines to prevent the spread of COVID-19 but nonetheless, there were a few cases of coronavirus infections amongst villagers. Malaria is the biggest health concern in Campbelltown (Consultant Personal Communication 06).

### **Infrastructure, Services and Equipment**

The Village Council operates the market, the village shop, the Village Council office, a guest house, a bond, a benab and a kitchen. The Council also has two pick-up trucks (only one of which is operational), two ATVs in Campbelltown, one ATV in Muruwa, a tractor, a canter, a bus and an excavator. There are two sports fields used for football and cricket and other recreational activities. The Village Council funded these facilities and machinery from a ten percent mining tax charged to residents or outsiders conducting mining operations on the titled lands of the Campbelltown village (Consultant Personal Communication 06).

There is a nursery school in Campbelltown and students from the village travel to Mahdia for primary and secondary school. There are both nursery and primary schools in Princeville and Muruwa while secondary school students attend Mahdia Secondary and stay in the dormitory. All other Government services are accessed in Mahdia (Consultant Personal Communication 06).

Digicel and GTT cellular service and internet connectivity are available in Campbelltown and some parts of Princeville. Campbelltown also benefits from free government wireless internet. There is no cell phone or internet service in Muruwa (Consultant Personal Communication 06).

### **Water**

Most residents of Campbelltown use water supplied by GWI from Salbora Creek. In addition, there are a few wells in the village. Water pressures are reportedly low and the well operating times are too short. Previously, residents of Campbelltown depended on Wariabe Creek and Kunuwa Creek for water and fetched this over long distances. Princeville and Muruwa use water from creeks and experience shortages or have to travel long distances to access water during the dry seasons. Mining activities have polluted most water sources and destroyed some land in the area, although GGMC has tried to monitor and control mining (Consultant Personal Communication 06).

### **Sanitation**

The Village Council manages a dumpsite in Campbelltown but Mahdia residents and business owners use it, even though they are not supposed to do so. Business operators in Mahdia also dump their waste on Campbelltown land, despite efforts by the Village Council and the Mahdia Town Council to stop them (Consultant Personal Communication 06).



### **Culture and Religion**

Some residents of Campbelltown, Princeville and Muruwa practice indigenous religions, dances, prayers, use indigenous medicines and speak indigenous languages (mainly Patamona, Wapishan and Machusi).

### **Social Concerns**

The main social concerns in Campbelltown include increased dependency on alcohol and drugs within the community and harassment and exploitation of Amerindians in Mahdia and the mining camps. The Village Council has also struggled with implementation of projects or extraction of resources from the village without authorization or adherence to the principle of Free, Prior and Informed Consent (FPIC). The crime rate in Campbelltown is relatively low (Consultant Personal Communication 06).

#### **4.3.3.3 Other Communities**

Region 8 is divided into two sub-regions. Sub-Region 1 includes communities in the Pakaraimas. Sub-Region 2 covers all communities between Mango Landing and Mahdia. The project site is located within the Mahdia Township in Sub-Region 2. The area between Mango Landing and Mahdia includes several communities including Seven Miles, Nine Miles, El Paso/Tumatumari and Micobie. Micobie is the only titled Amerindian village amongst these other communities. Amerindian communities in relation to the project site are shown in Figure 4-44.

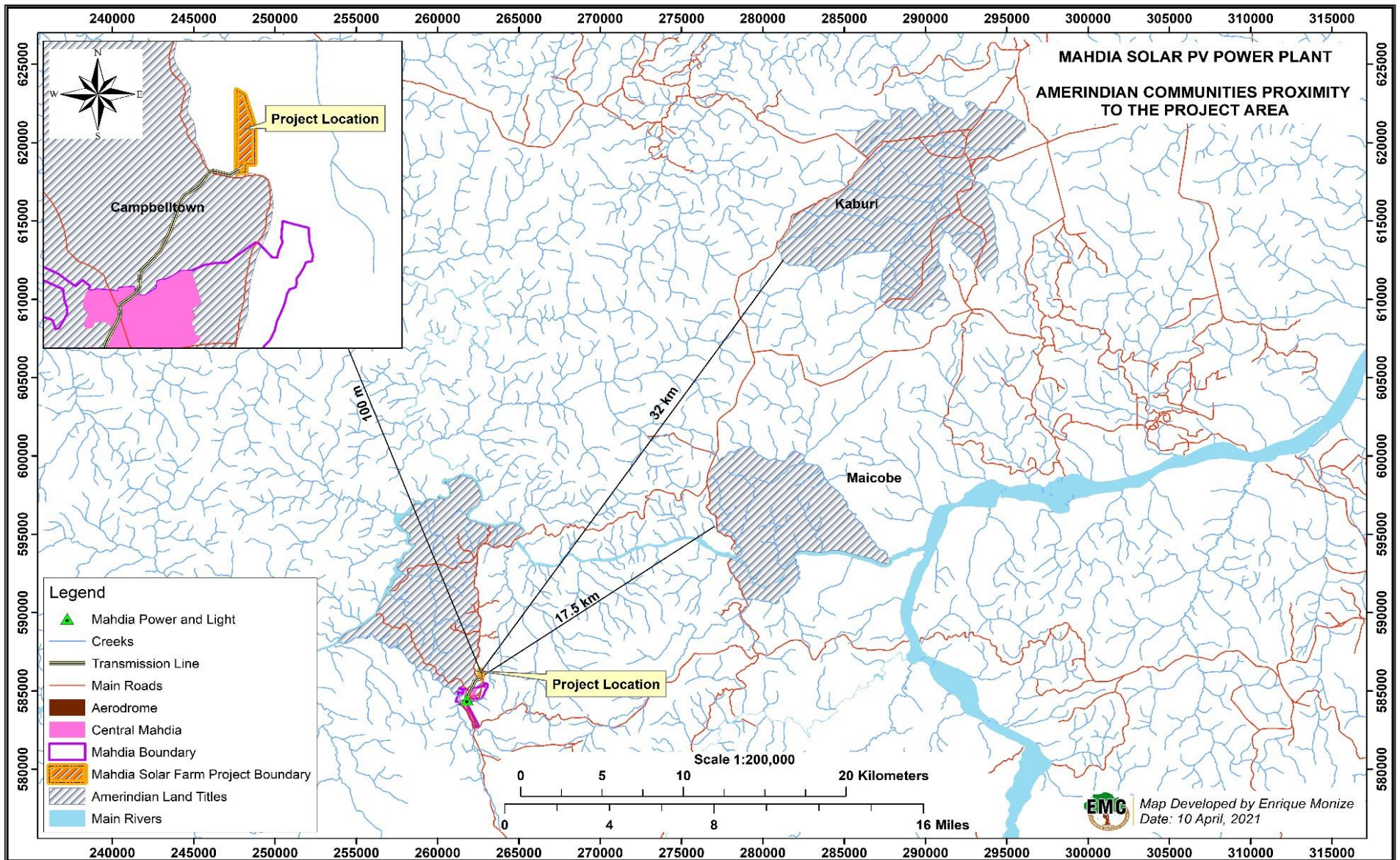


Figure 4-44: Location of Amerindian Communities in relation to the Project Site

#### ***4.3.4 Key Heritage and Archaeological Sites***

The project area and the wider extent currently have no known or documented archaeological nor heritage sites. This was conveyed by several persons with extensive knowledge of the area during the stakeholders' engagement. In addition, there were also no documented records found to suggest otherwise. The closest documented finds in relation to the project area are shown in Figure 4-45. While there are no known archaeological nor heritage sites within the project area, the Mahdia Monument, an unsculpted rock taken from Eagle Mountain, is located in the township.

The Campbelltown Village Council confirmed that there are no indigenous religious or spiritual sites within the project site. However, sacred sites for the village are located by the Potaro River.



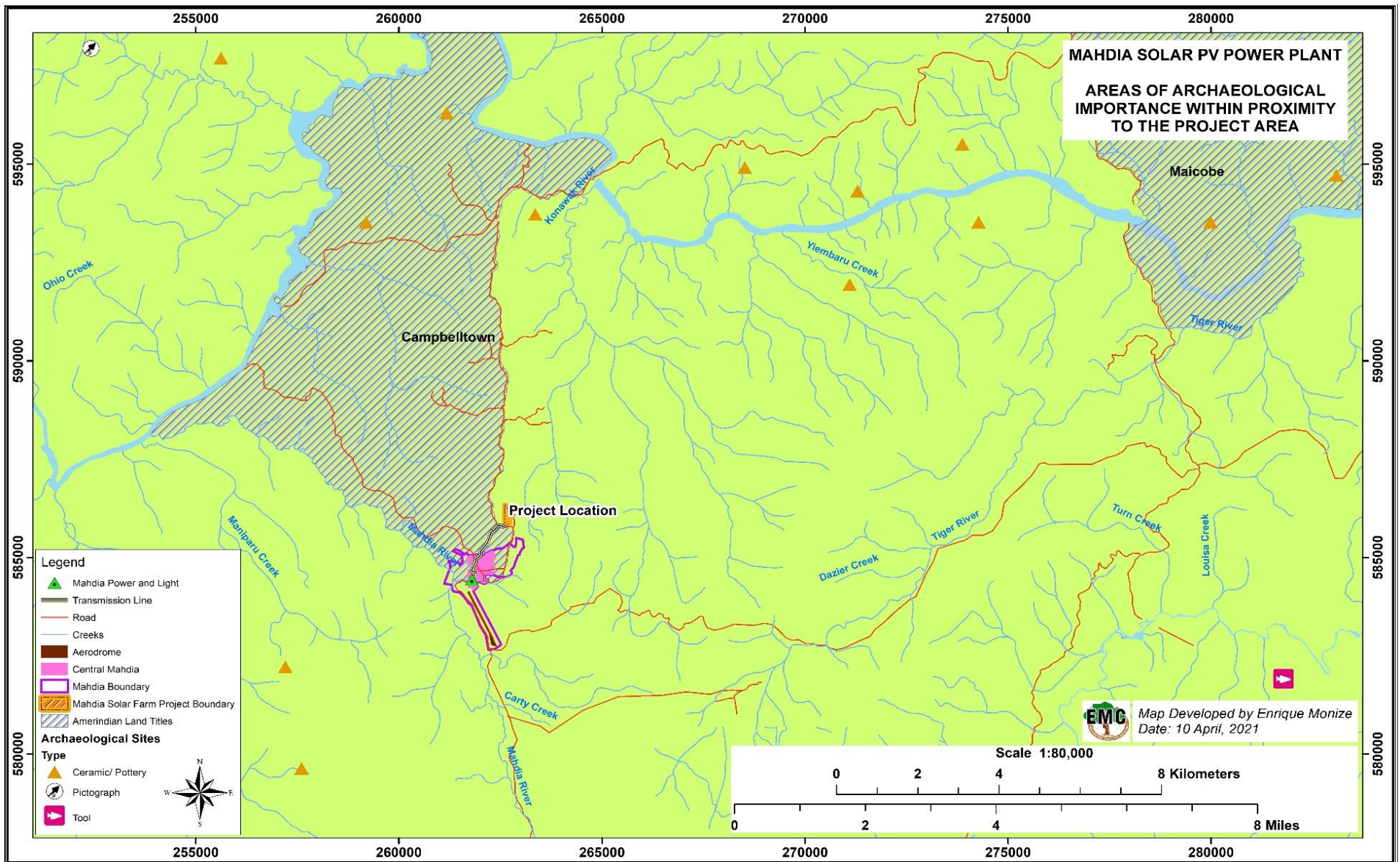


Figure 4-45: Areas of Archaeological Importance in the Wider Project Area

## 5.0 STAKEHOLDER ENGAGEMENTS

### 5.1 Stakeholder Engagement Approach

Stakeholder engagements were an important element of the ESAR preparation process since feedback garnered from stakeholders can support the identification and assessment of potential impacts and the development of measures to mitigate these impacts. Stakeholder engagements are also a key component of managing project risk since it familiarises local and regional stakeholders with the planned project activities and provides a platform for concerns to be raised and lays the foundation for a positive relationship between the Project and the local communities. The overall purpose of the stakeholder engagements conducted during the ESAR preparation was to build awareness among stakeholders of the project and provide a platform for receiving feedback on issues of concern and recommendations. These engagements also built on previous engagements on the project conducted by the GEA with local stakeholders. The specific objectives were to:

- Provide progress update to local stakeholders including in relation to the Project location, project components and planned project activities.
- Initiate open dialogue with stakeholders to provide clarifications on the Project and for stakeholders to share their views, concerns and expectations.
- Receive feedback from stakeholders on environmental and social concerns associated with the project components and project activities for inclusion and consideration in the EMP.
- Promote understanding of the claims of tenure of existing occupants of the Project location and the activities which are ongoing on-site.
- Create a mechanism through which feedback from stakeholder engagements are shared with Project personnel so as to ensure that stakeholder engagements are meaningful and are considered in decision-making.

The stakeholder engagement approach for this ESAR consisted of the following key elements:

- Identification of stakeholders for engagement.
- Determining the methods and tools for engagement of various stakeholders.
- Organisation of feedback received for consideration by all team members in ESAR preparation process.

### 5.2 Stakeholder Identification

Stakeholders identified for engagement generally comprised of representatives of local communities and regional/local government authorities and institutions who are expected to be impacted, either positively or negatively, by the Project. These stakeholders were:

- The people who are occupying lands on or in proximity to the project site.
- The Mahdia Mayor and Town Council.
- Regional Democratic Council of Region # 8.
- Mahdia Power and Light.
- Campbelltown Village Council.
- Residents of Mahdia and Campbelltown.



### 5.3 Stakeholder Engagement Strategy and Methods

The stakeholder engagement strategy was designed to utilise appropriate methods and tools to efficiently engage with stakeholders. The overarching objective was to employ methods to facilitate meaningful consultations with stakeholders to encourage the free sharing of information and views about the project.

#### 5.3.1 One-on-One Engagements

One-on-one engagements were considered to be the most appropriate tool to effectively and transparently engage most of the stakeholders identified in Section 5.2 above. In addition, one-on-one engagements also allowed stakeholder engagements to comply with the public health restrictions associated with the COVID-19 pandemic. In most instances, stakeholders were available to facilitate in-person discussions with the Consulting Team. However, in instances where stakeholders could not participate in-person, engagements were conducted via telephone. The schedule of the one-on-one engagement with stakeholders is presented in Table 5-1 below.

**Table 5-1: Schedule of One-on-One Engagements with Stakeholders**

Stakeholders	Date of Engagement
<b>In-Person Engagements</b>	
People occupying lands within or around the Project site (Tyrone Edwards, Claudette James and Martin Rodriguez)	March 10 to 11, 2021 July 14 to 16, 2021 (led by the GEA) August 19, 2021 (led by the GEA) September 10-12, 2021 (led by GEA) November 01, 2021
Mahdia Mayor and Town Council	March 11, 2021
Regional Democratic Council of Region # 8	March 11, 2021
Mahdia Power and Light	March 11, 2021
Campbelltown Village Council	March 11, 2021
<b>Engagements via Telephone</b>	
Mahdia Power and Light	March 17, 2021

The critical first step in all of the one-on-one engagement exercises was to share information on the project to enhance stakeholders understanding on project activities and allow them to consider how they may be impacted (positively or negatively). Project information was shared with most stakeholders by GEA at the outset of the meetings. This then led to the second step of the stakeholder engagement strategy, where stakeholders would have been provided with the opportunity to engage with the project personnel to provide feedback on their concerns and to share recommendations. In addition, the Consulting Team also requested information from stakeholders relating primarily to the socio-economic conditions of the settlements which may be impacted by the project. Photos of some of the engagements by the Consultants with local stakeholders can be seen in Figure 5-1 to Figure 5-4.



**Figure 5-1: Engagements with Mahdia Mayor and Town Council**



**Figure 5-2: Engagements with the Campbelltown Village Council**



**Figure 5-3: Engagements with potentially affected people**



**Figure 5-4: Engagements with potentially affected people**

### **5.3.2 Public Community Meeting**

The GEA convened a public meeting to facilitate broad-based stakeholder consultations on the project with residents of Mahdia and Campbelltown. The meeting was held on March 10, 2021 at the Boardroom of the Regional Democratic Council in Mahdia (Figure 5-5). However, the turnout was poor and only people in attendance were representatives of the Mahdia Mayor and Town Council and the Regional Democratic Council of Region 8.

The GEA convened another public meeting with the Village Council and residents of Campbelltown on November 01, 2021 at the Village Shop to update the community on the project, discuss the provision of electricity to the community, and present the environmental and social concerns relating to the project. The minutes of this meeting is included in Appendix D.



**Figure 5-5: Public Community Meeting**

## 5.4 Stakeholder Feedback

The critical issues, concerns and recommendations identified by stakeholders during the stakeholder engagements conducted by the Consultants during the ESAR preparation process are summarized in Table 5-2. The principal areas of concern identified covered several critical issues including land use, employment, potential impacts of the project and stakeholder engagement.

In the immediate aftermath these engagements, the GEA further engaged the GLSC on land tenure at Project location and a decision was taken to re-survey the area so as to excise all overlapping land uses from the Lease to be issued to the project. Moreover, GEA-led engagements in July, August, and September 2021 formalized agreements with the occupants of overlapping lands to ensure there was understanding of the new boundaries of the project site and to obtain consent that current activities will be discontinued. As a consequence, most of the issues identified by stakeholders relating to land use and land tenure during engagements with the Consultant team are no longer considered as primary issues of concern. Appendix D presents for notes of each of the stakeholder engagements conducted by the consultant and support team, and the GEA report from the subsequent stakeholder consultations.

**Table 5-2: Summary of Stakeholder Feedback**

Themes and Issues	Stakeholder Questions, Concerns and Recommendations
<b>Land Use and Resettlement</b>	<p><u>(Existing Occupant at and around Project Site)</u></p> <ul style="list-style-type: none"> <li>▪ Lands were being used for agricultural purposes for approximately 18 years. Farms consist of permanent crops and short-term crops. Cassava by-products are prepared at a camp adjacent to the project site.</li> <li>▪ Small temporary/periodical use dwellings (camps) were also constructed.</li> <li>▪ Resettlement will be considered but there are concerns about relocating farming activities to an area that is not accessible by walking from either her residence or to markets in Mahdia.</li> </ul>



Themes and Issues	Stakeholder Questions, Concerns and Recommendations
	<ul style="list-style-type: none"> <li>Relocation would require fair compensation including compensation for manual labour to clear and construct an alternative temporary dwelling structure.</li> <li>Would prefer to be compensated and rebuild her dwellings rather than the GEA constructing a dwelling for her.</li> <li>She has access to a clean water source at alternate locations behind both her current farm and the solar farm and has access to water provided by GWI 5 minutes away from the farm.</li> <li>Would like to seek employment with the project.</li> </ul>
<b>Environmental and Social Impacts</b>	<p><u>Campbelltown Village Community Meeting</u></p> <ul style="list-style-type: none"> <li>Whether there will be any social or environmental impacts related to the planting of the poles.</li> </ul>
<p><b>Expected Project Benefits:</b></p> <ul style="list-style-type: none"> <li>Development,</li> <li>Lower electricity rates,</li> <li>Employment,</li> <li>Local content</li> </ul>	<p><u>Public Community Meeting</u></p> <ul style="list-style-type: none"> <li>Local communities are excited about the Project because they expect lower electricity rates.</li> </ul> <p><u>Mahdia Mayor and Town Council</u></p> <ul style="list-style-type: none"> <li>Electricity is a key factor in promoting development and as such, the Project is expected to contribute to increased business investments and development in Mahdia.</li> <li>Residents expect lower electricity rates.</li> <li>The project would also provide an alternative source of employment for youth in Mahdia who frequently have no options but to go to the back dams for mining.</li> </ul> <p><u>Regional Democratic Council of Region 8</u></p> <ul style="list-style-type: none"> <li>Electricity is a key factor in promoting development and as such, the project is expected to contribute to increased business investments and development in Mahdia.</li> <li>Residents expect lower electricity rates.</li> </ul> <p><u>Campbelltown Village Council</u></p> <ul style="list-style-type: none"> <li>There have been previous instances of contractors from Georgetown bringing external personnel for jobs which could be filled locally. It was recommended that priority should be given the local persons for employment.</li> <li>The Campbelltown Village Council owns an excavator that will be available to be rented to the project if necessary.</li> </ul> <p><u>Campbelltown Village Community Meeting</u></p> <ul style="list-style-type: none"> <li>Job opportunities for persons in the community with the establishment of the new transmission line.</li> </ul>
	<p><u>Public Community Meeting</u></p> <ul style="list-style-type: none"> <li>Residents have been asking the Town Council for updates about the project including status of construction and timelines for completion.</li> </ul> <p><u>Mahdia Mayor and Town Council</u></p> <ul style="list-style-type: none"> <li>Grateful that the Town Council was consulted on the project.</li> </ul>

Themes and Issues	Stakeholder Questions, Concerns and Recommendations
<b>Stakeholder Engagements</b>	<p><u>Regional Democratic Council of Region 8</u></p> <ul style="list-style-type: none"> <li>▪ The RDC has not been sufficiently engaged in the project. This is concerning because the RDC may be expected to play a role in monitoring the project when construction is completed.</li> <li>▪ Relevant stakeholders should have frequent updates on the project.</li> </ul> <p><u>Campbelltown Village Council</u></p> <ul style="list-style-type: none"> <li>▪ The Campbelltown Village has not been provided with updates on the project and became aware of new location when the billboard was erected. Also, believed that the building on the site belonged to the project.</li> <li>▪ The Village should be engaged in the future development of the project and consultations should be consistent with FPIC guidelines.</li> </ul> <p><u>Campbelltown Village Community Meeting</u></p> <ul style="list-style-type: none"> <li>▪ How grievances can be communicated to the GEA, if there are any.</li> </ul>
<b>Expanding access to electricity in Campbelltown</b>	<p><u>Campbelltown Village Council</u></p> <ul style="list-style-type: none"> <li>▪ Only a small part of Campbelltown has electricity and neither of the satellite villages are electrified.</li> <li>▪ The Village Council has requested expanded electricity access from MPL.</li> </ul> <p><u>Campbelltown Village Community Meeting</u></p> <ul style="list-style-type: none"> <li>▪ Whether or not persons along the roadway where the poles are being planted will receive electricity.</li> <li>▪ Aware that not all households within the Village will benefit from the electricity to be supplied but is hopeful that eventually the entire community will benefit.</li> </ul>
<b>Reliability and Quality of Service</b>	<p><u>Campbelltown Village Council</u></p> <ul style="list-style-type: none"> <li>▪ Significant voltage fluctuations in power supply from MPL has resulted in damage to equipment and appliances.</li> <li>▪ Only certified electricians and other technical personnel should be recruited to work on the project.</li> </ul>
<b>Electricity Cost</b>	<p><u>Campbelltown Village Council</u></p> <ul style="list-style-type: none"> <li>▪ Will the cost of electricity be reduced when the project is operational?</li> </ul> <p><u>Campbelltown Village Community Meeting</u></p> <ul style="list-style-type: none"> <li>▪ Concern about the cost of electricity in the village.</li> </ul>
<b>Management of the Project</b>	<p><u>Campbelltown Village Council</u></p> <ul style="list-style-type: none"> <li>▪ Will a committee be established to manage the project?</li> </ul>
<b>Transmission and Distribution System</b>	<p><u>Mahdia Power and Light</u></p> <ul style="list-style-type: none"> <li>▪ Transmission line for the Project should piggyback on the existing system to ease the establishment of the secondary network and increase chances of providing service to unserved areas.</li> </ul>



Themes and Issues	Stakeholder Questions, Concerns and Recommendations
MPL Capacity	<p><i>Mahdia Power and Light</i></p> <ul style="list-style-type: none"> <li>▪ MPL needs development of technical capacity to improve reliability of quality of service provided to consumers.</li> </ul>

## 6.0 IMPACT ASSESSMENT

### 6.1 Impact Assessment Methodology

The project comprises of an EPC and turn-key delivery of a 0.65 MWp solar PV power plant inclusive of a 2-hour battery energy storage system in the hinterland town of Mahdia, Region 8. The electricity generated by the project will be integrated into the existing Mahdia Transmission and Distribution Grid and the transmission line will cover a distance of approximately 2 kilometers and about 0.94 of this line will run through the titled indigenous village of Campbelltown. MPL has been granted permission to occupy 4.65 hectares (11.48 acres) on which the solar PV power plant will be situated. The installation of the 0.65 MWp solar PV power plant is supported by the IDB as part of the EMISDE Programme and will occupy a footprint of approximately 1.3 hectares (3.25 acres) of the total land area. The remaining land area may be used in the future for expansion of the solar PV power plant.

This ESAR focuses on the installation of the 0.65 MWp solar PV power plant as well as the concomitant transmission and distribution system. Potential impacts associated with the decommissioning of the solar PV power plant are also examined. The aim of this chapter is to identify and evaluate the potential impacts that the project may have on environmental and social receptors. This was done by identifying and rating potential impacts which could occur as a result of the proposed project activities. The analysis includes two aspects. The first is having a clear understanding of the operational activities of the project (as detailed in Chapter 2) and the Area of Influence (AoI) of the project. The primary AoI of the project is defined as the footprint of the solar PV power plant which will be constructed by the project. The secondary AoI is defined as the route to be followed for the establishment of the transmission line from the project site to interconnect with the existing transmission network. The AoI includes a fringe of land extending some 15-meters around the project components in all directions. The AoI determined for the project can be observed in Figure 6-1.

The second aspect is to predict potential impacts that might reasonably be expected to occur during the construction and operational phases and their significance. Significant impacts will need to be managed, mitigated and/or monitored to reduce potential adverse impacts and enhance positive impacts.

The approach to the ESAR involves a standard impact assessment methodology as outlined below:

- **Stage 1 – Impact Identification:** To determine the potential impacts associated with project activities. This was achieved through professional judgment, field work, desk top analysis and review of relevant literature and the environmental management plans of similar projects, and consultations with project stakeholders.
- **Stage 2 – Impact Assessment:** To determine the importance of the issues identified by rating their significance and likelihood to occur.
- **Stage 3 – Mitigation and Management:** To recommend appropriate mitigation measures and management or monitoring controls to address significant negative impacts.

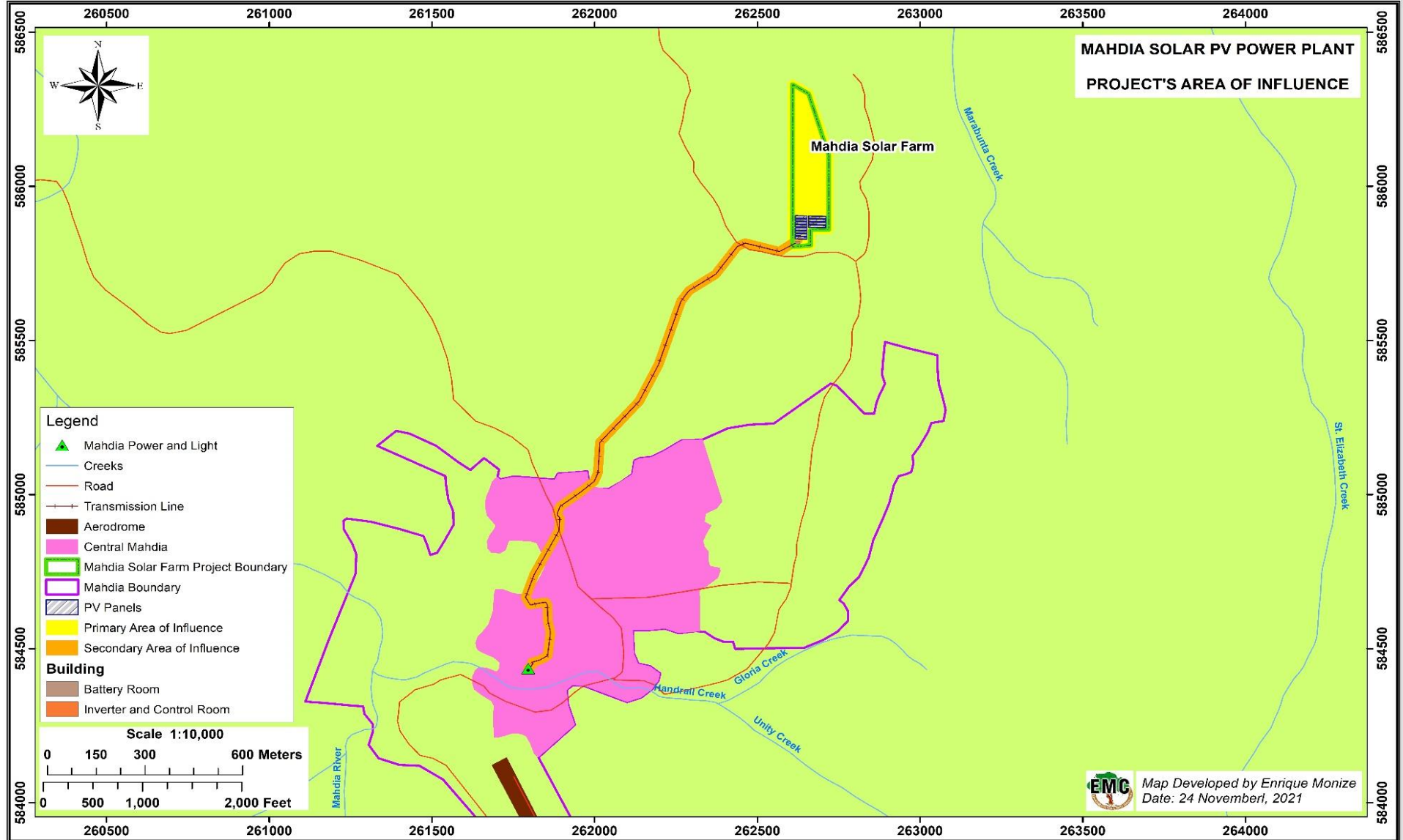


Figure 6-1: Area of Influence of the Project

### 6.1.1 Stage 1 - Impact Identification

The potential impacts of the project are those that change existing physical, ecological or socioeconomic conditions within the project Aol in a negative or positive way. Identifying potential impacts attributable to the project requires an understanding of the receiving environment. This understanding was achieved from the gathering and analysing of information on baseline physical, ecological and socioeconomic conditions as described in Chapter 4 of this ESAR. Further, an understanding of the project related activities was required, as is outlined in Chapter 2.

Impacts are considered as positive or negative, direct or indirect, short-term or long-term, localised or local, regional and cumulative. Table 6-1 provides definitions for each type of impact considered.

**Table 6-1: Definitions of Types of Impacts**

Impact Type	Definition
Positive	An impact that results in a positive effect on the receiving environment or resource from activities performed at or by the project.
Negative	An impact that results in a negative effect on the receiving environment or resource from activities performed at or by the project.
Direct	An impact created as a direct result of the project.
Indirect	An impact which may be caused by the project, but will occur in the future or outside the project's Aol.
Short-term	An impact or activity that is expected to dissipate shortly after the cause ceases
Long-term	An impact or activity that is expected to continue for significant time after the cause ceases
Cumulative	The total impact to a particular resource anticipated to occur as a result of a combination of effects produced together with neighboring projects.
Localised	Impact which is limited to the project's Aol.
Local	Impact which extends outside the project's immediate Aol, but is contained within the general vicinity of the project.
Regional	Impact which has extended beyond the vicinity of the project's Aol.

### 6.1.2 Stage 2 - Impact Assessment

The approach to assessing impacts can be either qualitative or quantitative, depending on available information and historical site-specific experience. Both are important in normal impact analyses. However, considering that the project is not complex, and employs well understood and widely used solar energy generation technology, the impact assessment adopted more of a qualitative approach.

The importance of an impact has been assessed by combining two impact elements:

- The **significance** of the impact on the resources should the impact occur; and
- The **likelihood** of that impact occurring.

In determining **the significance level**, consideration was given to the types of impacts from each project activity relative to existing baseline physical, environmental and socioeconomic conditions. This is described in Table 6-2.



**Table 6-2: Impact Significance Level Descriptors**

Significance Level to Potentially Impacted Physical, Ecological or Socio-Economic Resources				
Negligible	Minor	Moderate	Major	Extreme
Minimal impact in a localised area of little or no consequence.	Low impact in a localised or regional area with a functional recovery within one year.	Medium impact in a localised or regional area with a functional recovery of 1 to 5 years.	High impact in a localised or regional area with a functional recovery within 5 to 10 years.	Very high impact in a broad regional area or area of national significance with functional recovery in greater than 10 years, if at all.

In determining **the likelihood levels**, consideration was given to the probability of an identified physical, ecological or socioeconomic resource being impacted by the project. The anticipated likelihood of occurrence of an impact was identified to range from Rare to Certain (Table 6-3).

**Table 6-3: Impact Likelihood Levels**

Likelihood of Impact to Physical, Ecological or Socio-Economic Resources				
Rare	Unlikely	Likely	Almost Certain	Certain
Highly unlikely to occur but theoretically possible.	May occur within the life of the Project or activity.	Likely to occur more than once during the life of the Project or activity.	Very likely to occur during the life of the Project or activity.	Expected to occur as a result of the Project or activity.

Utilizing the outcomes of both the impact significance ranking and the identified likelihood of impact, the effect of each impact causing action on the receiving environment is evaluated. The risk level (or importance) is assessed by combining the significance column and the probability row in the following Risk Assessment Matrix (Table 6-4).

**Table 6-4: Risk Assessment Matrix**

		Significance				
		Negligible	Minor	Moderate	Major	Extreme
Likelihood	Rare	Low	Low	Low	Medium	Medium
	Unlikely	Low	Low	Medium	Medium	High
	Likely	Low	Medium	Medium	High	High
	Almost certain	Low	Medium	High	High	Critical
	Certain	Low	Medium	High	Critical	Critical

*Note: Where the Significance of an impact is indicated to be positive, the importance will also be positive.*

## 6.2 Physical Resources

The potential impacts to physical resources of the project are related to interactions with local soils and geology, surface and ground water resources, ambient noise levels, as well as ambient air quality. In addition, the vulnerability of the project to adverse climate change impacts are anticipated to occur and are also assessed.

### 6.2.1 Soils and Geology

Potential impacts of planned project activities include erosion, loss of topsoil, topographical changes, compaction and pollution.

#### 6.2.1.1 Erosion

The type of soil prevalent at the project site presents a slight to moderate potential for erosion (as discussed in Section 4.1.3). As a consequence, there are expected to be potential impacts of erosion associated with project construction activities that require the clearing of vegetation and soil disturbing activities required to construct foundations for the mounting structure for the solar PV modules. Erosion potential may be amplified on slopes. Based on the layout of the site, key project components such as some of the PV arrays will be sited on the slope of the hill located in the project site. These areas will be more susceptible to erosion especially because of the tendency of runoff from this area to flow west into the catchment area of the tributary of the Marabunta Creek. In addition, construction of other supporting infrastructure, such as fencing around the project, may also require work on slopes.

Potential impacts of erosion associated with establishing the transmission and distribution system are not significant and only anticipated to occur as a result of runoff during rainfall events. There is only limited potential for erosion occurring during the operational phase of the project given that no soil disturbing activities will be conducted routinely. During operations, potential for erosion will be associated mainly with the surface runoff during periods of heavy rainfall but is not significant given the limited footprint of the facility. The potential impacts of erosion can be managed by implementing appropriate soil management measures during the construction phase and by establishing a drainage system within the facility to manage runoff during operations. Potential impacts of erosion are **negative, direct, short-term** and **localised**. With appropriate erosion management controls these impacts will be of **negligible significance** but will nonetheless be **likely** to occur even in a limited extent. As such, erosion is a **Low Risk** of project activities throughout the lifetime of the project.

#### 6.2.1.2 Change in Topography

The project site comprises of a flattened hill and a downward slope along the northern orientation. Some of the key project components such as the battery room, inverters, control room and some of the PV arrays will be sited largely atop the surface of the flattened hill. However, some of the northernmost PV arrays are expected to occur on the slope of the project site. As such, construction activities may require some levelling of the slope. The contractor may also be required to construct fencing around the project site which may also require topographical levelling. Moreover, changes in topography may be required so as to ensure the stability of any area of the slope on which PV arrays will be installed. Ultimately, the extent of topographical changes required will be determined by the EPC contractor's work programme. In light of planned expansion of PV arrays on site, GEA and MPL should also consider engaging with the contractor on site preparation and levelling to ensure that works undertaken in this phase are not restrictive to the intended future uses of the total land area. However, the extent to which these considerations can be implemented by the contractor is conditional on the costs of such interventions. No topographical changes are expected to be associated with the establishment of the transmission system or to occur during the operational phase of the project.

Changes in topography will have implications for the contiguous physical systems and are likely to permanently change the natural landscape. However, any topographical changes during the construction phase are expected to be limited in extent given the relatively small footprint of the project. Potential impacts of changes in topography during the construction phase of the project are **negative, direct, long-term** and **localised**. Given the limited footprint of the project, this potential impact will be of **minor significance** and is **likely** to occur. As such, this is a **Medium Risk** of the project.

### 6.2.1.3 Loss of Topsoil

The disturbance of topsoil is a certainty within the area which will be used for the construction of project components which require excavation of topsoil to facilitate the erection of fixed structures such as the PV mounting units, the battery room, inverter storage area and control room. Topsoil loss from these activities is inevitable unless measures are taken to manage its removal. The extent of topsoil removal from the site will also depend on the extent of topographical changes required for construction activities. Given the limited footprint of the project activities, topsoil loss is not expected to be significant. During the operational phase of the project, the majority of the surface area within the site will not be disturbed after the PV mounting structures have been installed. In addition, limited clearing of topsoil is also required to erect transmission poles but, in these instances, a common practice is to place the removed soils around the base of the pole for additional support. As such, these potential impacts are not considered significant.

Generally, topsoil is considered to be a valuable natural resource. However, as discussed in Section 4.1.3, the soils in the project site are not considered valuable and stockpiling topsoil within the project site for potential use following the potential decommissioning of the facility may not be a viable option over the 20-year lifetime of the project. Alternative measures for topsoil management should be explored including the potential of donating cleared topsoil to the adjacent farm should the farmer be willing to accept it. Topsoil may also be used to support landscaping of the project site. Potential impacts of topsoil loss during the construction phase of the project are **negative, direct, long-term** and **localised**. Given the limited footprint of disturbance and opportunity for immediate beneficial use, this impact is of **negligible significance** and is **unlikely** to occur. As such, this is a **Low Risk** of the project.

### 6.2.1.4 Compaction

The permeable nature of the soil within the project site makes it susceptible to compaction which can ultimately contribute to soil subsidence. The use of heavy machinery can result in compaction of soils beyond their permeable limits. Potential risks of compaction are likely to be particularly high along routes utilized by heavy machinery on the construction site. In these areas, ponding of water can occur after rainfall and continuous compaction throughout the construction process may increase risks of erosion of the surface. Compaction can be minimised if appropriate mitigation and management measures are implemented. Collectively, the likelihood of soil compaction only account for a relatively limited section of the overall small project footprint. Given that the transmission line to be established to facilitate interconnection with the MPL grid will run along existing roadways, there are no potential impacts of compaction from these activities. The potential impacts of soil compaction from construction activities are **negative, direct, short-term** and **localised**, of **negligible significance** but are **certain** to occur in some areas of the project site during the construction phase. As such, this is a **Low Risk** of project activities.

### 6.2.1.5 Soil Contamination

Soils may be accidentally or intentionally contaminated by the discharge of fuels, waste oils, lubricants or other hazardous materials or wastes during the construction phase of the project. During the operational phase of the project, improper disposal of damaged, malfunctioning or decommissioned solar PV panels or lithium-ion batteries within the project site can result in the leaching of heavy metals into the soil. There is also potential for sewage from temporary sanitary facilities established on-site during the construction phase of the project and from permanent facilities established to support project operations. Improper disposal of general solid wastes may also cause soil pollution during both the construction and operational phases of the project.

The implementation of good environmental management measures during the construction and operation phases of the project can mitigate these risks entirely, including implementing appropriate environmental management practices during the handling, transport, use and storage of hazardous materials and wastes particularly during the construction phase of the project. In addition, the waste management measures to be implemented by the project to manage liquid, solid and hazardous wastes will prevent this impact from occurring. Special measures should also be put in place to facilitate the proper storage and disposal of damaged or defunct PV panels and lithium-ion batteries. Potential impacts of soil contamination are **negative, direct, long-term, localised, of moderate significance** but are **unlikely** to occur if appropriate management measures are implemented. As such, this is a **Medium Risk** of the project.

### 6.2.2 Water Resources

Potential impacts to surface and groundwater resources including filling in of surface water flows, sedimentation of surface water bodies, pollution of surface and ground water resources, and changes in the level of the water table both during the construction and operational phases of the project.

#### 6.2.2.1 Surface Water Flows

There are two small ravines running through the project site. Based on the project layout these ravines will not be disturbed by the project. The ravines are a seasonal tributary of Marabunta Creek and it is likely that they support the drainage network of the project site leading to Marabunta Creek. This tributary may also contribute to lower flood risks during periods of heavy rainfall. These ravines may be incorporated into the design of the drainage system of the project site and upgraded, if required, as part of construction as a means of limiting disturbance to the natural drainage features of the project landscape. Immediate east of the project site is still within the catchment area and would also continue to facilitate site drainage. The design of the drainage system should make provision for connection with any other proximate surface flow outside of the project footprint. No disruption to surface water flows is anticipated to occur in the establishment of the transmission and distribution system. Potential impacts of altering surface water flows are **negative, direct, long-term, localised, of minor significance** but are **likely** to occur if appropriate management measures are implemented. As such, this is a **Medium Risk** of the project.

#### 6.2.2.2 Sedimentation

The removal of vegetative cover and the disturbance of soil will result in an increase of sediments being transported in storm water runoff into surface water bodies within the project site. During the operational phase there will be no soil disturbing activities and this will reduce the potential for sedimentation as a result of storm water runoff. It is a normal process for sediment loads to increase during heavy rainfall though such events are brief and tend not to have lasting effects. These impacts may also be mitigated with the establishment of a system to drain the project site during periods of rainfall. Potential impacts of sedimentation on surface flows are **negative, direct, short-term and localised, of negligible significance** but are **likely** to occur during the rainy season particularly during project construction. As such, this is a **Low Risk** of project activities.

#### 6.2.2.3 Pollution

Surface waters within the project area may be accidentally or intentionally contaminated by the discharge of fuels, waste oils, lubricants, other hazardous wastes and non-hazardous wastes including general solid wastes during both the construction and operational phases of the project. In addition, improperly manage solid waste and sewage generated during the construction and operational phases can inadvertently pollute the water courses. Two small surface flows are located within the project site and potential impacts of surface water pollution may be mitigated entirely if appropriate management

measures are in place for hazardous materials and waste, especially during the construction phase. The potential impacts of pollution of surface waters are **negative, direct, short-term** and **localised**, of **minor significance** but are **unlikely** to occur. As such, this is a **Low Risk** of project activities.

Groundwater resources may be polluted by leaching of fuels, waste oils, lubricants or other hazardous wastes accidentally or intentionally discharged during the construction phase of the project. However, these impacts may be completely mitigated if appropriate fuel and environmental management practices during the handling, transport, use and storage of hazardous materials and wastes are implemented during the construction and operation phases. Potential impacts of groundwater pollution are **negative, direct, long-term, localised**, of **minor significance** but are **unlikely** to occur if appropriate management measures are implemented. As such, this is a **Low Risk** of the project.

### 6.2.3 Climate Change

Adverse climate change impacts which could contribute to heavy rainfall that could lead to flooding, and variable patterns of precipitation that result in prolonged rainy conditions may negatively impact the project. In addition, the project is expected to contribute to climate change mitigation but will also be a minor source of emissions through fuel combustion during the construction phase.

#### 6.2.3.1 Potential Adverse Climate Change Impacts

##### Precipitation

National-level projections for climate change in Guyana were prepared in 2010 using the outputs from several General Circulation Models following the A2, A1B and B1 scenarios<sup>57</sup>. According to the World Meteorological Organisation (2010), the current levels of greenhouse gas emissions put the world on a trajectory for more than 5°C of warming by end-century. This is most closely aligned with the A2 scenario and as a consequence, the outputs of this scenario are considered to be most relevant to Guyana.

All outputs from these models are projected changes in the mean relative to a 1960 – 2006 baseline period. The general trend from the three scenarios is that average annual precipitation will decrease but there is no clear direction of the trend as both positive and negative projections of change are generated when minimum and maximum values are considered. Moreover, the national level projections indicate that the proportion of total precipitation that falls in heavy events does not show a consistent direction of change as both positive and negative projections of change are generated indicating a future that includes risks of both flooding and drought.

Based on the precipitation datasets collected for Mahdia the highest mean monthly precipitation occurs in May with over 600 millimeters and in June with well over 550 millimeters. This is moderately higher than mean monthly precipitation experienced in Guyana during the primary wet season. It is likely that heavy precipitation events were amplified in the mean values given the small dataset which is available. Return periods for heavy rainfall events were not estimated as part of this ESAR given the limited dataset which is available. However, a farmer who has been occupying lands adjacent to the project site for almost two decades indicated that the project site has never been flooded even during periods of heavy rainfall.

Specifically, heavy precipitation experienced throughout Guyana during the period May to July 2021 resulted in widespread and significant flooding throughout the country, including Region 8 which resulted in complete destruction of some mining areas, agricultural lands and private residences. This

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<sup>57</sup> In 2000, the IPCC published a Special Report on Emissions Scenarios (SRES) covering a range of the main driving forces of future greenhouse gas emissions such as demographic, technological and economic changes. The A2, A1B and B1 were three of the scenarios developed by the IPCC and which were used to model projected climatic changes in Guyana.



heavy rainfall event occurred via an increase in the number of consecutive wet days (days with more than 10 millimeters of rainfall) and 7-day extreme wet spells. According to Guyana's Civil Defence Commission (CDC), the total rainfall in May 2021 was the second highest rainfall total for May since 1981.<sup>58</sup> According to the Regional Executive Officer of Region 8, the project site did not experience flooding during these extreme rainfall events but conditions on-site were slushy and slippery. This was verified by personnel from the GEA who visited the site periodically during this period.

The elevation, natural topographical features which facilitate drainage (such as the slope) and the permeable soil type all contribute to significantly reducing the inherent flood risk of the project site. Moreover, in the unlikely event of flooding of the project site, solar PV panels are unlikely to be adversely impacted by flood events since they will be mounted above ground level. However, heavy precipitation events could create flood-like or slushy conditions around the mounting structures and the foundations of these structures should be capable of withstanding such conditions. Potential impacts of flooding associated with heavy rainfall are **negative, direct, short-term** and **localised**. Potential impacts of flooding can be managed by establishing a system for drainage based on natural features of the project site. As such, flooding of the project area is of **minor significance** and is **unlikely** to occur. As such, this is a **Low Risk** to the project.

Adverse climate change impacts may also result in variable precipitation patterns. Prolonged wet season conditions which reduce shortwave radiation may marginally decrease power generation capacity of the solar PV power plant. There are no projections of changes in solar radiation for Guyana. However, national level projections do not show a clear direction of change. Annual average precipitation is expected to decrease and levels of shortwave solar radiation are lowest during rainy seasons, particularly the primary wet season. Variable precipitation patterns that reduce wet season conditions may contribute to a minute increase in shortwave radiation. The potential impact is **positive, direct, short-term** and **localised** but will be of **negligible significance**. However, the likelihood of such occurrences cannot be reasonably predicted. As such, no risk ratings can be produced for this potential impact.

### Temperature

The 2010 projections indicate that average annual temperatures will continue to increase relative to the 1961 to 1990 baseline. At the national level, the mean annual temperature is projected to increase by up to 2.0°C by the 2030s, up to 3.3°C by the 2060s, and up to 5.6°C by the 2090s. According to the International Panel on Climate Change AR5, warm days and nights will increase as well as there will be increased occurrences of temperature extremes in the South American Region.<sup>59</sup> The 2010 projections follow a consistent trend with substantial increases in the frequency of hot days and nights observed across all scenarios with the greatest increases occurring during the primary dry season. Consecutively occurring hot days can result in a heat wave.

Increased average annual temperatures and more frequent hot days could potentially result in heat stresses including heat strokes, heat exhaustion, heat induced cramps, heat rashes and dehydration being experienced by project staff. Indeed, mean net radiation is also greatest during the dry seasons and this may create a heat feeling for workers which exceeds ambient temperature levels. This impact may be amplified for project staff who work around heat generating machinery or who spend prolonged periods of strenuous work exposed to direct sunlight. The potential impacts associated with heat stresses are **negative, short-term** and **localized**, of **minor significance** but are **almost certain** to occur during both the construction phase and well as during the operational phase for maintenance of the solar PV arrays. Heat stresses present a **Medium Risk** to the project.

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<sup>58</sup> Trinidad and Tobago Weather Center. 2021. Guyana's Billion-Dollar National Disaster. The May-June 2021 Floods. Article on June 13.

<sup>59</sup> Intergovernmental Panel on Climate Change, 2014a. AR5 Climate Change 2014: Impacts, Adaptation and Vulnerability, Chapter 27. Page 1499

### 6.2.3.2 Greenhouse Gas Emissions

The primary direct sources of greenhouse gas emissions from the project will be emitted during the construction phase from deforestation and the combustion of fuel by construction machinery and vehicles to be used by the contractor. These emissions are not expected to be significant and will be generated during the construction phase of the project. Although vegetation clearing will be required, the project site is considerably disturbed and is not considered to be a forested area based on the definition of forests which has been adopted by the Guyana Forestry Commission (GFC) of crown cover of 30 percent, mature stand height of 5 meters and coverage of 1 hectare. Greenhouse gas emissions for clearing secondary vegetation cannot be estimated as there are no emissions factors for clearing of secondary vegetation. Based on these factors, the potential impacts to climate change from greenhouse gas emissions from this project is **negative, direct, long-term** and **localised** in extent. The significance of these impacts is **negligible** and their likelihood is **certain**. As a result, greenhouse gas emissions contributing to climate change are considered to present a **Low Risk** of contributing to increased greenhouse gas emissions at the national level.

### 6.2.3.3 Climate Change Mitigation

The operation of the solar power plant will offset the use of fossil fuel that would have been required to operate a diesel generator of a similar capacity. Over its 20-year lifetime, the project is expected to prevent the release of a total of 14,047 tons of carbon dioxide as compared with power generation from diesel. A solar power plant, in general, is built for more than the projected lifetime. After the expected lifetime, a solar power plant will be typically rehabilitated for a fraction of the newly built cost. Given the continuous development of technology and price reductions for project components, it is reasonable to expect the solar power plant to continue to operate beyond the 20-year design life. As such, additional emissions savings can be realised beyond this period if the solar power plant continues to operate. The project may also further contribute to climate change mitigation by reducing the number of return overland trips that would be required to transport fuel from Georgetown to Mahdia to be used by diesel generators. The potential impact of offsetting carbon emissions is **positive, direct, long-term** and **regional**. This impact is one of **moderate significance** and is **certain** to occur. As such, the project has a **High Likelihood** of contributing to a **Beneficial Impact** for climate change mitigation.

### 6.2.4 Ambient Noise Levels

Given that the limited social and economic activities occurring around the project site, ambient noise levels measured during the baseline assessment were associated primarily with the natural systems. Noise levels and vibrations are expected to increase during the construction phase and are expected to include construction activities including site preparation, earthworks, construction of project infrastructure; use of mobile equipment, which includes excavators and generators, and motorised vehicles for transportation of personnel, materials, and equipment to, and from the project site. During the operational phase, maintenance and repairs to project components as well as the periodic operation of various auditory safety signals such as fire alarms will also generate noise.

Project workers will be the main receptors of the potential noise impacts. According to the standard from the US Department of Labour, Occupational Safety and Health Administration, workers are at risk of adverse effects of noise exposure, including hearing loss, when noise exposure is at or above 85 decibels averaged over 8 working hours, or an 8-hour time-weighted average<sup>60</sup>. However, risks of occupational exposure to high noise levels may be mitigated with the use of appropriate hearing protection. As a consequence, these potential impacts are **negative, direct, short-term, localised**, of **moderate significance** but will **rarely** occur if appropriate personal protection equipment (PPE) is

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<sup>60</sup> US Department of Labour, Occupational Safety and Health Department, undated. Occupational Noise Exposure.

used and all appropriate occupational health and safety procedures are followed. As such, these are **Low Risks** of the project.

The persons who reside in the area and also practice small-scale agriculture are also nearby receptors to some of the project activities including potential noise nuisance from construction activities. These potential impacts could be managed by consulting with these receptors prior to the commencement of construction to inform them of planned project activities and to get feedback on any issues of concern. The contractor should also ensure noise levels during construction remain within the decibel limits established by the GNBS for construction activities which are a day-time limit of 90 dB and a night-time limit of 75dB. Potential impacts of environmental nuisances of noise from project activities are **negative, direct, short-term, localised, of minor significance** and are **unlikely** to occur if appropriate management measures are in place. As such, these are **Low Risks** of the project.

#### 6.2.5 Ambient Air Quality

As discussed in Section 4.1.8, all air quality sampling locations recorded PM<sub>2.5</sub> well within the threshold for “good” air quality and PM<sub>10</sub> was “moderate” to “poor” based on the categorisations of the Air Quality Index developed by the Environmental Protection Agency of Victoria, Australia. This quality of the air was as a result of large particulate matter being derived from trees which would be picked up by the wind. During the construction phase of the project there is likely to be an increase of particulate matter from soil disturbing activities given the type of soil prevalent at the project site. In addition, construction activities involving the use of materials such as sand and cement can generate some amount of dust. Further, during the construction phase pollutants associated with combustion of fuel used by construction machinery and other vehicles may be increased at the project location. However, particulate matter and gases from fuel combustion are likely to disperse rapidly given the open areas in which the project is situated. Potential impacts to ambient air quality are not anticipated during the operational phase of the project.

Project workers and neighbours to the project site are considered to be the main receptors to potential impacts that affect ambient air quality. According to the standard from the US Department of Labour, Occupational Safety and Health Administration, workers are at risk of adverse effects of exposure to particulate matter (dust) with maximum exposure limits of 15 mg/m<sup>61</sup>. Given the relatively low baseline levels, it is not expected that occupational or environmental levels will rise above this threshold. Therefore, potential impacts of occupational exposure to high levels of particulate matter are **negative, direct, short-term, localised, of minor significance** but are **unlikely** occur. As such, these are **Low Risks** of the project.

#### 6.3 Biological Resources

The Aol is made up of degraded forest characterised by secondary forest growth and successional species. The lower Potaro River is primarily known for its mineral resources and consists of active small and medium scale gold mining. Mining has changed the topography of the landscape in the lower Potaro River. Deep pits and depressions remain post-mining, and there is alteration of river channels and floodplains. The quality of the water and freshwater habitats of the lower Potaro River has over the years been continuously degraded due to discharges from mining activities within the district, where high levels of turbidity and changes in hydrology are evident.

These historical and ongoing human activities have modified the primary ecological functions and species composition of habitats, resulting in habitat loss and species displacement. Biodiversity resident within the project landscape is, therefore, habituated to the constantly changing and human-influenced environments. Moreover, the vegetation affected are prevalent and widespread in the

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<sup>61</sup> US Department of Labour, Occupational Safety and Health Department, undated. Permissible Exposure Limits. OSHA Annotated Table Z-1.

immediate surrounding landscape of the project. Plant species that will be impacted by land clearing are not species of special conservation interest. Consequently, project activities are not expected to significantly transform existing habitats and or affect the long-term survivability of species present within the project landscape.

### 6.3.1 Vegetation

Project design activities will include geotechnical investigations, topographic and environmental field surveys at the project site. Personnel involved in these activities will access the project site by vehicle and by foot. Minor vegetation clearing would be required to establish temporary camps and for surveying work. Design impacts will consequently be limited to potential impacts from personnel and vehicle access to the project site. The lines for the topographic and environmental surveys will be manually cleared and limited to the space desired for the surveys. The potential impacts resulting from design activities are **negative, direct, short-term** and **localised**. These potential impacts are of **negligible significance** and are **certain** to occur. Therefore, these are **Low Risks** of the project.

Land clearing activities during project construction activities will result in the loss of vegetation cover and habitats. Land clearing of predominantly successional vegetation will be undertaken primarily for the creation of space for the installation of project components. See Table 4-9 for a list of the species to be cleared to facilitate project construction. The project site will be accessed via the existing roads within Mahdia and the transmission line will be routed along the existing road from the project site to the Mahdia diesel powered electrical generation site. As such, no vegetation clearing is required for the construction of access to the site and the installation of the transmission line. Vegetation clearing will intensify habitat fragmentation, albeit not significantly beyond the current level of habitat fragmentation within the wider landscape of the project site. The habitat fragmentation may potentially contribute to a marginal weakening of ecological sub-units making the ecosystem of the impacted area more vulnerable to invasion and degradation. This potential impact is **negative, direct, long-term** and **localized**, of **minor significance** and **likely** to occur. Therefore, these are **Medium Risks** of the project.

Construction activities will also contribute to the loss of vegetation cover and habitat shelter, particularly for birds and small animals located within the project site. Resident fauna, particularly small animals will move to adjacent habitat areas to avoid construction impacts, while species habituated to existing conditions such as resident birds may easily adapt to and thrive successfully during project construction owing to their ability to adapt well to human altered environments. Consequently, it is important to preserve vegetation in areas not earmarked for project activities. Given the small footprint of the project, this potential impact is **negative, direct, long-term** and **localized**, of **negligible significance** and **likely** to occur. Therefore, these are **Low Risks** of the project.

The loss of cover vegetation in project affected areas may also result in the depletion of soil nutrients from enhanced leaching, occasioned by clearing, and erosion from surface runoff. Nutrient depletion may also affect regeneration of native species and may result in the proliferation of aggressive successional vegetation consisting mainly of grass species. The proliferation of aggressive grass species can effectively prevent seed-bearing plants from finding satisfactory living conditions. These grasses can, however, serve as a significant food source for habituated fauna. The potential depletion of soil nutrients can result in impact which is **negative, direct, short-term** and **localized**, of **negligible significance** and **likely** to occur. Therefore, this is a **Low Risk** of the project.

The removal of vegetation cover and land clearing activities may result in the increase of sediment loads to receiving water bodies from eroded soil run-off during rain events resulting in the changes in water quality and increase turbidity. The loss of vegetation cover may also result in increases of nutrient loads in receiver water bodies from surface run off. Increases in nutrient loads could promote the proliferation of primary producers and lead to eutrophication and algal blooms. The potential for

eutrophication and algal blooms are **negative, direct, short-term** and **localized**, of **negligible significance** and **unlikely** to occur. Therefore, these are **Low Risks** of the project.

There are no perceivable impacts on the vegetation during operation of the solar PV power plant.

### **6.3.2 Terrestrial and Aquatic Fauna**

Vegetation clearing and the consequent habitat loss will result in some mortality of terrestrial vertebrate species, particularly those with reduced movement capabilities such as herpeto-faunal species and invertebrates. Only temporary and or localised displacement of birds and small mammals is expected due to their high mobility and the availability of alternative areas of similar suitable habitat types adjacent to the project site. Resident fauna, particularly small mammals and birds will move to adjacent habitat areas to avoid construction impacts, while species habituated to existing conditions such as some resident birds may easily adapt to and thrive successfully during project construction owing to their ability to adapt well to human altered environments. Potential impacts of habitat loss and displacement impacts on terrestrial fauna during project construction are expected to be **negative, direct, long-term** and **localised** of **minor significance** and **likely** to occur. Therefore, these are **Medium Risks** of the project.

The removal of vegetation cover may increase sedimentation of receiving water bodies resulting in the changes in water quality and increase turbidity. Changes in the water quality may result in temporarily reduced habitat quality for aquatic organisms, in turn resulting in temporary changes in the aquatic ecology. However, sedimentation of water bodies as a result of construction activities is not expected to be significant and can be managed with the establishment of a system for drainage. These potential impacts are **negative, direct, short-term** and **localized**, of **negligible significance** and **unlikely** to occur. Therefore, these are **Low Risks** of the project.

The physical disturbance and noise produced by equipment may impose additional stresses upon wildlife and may lead to increased migration away from impacted areas. While disturbances may be stressful for some wildlife, other species may easily adapt to and thrive successfully in the area owing to the phenomenon of habituation. These impacts are expected to be **negative, direct, short-term** and **localized**, of **negligible significance** and **likely** to occur. Therefore, these are **Low Risks** of the project.

During project construction, there could be the possibility of hydrocarbon contamination of the aquatic systems from accidental spills of lubricants and fuel and other contaminants. Hydrocarbons introduced into aquatic environments may change aquatic plant and animal growth, mortality and communities. Contaminants entering the aquatic systems could be ingested by aquatic organisms causing reproductive impairment, stunted growth, and other physiological effects. Also, as contaminants naturally break down, they use dissolved oxygen, sometimes significantly reducing the dissolved oxygen content of the water, which could reduce the overall habitat suitability for many aquatic organisms. However, these impacts can be managed with the implementation of a proper waste management measures. Potential impacts on aquatic species of hydrocarbon spills are **negative, direct, short-term** and **localized**, of **minor significance** and **unlikely** to occur. Therefore, these are **Low Risks** of the project.

The presence of workers may promulgate the presence of domestic and synanthropic species during the construction and operational phases. An increase in these species may affect native species by acting as predators, competitors and disease vectors. Synanthropic species such as mice and rats tend to increase due to the availability of food from workers camp. Predator and scavenger species may also be attracted to the site for fleeing or dead animals. These impacts are **negative, direct, short-term** and **localized**, of **negligible significance** and **unlikely** to occur as a result of project activities. Therefore, these are **Low Risks** of the project.



Large scale solar farms, of approximately 50MW, have the potential to deter, attract, or be imperceptible to individuals, all of which can lead to negative consequences during operations, including:

- Avoidance of solar facilities, which may lead to use of lower quality habitat or population fragmentation; and species attracted to solar facilities might be victims of ecological traps.
- Electromagnetic fields created by buried and aerial cables transporting energy can affect orientation of some organisms, impairing habitat use and likely causing additional physiological harm.
- Changes in albedo from vegetation removal could cause local increases in temperature and evapotranspiration, which may influence movement patterns, reproductive success, and survival.
- Species unable to detect or avoid structures (e.g., power lines, glass windows) are at risk of collision and direct mortality.<sup>62</sup>

The Mahdia Solar PV Power Plant is a small-scale facility and the potential impacts described above are not anticipated to occur. Alternatively, solar facilities may attract and provide high quality habitat for non-native or urban adapted species. Individuals might be attracted to these sites because of microclimatic conditions, cover and enhanced prey density, which could benefit species such as birds that can exploit solar facility structures for foraging, roosting or nesting. This potential impact is **positive, direct, short-term** and **localised**, of **negligible significance** and **unlikely** to occur. As such, this impact has a **Low Likelihood** of producing a **Beneficial Impact**.

## 6.4 Socio-Economic Resources

The project is expected to have both positive and negative socio-economic impacts during its planning, construction, and operation phases. The overall positive impacts include access to clean, cost-effective electricity, increased income and employment, and community development. If not properly managed or mitigated, negative impacts such as glare and traffic can affect nearby communities, road users, and other activities within the area. During the construction phase, the impacts may be regarded as temporary or short-term, while long-term impacts may be observed during the operation stage.

### 6.4.1 Land and Resource Use Conflicts

The original project site overlapped with lands being used by three occupants. The first occupant was erecting a permanent two-storey private residence, the second was engaged in small-scale commercial crop cultivation and had erected a temporary dwelling, and the third was residing in a temporary structure. The GEA and MPL engaged the GLSC to resurvey the project site so as to excise all overlapping land uses and prevent land use conflicts. The revised Survey Plan for the project site was issued by the GLSC in April 2021. This action entirely mitigated land use conflicts with the first occupant of the project site. A Letter of Agreement was subsequently signed with this Occupant indicating understanding of new boundaries of the project site (see Appendix G for a copy of the Letter of Agreement). By August 2021, the third occupant (referred to as Occupant 3 in Section 4.3.2) had voluntarily relocated and thus, there are no overlaps with these lands.

However, the dwellings and a portion of a farm used by Occupant 2 overlaps onto the site. The farmer has five active farming areas. The farm area which overlaps onto the project site is approaching harvesting time and the occupant practices shifting cultivation and does not replant in the same area for more than one harvest cycle. As such, the occupant has indicated a willingness to shift the farming activities out of the project boundary once harvesting is completed. The farmer has signed a Letter of Consent formalizing this arrangement (a copy of the Letter of Consent is in Appendix G). Moreover,

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<sup>62</sup> Chock, et al. 2020. Evaluating Potential Effects of Solar Power Facilities on Wildlife from an Animal Behaviour Perspective.

Occupant 2 had constructed a temporary dwelling structure which was determined to be located within the boundaries of the re-surveyed project site. Subsequently, the GEA also engaged Occupant 2 on the removal of these structures from the project site. The occupant agreed to be relocated but requested compensation to cover costs of clearing a new plot of land and constructing another structure. GEA has agreed to provide this compensation. GEA is also assisting the farmer in accessing the land for relocation, and has committed to have this process completed prior to the commencement of construction. A copy of the Letter of Consent to Remove Structures is presented in Appendix G. However, it should be noted that although the dwellings and farmlands falls within the project site, these are not located within the current footprint of the project. Potential impacts of land use conflicts with overlapping and nearby land users are considered **negative, direct, short-term** and **localized**, of **minor significance** and **unlikely** to occur. Therefore, these are **Low Risks** of the project.

Land use conflicts with other land uses are possible particularly with illegal artisanal and small-scale mining which proliferate the wider project area. Potential land use conflicts with unregulated mining activities can be prevented by fencing the project site. Given the measures which have been undertaken and which will be implemented as part of project activities, these potential impacts are considered **negative, direct, short-term** and **localized**, of **minor significance** and are expected to **rarely** to occur. Therefore, these are **Low Risks** of the project.

A section within one of the two small ravines, described as the small seasonal flow (SW 2) in Section 4.1.6.1, is used by the small-scale commercial farmer (referred to as Occupant 2 in Section 4.3.2) whose activities are based in proximity to the project site as the supplementary source of drinking water. However, use of this stream is seasonal since it dries out during the dry season. The farmer practices rainwater harvesting as the primary source of drinking water. The section of the ravine used by the farmer is located within the project site and fencing of the area will restrict the farmer's access to this resource thereby requiring the farmer to find an alternative source of water for drinking during the dry seasons when rainwater harvesting is not feasible. During an interview the farmer explained reliance on this section of the surface flow since other nearby flows are not considered to be of good quality for drinking. This has been the farmer's main source of drinking water for well over a decade. The paucity of alternate sources in proximity to the operation as well as the farmer's limited financial resources to either purchase water or find another source located further away presents a challenging circumstance. However, during recent engagement with the farmer she has indicated that she has access to a clean water source at alternate locations behind both her current farm and the solar farm site and also has access to water provided by GWI 5 minutes away from the farm (see Appendix D). Nevertheless, given that the farmer will be relocating farming and temporary dwelling structures from the vicinity of the project area, alternative sources of drinking water are not required. The potential impact of restricting the farmer's access to the main source of drinking water is **negative, direct, long-term, localised**, of **minor significance**. In light of the farmer's relocation from the area, this potential impact is considered **unlikely** to occur. As such, this is **Low Risk** of the project.

Approximately 0.94 of the 2-kilometer transmission line connecting the solar PV plant to the existing MPL facility in Mahdia will pass through the titled indigenous village of Campbelltown. Based on feedback during the stakeholder consultations, some sections of the central Campbelltown are already connected to the existing MPL grid and are electrified. Therefore, as discussed in Section 4.3.2.1, there are already transmission structures in place which could be used to support interconnection of the project site to MPL. In several instances, these structures are located within proximity to the residential and commercial structures in the village. Similarly, there are a few scattered residential and commercial land uses in proximity to the public road where new transmission structures will have to be constructed. No new transmission structures will be required in Mahdia.

Transmission infrastructure being installed within areas considered by residents to be their property may create conflicts between the Campbelltown community and the project. These impacts are expected to be **negative, direct, short-term** and **localised** of **moderate significance**. However,

direct interactions with occupied lands along the transmission route could be avoided given the small number of poles to be installed and by the spacing design of the poles (40 to 70 meters). In addition, the Campbelltown Village Council has formally issued a Letter of Approval for the project to utilize village lands for the construction of the transmission line, which is included in Appendix F. Recently, the Village Council and residents were fully briefed by the GEA at a public meeting held within the community on the proposed alignment of the transmission route and potential impacts (see Appendix D). With the implementation of management measures adverse impacts of situating the transmission line within titled indigenous lands will only **rarely** occur. Therefore, this is a **Low Risk** of the project, especially since no land acquisition, resettlement or displacement will occur.

#### **6.4.2 Economic Development**

The project has the potential to significantly contribute to the economic development of Mahdia and Campbelltown, the project's main beneficiary communities. The solar PV power plant will diversify the grid and make an additional, alternative source of power available to address the challenges associated with generator malfunction, fuel shortages and intermittent power supply which are current and historical challenges of power generation in Mahdia. In particular, when the solar PV power plant is operational, daily blackouts at noon and the associated voltage fluctuations accompanying repowering the grid are no longer expected to occur. Instead, power supply is expected to be uninterrupted throughout the day. A stable and reliable source of electricity is expected to contribute to encouraging greater investments in the local economy. With a stable source of electricity, increased numbers of small businesses could also emerge due to an increased population and spending power in the local economy.

These benefits may be magnified if the project can result in lower rates of electricity and if the existing MPL grid can be expanded to encompass currently unelectrified areas such as some areas of the Campbelltown village and the satellite community of Princeville. Indeed, most of the stakeholders engaged as part of the preparation of this ESAR shared expectations of reduced electricity rates particularly given that the existing rates are reported the highest in the country. Stakeholders also expect the existing MPL grid to be expanded to allow for greater provision of services. In particular, the Mahdia Town Council shared expectations that the grid will be expanded to the area where their new office building will be located as well as to extend to new housing scheme which will be developed in the vicinity of the airstrip. Moreover, the Campbelltown Village Council has been requesting electrification of areas of Campbelltown and Princeville for a few years but there has been no progress in this regard.

As such, stakeholder expectations of this project need to be carefully handled. Key stakeholders such as the RDC, Mahdia Mayor and Town Council and the Campbelltown Village Council should be informed of the expected LCOE when this is provided by the EPC contractor. In addition, these stakeholders should also be informed of the near- to medium-term plans for the expansion of the MPL grid as well as improvements to the provision of services which can be reasonably delivered by the project. Overall, the potential impacts of community development resulting from a stable source of power for local communities are **positive, direct, long-term and localised, of moderate significance and almost certain** to occur in Mahdia and some areas of Campbelltown but **unlikely** to occur for communities which are not currently part of MPL's grid. This is considered to result in a **Medium to High Likelihood** of positive impacts.

#### **6.4.3 Employment and Local Content**

Positive socio-economic impacts are expected to occur whenever a project of this magnitude and duration is undertaken in remote, hinterland communities, especially in remote communities, such as Mahdia and Campbelltown, where employment opportunities outside of the mining sector are limited. In particular, the project may provide opportunities for employment for vulnerable and marginalised

groups including women, youth and indigenous peoples. Income earned from employment with the project can play a role in improving welfare and the quality of life of employees and this positive effect will be amplified if vulnerable persons have the opportunities to be employed. In particular, the project will support the Women's Economic Empowerment Programme through which approximately 200 women in the three EMISDE project locations namely Bartica, Mahdia and Lethem are to be involved. The Programme will encourage its participants to become engaged in a productive use of electricity generated by the project thereby contributing to employment and community development. The potential impacts of project employment on local populations are **positive, direct, short- to long-term and local**. To the extent possible, the project will prioritise employment of persons from local communities during both the construction and operational phases. As such, these impacts are expected to be of **minor significance** and **almost certain** to occur. In this regard, project employment is considered to result in a **Medium Likelihood** of creating a **Beneficial Impact**.

As part of the EPC, the contractor will be required to provide training to staff on safety, best practices, and operation and maintenance of the solar power plant. The training will be provided on-site by a certified engineer after commissioning of the solar PV power plant. MPL has highlighted the need for capacity building of its personnel to manage the solar PV power plant. As such, the project will provide the opportunity for capacity building and skills development of MPL employees who will work at the solar plant. During the operational phase of the project, opportunities for training could encourage young people to seek employment with the project and to remain in Mahdia since a viable and skilled livelihood option is available within the township. Employees training by the EPC contractor may then provide training and knowledge sharing with other MPL employees. The potential impacts of providing training to the project workforce are **positive, direct, short- to long-term, and local**. If the project prioritizes local talent for employment, these impacts are expected to be of **moderate significance** and **almost certain** to occur. As such, project employment is considered to result in a **High Likelihood** of **Beneficial Impacts**.

In addition to local communities benefitting from direct employment with the project, there are several opportunities for the project to provide indirect employment and support local content. For example, construction materials, such as timber, could be sourced from local suppliers thereby supporting local businesses and providing indirect employment. The project is also expected to indirectly impact employment prospects for businesses that will provide goods and services to support the workforce including off-site accommodation, catering, and transport. Heavy equipment required for construction activities could be rented from local communities, such as renting an excavator from the Campbelltown Village Council, providing that such equipment is in good working condition. This not only provides additional opportunities for local communities to benefit from the project, but will also reduce costs required to transport construction materials, equipment and other goods and services from Georgetown. The potential impacts of indirect employment and procurement from local suppliers are **positive, direct, short- to long-term, and local**. If the project prioritizes local talent for employment, these impacts are expected to be of **moderate significance** and **almost certain** to occur. As such, project employment is considered to result in a **High Likelihood** of **Beneficial Impacts**.

#### **6.4.4 Aesthetics and Visual Impacts**

The construction phase will see a total transformation from the current setting and landscape of the proposed site. The elements associated with the project will have a visual impact and, in so doing, impact the landscape and potentially cause visual intrusion. Construction activities are expected to change the aesthetics of the project site as a result of clearance of vegetation, construction of buildings, power lines, worker presence and activity, dust emissions, and soil stockpiles. However, aesthetic impacts during project construction are temporary.

During the operation of the project, the solar panels will reflect sunlight and could become a distraction for motorists, aircraft and surrounding land users. The impact can be managed by careful

consideration of the position of solar PV panels so as to minimize visual disturbance while also maximizing power generation capacity. Solar PV panels with low reflectivity should also be utilised. Potential aesthetic and visual impacts of the project are **negative, direct, short- to long-term**, and **localised** of **minor significance**. Even with the implementation and mitigation measures, these impacts are **likely** to occur. As such, this is a **Medium Risk** of the project.

#### 6.4.5 Traffic

Traffic within the area, more so along the Bartica-Potaro Road in the vicinity of the project site is not significant. When the construction phase begins, there will be a marginal increase in traffic volumes, particularly of heavy vehicles used to transport equipment and construction materials to the project site. In addition, during the construction phase, the contractor may transport materials and equipment overland from Georgetown although these plans have to be determined. Given that these are laterite roads this may potentially result in related indirect impacts of deteriorating roads, increasing dust and noise levels, and safety risks. Potential impacts of increased traffic associated with project activities, particularly during the construction phase, are **negative, direct, short-term**, and possibly, **regional**. Given that information on potential traffic associated is entirely unknown, the magnitude of the impact and its associated risks are not assessed.

#### 6.4.6 Conflicts with Local Communities

The presence of non-local project workers during the construction phase could have a negative impact on these local communities, if not properly managed. Non-local workers could lead to bad relations particularly between the male workers when the females are shown increased attention that is perhaps unwanted. Interpersonal relationships with married persons could disrupt the community dynamic. There could also be cases of unwanted pregnancies particularly affecting the younger women of the community. The abuse of alcohol and other drugs can be detrimental to the community when introduced and encouraged by non-local workers. There could be an increase in the risk of transmission of sexual diseases with the migration of workers into the communities who will have purchasing power and can use that power to influence persons to engage in sexual practices. In addition, the presence of a non-local construction crew to the area can create security fears among local residents. Further, non-local workforce may be reluctant to comply with communities' rules and norms particularly for any workers entering the Campbelltown village for recreational purposes. Potential impacts of conflicts between locals and non-local project workers are **negative, direct, short- to long-term** and **localised**, of **moderate significance** but are **unlikely** to occur if appropriate management measures are put in place. As such, these are **Medium Risks** of project activities.

#### 6.4.7 Archaeological Resources

Even though the project site is not associated with any known archeological findings there is still the possibility of finds that may be of historical value to Guyana and the world at large. Therefore, if present within the area, artefacts can become damaged or lost as a result of certain activities, especially land clearing. As such, historical and cultural information on Guyana's early period could be permanently lost. However, the impacts could be entirely mitigated if appropriate chance find measures are implemented during the construction phase of the project. Potential impacts of loss or damage to archaeological resources during the construction phase are **negative, direct, long-term, regional**, of **moderate significance** but may **rarely** occur given the small footprint of the project and that no other archaeological resources are known to have been found in the area even though it is disturbed. As such, this presents **Low Risks**.

#### 6.5 Health and Safety



### 6.5.1 Occupational Health and Safety

Health and safety are key concerns at construction sites. Workers are usually exposed to situations which can result in serious accidents, some of which can be fatal, if an occupational health and safety system is not designed and properly communicated and enforced. Given the nature of this project, the occupational health and safety risks are most significant during the construction phase of the project including the establishment of the transmission and distribution system. The following are therefore possible health and safety risks which are likely to be encountered at the construction site:

- Sickness caused by the consumption of untreated water.
- Sickness caused by continuous exposure to excessive noise from heavy duty equipment.
- Injuries or death caused by the toppling of heavy-duty equipment and this is especially important for work being conducted on slopes.
- Injuries or death from vehicular collisions particularly project personnel travelling overland from Georgetown to Mahdia.
- Injuries from slips, trips and falls.
- Injuries or fatalities from electrocution.
- Ill health caused by insect bites/stings from hostile fauna.
- Injuries or death caused by snake bites.
- Injuries or ill health caused by heat-related illnesses such as sunburn, heat stress, heat exhaustion or heat stroke as a result of working under extremely hot conditions.
- Injuries or death caused by tree felling particularly along the northern boundary of the project site.
- Illness caused by malaria or other vector borne diseases.

While training and monitoring will be conducted and can reduce the risk of any serious incidents, accidents can still occur. Risks may include accidents during land clearing operations, transporting of materials, the use of heavy-duty equipment, improper use of equipment, slip or trip while traversing the work sites, etc. In such cases, these exposures can result in physical injuries such as cuts, bruises, loss of limbs or can even be fatal. Exposure to high noise or dust levels can also result in increased stress levels.

Construction works can lead to water lodging which increases the risk of mosquito borne diseases such as malaria and this risk is especially significant in Mahdia which is a hotspot for malaria given the active artisanal, small- and medium-scale gold mining industry that thrives in the location. Health and safety impacts could be exacerbated taking into consideration the access to immediate emergency and proper health care within the area since the District Hospital is not equipped to handle serious health cases and serious cases have to be referred to Georgetown. Potential impacts to workers health and safety are **negative, direct, short- to long-term** and **local**. These potential impacts are of **major significance** but can be largely avoided if appropriate mitigation measures are put in place and are therefore are **unlikely** to occur. This presents **Medium Risks** of the project.

### 6.5.2 Public Health and Safety

Given that the project site is located in a very accessible area along the public road and also has neighbouring land uses curiosity can draw persons closer to certain activities which presents serious danger and this particularly so for the children of the neighbours to the project site. As such, if the sites are not secured members of the public could get too close to the activities, creating a safety risk. Traffic increase will also be seen along the roadway as works intensify as construction materials and workers are sourced from nearby areas. Currently, traffic within the area is minimal. There is the risk of accidents occurring during both the construction and operation phases. Potential impacts to public health and safety are **negative, direct, short to long-term, local**, of **major significance** but are

**unlikely** to occur if appropriate measures are put in place. These potential impacts are therefore **Medium Risks** of the project.

### 6.5.3 COVID-19 Pandemic

The possibility of a COVID-19 outbreak remains high and as of April 2021, the number of cases continues to increase nationally. Nevertheless, it is recognized that this situation can only be partially managed by the project even if all measures are followed to prevent occupational spread, given that employees may engage in risky behaviours when not on duty. Interactions among employees coming from local communities and from other areas in Guyana, including Georgetown which is a hotspot for the virus, can put each other at risk of contracting and spreading the virus. When these employees return to their homes, they in turn put family members and local communities at risk of contracting the virus. Adverse health outcomes associated with the spread of COVID-19 are **negative, direct, long-term** and **regional**. These potential impacts are of **extreme significance** and are **unlikely** to occur if recommended public health measures are followed. This is considered to be a **High Risk** of the project.

## 6.6 Project Site Decommissioning

Based on feedback provided by the GEA, the project site is expected to continue to operate beyond the 20-year lifetime due to the interaction of several factors. National policies have prioritized the transition of power generation to renewable and other cleaner sources of energy. With the infrastructure in place to replace damaged or defunct plant components (PV panels, batteries and inverters), it is likely that investments will be made to ensure that the solar PV facility remains operational well beyond the stated 20-year time frame. Moreover, the GEA plans, in the near- to medium-term, to expand the solar PV farm to more than double the generation capacity of this planned phase. This expansion is also intended to last well beyond a 20-year project life. Anticipated enhancements to solar PV technology may further extend functional lifetimes of any components which are replaced either during or after the lifetime of the project. As a consequence, decommissioning of the solar PV plant is not anticipated to occur within the 20-year project lifetime. Instead, the positive benefits of power generation associated with the project is expected to continue beyond this time. These impacts are **positive, direct, long-term** and **localised** of **moderate significance** and **almost certain** to occur. As such, this impact has a **High Likelihood** of producing a **Beneficial Impact**. However, if the plant will be decommissioned the future use of the site will be determined by the Government and other stakeholders.

## 6.7 Cumulative Impacts

### 6.7.1 Energy Generation and Renewable Sources of Energy

In Guyana's Nationally Determined Contribution which was submitted to the United Nations Framework Convention on Climate Change (UNFCCC) in 2015, Guyana aspires to generate 100 percent of electricity from renewable sources by 2030. At the national level, the Mahdia Solar PV Power Plant will contribute to the total renewable energy already being generated from multiple projects including the EMISDE solar power projects in Bartica and Lethem, Hinterland Electrification Programme, the Green Public Sector Programme and the hydropower facility in Hosororo, Region 1 and the ongoing construction of the Kato Hydropower Project in Region 8. Other plans for developing renewable energy initiatives include the Amaila Falls Hydropower Programme which is also located in Region 8, the Ikuribisi Hydropower Project in Region 7 and the Kumu Hydropower Project in Region 9. The Government is also working to operationalize the solar farm in Mabaruma (Region 1) and to rehabilitate the Moco Mosco Hydropower Plant (Region 9). This impact is **positive, direct, long-term, cumulative, regional**, of **moderate significance** and **almost certain** to occur. As such, this impact has a **High Likelihood** of producing a **Beneficial Impact**.

### **6.7.2 Employment and Community Development**

As discussed above, the project is expected to contribute to the overall well-being of the township of Bartica and other small communities including Campbelltown by providing local employment and procurement of goods and services particularly during the construction phase of the project. Cheaper, more reliable and expanded electricity supply can also facilitate economic development and diversification with the local economy in Mahdia and Campbelltown when the facility becomes operational. These positive benefits of the project, in combination with existing commercial activities and livelihood activities in the gold mining sector in Mahdia and its environs will likely result in economic impacts that are **positive, direct, cumulative, regional, short- to long-term, of minor significance** and **certain** to occur. This impact therefore has a **Medium Likelihood** of producing **Beneficial Impacts**.

### **6.7.3 Vegetation Clearing**

The project site is situated within a landscape that has been significantly disturbed by anthropogenic activities. Most of the primary vegetation from the footprint of the project site was previously cleared so that land use transitioned from forested to lands used for agricultural purposes. Contiguous land areas within the Aol have also been significantly disturbed for either residential or agricultural purposes to the extent that none of these areas is considered forested. Within the wider project landscape, there is significant deforestation associated with the widespread proliferation of artisanal and small- to medium-scale mining activities. Vegetation clearing associated with project activities will contribute to the degraded and deforested state of lands within the Aol and the wider landscape. These impacts are **negative, direct, cumulative, local** and **short- to long-term**. Given the relatively small footprint of the project location and the significant degradation which has already occurred at the site, these impacts are of **negligible significance** but are **certain** to occur. As such, the cumulative clearing of vegetation for project activities are **Low Risks** of the project.

Please see Table 7-1 which provides a summary of the Potential Impacts of the Project along with the Management and Mitigation Measures.

## 7.0 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

The activities to be conducted for the implementation of the project, in particular the construction and operational phases, will be carried out in a manner which is in compliance with the legislation and guidelines outlined in Chapter 3. The project will also be required to comply with the terms and conditions of the Environmental Authorisation (Construction Permit) which was issued by the EPA, and the requirements of the GEA and MPL.

The potential impacts of the project are discussed in Chapter 6 and summarized in Table 7-1. For each impact the impact causing activities, including the phase in which the impact is likely to occur are stated, along with the impact types, likelihood of the impact occurring, the impact significance and the impact risks. Adverse impacts that pose a **Low to Medium Risk** based on the impact assessment do not require to be mitigated but require to be managed. Impacts to be mitigated are those which pose a **High to Critical Risk**. In such cases actions to avoid (remove or minimize the source of the impact by modifying project operations) or reduce (lessen the chances of adverse interaction between the project activities and receptions) the potential adverse impacts, mitigation and management measures are identified. These measures are presented in this Environmental and Social Management Plan (ESMP) and are grouped based on the environmental components.

This ESMP has been prepared to guide the project's activities by setting out measures and strategies to address the environmental issues related to the implementation of the project. Firstly, the ESMP identifies mitigation measures that would be considered during the construction phase to mitigate and manage potential impacts. The ESMP also identifies activities to be undertaken in an effort to mitigate the principal adverse effects of project operations and describes the way in which the main potential environmental and safety impacts of the project can be managed. The mitigation measures identified to prevent, minimize and manage the adverse impacts discussed in Chapter 6 are outlined. Further, the ESMP incorporates the measures recommended by the EPA outlined as conditions of the Construction Permit.

During the pre-construction phase the GEA will be responsible for ensuring that the measures required to establish the framework to minimise and prevent project risks and impacts are implemented. The contractor will be required to prepare a Construction Environmental and Social Management Plan (CESMP) which should address the measures outlined herein in greater detail and specific to the construction work programme and construction methods to be employed. The Contractor is expected to implement the CESMP during the construction phase of the project. For the operational phase MPL will be responsible for ensuring implementation of the mitigation and management measures.

### 7.1 Physical Resources

During the construction phase of the project there will be some activities which will affect the soil, as discussed in Chapter 6. These activities can contribute to soil erosion, loss of topsoil, compaction and pollution/contamination and which can be prevented or minimised if appropriate management measures are implemented. The measures outlined below would be implemented to reduce these impacts.

#### 7.1.1 Soils and Geology

##### 7.1.1.1 Erosion

The following measures should be implemented by the project to manage the risks of erosion during the construction and operational phases of the project:

- Implement the conditions outlined in Section 4 of the Construction Permit issued by the EPA.

- Soil disturbance should be limited to areas only where it is absolutely necessary.
- Movement of project equipment/vehicles should be reduced on the slope, where possible.
- Measures should be put in place to limit traffic on disturbed areas.
- Water flows should be controlled via adequate drainage systems at temporary work areas and runoff managed on exposed soils.
- A permanent system for drainage of the site should be established.
- Revegetating cleared areas with grass, including between the PV arrays, if possible, should be done.
- Weather patterns should be considered before initiating major earthworks. Earthworks should be avoided during periods of heavy rainfall.
- Material stockpiles and waste debris should be located at least 10 meters away from the drainage system.
- Material stockpiles should be kept to a minimum. Stockpiles may require berming to collect sediments from runoff during periods of heavy rainfall. Wooden or other material may be used to contain stockpiled material to prevent erosion.
- Excavated materials should be reused where possible. In general, excavated materials should not remain onsite for more than two weeks and be disposed of at sites approved by the Mahdia Mayor and Town Council.

#### 7.1.1.2 Changes in Topography

The following measures should be implemented to manage the potential impacts of topographical changes resulting from project activities during the construction phase of the project:

- Recontouring of excavated landscape to have minimum impact to runoff from precipitation.
- Engaging with the contractor to ensure that any topographical changes planned for this project will not adversely impact future use of the site for expansion of the solar PV power plant.

No measures for mitigation and management of topographical changes are required during project operations.

#### 7.1.1.3 Loss of Topsoil

The measures outlined below should be implemented to ensure that risks associated with loss of topsoil as a result of project activities are managed during the construction and operational phase of the project:

- Removal of topsoil before development of any area where topsoil would be destroyed.
- Engaging with regulatory authorities to determine whether some of the cleared topsoil may be provided to neighbouring land uses such as the farm, if these stakeholders are willing to accept this topsoil.
- Use cleared topsoil for landscaping of the project site.
- Avoid stockpiling topsoil on-site for use post-decommissioning of the project site.

#### 7.1.1.4 Compaction

The measures outlined below should be implemented to manage the risks associated with soil compaction and subsidence during the construction phase of the project:

- Ensure that heavy duty equipment only traverses on designated routes.
- Soils that have been compacted by heavy-duty equipment during transport of materials and also during site works should be scarified.
- Material stockpiles should be established on any impermeable surfaces, if practical.



- Traffic and movement of heavy-duty equipment over open areas should be restricted and controlled and damage to these areas should be repaired as soon as possible.
- Appropriate heavy-duty equipment should be utilised for all works.

No measures for mitigation and management of compaction are required during project operations.

### **7.1.2 Water Resources**

The following measures should be implemented to reduce the potential impacts of planned project activities pose to surface and ground water resources.

#### **7.1.2.1 Surface Water Flows**

To manage potential impacts to surface water flows a system for drainage of the site should be installed for site drainage particularly during the operational phase. Key considerations in designing the drainage system should include:

- Incorporating natural drainage features of the project site into the design of the drainage system. This may be considered as a means of limiting disturbance to the natural drainage features of the project landscape.
- Minimise any disturbance to the ravine.
- If the ravine located at the project site will be filled in, ensure that the drainage system is designed to accommodate surface water flows which would have been received by the ravine.
- Connect the site drainage system with any other proximate surface flow outside of the project footprint.

#### **7.1.2.2 Sedimentation**

The following measures should be implemented to manage the risks of sedimentation of surface water resources during project construction and operations:

- Implement the conditions outlined in Section 4 of the Construction Permit issued by the EPA.
- Cleared soils, where possible, should be distributed around the premises, provided to neighbouring land uses or removed from site for appropriate disposal.
- Where possible, storm water runoff should not be directly be discharged into the drainage system or streams. This can be channelled through a vegetated area. Vegetated lands acts as a filter, trapping any large solid particles before the water enters the stream, thus can contribute to reducing the level of sedimentation.
- Weather patterns should be considered during construction as heavy rainfall would increase sedimentation rates in areas where vegetation has been cleared.
- Material stockpiles and waste debris should be located at least 10 meters away from the drainage system.
- Revegetate all exposed and cleared surfaces where possible to prevent/minimise erosion due to runoff.
- Water quality monitoring of all discharge points and water bodies should be done during the construction phase.

#### **7.1.2.3 Contamination**

The following measures should be implemented to prevent contamination of surface and groundwater resources during the construction and operational phases:

- Implement the conditions outlined in Section 4 of the Construction Permit issued by the EPA.

- During construction fuel and other hazardous materials should be handled and stored in a manner to reduce spills and leaks, and to prevent contamination. Measures outlined in Section 7.1.4 should be complied with.
- All waste generated should be properly collected, stored and disposed. Measures outlined in Section 7.1.3 should be complied with.
- Water quality monitoring of all discharge points and water bodies should be done during the construction phase.

### **7.1.3 Waste Management**

Waste likely to be generated from the project includes construction waste and domestic garbage. Liquid waste will also be generated including wastewater from sanitary facilities and kitchen facilities during the construction phase if workers camp are established onsite. During the operational phase sewage waste will also be generated. Hazardous waste to be generated include used batteries (including lithium-ion batteries), waste oil, filters, oil containers, contaminated soils and damaged/decommissioned solar PV panels. If not managed properly, waste can result in soil and water contamination, contribute to ill health, and affect environmental aesthetics. The improper disposal of waste can result in malodours and attract vermin and other pests. Proper waste management is especially important as the proposed site is relatively undisturbed.

For each category of waste, the handling, storage and disposal measures varies. It is expected that the disposal frequency of each waste type will also vary, depending on rates of generation. No significant amount of waste should be allowed to accumulate onsite. Outlined below are various measures that should be implemented to properly dispose of waste associated with the project. Measures outlined in Section 6 of the Construction Permit issued by the EPA should also be complied with.

#### **7.1.3.1 Liquid Waste**

The following measures should be implemented to manage the liquid waste generated by the project during the construction and operational phases:

- Sewage will be generated from project activities during the construction and operational phases of the project. Adequate toilets should be provided based on the number of workers onsite.
- Portable toilets should be the first option considered by the Contractor to be used during the construction phase, if feasible. Alternatively, if there are no service providers of portable toilets in the area, pit latrines may be utilized. If pit latrines are to be utilized these should be the Ventilated Improved Type and constructed in accordance with the GNBS guidelines.
- Septic systems should be used during project operations and should be constructed a part of the permanent project infrastructure. The septic tanks should be constructed in accordance with GNBS guidelines. Septic tanks should be equipped with a filter bed and soak-away.
- Septic systems should be continuously monitored for signs of being filled to capacity. A qualified septic cleaning service should be hired to clean the tanks, as necessary.
- Pending availability of resources, the project may consider supporting upgrades of sanitary facilities used by neighbours to the project site.

#### **7.1.3.2 Solid Waste**

The following measures should be implemented to manage the solid wastes generated by the project during the construction and operational phases:

- Waste such as paper and cardboard, empty plastic bottles, cans, etc. should be collected via bins placed at strategic points around the construction zone and work areas. The bins should be emptied on a regular basis, or once filled.
- All construction waste should be consolidated and reused as much as possible. If it cannot be reused then it should be properly disposed of. Consideration should be given to making the materials available to neighbours at the project site as well as local communities, if requested. Construction waste should not be left in the open to litter the work areas where it can also pose a safety risk and should be disposed of within 30 days.
- Garbage should not be allowed to accumulate onsite and should be collected and disposed of at an area and in a manner approved by the Town Council.
- All workers should be made aware of the proper waste handling and disposal requirements and practices. This ensures that all are aware of how to dispose of the different types of wastes generated, therefore minimizing the impacts that may occur from improper disposal.
- Solid wastes associated with replacing damaged mounts (steel reinforcements, conduits and pipes, as well as timber and metal formwork) should be transported offsite for disposal at an appropriate facility or recycled for either on-site or off-site uses.

#### 7.1.3.3 Hazardous Waste

The following measures should be implemented to manage the hazardous wastes generated by the project during the construction and operational phases:

- Waste oil from servicing of machinery and vehicles should be collected and reused/disposed in a safe and acceptable manner. Waste oil drained from vehicles and machinery should be collected by pans and transferred to storage drums located in a designated area at least 100 meters away from waterways.
- No machinery or machine parts should be washed in any surface waterway. This measure ensures that any oily wastes do not contaminate surface water.
- Used vehicle batteries should not be disposed in the environment. These batteries should be collected and returned to the suppliers or provided to used batteries dealers approved by the EPA.
- Special provisions should be put in place to facilitate the disposal of used lithium-ion batteries, hazardous inverter components, as well as solar PV panels that have been damaged or broken if the Mahdia dumpsite cannot accept these waste streams.
  - Any hazardous plant components stored temporarily on-site should be kept in an enclosed and covered area on an impermeable surface pending off-site disposal.
  - Include considerations in the bidding documents for a supplier who has a proven track record of supporting and facilitating disposal or recycling of these components.
  - Explore opportunities for contracting a company operating in Guyana to support disposal or recycling of these panels. Several specialised waste disposal companies operating in Guyana to support the oil and gas industry (such as Tiger Rentals or the Integrated Waste Management Facility) may have these capabilities.
- Hazardous wastes listed above should not be stored at the project site for extended periods.

#### 7.1.4 Fuel, Lubricants and other Hazardous Materials

Special considerations should be made for the transportation, handling and storage of fuel and lubricants as these are classified as hazardous substances. To reduce the risks on the environment and human health, and to avoid contamination of the surface waterways, preventative actions should be taken and/or mitigation measures implemented. It is necessary to implement the following measures to prevent and or reduce the impacts on the environment, in particular, contamination of soil and water from leaks and spills during project construction:

- Implement the conditions outlined in Section 6 of the Construction Permit issued by the EPA.
- Only small quantities of fuel should be stored at the construction site. It should be stored within secondary containment and an area with an impermeable surface. Fuel storage areas should be sited at a safe distance from active work areas and should not be stored within 100 meters of any waterway.
- Efforts should be made to ensure the necessary preventative and response measures such as adequate signage and fire extinguishers and/or sand buckets are placed in and around the fuel storage areas.
- Fuel storage containers should be regularly monitored for leaks.
- When handling fuel, care would be taken to prevent spillage and leaks. All nozzles and hoses should be properly secured and stored away to avoid spills and/or accidents if these are utilised. Nozzles and hoses should be placed in a drip drum after use to prevent any spills from entering the environment and would be frequently inspected for leaks.
- Regular maintenance should be conducted to ensure the proper functioning of machines, equipment and vehicles to avoid unnecessary leaks.
- Spill kits should be made available in the event of spillages. The kits should be placed in strategic locations that are accessible to key personnel who should be trained in the proper use of these kits through the executions of drills.
- Training in proper fuel handling practices should be provided to all staff who are involved in this activity.

### **7.1.5 Climate Change**

The project may be affected by adverse impacts of climate change which can cause extreme precipitation events resulting in flooding, variable precipitation regimes and also increase ambient air temperatures. Fuel combustion associated with construction activities may also contribute to the emissions of greenhouse gases but the operation of the project will support climate change mitigation. The measures outlined below are intended to help to build resilience to adverse climate change impacts which may affect both the construction and operational phases, and also manage greenhouse gas emissions from project construction.

#### **7.1.5.1 Measures to Build Resilience to Precipitation Extremes and Variability**

The following measures should be implemented to build the resilience of the project to heavy rainfall resulting from adverse climate change impacts during the construction and operational phases of the project:

- Designing an internal drainage system that can accommodate maximum daily or monthly rainfall experienced in Mahdia, in addition to excess capacities to compensate for reduced absorptive capacities of newly impermeable areas as well as potential filling in of the ravine located on the project site.
- Ensuring that all drainage systems are fully functional.
- Ensuring that all mounting structures have suitable foundations to withstand temporary flooded or slushy conditions that may be prevailing on the project site.
- Establishing footpaths to allow easy and safe movement around the project site when conditions are slushy.
- The drainage system should be monitored periodically, such as on a weekly basis, to ensure that it is in good condition and free of any obstructions or debris.
- Subscribing to the Weather Bulletin prepared by the Hydrometeorological Department of the Ministry of Agriculture to stay abreast of national precipitation trends and forecasts.

#### **7.1.5.2 Measures to Build Resilience to Increased Temperatures**

The following measures should be implemented during the construction and operation phases to adapt and build resilience to adverse climate change impacts:

- Building awareness of the work force of the signs and symptoms of heat stresses and measures to bring relief.
- Developing an occupational safety and health protocol for the work force to follow during periods of high temperatures including access to emergency health care should it be required, such as in the event of a heat stroke.
- Establishing cool areas for rest for workers who work in hot conditions such as in heat generating equipment and machinery during both project construction and operations.

#### **7.1.5.3 Greenhouse Gas Emissions**

The management measures which could be implemented to address greenhouse gas emissions from construction activities include:

- Periodically schedule maintenance of all engines to maximize fuel efficiency.
- Monitoring and recording, on a continuous basis, the volume of fuel used by all combustion sources.

#### **7.1.7 Ambient Noise Levels**

Noise is not expected to be a significant environmental impact given that the main source of noise will be construction activities which are temporary and short-lived. However, there is still the need to implement measures to prevent and minimise noise, especially occupational exposure of noise as well as to manage potential risks to nearby receptors. Therefore, the following measures should be implemented to reduce the impacts of noise during the construction phase:

- Implement the conditions outlined in Section 3 of the Construction Permit issued by the EPA.
- Workers should be equipped with the necessary PPE including hearing protection for employees exposed to high noise levels: ear muffs and earplugs for employees who operate heavy-duty machines/equipment.
- Noisy activities should not occur in close proximity to proximate receptors during the night, on Sundays and on Holidays. It is not recommended to conduct any works after 18:00hrs and prior to 06:00hrs.
- Noise levels should be controlled at the source through installation of muffles on exhaust system.
- Noisy equipment such as generator should be sited away from receptors.
- The contractor should ensure that machinery and equipment are working efficiently.
- Periodic monitoring of noise levels should be conducted during the construction phase.

#### **7.1.8 Ambient Air Quality**

The measures outlined below would be implemented to manage risks associated with air pollution particularly the generation of particulate matter during soil disturbing activities and fuel combustion during the construction phase:

- Implement the conditions outlined in Section 3 of the Construction Permit issued by the EPA.
- Workers should be equipped with the necessary PPE to combat dust nuisance. Personnel working within dusty environments should be required to use dust masks and respirators as needed.



- During dry periods, it may be necessary to soak some areas of the construction zone and routes where vehicles and equipment traverse.
- Dry materials used for construction such as sand should not be stockpiled in close proximity to receptors such as site offices, workers break/lunch areas, and neighbouring properties.
- All vehicles transporting loose materials should be covered to minimize dust emissions.
- All mechanical equipment should be adequately maintained to reduce gaseous emissions.

## 7.2 Biological Resources

Measures to minimise or prevent impacts to flora and fauna of the project area are outlined below.

### 7.2.1 Vegetation

Impacts resulting from the loss of vegetation should be managed by the following measures during the construction phase:

- Vegetation clearing should be staged to minimise soil erosion and unwanted loss of vegetation cover, and that remnant vegetation should be preserved as much as is practical.
- Clearing should be conducted in a manner to maintain the aesthetics of the natural landscape and should be limited only to areas required for construction.
- Re-vegetation utilising native vegetation should be done where practical, particularly in areas susceptible to erosion.

No mitigation or management measures are required for vegetation clearing during the operational phase of the project.

### 7.2.2 Terrestrial and Aquatic Fauna

Impacts on terrestrial and aquatic fauna during construction and operational phases should be managed by implementing the following measures:

- Cover vegetation should be maintained in areas not earmarked for construction activities to enable wildlife present in the area to relocate to adjacent areas. Prior to land clearing, the project site should be thoroughly inspected for the presence of small animals, including herpetofauna, small mammals and nesting birds.
- Animals with reduced movement capabilities should be allowed to escape if encountered or captured and released using an appropriate capture and handling method specific to the animal to be relocated.
- Live capture should adhere to the following guidelines:
  - Live captured animals should be retained for brief periods (no more than a few hours) and or transported to the release location.
  - Live captured animals must be placed in appropriate holding cages, which can include live traps if those traps are provided with adequate ventilation, food, and a source of moisture, and if they encompass sufficient space with appropriate padding and bedding to ensure the comfort of the captive animal.
  - Live traps also should be positioned to permit drainage of urine produced by the captive animals.
  - For injured animals care must always be taken to ensure that any additional stress to which the casualty is exposed is minimized, that no further injury is sustained and that the animal is secure from escape. At the same time precautions must also be taken to ensure that both handlers and the public are protected from any potential injury. The injured animal should be transported to a rehabilitation site, for example, the Guyana Zoological Park, or a veterinary practice.
  - While being transported, captured animals should be provided with adequate food,

sources of moisture (e.g., moist fruits, if water is not a practical option), and an appropriate environment for thermoregulation.

- Animals in transport should never be subjected to thermal environments that exceed their limits of tolerance.
  - Cages for transporting mammals should be kept out of the sun, wind, and precipitation and at a comfortable temperature. Captives should be checked frequently.
  - Live caught animals must be released only at the sites with similar habitat characteristics to where they were captured.
  - Animals should be released as soon as possible after capture to minimize behavioral or physiological stresses resulting from the conditions of captivity, or immigration of replacement individuals.
  - Consideration should be given to releasing animals at times coincident with their normal daily and seasonal activity patterns.
  - Persons dealing with wild-caught animals in the field should work under the assumption that the animals they are handling pose some risk to their health and safety. The risk can be substantially reduced by common sense and good personal hygiene (e.g., wash hands often with soap and water).
  - Handlers should endeavor to minimize the chances of being bitten or scratched (e.g., wear leather or fabric gloves) and should use latex gloves to avoid unnecessary exposure to blood or other body fluids and feces, which may contain parasites or pathogens that affect humans.
  - Handlers who work with carnivores or bats should be careful to avoid being bitten and should be immunized against rabies and should maintain up-to-date tetanus immunizations.
- Land clearing should be conducted, to the extent practical, outside the nesting period of the animals identified onsite.
  - Waste storage and disposal should be undertaken according to best practices (see Section 7.1.3).
  - Measures to manage risks of erosion and sedimentation outlined in Sections 7.1.1.1 and 7.1.2.2 of this ESMP should be fully implemented.
  - Vegetation cover should be maintained on site to the extent practical so as to maintain existing habitats.
  - Water quality of receiving water bodies within project impacted areas should be monitored to ensure ecologically acceptable turbidity, nutrient and sediment levels are maintained during construction.

### 7.3 Socio-Economic Resources

The measures outlined below should be implemented to manage negative impacts and to promote the positive impacts of the project.

#### 7.3.1 Land and Resource Use

The following measures should be implemented to manage risks associated with land use conflicts during the construction phase:

- The farmer currently occupying portions of the property should be relocated prior to the commencement of construction. The farmer should also be allowed to reap all crops prior to the commencement of construction. Adequate notice should be given in this regard.
- Fence the boundaries of the property and erect appropriate signage so as to prevent occupation of any section of the project site.
- Unauthorized locals should be restricted from entering the premises.

- All staff should be informed and educated to avoid direct confrontation with any other land users or neighbours and to report all issues relating to such matters to the site manager.
- Re-engage neighbours to the project site, following the finalization of the lease, to inform them of the boundaries of the site.
- Design spacing of the transmission structures to avoid direct interactions between any residential, commercial or other land users located along the transmission line route.
- Obtain guidance from the Village Council on the extent of the right-of-way (ROW) which should be observed within village lands.
- Obtain guidance from the MoPW on the extent of the ROW for the sections of the Bartica-Potaro Road on which transmission structures may have to be installed.

### **7.3.2 Conflict Management**

The measures outlined below should be implemented by the contractor and operator of the solar PV power plant to manage any potential conflicts arising as a result of project activities during both the construction and operational phases of the project.

#### **7.3.2.1 Conflict Prevention**

To prevent any conflicts during construction the following should be implemented:

- Potential affected parties should be informed of the details of the project and be engaged in discussions on possible measures to reduce the negative impacts prior to commencing construction.
- The relevant authorities should be notified of any emerging problems and the contractor should work with the local authorities to address any issues.

#### **7.3.2.2 Code of Conduct for Workers**

A Code of Conduct for workers should be prepared to guide the behaviour of workers onsite particularly during project construction. The Code of Conduct should make the following provisions:

- Compliance with applicable laws, rules, and regulations.
- Compliance with applicable health and safety requirements (including wearing prescribed personal protective equipment, preventing avoidable accidents and a duty to report conditions or practices that pose a safety hazard or threaten the environment).
- The prohibition of the use of illegal substances.
- Sexual harassment (for example to prohibit use of language or behavior, in particular towards women or children, that is inappropriate, harassing, abusive, sexually provocative, demeaning or culturally inappropriate).
- Violence or exploitation (for example the prohibition of the exchange of money, employment, goods, or services for sex, including sexual favors or other forms of humiliating, degrading or exploitative behavior).
- Protection of children (including prohibitions against abuse, defilement, or otherwise unacceptable behavior with children, limiting interactions with children, and ensuring their safety in the project area).
- Sanitation requirements (for example, to ensure workers use specified sanitary facilities provided by the contractor and not open areas).
- Avoidance of conflicts of interest (such that benefits, contracts, or employment, or any sort of preferential treatment or favours, are not provided to any person with whom there is a financial, family, or personal connection).
- Respecting reasonable work instructions (including regarding environmental and social norms).

- Protection and proper use of property (for example, to prohibit theft, carelessness or waste).
- Duty to report violations of the Code.
- Non retaliation against workers who report violations of the Code.
- Respecting the rules, norms, customs and practices of the nearby indigenous community.

### **7.3.2.3 Conflict Resolution (Grievance Mechanism)**

All stakeholders who believe aspects of project construction or operations are likely to have a detrimental impact on their organisation, community, day to day activities, the environment, or on their quality of life should be able to communicate their grievances. These grievances should be documented, analysed and responded to efficiently. Stakeholders should also be able to submit comments and suggestions that they feel will increase the benefits of the project and reduce or mitigate any adverse impacts.

It is envisaged that any potential grievances arising from the construction activities will be localised. As such, to ensure that the process is effective, a site level mechanism to address such grievances should be put in place.

The grievance mechanism should be coordinated by the contractor during the construction phase and by MPL during operations with the support of a Stakeholder Engagement Plan. These Parties are the respective points of contact to receive complaints and work to address all grievances in a timely, effective and satisfactory manner, and to foster positive engagement when issues arise. Information on the grievance mechanism, including contact person and contact information should be shared with stakeholders, including the schools' administration, in particular the nearby community through notices. These can be posted at the site and at public places within the community.

#### **Grievance Mechanism During Project Construction**

The following is an outline of actions that should be taken once grievances resulting from the execution of construction works is received:

- The contractor should inform the GEA that a grievance has been received.
- The contractor and environmental personnel from the GEA should investigate reported grievances to determine the cause for the grievance.
- It should then be determined whether the grievance can be resolved by the contractor and the GEA or whether authorities with regulatory or other responsibilities and relevant skills are to be consulted or engaged.
- Or it should be determined whether corrective action must be taken by the contractor and what those actions are.
- The contractor should prepare a grievance report, including supporting materials such as photographs. If necessary, a clear list of tasks and outcomes expected should be developed.
- If a grievance is the fault of the contractor, then the contractor should implement corrective actions immediately.
- The contractor should conduct follow-up inspection to monitor the situation and determine whether the issue is likely to recur and to put measures in place to prevent recurrence.

A register of grievances received should be maintained by the contractor and should include information such as date of complaint, by whom, nature of grievance, date investigated and by whom, validity and corrective action required, timeline for implementation of corrective action, and if the grievance was satisfactorily addressed or not. A review on the status of grievances received/addressed should be conducted by the GEA upon conclusion of the project.

GEA should request that the Campbelltown Village Council act as the channel for presented grievances villagers experience during project construction. The Council should also be requested to publicly inform villagers of this mechanism for grievance reporting at a forum which features representation from the GEA. Notes of this meeting should be documented by the GEA.

### **Grievance Mechanism During Project Operations**

During the operational phase of the project, the grievance mechanism should be managed by MPL. The following actions should be followed once a grievance related to project operations is received:

- The grievance should be documented by MPL.
- MPL should investigate the reported grievance so as to determine the cause for the grievance.
- Based on the findings of the investigation, MPL should identify corrective measures to be taken.
- MPL should prepare a grievance report, including supporting materials such as photographs. If necessary, a clear list of tasks and outcomes expected should be developed.
- If any support for grievance resolution is required of any regulatory body, MPL engage such institutions by providing the grievance report along with a formal request for support in grievance resolution.
- MPL should follow-up to monitor the situation so as to determine whether the grievance was satisfactorily resolved.
- MPL should put measures in place to prevent the recurrence of such a grievance.

A register of grievances received should be maintained by MPL and should include information such as date of complaint, by whom, nature of grievance, date investigated and by whom, validity and corrective action required, timeline for implementation of corrective action, and if the grievance was satisfactorily addressed or not.

MPL should request that the Campbelltown Village Council act as the channel for presented grievances villages experience during the operational phase of the project. The Council should inform also be requested to publicly inform villagers of this mechanism for grievance reporting at a forum which features representation from the MPL. Notes of this meeting should be documented by MPL.

### ***7.3.3 Employment and Community Development***

Although the project is anticipated to contribute positively to employment and community development, some measures can be implemented to enhance the positive effect of all phases of the project. These measures include:

- The contractor should prioritise employment opportunities for persons residing in surrounding communities such as Mahdia and Campbelltown.
- The possibilities of employing women should also be explored and considered during all phases of the project, so as to ensure that there are opportunities for both genders.
- The contractor should support local content through local procurement. This may include purchasing of agricultural products, poultry, other meats, and fish from the surrounding communities. This may also include rentals of required equipment and machinery, if in good working condition and available locally.
- Wages offered to local staff should be in keeping with Guyana's labour laws or higher set standards which should be competitive in all categories of workers.
- Local workers should work for standard working hours (an eight-hour work day) and be fairly remunerated.



### **7.3.4 Aesthetics and Visual Impacts**

The following measures should be implemented to manage risks of aesthetics and visual impacts of the project:

- Examine options for positioning of solar PV arrays so as to maximize power generation capacity while minimizing visual distractions for motorists and project site neighbours.
- Limit vegetation clearing only to areas where it is necessary.
- Remove all construction waste from the site within 30 days of generation.
- Ensure that the contractor properly demobilized from the site at the end of the construction period. This should include removal of all of the contractor's buildings, materials, waste, and equipment. Landscaping and restoration of disturbed areas should also be done, including the contractor's stockpile and staging areas.

### **7.3.5 Traffic**

Although the extent of the potential impact on the project was not assessed, the following measures should be implemented to manage the risks associated with project traffic particularly during the construction phase:

- Journey Risk Management Plans should be developed and implemented prior to the transporting of large equipment or materials during the construction phase.
- All drivers and operators must be licensed in accordance with the Laws of Guyana and have the requisite experience and training.
- First Aid Kits with the requisite drugs and equipment to cater to emergencies or occurrences should be available in all vehicles.
- Drivers should be instructed to observe and respect all traffic and warning signs along the various roadways and to maintain all required speed limits.
- Appropriate safety signage should be posted leading up to the entrance of the construction site.
- All light and heavy-duty equipment and vehicles should be properly maintained and in good working condition so as to comply with the national road fitness/safety requirements and manufacturer's safety recommendation.
- Passengers should not be permitted on mobile equipment unless they are being trained to operate the machine or are required to ride on it as an unavoidable part of their duties, provided it is safe to do so.

### **7.3.6 Stakeholder Engagements**

Stakeholder engagement is essential for the project and should be fully integrated into the various stages of the process. To achieve this the following measures should be considered particularly during the construction phase through a dedicated Stakeholder Engagement Plan which will complement the grievance mechanism:

- GEA and MPL should engage with local stakeholders including the Mahdia Municipality, RDC Region 8 and the Campbelltown Village Council prior to the commencement of works to provide information about the proposed works, employment opportunities, and health and safety measures. These stakeholders should also be made aware of the simple LCOE estimated by the contractor and the opportunities for expanding the MPL grid under the project.
- All engagements with indigenous peoples should adhere to the principles of FPIC.
- Updates of progress of the operations should be periodically provided to the local authorities, if required.

- Messages from the project relating to possible employment and other opportunities should be posted or distributed in local communities thereby ensuring that all interested persons, including vulnerable groups like women and young people who are willing to work are aware. This should also include opportunities to participate in the Women's Economic Empowerment Programme.

### **7.3.7 Archaeological Finds**

The following procedure should be followed during project construction in the event that archaeological materials or site is discovered within the project area:

- All activities in the immediate vicinity of the remains should cease immediately.
- The find location should be recorded, and all remains left in place.
- The contractor should inform the GEA who should then inform and the National Trust of Guyana of the find.
- The National Trust of Guyana should coordinate with the relevant personnel to determine the significance of the findings and assess appropriate mitigative options.
- If the significance of the remains is judged to be sufficient enough to warrant further actions which cannot be avoided, the GEA, in collaboration with the National Trust of Guyana, should determine the appropriate course of such action.
- Relocation of the artefacts for preservation and security reasons may be determined as an appropriate action.
- In the case of human remains, the appropriate authority should be contacted. In addition, a coroner and/or physical anthropologist may be involved if the remains are classified as an artefact. Options for removal and burial should be considered if the location must be disturbed.
- The National Trust of Guyana should inform the GEA of when work may recommence in the specific area.

In addition, to effectively safeguard potential archaeological finds, GEA should also ensure that the contractor provides training to employees on identifying and protecting finds by causing limited disruption and damage to archaeological materials, if found.

## **7.4 Health and Safety**

Measures should be recommended to protect the health and safety of workers as well members of the public, as is outlined below.

### **7.4.1 Occupational Health and Safety**

The contractor should be required to comply with provisions of Guyana's Occupational Health and Safety Act and as such, implement measures to comply so as to ensure a safe and healthy environment for all of its staff and other land and road users. The following measures should be considered. However, the project should not be limited to these measures alone as there may be others that can also be implemented:

- The contractor should have an Occupational Health and Safety Policy which should be used to guide all mobilization, construction and demobilization works. This policy should be well known to all staff and posted where it can be easily accessible.
- The contractor should have a permanent Health and Safety Officer on site, or at least designate a senior member of staff with that responsibility. Given the challenges in accessing emergency health care services in Mahdia, this individual should have training and experience in First Aid and CPR. The Health and Safety Officer should conduct daily routine checks to all active construction sites and equipment so as to ensure that all safety measures are fully in

place. Checks should be guided by a simple to use checklist form. Operational areas are also to be monitored to ensure compliance with all health and safety requirements and that good health and safety practices are maintained throughout every aspect of the construction.

- A Job Safety Analysis (JSA) should be conducted for jobs that are determined to be of high risk to safety and health.
- A vehicle should be permanently available on site to be used for all emergency cases. This vehicle should be regularly serviced and be kept in a good working condition at all time.
- The contractor should establish or have in place arrangements with the Mahdia District Hospital for any emergency cases and medi-vac.
- A Health and Safety Committee should be established and meet on a monthly basis to review health and safety performance and discuss measures for improvements. This Committee should include at least one member from the GEA.
- All staff should undergo an induction exercise on occupational health and safety and regular training programmes on safe practices and proper handling of equipment and machinery.
- Workers operating certain equipment and conducting risky tasks should be provided with specialized training and proper skills set to allow for efficient and safe utilization of vehicles and machinery.
- All employees should be properly oriented to safety and health practices consistent with the construction activities.
- All workers should be provided with the necessary protective gear and attire (gloves, respirators, hard hats, high visibility vests, protective glasses, long boots and safety boots) as required. Employees required to work in the rain should be provided with wet weather gear.
- All employees should be required to wear safety equipment and protective clothing provided in designated areas. Employees not wearing prescribed safety clothing and associated equipment in an area where the use of such is mandatory should be required to leave such designated area and should be subject to disciplinary action.
- Smoking should not be permitted anywhere in or near the fuel storage areas or in any other designated non-smoking area.
- First Aid Kits with the requisite drugs and equipment to cater to emergencies or occurrences should be available.
- Workers should be trained to use emergency response equipment such as fire extinguishers and first aid equipment.
- Prescribed COVID-19 measures should be implemented and followed so as to avoid an outbreak among workers, which can eventually spread to nearby communities. Guidelines prepared specially for construction sites such as those by PAHO should be utilized for guidance.
- Appropriate safety signage should be posted throughout the construction site and along the roadways, particularly during the installation of the transmission line.
- Potable water should be provided for all employees, thus reducing the possibility of water borne diseases.
- All vehicles and equipment should comply with the traffic rules while traversing the main road.
- An Emergency Response Plan should be prepared as part of the CESMP and made available to all relevant personnel and the necessary training and resources required should be provided.

#### **7.4.2 Public Health and Safety**

The following are measures which can be implemented to minimize harm to both project personnel as well as the general public:

- The project site should be secured to prevent access to unauthorized personnel, especially those who are visiting out of curiosity and children.

- Members of the community should be engaged prior to the commencement of works and made aware of the risks presented by the works and the precautionary measures with which they should abide.
- Vehicles passing through communities should not exceed the stipulated speed limit and drivers should exercise extreme caution.
- All vehicles should be in a full functional state prior to its use on the roadways, and within and outside of the project area.
- Advance warning signs should be posted along the roadway during the installation of the transmission line. Equipment and materials kept along the roadway should be clearly demarcated, including at nights. There should be no encumbrance of the roadway.
- All drivers and operators should be employed based on their experience working in similar terrain and should be provided with further training, particularly in road safety practices.
- Drivers should be instructed to stop and park along open roads during periods of high rainfall and poor visibility, especially when transporting heavy materials.
- Trucks should at no time carry more materials than their rated carrying capacity.

### 7.5 Emergency Response

The contractor is required to prepare an Emergency Response Plan (ERP) as part of the CESMP. The ERP should outline protocols for responding to environmental emergencies that may occur as a result of unforeseeable circumstances such as a spill of hazardous materials, accidents or medical emergencies. The ERP should describe the general types of emergency and actions to be followed should an emergency occur during the mobilization and operational phases of the project and should include:

- Emergency Contact Details
- Emergency Procedures
- Authority of Control
- Emergency Response Equipment
- Scenario Description and Response
- Incident Reporting.

All personnel should be aware of potential risks and take steps to cope with hazards in their work area. In addition, all personnel are expected to alert the correct personnel if they discover an accident, medical emergency, fire or spill. As such, the ERP should also outline the role of the various personnel in emergency response. The types of emergencies to be covered by the ERP should include fuel and other hazardous material spills, accidents to workers, traffic accidents, fire, etc.

The ERP should consider the remoteness of the project site and the limitations in terms of access and services available and should outline practical measures to respond to the various types of emergencies occurring at the project location.

The EPC contractor and MPL should collaboratively develop an Emergency Response Plan for the solar PV plant when it is operational.

### 7.6 Summary of Impacts and Management and Mitigation Measures

The following Table provides the Impact Summary Table along with the Management and Mitigation Measures.

**Table 7-1: Impact Summary and Management and Mitigation Measures**

Project Phase	Anticipated Impact	Impact Assessment			Impact Risk	Management and Mitigation Measures
		Type	Significance	Likelihood		
Physical Resources						
Soils and Geology						
Construction and Operation	Erosion from vegetation clearing and soil disturbing activities and stormwater runoff	Negative, Direct, Short-Term, Localised	Negligible	Likely	Low	<ul style="list-style-type: none"><li>▪ Soil disturbance should be limited to areas only where it is absolutely necessary.</li><li>▪ Movement of project equipment/vehicles should be reduced on the slope, where possible.</li><li>▪ Measures should be put in place to limit traffic on disturbed areas.</li><li>▪ Water flows should be controlled via adequate drainage systems at temporary work areas and runoff managed on exposed soils.</li><li>▪ A permanent system for drainage of the site should be established.</li><li>▪ Revegetating cleared areas with grass, including between the PV arrays, if possible should be done.</li><li>▪ Weather patterns should be considered before initiating major earthworks. Earthworks should be avoided during periods of heavy rainfall.</li><li>▪ Material stockpiles and waste debris should be located at least 10 meters away from the drainage system.</li><li>▪ Material stockpiles should be kept to a minimum. Stockpiles may require berming to collect sediments from runoff during periods of heavy rainfall. Wooden or other material may be used to contain stockpiled material to prevent erosion.</li><li>▪ Excavated materials should be reused, where possible. In general, excavated materials should not remain onsite for more than two weeks and be disposed of at sites approved by the Mahdia Mayor and Town Council.</li></ul>
Construction	Changes in topography from site preparation activities	Negative, Direct, Long-Term, Localised	Minor	Likely	Medium	<ul style="list-style-type: none"><li>▪ Recontouring of excavated landscape to have minimum impact to runoff from precipitation.</li><li>▪ Engaging with the contractor to ensure that any topographical changes planned for this project will not adversely impact future use of the site for expansion of the solar PV power plant.</li></ul>
Construction	Loss of topsoil from vegetation clearing and soil disturbing	Negative, Direct, Long-Term, Localised	Negligible	Unlikely	Low	<ul style="list-style-type: none"><li>▪ Removal of topsoil before development of any area where topsoil would be destroyed.</li><li>▪ Engaging with regulatory authorities to determine whether some of the cleared topsoil may be provided to neighbouring land uses such as the farm, if these stakeholders are willing to accept this topsoil.</li><li>▪ Use cleared topsoil for landscaping of the project site.</li></ul>



Project Phase	Anticipated Impact	Impact Assessment			Impact Risk	Management and Mitigation Measures
		Type	Significance	Likelihood		
	activities such as excavation					<ul style="list-style-type: none"> <li>Avoid stockpiling topsoil on-site for use post-decommissioning of the project site.</li> </ul>
Construction	Compaction of soils due to traversing of heavy machinery during project construction	Negative, Direct, Short-Term, Localised	Negligible	Certain	Low	<ul style="list-style-type: none"> <li>Ensure that heavy duty equipment only traverses on designated routes.</li> <li>Soils that have been compacted by heavy-duty equipment during transport of materials and also during site works should be scarified.</li> <li>Material stockpiles should be established on any impermeable surfaces, if practical.</li> <li>Traffic and movement of heavy-duty equipment over open areas should be restricted and controlled and damage to these areas should be repaired as soon as possible.</li> <li>Appropriate heavy-duty equipment should be utilised for all works.</li> </ul>
Construction and Operation	Contamination or pollution of soils from improper management of general and hazardous wastes and hazardous materials particularly during project construction	Negative, Direct, Long-Term, Localised	Moderate	Unlikely	Medium	<p>The following measures cover Liquid Waste, Solid Waste, Hazardous Waste Fuel, Lubricants and other Hazardous Materials:</p> <ul style="list-style-type: none"> <li>Sewage will be generated from project activities during the construction and operational phases of the project. Adequate toilets should be provided based on the number of workers onsite.</li> <li>Portable toilets should be the first option considered by the contractor to be used during the construction phase, if feasible. Alternatively, if there are no service providers of portable toilets in the area, pit latrines may be utilized. If pit latrines are to be utilized these should be the Ventilated Improved Type and constructed in accordance with GNBS guidelines.</li> <li>Septic systems should be used during project operations and should be constructed a part of the permanent project infrastructure. The septic tanks should be constructed in accordance with GNBS guidelines. Septic tanks should be equipped with a filter bed and soak-away.</li> <li>Septic systems should be continuously monitored for signs of being filled to capacity. A qualified septic cleaning service should be hired to clean the tanks, as necessary.</li> <li>Pending availability of resources, the project may consider supporting upgrades of sanitary facilities used by neighbours to the project site.</li> <li>Waste such as paper and cardboard, empty plastic bottles, cans, etc. should be collected via bins placed at strategic points around the construction zone and work areas. The bins should be emptied on a regular basis, or once filled.</li> <li>All construction waste should be consolidated and reused as much as possible. If it cannot be reused then it should be properly disposed of. Consideration should be given to making the materials available to neighbours to the project site as well as local</li> </ul>

Project Phase	Anticipated Impact	Impact Assessment			Impact Risk	Management and Mitigation Measures
		Type	Significance	Likelihood		
						<p>communities, if requested. Construction waste should not be left in the open to litter the work areas and should be disposed of within 30 days.</p> <ul style="list-style-type: none"> <li>▪ Garbage should not be allowed to accumulate onsite and should be collected and disposed of at an area and in a manner approved by the Town Council.</li> <li>▪ All workers should be made aware of the proper waste handling and disposal requirements and practices. This ensures that all are aware of how to dispose of the different types of wastes generated, therefore minimizing the impacts that may occur from improper disposal.</li> <li>▪ Solid wastes associated with replacing damaged mounts (steel reinforcements, conduits and pipes, as well as timber and metal formwork) should be transported offsite disposal at an appropriate facility or recycled for either on-site or off-site uses.</li> <li>▪ Waste oil from servicing of machinery and vehicles should be collected and reused/disposed in a safe and acceptable manner. Waste oil drained from vehicles and machinery should be collected by pans and transferred to storage drums located in a designated area at least 100 meters away from waterways.</li> <li>▪ No machinery or machine parts should be washed in any surface waterway. This measure ensures that any oily wastes do not contaminate surface water.</li> <li>▪ Used vehicle batteries should not be disposed in the environment. These batteries should be collected and returned to the suppliers or provided to used batteries dealers approved by the EPA.</li> <li>▪ Special provisions should be put in place to facilitate the disposal of used lithium-ion batteries, hazardous inverter components, as well as solar PV panels that have been damaged or broken if the Mahdia dumpsite cannot accept these waste streams. <ul style="list-style-type: none"> <li>○ Any hazardous plant components stored temporarily on-site should be kept in a enclosed and covered area on an impermeable surface pending off-site disposal.</li> <li>○ Include considerations in the bidding documents for a supplier who has a proven track record of supporting or facilitating disposal or recycling of these components.</li> <li>○ Explore opportunities for contracting a company operating in Guyana to support disposal or recycling of these panels. Several specialised waste disposal companies operating in Guyana to support the oil and gas sector (such as Tiger Rentals or the Integrated Waste Management Facility) may have these capabilities.</li> </ul> </li> </ul>

Project Phase	Anticipated Impact	Impact Assessment			Impact Risk	Management and Mitigation Measures
		Type	Significance	Likelihood		
						<ul style="list-style-type: none"> <li>▪ Hazardous wastes listed above should not be stored at the project site for extended periods.</li> <li>▪ Only small quantities of fuel should be stored at the construction site. It should be stored within secondary containment and within an area with an impermeable surface. Fuel storage areas should be sited at a safe distance from active work areas and should not be stored within 100 meters of any waterway.</li> <li>▪ Efforts should be made to ensure the necessary preventative and response measures such as adequate signage, fire extinguishers and/or sand buckets are placed in and around the fuel storage areas.</li> <li>▪ Fuel storage containers should be regularly monitored for leaks.</li> <li>▪ When handling fuel, care should be taken to prevent spillage and leaks. All nozzles and hoses should be properly secured and stored away to avoid spills and/or accidents if utilised. Nozzles and hoses should be placed in a drip drum after use to prevent any spills from entering the environment and should be frequently inspected for leaks.</li> <li>▪ Regular maintenance should be conducted to ensure the proper functioning of machines, equipment and vehicles to avoid unnecessary leaks.</li> <li>▪ Spill kits should be made available in the event of spillages. The kits should be placed in strategic locations that are accessible to key personnel who should be trained in the proper use of these kits through the executions of drills.</li> <li>▪ Training in proper fuel handling practices should be provided to all staff involved in that activity.</li> </ul>
<b>Water Resources</b>						
Construction	Alterations of surface flow of ravines within the project site	Negative, Direct, Long-Term, Localised	Minor	Likely	Medium	<ul style="list-style-type: none"> <li>▪ Establish a system for drainage of the site. Key considerations in designing the drainage system include: <ul style="list-style-type: none"> <li>○ Incorporating natural drainage features of the project site into the design of the drainage system. This may be considered as a means of limiting disturbance to the natural drainage features of the project landscape.</li> <li>○ Minimise any disturbance to the ravine.</li> <li>○ If the ravine located in the project site will be filled in, ensure that the drainage system is designed to accommodate surface water flows which would have been received by the ravine.</li> <li>○ Connect the site drainage system with any other proximate surface flow outside of the project footprint.</li> </ul> </li> </ul>

Project Phase	Anticipated Impact	Impact Assessment			Impact Risk	Management and Mitigation Measures
		Type	Significance	Likelihood		
Construction	Sedimentation of nearby waterways as a result of increased erosion from vegetation clearing and soil disturbance	Negative, Direct, Short-Term, Localised	Negligible	Likely	Low	<ul style="list-style-type: none"> <li>Cleared soils, where possible, should be distributed around the premises, provided to neighbouring land uses or removed from site for appropriate disposal.</li> <li>Where possible, storm water runoff should not be directly be discharged into the drainage system or streams. This can be channelled through a vegetated area. Vegetated lands acts as a filter, trapping any large solid particles before the water enters the stream, thus can contribute to reducing the level of sedimentation.</li> <li>Weather patterns should be considered during construction as heavy rainfall would increase sedimentation rates in areas where vegetation has been cleared.</li> <li>Material stockpiles and waste debris should be located at least 10 meters away from the drainage system.</li> <li>Revegetate all exposed and cleared surfaces where possible to prevent/minimise erosion due to runoff.</li> <li>Water quality monitoring of all discharge points and water bodies should be done during the construction phase.</li> </ul>
Construction and Operation	Contamination or pollution of surface and ground water from improper management of waste or hazardous materials particularly during project construction	Negative, Direct, Long-Term, Localised	Moderate	Unlikely	Medium	The same measures to address the possible contamination or pollution of soils apply here and which cover Liquid Waste, Solid Waste, Hazardous Waste Fuel, Lubricants and other Hazardous Materials.
<b>Climate Change</b>						
Operations	Heavy rainfall events resulting in flooded or slushy conditions on-site	Negative, Direct, Short-Term, Localised	Minor	Unlikely	Low Risks to the project	<p>The following measures should be implemented to build the resilience of the project to adverse climate change impacts:</p> <ul style="list-style-type: none"> <li>Designing an internal drainage system that can accommodate maximum daily or monthly rainfall experienced in Mahdia in addition to excess capacities to compensate</li> </ul>

Project Phase	Anticipated Impact	Impact Assessment			Impact Risk	Management and Mitigation Measures
		Type	Significance	Likelihood		
Operations	Variable rainfall patterns result in dry season conditions with expected increases in shortwave radiation	Positive, Direct, Short-Term, Localised	Negligible	N/A	N/A	<p>for reduced absorptive capacities of newly impermeable areas as well as potential filling in of the ravine located on the project site.</p> <ul style="list-style-type: none"> <li>Ensuring that all drainage systems are fully functional.</li> <li>Ensuring that all mounting structures have suitable foundations to withstand temporary flooded or slushy conditions that may be prevailing on the project site.</li> <li>Establishing footpaths to allow easy and safe movement around the project site when conditions are slushy.</li> <li>The drainage system should be monitored periodically, such as on weekly basis, to ensure that it is in good condition and free of any obstructions or debris.</li> <li>Subscribing to the Weather Bulletin prepared by the Hydrometeorological Department of the Ministry of Agriculture to stay abreast of national precipitation trends and forecasts.</li> </ul>
Construction and Operations	Increased temperatures result in heat related illnesses among project workforce	Negative, Short-Term, Localised	Minor	Almost Certain	Medium Risks <u>to</u> the Project	<p>The following measures should be implemented to build resilience to increased temperatures:</p> <ul style="list-style-type: none"> <li>Building awareness of the work force of the signs and symptoms of heat stresses and measures to bring relief.</li> <li>Developing an occupational safety and health protocol for the work force to follow during periods of high temperatures including access to emergency health care should it be required, such as in the event of a heat stroke.</li> <li>Establishing cool areas for rest for workers who work in hot conditions such as in heat generating equipment and machinery during both project construction and operations.</li> </ul>
Construction	Greenhouse gas emissions from fuel combustion during the construction phase	Negative, Direct, Long-Term, Localised	Negligible	Certain	Low	<p>The following could be implemented to address greenhouse gas emissions from construction activities:</p> <ul style="list-style-type: none"> <li>Periodically schedule maintenance of all engines to maximize fuel efficiency.</li> <li>Monitoring and recording, on a continuous basis, the volume of fuel used by all combustion sources.</li> </ul>
Operations	Climate change mitigation from offsets of diesel combustion for power generation	Positive, Direct, Long-Term, Regional	Moderate	Certain	High Likelihood of Beneficial Impact	Measures Not Required



Project Phase	Anticipated Impact	Impact Assessment			Impact Risk	Management and Mitigation Measures
		Type	Significance	Likelihood		
	and fuel transportation					
Ambient Noise Levels						
Construction	Occupational ambient noise levels during the construction period	Negative, Direct, Short-Term, Localised	Moderate	Rare	Low	<ul style="list-style-type: none"><li>Workers should be equipped with the necessary PPE including hearing protection for employees exposed to high noise levels: earmuffs and earplugs for employees who operate heavy-duty machines/equipment.</li><li>Noisy activities should not occur in close proximity to proximate receptors during the night, on Sundays and on Holidays. It is not recommended to conduct any works after 18:00hrs and prior to 06:00hrs.</li><li>Noise levels should be controlled at the source through installation of muffles on exhaust system.</li><li>Noisy equipment such as generator should be sited away from receptors.</li><li>The contractor should ensure that machinery and equipment are working efficiently.</li><li>Periodic monitoring of noise levels should be conducted during the construction phase.</li></ul>
Construction	Environmental receptors exposed to high noise levels	Negative, Direct, Short-Term, Localised	Minor	Unlikely	Low	
Ambient Air Quality						
Construction	Occupational and environmental exposure to emissions of particulate matter (dust) and emissions from fuel combustion	Negative, Direct, Short-Term, Localised	Minor	Unlikely	Low	<ul style="list-style-type: none"><li>Workers should be equipped with the necessary PPE to combat dust nuisance. Personnel working within dusty environments should be required to use dust masks and respirators if needed.</li><li>During dry periods, it may be necessary to soak some areas of the construction zone and routes where vehicles and equipment traverse.</li><li>Dry materials used for construction such as sand should not be stockpiled in close proximity to receptors such as site offices, workers break/lunch areas, and neighbouring properties.</li><li>All vehicles transporting loose materials should be covered to minimize dust emissions.</li></ul>

Project Phase	Anticipated Impact	Impact Assessment			Impact Risk	Management and Mitigation Measures
		Type	Significance	Likelihood		
						<ul style="list-style-type: none"> <li>All mechanical equipment should be adequately maintained to reduce gaseous emissions.</li> </ul>
<b>Biological Resources</b>						
<b>Vegetation</b>						
Design	Limited vegetation clearing to conduct site surveys and waste disposal onsite	Negative, Direct, Short-Term, Localised	Negligible	Certain	Low	<ul style="list-style-type: none"> <li>Vegetation clearing should be staged to minimise soil erosion and unwanted loss of vegetation cover, and that remnant vegetation should be preserved as much as is practical.</li> <li>Clearing should be conducted in a manner to maintain the aesthetics of the natural landscape and should be limited only to areas required for construction.</li> <li>Re-vegetation utilising native vegetation should be done where practical, particularly in areas susceptible to erosion.</li> </ul>
Construction	Deforestation intensifies habitat fragmentation at the project site	Negative, Direct, Long-Term, Localised	Minor	Likely	Medium	
Construction	Loss of vegetation cover and habitat shelter for resident fauna	Negative, Direct, Long-Term, Localised	Negligible	Likely	Low	
Construction	Vegetation loss may deplete soil nutrients and hinder plant regeneration	Negative, Direct, Short-Term, Localised	Negligible	Likely	Low	
Construction	Increased sedimentation of water bodies as a result of deforestation contributes to eutrophication	Negative, Direct, Short-Term, Localised	Negligible	Unlikely	Low	

Project Phase	Anticipated Impact	Impact Assessment			Impact Risk	Management and Mitigation Measures
		Type	Significance	Likelihood		
Terrestrial and Aquatic Fauna						
Construction	Habitat loss and displacement of terrestrial fauna	Negative, Direct, Long-Term, Localised	Minor	Likely	Medium	<ul style="list-style-type: none"><li>▪ Cover vegetation should be maintained in areas not earmarked for construction activities to enable wildlife present in the area to relocate to adjacent areas.</li><li>▪ Prior to land clearing, the project site should be thoroughly inspected by a biologist for the presence of small animals, including herpetofauna, small mammals and nesting birds.</li><li>▪ Animals with reduced movement capabilities should be allowed to escape if encountered or captured and released using an appropriate capture and handling method specific to the animal to be relocated.</li><li>▪ Live capture should adhere to the following guidelines:<ul style="list-style-type: none"><li>○ Live captured animals should be retained for brief periods (no more than a few hours) and or transported to the release location.</li><li>○ Live captured animals must be placed in appropriate holding cages, which can include live traps if those traps are provided with adequate ventilation, food, and a source of moisture. and if they encompass sufficient space with appropriate padding and bedding to ensure the comfort of the captive animal.</li><li>○ Live traps also should be positioned to permit drainage of urine produced by the captive animals.</li><li>○ For injured animals care must always be taken to ensure that any additional stress to which the casualty is exposed is minimized, that no further injury is sustained and that the animal is secure from escape. At the same time precautions must also be taken to ensure that both handlers and the public are protected from any potential injury. The injured animal should be transported to a rehabilitation site, for example, the Guyana Zoological Park, or a veterinary practice.</li><li>○ While being transported, captured animals should be provided with adequate food, sources of moisture (e.g., moist fruits, if water is not a practical option), and an appropriate environment for thermoregulation.</li><li>○ Animals in transport should never be subjected to thermal environments that exceed their limits of tolerance.</li><li>○ Cages for transporting mammals should be kept out of the sun, wind, and precipitation and at a comfortable temperature. Captives should be checked frequently.</li></ul></li></ul>
Construction	Increased sedimentation of water bodies contributes to altered aquatic habitats	Negative, Direct, Short-Term, Localised	Negligible	Unlikely	Low	
Construction	Physical noise during project construction leads to stress and/or migration of some species	Negative, Direct, Short-Term, Localised	Negligible	Likely	Low	
Construction	Contamination or pollution of surface waters from hydrocarbon spills contributes to oxygen depletion and reduces habitat suitability for some species	Negative, Direct, Short-Term, Localised	Minor	Unlikely	Low	
Construction and Operation	Presence of workers promulgate the presence of domestic and	Negative, Direct, Short-Term, Localised	Negligible	Unlikely	Low	

Project Phase	Anticipated Impact	Impact Assessment			Impact Risk	Management and Mitigation Measures
		Type	Significance	Likelihood		
	synanthropic species					
Operation	Project infrastructure attract individuals and provide opportunities for foraging, roosting or nesting	Positive, Direct, Short-Term, Localised	Negligible	Unlikely	Low Likelihood of Beneficial Impact	<ul style="list-style-type: none"> <li>○ Live caught animals must be released only at the sites with similar habitat characteristics to where they were captured.</li> <li>○ Animals should be released as soon as possible after capture to minimize behavioral or physiological stresses resulting from the conditions of captivity, or immigration of replacement individuals.</li> <li>○ Consideration should be given to releasing animals at times coincident with their normal daily and seasonal activity patterns.</li> <li>○ Persons dealing with wild-caught animals in the field should work under the assumption that the animals they are handling pose some risk to their health and safety. The risk can be substantially reduced by common sense and good personal hygiene (e.g., wash hands often with soap and water).</li> <li>○ Handlers should endeavor to minimize the chances of being bitten or scratched (e.g., wear leather or fabric gloves) and should use latex gloves to avoid unnecessary exposure to blood or other body fluids and feces, which may contain parasites or pathogens that affect humans.</li> <li>○ Handlers who work with carnivores or bats should be careful to avoid being bitten and should be immunized against rabies and should maintain up-to-date tetanus immunizations.</li> <li>▪ Land clearing should be conducted, to the extent practical, outside the nesting period of the animals identified onsite.</li> <li>▪ Waste storage and disposal should be undertaken according to best practices (see Section 7.1.3).</li> <li>▪ Measures to manage risks of erosion and sedimentation outlined in Sections 7.1.1.1 and 7.1.2.2 of this ESMP should be fully implemented.</li> <li>▪ Vegetation cover should maintained on site to the extent practical, so as to maintain any existing habitats.</li> <li>▪ Water quality of receiving water bodies within project impacted areas should be monitored to ensure ecologically acceptable turbidity, nutrient and sediment levels are maintained during construction.</li> </ul>

Project Phase	Anticipated Impact	Impact Assessment			Impact Risk	Management and Mitigation Measures
		Type	Significance	Likelihood		
Socio-Economic Resources						
Land Use						
Construction and Operation	Land use conflicts with overlapping land users, neighbours to project site or unregulated activities	Negative, Direct, Short-Term, Localised	Minor	Unlikely	Low	<p>The following measures should be implemented to manage risks associated with land use conflicts:</p> <ul style="list-style-type: none"><li>▪ The farmer occupying portions of the property should be allowed to relocate the farm prior to the commencement of construction. She should also be allowed to reap all crops prior to the commencement of construction. Adequate notice should be given in this regard.</li><li>▪ Fence the boundaries of the property and erect appropriate signage so as to prevent occupation of any section of the project site. This should clearly state that any occupation is illegal and new occupiers must relocate at their own expense and are not eligible for project support.</li><li>▪ Unauthorized locals should be restricted from entering the premises.</li><li>▪ All staff should be informed and educated to avoid direct confrontation with any other land users or neighbours and to report all issues relating to such matters to the site manager.</li><li>▪ Re-engage neighbours to the project site, following the finalization of the lease, to inform them of the boundaries of the site.</li><li>▪ Design spacing of the transmission structures to avoid direct interactions between any residential, commercial or other land users located along the transmission line route.</li><li>▪ Obtain guidance from the Village Council on the extent of the right-of-way (ROW) which should be observed within village lands.</li><li>▪ Obtain a formal letter of ‘No-Objection’ from the Campbelltown Village Council on the use of village lands for establishment of a section of the transmission line prior to the commencement of construction works. The ‘No-Objection’ letter should clearly state that the Village has been informed of the proposed activities, the potential negative impacts associated with these activities and the measures which will be put in place to manage these impacts.</li><li>▪ Obtain guidance from the MoPW on the extent of the ROW for the sections of the Bartica-Potaro Road on which transmission structures may have to be installed.</li></ul> <p>The following measures should be put in place for conflict management:</p>
Construction and Operation	Resource use conflict with neighbouring farmer over drinking water source	Negative, Direct, Long-Term, Localised	Minor	Unlikely	Low	
Construction and Operation	Conflicts with members of the Campbelltown indigenous village related to the construction and maintenance of the transmission line	Negative, Direct, Long-Term, Localised	Moderate	Rare	Low	



Project Phase	Anticipated Impact	Impact Assessment			Impact Risk	Management and Mitigation Measures
		Type	Significance	Likelihood		
						<ul style="list-style-type: none"> <li>Potential affected parties should be informed of the details of the project and be engaged in discussions on possible measures to reduce the negative impacts prior to commencing construction.</li> <li>The relevant authorities should be notified of any emerging problems and the contractor should work with the local authorities to address any issues.</li> <li>Developing a Code of Conduct for Workers</li> <li>A Stakeholder Engagement Plan and Grievance Redress Mechanism is implemented for both the construction and operational phases of the project.</li> <li>The Campbelltown Village Council should be requested to act as one of the available channels for presented grievances villagers experience during project construction. The Council should also be requested to publicly inform villagers of this mechanism for grievance reporting at a forum which features representation from the GEA.</li> </ul>
<b>Economic Development</b>						
Construction and Operation	Project encourages investment due to stable source of power and new businesses emerge	Positive, Direct, Long-term, Localised	Moderate	Almost Certain (Mahdia and Campbelltown)  Unlikely (Currently unelectrified areas)	Medium to High Likelihood of Beneficial Impact	Measures Not Required
<b>Employment and Local Content</b>						
Construction and Operation	Employment of local populations including vulnerable groups such as indigenous	Positive, Direct, Short to Long Term, Local	Minor	Almost Certain	Medium Likelihood of a Beneficial Impact	<p>To enhance the positive benefits, the following measures should be implemented:</p> <ul style="list-style-type: none"> <li>The Contractor should have a contractual obligation to provide employment opportunities for persons residing in surrounding communities.</li> <li>The possibilities of employing women should be explored and considered during all phases of the project, so as to ensure that there are opportunities for both genders.</li> </ul>

Project Phase	Anticipated Impact	Impact Assessment			Impact Risk	Management and Mitigation Measures
		Type	Significance	Likelihood		
	people, women and youth					<ul style="list-style-type: none"> <li>The Contractor should be encouraged to promote the development of emerging businesses through local procurement. This may include purchasing of agricultural products, poultry, other meats, and fish from the surrounding communities.</li> <li>Wages offered to local staff should be in keeping with Guyana's labour laws or higher set standards which will be competitive in all categories of workers. Local workers should work for standard working hours (an eight-hour workday) and should not be underpaid.</li> </ul>
Construction and Operation	EPC contractor providing training to employees	Positive, Direct, Short to Long Term, Local	Moderate	Almost Certain	High Likelihood of a Beneficial Impact	
Construction and Operation	Local procurement of goods, services and other materials/Equipment	Positive, Direct, Short to Long Term, Local	Moderate	Almost Certain	High Likelihood of a Beneficial Impact	Measures Not Required
<b>Aesthetics and Visual Impacts</b>						
Construction and Operation	Site clearing, stockpiling and PV arrays change aesthetics and cause distractions	Negative, Direct, Short to Long Term, Localised	Minor	Likely	Medium	<ul style="list-style-type: none"> <li>Examine options for positioning of solar PV arrays so as to maximize power generation capacity while minimizing visual distractions for motorists and project site neighbours.</li> <li>Limit vegetation clearing only to areas where it is necessary.</li> <li>Remove all construction waste from the site within 30 days of generation.</li> <li>Ensure that the contractor properly demobilized from the site at the end of the construction period. This should include removal of all of the contractor's buildings, materials, waste, and equipment. Landscaping and restoration of disturbed areas should also be done, including the contractor's stockpile and staging areas.</li> </ul>
<b>Traffic</b>						
Construction	Increased traffic associated with transportation of construction materials and other items	Negative, Direct, Short-Term, Regional	Not assessed	Not assessed	Not assessed	<ul style="list-style-type: none"> <li>Journey Risk Management Plans should be developed and implemented prior to the transporting of large equipment or materials during the construction phase.</li> <li>All drivers and operators must be licensed in accordance with the Laws of Guyana and have the requisite experience and training.</li> <li>First Aid Kits with the requisite drugs and equipment to cater to emergencies or occurrences should be available in all vehicles.</li> <li>Drivers should be instructed to observe and respect all traffic and warning signs along the various roadways and to maintain all required speed limits.</li> <li>Appropriate safety signage should be posted leading up to the entrance of the construction site.</li> </ul>

Project Phase	Anticipated Impact	Impact Assessment			Impact Risk	Management and Mitigation Measures
		Type	Significance	Likelihood		
						<ul style="list-style-type: none"> <li>All light and heavy-duty equipment and vehicles should be properly maintained and in good working condition so as to comply with the national road fitness/safety requirements and manufacturer's safety recommendation.</li> <li>Passengers should not be permitted on mobile equipment unless they are being trained to operate the machine or are required to ride on it as an unavoidable part of their duties, provided it is safe to do so.</li> </ul>
<b>Archaeological Resources</b>						
Construction	Archaeological resources are lost or damaged during project construction	Negative, Direct, Long-Term, Regional	Moderate	Rare	Low	<ul style="list-style-type: none"> <li>All activities in the immediate vicinity of the remains should cease immediately.</li> <li>The find location should be recorded, and all remains left in place.</li> <li>The contractor should inform the GEA who should then inform and the National Trust of Guyana of the find.</li> <li>The National Trust of Guyana should coordinate with the relevant personnel to determine the significance of the findings and assess appropriate mitigative options.</li> <li>If the significance of the remains is judged to be sufficient enough to warrant further actions which cannot be avoided, the GEA, in collaboration with the National Trust of Guyana, should determine the appropriate course of such action.</li> <li>Relocation of the artefacts for preservation and security reasons may be determined as an appropriate action.</li> <li>In the case of human remains, the appropriate authority should be contacted. In addition, a coroner and/or physical anthropologist may be involved if the remains are classified as an artefact. Options for removal and burial should be considered if the location must be disturbed.</li> <li>The National Trust of Guyana should inform the GEA of when work may recommence in the specific area.</li> </ul>
<b>Health and Safety</b>						
Construction and Operation	Project activities, particularly during the construction phase, increase risks to workers health and safety	Negative, Direct, Short- to Long-Term, Local	Major	Unlikely	Medium	<ul style="list-style-type: none"> <li>The contractor should have an Occupational Health and Safety Policy which should be used to guide all mobilization, construction and demobilization works. This policy should be well known to all staff and posted where it can be easily accessible.</li> <li>The contractor should have a permanent Health and Safety Officer on site. Given the challenges in accessing emergency health care services in Mahdia, this individual should have training and experience in First Aid and CPR. The Health and Safety Officer should conduct daily routine checks to all active construction sites and</li> </ul>

Project Phase	Anticipated Impact	Impact Assessment			Impact Risk	Management and Mitigation Measures
		Type	Significance	Likelihood		
						<p>equipment so as to ensure that all safety measures are fully in place. Checks should be guided by a simple to use checklist form. Operational areas are also to be monitored to ensure compliance with all health and safety requirements and that good health and safety practices are maintained throughout every aspect of the construction.</p> <ul style="list-style-type: none"> <li>▪ A Job Safety Analysis (JSA) should be conducted for jobs that are determined to be of high risk to safety and health.</li> <li>▪ A vehicle should be permanently available on site to be used for all emergency cases. This vehicle should be regularly serviced and be kept in a good working condition at all time.</li> <li>▪ The Contractor should establish or have in place arrangements with the Mahdia District Hospital for any emergency cases and medi-vac.</li> <li>▪ A Health and Safety Committee should be established and meet on a monthly basis to review health and safety performance and discuss measures for improvements. This Committee should include at least one member from the GEA.</li> <li>▪ All staff should undergo an induction exercise on occupational health and safety and regular training programmes on safe practices and proper handling of equipment and machinery.</li> <li>▪ Workers operating certain equipment and conducting risky tasks should be provided with specialized training and proper skills set to allow for efficient and safe utilization of vehicles and machinery.</li> <li>▪ All employees should be properly oriented to safety and health practices consistent with the construction activities.</li> <li>▪ All workers should be provided with the necessary protective gear and attire (gloves, respirators, hard hats, high visibility vests, protective glasses, long boots and safety boots) as required. Employees required to work in the rain should be provided with wet weather gear.</li> <li>▪ All employees should be required to wear safety equipment and protective clothing provided in designated areas. Employees not wearing prescribed safety clothing and associated equipment in an area where the use of such is mandatory should be required to leave such designated area and should be subject to disciplinary action.</li> <li>▪ Smoking should not be permitted anywhere in or near the fuel storage areas or in any other designated non-smoking area.</li> <li>▪ First Aid Kits with the requisite drugs and equipment to cater to emergencies or occurrences should be available.</li> </ul>

Project Phase	Anticipated Impact	Impact Assessment			Impact Risk	Management and Mitigation Measures
		Type	Significance	Likelihood		
						<ul style="list-style-type: none"> <li>Workers should be trained to use emergency response equipment such as fire extinguishers and first aid equipment.</li> <li>Prescribed COVID-19 measures should be implemented and followed so as to avoid an outbreak among workers, which can eventually spread to nearby communities. Guidelines prepared specially for construction sites such as those by PAHO should be utilized for guidance.</li> <li>Appropriate safety signage should be posted throughout the construction site and along the roadways, particularly during the installation of the transmission line.</li> <li>Potable water should be provided for all employees, thus reducing the possibility of water borne diseases.</li> <li>All vehicles and equipment should comply with the traffic rules while traversing the main road.</li> <li>An Emergency Response Plan should be prepared as part of the CESMP and made available to all relevant personnel and the necessary training and resources required should be provided.</li> </ul>
Construction and Operation	Project activities, particularly during the construction phase, increase risks to public health and safety	Negative, Direct, Short to Long Term, Local	Major	Unlikely	Medium	<ul style="list-style-type: none"> <li>The project site should be secured to prevent access to unauthorized personnel, especially those who are visiting out of curiosity and children.</li> <li>Members of the community should be engaged prior to the commencement of works and made aware of the risks presented by the works and the precautionary measures with which they should abide.</li> <li>Vehicles passing through communities should not exceed the stipulated speed limit and drivers should exercise extreme caution.</li> <li>All vehicles should be in a full functional state prior to its use on the roadways, and within and outside of the project area.</li> <li>Advance warning signs should be posted along the roadway during the installation of the transmission line. Equipment and materials kept along the roadway should be clearly demarcated, including at nights. There should be no encumbrance of the roadway.</li> <li>All drivers and operators should be employed based on their experience working in similar terrain and should be provided with further training, particularly in road safety practices.</li> <li>Drivers should be instructed to stop and park along open roads during periods of high rainfall and poor visibility, especially when transporting heavy materials.</li> <li>Trucks should at no time carry more materials than their rated carrying capacity.</li> </ul>



Project Phase	Anticipated Impact	Impact Assessment			Impact Risk	Management and Mitigation Measures
		Type	Significance	Likelihood		
Construction and Operation	Project workforce and local communities are at risk of transmission of the COVID-19 virus	Negative, Direct, Long-Term, Regional	Extreme	Likely	High	<ul style="list-style-type: none"> <li>All project workers should be vaccinated. Prescribed COVID-19 measures should be implemented and followed so as to avoid an outbreak among workers, which can eventually spread to nearby communities. Guidelines prepared specially for construction sites such as those by PAHO should be utilized for guidance.</li> </ul>
<b>Decommissioning</b>						
Decommissioning	Project is not decommissioned following stated 20-year project lifetime	Positive, Direct, Long-term, Localised	Moderate	Almost Certain	High Likelihood of a Beneficial Impact	Measures Not Required.
<b>Cumulative Impacts</b>						
<b>Energy Generation and Renewable Sources of Energy</b>						
Operation	Contribution to national targets to generate 100 percent of electricity from renewable sources	Positive, Direct, Long-Term, Cumulative, Regional	Moderate	Almost Certain	High Likelihood of a Beneficial Impact	Measures Not Required
<b>Employment</b>						
Construction and Operation	The project contributes to employment in local communities and Region 8	Positive, Direct, Short-Term, Cumulative, Regional	Minor	Certain	Medium Likelihood of a Beneficial Impact	Measures Not Required
<b>Vegetation Clearing</b>						
Construction	The project further contributes to	Negative, Direct, Long-Term,	Negligible	Certain	Low	See Measures under Biological Resources (Vegetation)

Project Phase	Anticipated Impact	Impact Assessment			Impact Risk	Management and Mitigation Measures
		Type	Significance	Likelihood		
	degradation and deforestation within the Aol and wider project landscape	Cumulative, Local				

## 8.0 IMPLEMENTATION FRAMEWORK

### 8.1 Introduction

This chapter provides the framework for the implementation of the ESMP outlined in Chapter 7. The Implementation Framework aims to ensure that the project complies with the relevant policies, legislation and guidelines detailed in Chapter 3 and the requirements of the EPA's Construction Permit.

### 8.2 Roles and Responsibilities

The Mahdia Solar PV Power Plant Project is being implemented through an Engineering, Procurement, Construction (EPC) approach for the Installation, Commissioning and Turn-key Delivery of a solar PV power plant, including battery energy storage system. As part of the EPC approach, the project will be publicly tendered and a contractor will be procured for the activities comprising the EPC. The GEA is envisaged to provide technical oversight and supervision of the design-build aspect of the project. MPL, under supervision of HECL, will be the operator for the project. The EPC contractor will be required to provide technical support on the operation of the solar PV power plant for a one-year period after which the project will be fully handed over to the HECL. To ensure the environmental and social management measures are implemented GEA and the contractor will have major roles to play.

The roles and responsibilities are outlined below.

#### GEA

The project is being executed by the GEA on behalf of the Ministry of Public Works. The GEA's role is to provide technical oversight and provide supervision to the contractor. An integral element of this role is to ensure that the environmental and social requirements are fulfilled.

During the construction/installation phase, the GEA will have oversight of the contractor's activities so as to ensure that all recommended environmental and social measures are implemented. The GEA will also lead monitoring and reporting based on the requirements outlined the EPA's Construction Permit, those outlined in the ESMP and those of the IDB. To effectively executive this mandate, the GEA should assign dedicated personnel to fulfill the role of Environmental and Social Officer whose responsibilities of ensuring compliance with the environmental, social, health and safety requirements. Specific responsibility of the Environmental and Social Officer should include but not be limited to the following:

- Review of the contractor's CESMP to ensure it is compliant with the EPA's Construction Permit, requirements of IDB's safeguards and the provisions of this ESAR.
- Approve the contractor's CESMP.
- Conduct routine inspection of construction activities for compliance with the CESMP.
- Conduct environmental and social monitoring of key parameters.
- Prepare Monthly Inspection Reports on environmental compliance by the contractor and which should include recommendations for corrective actions for any non-compliances observed.
- Engage with the contractor on a continuous basis to ensure any recommended corrective actions are implemented.
- Participate in stakeholder engagements and outreach to key stakeholders.
- Ensure the views of stakeholders are reported and any grievances received from stakeholders are addressed in a timely manner.
- Participate in project progress meetings to discuss and report on environmental compliance.
- Prepare the Annual Environmental Report for submission to the EPA, which is a requirement of the Construction Permit.

### EPC Contractor

The contractor will be responsible for ensuring environmental compliance during the construction phase of the project. It is recommended that the contractor be required to prepare a CESMP and employ full-time environmental and social personnel to assist with the implementation of environmental management measures. Such personnel should be suitably qualified and experienced for such a portfolio and to be responsible for the following:

- Prepare the contractor's CESMP. The CESMP should be guided by the EPA's Construction Permit for the project and the provisions of this ESAR including the ESMP.
- Oversee implementation of the CESMP at the construction site.
- Conduct orientation for all staff and sub-contractors on the health, safety, environmental and social requirements.
- Monitor all construction activities onsite and prepare and submit monthly environmental and social compliance reports to the GEA.
- Work closely with the contractor's workforce to ensure full compliance with the CESMP.
- Ensure the implementation of mitigation measures to ensure compliance with the requirements.
- Identify any non-compliance and ensure corrective actions are taken as appropriate.
- Liaise routinely with the GEA's Environmental and Social Officer.
- Assist in arranging and participate in meetings and engagements with stakeholders.
- Take the lead from the contractor's end to address grievances from stakeholders and maintain liaison.
- Attend project progress meetings to report on environmental compliance.
- Following the completion of construction, ensure all of the construction worksites are adequately decommissioned.
- Design a training programme for MPL's technicians to ensure that operation and maintenance of the power plant follows all health and safety requirements.

### HECI/MPL

The project will be handed over to HECI for operations and MPL will be the on-the-ground operator. The EPA's Construction Permit was issued to HECI. As such, MPL will be responsible for ensuring the provisions of the Permit are implemented and that monitoring and reporting during project execution are consistent with Permit conditions. To fulfill this requirement, MPL will need to assign suitably qualified personnel with the requisite qualification and experience.

Responsibilities for environmental management for the EPC and operational phases of the project will held by three entities at different stages, GEA, the Contractor and HECI/MPL. These are summarised in Table 8-1 below.

**Table 8-1: Summary of Environmental related Responsibilities**

<b>Pre-Construction Phase</b>	
GEA	Prepare construction bidding documents to include environmental and social requirements
	Assign an Environmental and Social Officer
	Require the contractor to prepare a CESMP
	Review the CESMP and make recommendations for revision, if necessary
	Approve the CESMP
Contractor	Employ environmental and social personnel
	Prepare the CESMP

	Conduct site induction and training of employees and any sub-contractor personnel
HECI	Secure Environmental Authorisation (Construction Permit already obtained)
<b>Construction Phase</b>	
GEA	General oversight of the contractor's environmental performance
	Monitor project activities to ensure health, safety, environmental and social compliance.
	Identify non-compliances and recommend corrective actions.
	Participate in stakeholder engagements and take the lead in conflict management and grievance redress
	Ensure all monitoring and reporting obligations are satisfied
	Convene monthly meetings and discuss status of contractor's compliance with environmental requirements
	Prepare Annual Environmental Report for submission to EPA.
Contractor	Implement the CESMP; environmental, social, health and safety mitigation and management measures; and corrective actions
	Participate in the progress meetings
	Prepare monthly environmental and social compliance reports
	Monitor for non-compliances and effectiveness of mitigation measures
	Engaging with stakeholder and addressing any grievances which might arise
	Conducting regular refresher training for workers on health, safety, environmental and social requirements
<b>Operation Phase</b>	
HECI/MPL	Assign environmental and social personnel to the project
	Conduct compliance monitoring and reporting in accordance with the EPA Permit.
Contractor	Provide technical support during the first year of operation. This support should include requirements for health and safety in operations
	Design programme for training and knowledge transfer to HECI/MPL including requirements for health and safety

### 8.3 Construction ESMP (CESMP)

The Contractor will be required to prepare a CESMP to mitigate issues pertinent to the construction phase of the project and relevant to their assigned tasks. This CESMP is to be submitted to the GEA for approval following the approval of the design and prior to the commencement of works. Once approved, the CESMP is expected to be implemented during the construction period.

Preparation of the CESMP should be guided by this ESAR, the requirements outlined in the EPA's Construction Permit, IDB safeguards, relevant national standards and guidelines including those of the GNBS, GEA and the Ministry of Public Works. The following should be addressed/included in the CESMP:

- HSSE Policy – The contractor's Health Safety, Social and Environmental Policy should be included in the Plan. The policy should also address alcohol and drug use, hunting and the prevention of harm to wildlife, and interactions with local communities and stakeholders.
- Management Structure – The CESMP should describe the Contractor's management structure for the project, clearly highlighting the responsibilities for health, safety, and the environment.
- Contractors' Work Programme – An overview of the Contractor's proposed Work Programme, including information on the duration of works, number of workers to be onsite, type and



quantity of heavy equipment to be onsite, construction activities to be undertaken, forms of transportation to be utilised, etc. This information will be essential in the review process of the CESMP.

- Waste Management – Measures to manage the various waste types to be generated should be included, including solid waste, liquid waste/wastewater, hazardous waste and construction waste. This should include measures for collection and disposal.
- Erosion and Sedimentation Control – The CESMP should describe measures to be implemented by the Contractor to prevent erosion onsite, and sedimentation of the nearby surface water flows.
- Hazardous Materials Management – The Plan should outline how hazardous materials will be managed onsite, including fuel and lubricants.
- Dust Control - The CESMP should outline measures to prevent dust nuisance from occurring.
- Noise Prevention – The Plan should put forward measures to reduce noise levels and prevent noise nuisances.
- Workers Health and Safety – A Health and Safety Plan for workers should form a component of the CESMP.
- Community Safety – Measures should be implemented to ensure that the safety of members of the public is not compromised, especially relating to the use of the roadway, and managing interactions with project site neighbours. These measures should be documented in the CESMP.
- Contingency and Emergency Response Plan – A Contingency and Emergency Response Plan needs to be included in the CESMP to address emergencies relevant to the project. The possible emergencies are:
  - a. Accidents/Medical Emergencies
  - b. Fires
  - c. Fuel/Chemical Spills
  - d. Flooding

The Contingency and Emergency Response Plan should also address training of employees, assembly point in case of emergency, emergency contacts, communications, responsible personnel, response procedures and incident reporting.

- Chance Find Procedure – This should be included to cater for if during project activities archaeological pieces are found. The procedures to be followed should be outlined.
- Training Plan - Training to be conducted should be described in the CESMP.
- Site Closure, Decommissioning and Restoration - At the conclusion of works the site will need to be cleaned up, all waste removed and all temporary structures belonging to the contractor dismantled and removed. The measures to be employed by the contractor during this process should be described in the CESMP.
- Grievances – A Grievance Mechanism is included in this ESAR (Section 7.3.2.3). Since the Contractor will be responsible for addressing grievances, including implementation of

corrective actions, the measures to be employed by the contractor in dealing with grievance should be outlined in the CESMP.

- **Monitoring and Reporting** – The CESMP should outline how monitoring will be done including frequency, areas to be monitored, etc. A checklist to be utilized should be included.

#### 8.4 Environmental Monitoring

Monitoring of project activities should be conducted to ensure that the recommended mitigation measures and management practices identified in the ESMP are implemented and effective. This is required mainly for the construction phase of the project.

The GEA and the contractor, through their environmental and social personnel, should conduct periodic monitoring during the construction phase of the project. This will require frequent visits to the project site, compliance monitoring, and preparation of monthly environmental compliance reports. Table 8-2 below identifies the various parameters to be monitored as well as the frequency and location of monitoring activities. Additional parameters may be added to those identified in the Table based on the Contractor's CESMP or any other determined as necessary during project implementation.

**Table 8-2: Environmental Monitoring during Construction**

Parameters	Frequency	Locations
<b>Air Quality</b> <ul style="list-style-type: none"> <li>▪ Evidence of dust accumulation and suspended particles through visible observation</li> <li>▪ Ease of visibility</li> <li>▪ PM<sub>2.5</sub> and PM<sub>10</sub></li> </ul>	Continuous  Quarterly	Construction site
<b>Meteorology</b> <ul style="list-style-type: none"> <li>▪ Temperature</li> <li>▪ Humidity</li> <li>▪ Rainfall</li> <li>▪ Wind speed, direction</li> <li>▪ Solar radiation</li> </ul>	Continuous	Construction site
<b>Water Quality</b> <ul style="list-style-type: none"> <li>▪ pH</li> <li>▪ Turbidity</li> <li>▪ Total Suspended Solids</li> <li>▪ Oil and Grease</li> <li>▪ Dissolved Oxygen</li> <li>▪ Chemical Oxygen Demand</li> <li>▪ Coliforms</li> </ul>	Quarterly	Nearby surface water bodies including the ravines draining the Project Site
<b>Noise</b> <ul style="list-style-type: none"> <li>▪ Decibel</li> </ul>	Quarterly	<ul style="list-style-type: none"> <li>▪ Active construction areas</li> <li>▪ Boundaries of project site and neighbouring land uses</li> </ul>
<b>Waste Management</b> <ul style="list-style-type: none"> <li>▪ Compliance with CESMP and waste management practices</li> </ul>	Weekly	Waste receptacles, disposal sites and active construction sites.

Parameters	Frequency	Locations
<ul style="list-style-type: none"> <li>Littering and waste accumulation</li> </ul>		
<b>Wildlife</b> <ul style="list-style-type: none"> <li>Aquatic and terrestrial fauna presence</li> <li>Hunting and trapping of wildlife by workers</li> </ul>	On Observance	Within the project's area of influence
<b>Vegetation</b> <ul style="list-style-type: none"> <li>Restriction of Clearance to where absolutely necessary</li> <li>Re-vegetation of cleared areas not utilised</li> </ul>	Daily	Construction site
<b>Health and Safety</b> <ul style="list-style-type: none"> <li>Use of protective gear by workers</li> <li>Adequate and appropriate signage installed</li> <li>Location of Emergency Procedures</li> <li>Availability of emergency response equipment</li> <li>Tool box talks, Induction Training, etc.</li> <li>Health conditions of staff.</li> <li>Stocked First Aid Kit</li> <li>Demarcation and securing of construction site</li> <li>COVID-19 Preventative Measures</li> </ul>	Daily	Construction site
<b>Community Wellbeing/Concerns</b> <ul style="list-style-type: none"> <li>Employment</li> <li>Trained workforce</li> <li>Road safety measures for transmission line installation</li> <li>Ongoing stakeholder engagement</li> <li>Grievance redress</li> <li>Any emerging issue</li> </ul>	Monthly	Mahdia and Campbelltown

Environmental monitoring should continue by MPL during the operational phase of the project and be guided by the Monitoring Plan presented in Table 8-3.

**Table 8-3: Monitoring Plan for Project Operations**

Parameters	Frequency	Locations
<b>Meteorology</b> <ul style="list-style-type: none"> <li>Temperature</li> <li>Humidity</li> <li>Rainfall</li> <li>Wind speed, direction</li> <li>Solar radiation</li> </ul>	Continuous	Project site

Parameters	Frequency	Locations
<b>Water Quality</b> <ul style="list-style-type: none"> <li>pH</li> <li>Turbidity</li> <li>Total Suspended Solids</li> <li>Oil and Grease</li> <li>Dissolved Oxygen</li> <li>Chemical Oxygen Demand</li> <li>Coliforms</li> </ul>	Bi-Annually	Discharge points from the site drainage system into the receiving environment.
<b>Waste Management</b> <ul style="list-style-type: none"> <li>Compliance with waste management practices.</li> <li>Littering and waste accumulation.</li> <li>Monitoring septic system for signs of its being filled to capacity.</li> </ul>	Weekly	Waste receptacles, septic system disposal sites and temporary storage areas for damaged or defunct plant components.
<b>Drainage System</b> <ul style="list-style-type: none"> <li>Condition of drainage infrastructure.</li> <li>Cleanliness of drains.</li> </ul>	Weekly	Internal site drainage.
<b>Wildlife</b> <ul style="list-style-type: none"> <li>Capture and release of wildlife trapped within project fencing</li> </ul>	On Observance	Within the boundaries of the project site
<b>Health and Safety</b> <ul style="list-style-type: none"> <li>Use of protective gear by workers</li> <li>Adequate and appropriate signage installed</li> <li>Location of Emergency Procedures</li> <li>Availability of emergency response equipment</li> <li>Tool box talks, Induction Training, etc.</li> <li>Health conditions of staff.</li> <li>Stocked First Aid Kit</li> <li>COVID-19 Preventative Measures</li> <li>Safety Drills</li> <li>Fire extinguishers serviced and available at strategic locations</li> </ul>	Daily	Project site
<b>Community Wellbeing/Concerns</b> <ul style="list-style-type: none"> <li>Employment</li> <li>Trained workforce</li> <li>Grievance redress</li> <li>Any emerging issue</li> </ul>	Monthly	Mahdia and Campbelltown

## 8.5 Reporting

### 8.5.1 Reporting During the Construction Phase

Regular meetings between the project management team (GEA and the contractor) should be convened to discuss progress and to address challenges. These meetings should be supplemented by formal compliance monitoring reports prepared by both the contractor and the GEA.

The GEA is expected to convene such progress meetings at least monthly at which the contractor's environmental and social personnel will attend as well as the GEA's Environmental and Social Officer. The agenda of each meeting should include environmental, health, safety and social compliance and where a report should be presented on the contractor's environmental and social performance. This report should then allow for discussion on areas for improvements, review the progress of implementation of corrective actions and to plan ahead to prevent non-compliances from occurring. Representatives from HECI and MPL should be invited to attend these meetings so as to stay abreast of any emerging issues which may become areas of concern during the operational phase. These meetings should be convened on a statutory basis throughout the duration of the project and should be documented.

The contractor's environmental personnel should prepare a Monthly Environmental Compliance Report which should indicate areas of non-compliances, reasons for the non-compliances and corrective actions which have been taken or are planned to be implemented. The report should also indicate environmental incidents occurring during the month, complaints or grievances received and follow-up actions. This report should be submitted to the GEA prior to the convening of the monthly meetings and should include but not limited to the following:

- Environmental incidents or non-compliances observed and corrective actions taken with regards to contract requirements, including waste management, contamination, noise and dust control, traffic management, etc.
- Health and safety incidents, accidents, injuries and all fatalities that require treatment and actions taken to improve conditions. Information on number of workers, work hours, PPE provided and usage, and worker violations and follow-up actions taken (if any).
- CESMP implementation progress, including implementation of the management and mitigation measures outlined in the plan, effectiveness of the measures being implemented, any emerging environmental, social, health and safety issue and adjustments required (if any).
- Grievances by workers and the community, including grievances received, how resolved, those unresolved and plan for resolving these.

Prior to construction, the contractor should prepare and submit a reporting format to the GEA for approval.

In addition to the monthly report, the contractor should also provide immediate notification to the GEA of incidents in the following categories:

- confirmed or likely violation of any Construction Permit conditions or any relevant legislation.
- any fatality or serious (lost time) injury.
- significant adverse effects on the environment.
- damage to private or public properties.

Full details of such incidents should be provided within the timeframe agreed with the GEA.



The Construction Permit requires the preparation of an Annual Environmental Report for submission to the EPA. This report should be prepared by the GEA for submission to the EPA prior to March 31 of the following year.

#### **8.5.2 Reporting and Record Keeping During the Operational Phase**

Overall monitoring should be carried out by MPL's dedicated HSSE personnel. All areas of concerns should be visited daily, or more frequently, if necessary. Operational related activities such as use of safety gears and compliance with health and safety procedures should be monitored on an ongoing basis.

Annual Environmental Reporting should be carried out and report submitted to the EPA. The Annual Environmental Reports should include environmental performance, objectives and targets, and future planned improvements. The results of monitoring activities conducted throughout the year should also be presented. Additional reporting requirements should be done in compliance with the Operation Permit to be issued by the EPA.

Records of monitoring should be kept by MPL on-site and made available to the EPA or other regulatory authorities upon request. Monitoring results which exceed national standards should be reported to EPA.

The company should be willing to facilitate site monitoring activities to be conducted by regulatory bodies such as the EPA and the Ministry of Labour.

#### **8.6 Orientation and Training**

During the construction phase of the project it is essential that the contractor conduct orientation and training of workers prior and during construction activities. Training should include both theory and practical exercises and should cover a range of topics on health, safety and the environment including an overview of the CESMP and the roles and responsibilities of contractor personnel. Orientation and training should be done as part of site induction and should include, but not be limited to the following:

- Environmental requirements and environmental management and health and safety measures as outlined in the CESMP.
- Workers' role and responsibilities in environmental management and health and safety.
- First aid, occupational safety and health measures and the use of PPE.
- Emergency response measures.
- Methods for waste and hazardous materials management and disposal.
- Social responsibilities of all personnel working under the project and rules of engagement with stakeholders, in particular local communities.

Any new employee should undergo an orientation programme to ensure he/she fully understands the job requirements and employment conditions and is motivated to improve his/her skills.

On a day-to-day basis, there should be Tool Kit Orientation by the contractor's site manager or Health and Safety personnel to emphasise key issues on health, safety and the environment.

The EPC contractor should support MPL in the orientation and training of personnel to operate the solar PV power plant. These procedures should be documented to allow MPL to continue with these activities following the end of the EPC contractor's tenure.

## 8.7 Mitigation and Monitoring Budget

An indicative annual budget is presented in Table 8-4 and Table 8-5 respectively, outlining estimated costs for mitigation and monitoring activities during the construction phase of the project. The cost of mitigation activities are to be borne by the contractor and incorporated as part of the CESMP.

**Table 8-4: Annual Budget for Mitigation during Construction (Contractor Responsibilities)**

Environmental Component/ Impacts	Action	Equipment/ Personnel/ Activities	Annual Cost US\$
Human Resources	Hiring of contractor's environmental and social personnel		18,000
Waste Management	Collection and disposal of garbage and construction waste	Bins and garbage receptacles Disposal of waste	1,000
	Managing of liquid waste	Provision of Portable Toilets /Toilets with Septic Tanks	2,000
Health and Safety	First Aid Kits	Procure kits	500
	Protective gear for workers e.g. safety vests, helmets, gloves, dust masks, safety boots and ear piece.	Procure gears	5,000
	Warning signs at work sites.	Prepare and erect signs	500
Emergency Response	Fire Extinguishers and Spill Kits.	Procure equipment	1,000
Training	Training of personnel e.g. in Environmental Responsibilities, First Aid, Health and Safety, Emergency Response, etc.	Conduct training prior to start up and thereafter every 6 months	2,000
Incidentals and Emergencies	Response needed in event of accidents and emergencies.	Materials and personnel (depends on type/scale of incident or emergency)	10,000
<b>TOTAL</b>			<b>40,000</b>

The table below presents the indicative cost to the GEA for monitoring of construction activities to ensure environmental, social, health and safety compliance. Some of these costs such as for personnel may already be included in GEA's operational budget.

**Table 8-5: Annual Budget for Monitoring during Construction (GEA Responsibility)**

Environmental Component/ Impacts	Action	Equipment/ Personnel/ Activities	Annual Cost US\$
Human Resources	Hiring of GEA environmental and social personnel		18,000
Air Quality	Conducting air quality testing for PM <sub>2.5</sub> , PM <sub>10</sub>	Air Quality Meters/Contractor	5,000
Water Quality	Water quality tests such as pH, Turbidity, Oils/Grease, Dissolved Oxygen, Chemical Oxygen Demand, etc.	Samples collected tested <i>in-situ</i> and outsourced to Lab for analysis	2,000
Noise	Monitoring	Noise level testing	1,000
Miscellaneous	Report preparation etc.	Materials, printing etc.	1,000
<b>TOTAL</b>			<b>27,000</b>

The costs identified for monitoring are indicative since at this stage the final design for the project is not yet available. It is therefore expected that these budgets will be revised based on final project design.

## CONCLUSION

The Mahdia Solar Farm Project is being implemented to provide a 0.65-megawatt peak (MWp) solar PV power plant inclusive of a 2-hour battery energy storage system in the township of Mahdia, Region 8. The battery storage system (energy storage and battery inverter) will support the primary function of 'grid forming' and meet the demand of the Mahdia mini-grid during the periods for which solar energy is available. The electricity generated by the project will be integrated into the existing Mahdia Transmission and Distribution Grid. The design of the solar power plant will allow for future expansion of the solar PV system thereby increasing the solar PV capacity and upgrades to the battery storage system with energy storage to provide solar energy during the night. The approach to project development will be through an Engineering, Procurement, Construction contract that will see the Installation, Commissioning and Turn-key Delivery of the solar PV power plant.

This ESAR assessed the potential impacts of project activities across the various phases using the baseline conditions of the project areas and the planned project activities. This was done by establishing the potential interactions between the activities and the characteristics of the existing physical, biological and socio-economic environment. The mitigation and management measures which can be incorporated into the project design and execution were considered in the assessment of potential impacts and this contributed to significantly reducing the risks associated with potential impacts of the project. As a consequence, the significant majority of impacts assessed in this ESAR are of Low or Medium Risk. Moreover, none of the potential impacts assessed were associated with Critical Risks to any of the resources considered. This is consistent with the IDB screening of the project and its rating of it as Category B which indicates that the project will generate moderate environmental and social impacts that could be easily mitigated through the implementation of the required mitigation measures.

Mitigation and management measures to address potential adverse impacts have been identified and recommended. Measures to maximise the positive impacts of the project were also recommended. In addition, provisions have been made and guidance provided for detailed management measures to be determined and implemented during the construction phase, and as part of the CESMP. The EPA has also issued a Construction Permit for the project which outlines measures to be implemented to ensure impacts to the environment are prevented or minimised.

Once the recommended measures are implemented during the project execution it is envisaged that any potential adverse impacts will be prevented or reduced, thereby enabling the project to positively benefit the environment and the community.

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## APPENDICES

### Appendix A – Terms of Reference for the preparation of the ESAR

#### Annex 2: TERMS OF REFERENCE

##### GUYANA

##### LO-4676/BL-GY

#### ENERGY MATRIX DIVERSIFICATION AND INSTITUTIONAL STRENGTHENING OF THE DEPARTMENT OF ENERGY (GY-L1066)

#### CONSULTANCY SERVICE: PREPARATION OF AN ENVIRONMENTAL AND SOCIAL ANALYSIS REPORT

##### I. BACKGROUND AND JUSTIFICATION

- 1.1 Renewable Energy Solutions for the Hinterland under the Energy Matrix Diversification and Institutional Strengthening of the Department of Energy (EMISDE) Programme is one of three components which will address the energy diversification policy goals of the Government of Guyana. It will finance the investment of solar technology in three townships, by means of the installation of PV-tied mini-grid systems in Bartica (1.5 MW), Lethem (1 MW), and Mahdia (0.65 MW), totaling 3.15 MW and the implementation of a storage capacity to manage intermittence of these sources. Overall, the component will provide a reliable electricity source to the expanding needs of power supply in the townships, now relying on fossil fuel. The three townships have important presence of indigenous people: 17% Amerindian in Bartica, 17% Amerindian in Mahdia and 51% Amerindian in Lethem. The solar plants are located outside any protected areas and sensitive natural habitats.
- 1.2 In accordance with the IDB's Policy OP-703, this operation is classified as Category "B" and is anticipated that the project will generate moderate impacts that could be easily mitigated by the implementation of the required mitigation measures. The main impacts for Component 1 will be associated with land clearing (pre-construction) and erosion during both construction and operations. The three townships have important presence of indigenous people and these Amerindian communities are main beneficiaries of the Project; with mainly positive impacts being expected on indigenous people. In order to meet the requirements of the Bank's Environmental and Social Safeguard Policies, the Cooperative Republic of Guyana will comply to the satisfaction of the Bank with the contractual terms and conditions set forth. These conditions and definitions were incorporated into the Loan Agreement and as such the Borrower is legally bound to comply with these conditions.
- 1.3 To this end, the GEA is looking for a suitable candidate to offer consultancy services, in accordance with these Terms of Reference as it relates to the Special Conditions of Execution of Component 1: Renewable Energy Solutions for the Hinterland of the Operation GY-L1066, which require the Programme Coordinating Unit under the Guyana Energy Agency to prepare an Environmental and Social Analysis Report inclusive of an Environmental and Social Management Plan

## **II. OBJECTIVES**

The main objectives of this consultancy are as follows:

- 2.1. to identify, predict and evaluate the economic, environmental and social impact of the development of a solar PV Farm and all its associated activities in Mahdia
- 2.2. to provide information on the environmental consequences for decision making and
- 2.3. to promote environmentally sound and sustainable development through the identification of appropriate alternatives and mitigation measures.
- 2.4. The main activities will be the following:
  - 2.4.1. Carry out an Environmental and Social Analysis based on the inputs of and coordination with the Guyana Energy Agency for the Operation, and on information available in academic literature and on field visits and campaigns carried out.

## **III. REQUIREMENTS**

**Type of Consultancy:** Individual Consultancy

**Duration:** Forty (40) days

**Place of work:** Georgetown, Guyana, office work (or Consultant's habitual place of work) with multiple field visits to location of relevant infrastructure or activities.

**Qualification:**

A Master's Degree or Post Graduate Academic qualifications in Environmental Studies, Natural Resource Management, Forestry, Agriculture or other related fields with experience in solar plant construction and environmental and social impact, preferably with experience in the context of projects financed by the IDB or other multi-lateral agencies. Candidate must possess a minimum of seven years professional experience as a Senior Environmental Specialist with proven knowledge of management of biodiversity impacts. This experience would be preferably in the context of standards sets by multi-lateral agencies and in emerging and developing countries.

**Core and Technical Competencies:** Good analytical and communication skills. Command of English language is required, knowledge of local dialects might be necessary for consultations. Ability to plan, organize and meet goals in a timely manner. Ability to multitask and response to multiple demands and changing priorities. Pro-activity and motivation. Ability to work under minimal supervision when necessary.



#### IV. SCOPE OF ACTIVITIES

The scope of developing the Environmental and Social Analysis Report should include the following key aspects:

- a) Description of the Operation
- b) Diagnostic of Area of Influence (Direct and Indirect) and Stakeholders of the Operation
- c) Institutional and Legal Framework
- d) Main Environmental and Social Impacts
- e) Environmental and Social Management Plan
- f) Consultation Plan and Disclosure

#### V. DELIVERABLES

- Intermediate report on the preliminary findings as per activities described above, information gathered in the consultations and Environmental and Social Plan.
- A final report on Environmental and Social Analysis with respective Environmental and Social Management Plan, including Public Consultation Plan and Consultation Reports, and if necessary, FPIC procedure, Socio Cultural Analysis, Involuntary Resettlement Plan and/or Livelihood Restoration Plan.
- The final report shall be delivered via electronic submission (CD, flash drive) in addition to three (3) hard copies
- All should be carried out at Mahdia, and presented in one document, at discretion of the Consultant.

#### VI. PAYMENTS

Payments will be scheduled as follows:

- I. 20% (less 2% withholding tax where applicable) upon submission and approval of operational plan;
- II. 30% (less 2% withholding tax where applicable) upon submission and acceptance of the Draft version of the Environmental and Social Analysis and Environmental and Social Management Plan;
- III. 40% (less 2% withholding tax where applicable) upon submission and acceptance of the Final versions of both documents, which will incorporate all the comments of the Project Coordinating Unit made to the Draft version of the document.
- IV. 10% (less 2% withholding tax where applicable) upon final execution of all project's administrative closures

#### VII. COORDINATION

- The consultant will report to the Chief Executive Officer or any other representative of the Guyana Energy Agency, on all matters relating to the execution of this assignment.

## Appendix B – Consultant Support

The Consultant Mr. Shyam Nokta utilized the personnel outlined in the table below to support the preparation of the ESAR.

Personnel	Role
Mr. Khalid Alladin	Environmental Management Specialist
Ms. Kandila Ramotar	Community Engagement and Social Specialist
Ms. Stella Madete	Social Specialist
Mr. Hance Thompson	Biodiversity Specialist
Mr. Raeburn Jones	Biodiversity Survey Specialist - Flora
Mr. Omar Persaud	Geological and Environmental Engineer
Mr. Enrique George Monize	GIS Specialist
Mr. Michael Philander	Biologist
Ms. Latchmi Mukhlall	Environmental Assistant

## Appendix C – EPA Issued Construction Permit



**Environmental  
Protection  
Agency**

Ganges Street, Sophia  
Georgetown, GUYANA  
Tel. : (592) 225-2062 / 1218 / 0506/ 6917/  
5467  
Fax: (592) 225-5481  
Email: [epa@epaguyana](mailto:epa@epaguyana)  
Website: [www.epaguyana.org](http://www.epaguyana.org)

# Construction Permit

(Issued under the Environmental Protection Act, Cap. 20:05, Laws of Guyana, the Environmental Protection (Amendment) Act, 2005, and the Environmental Protection (Authorisations) Regulations, 2000)

Reference No.:	20200207-MDHEP
Fee:	Medium (C3) - US \$1,100
Fees Paid	US\$1,100 (1 year – December 2020 to November, 2021)
Addressee:	Mr Horace Williams Hinterland Electrification Company Inc. (HECI) Ministry of Public Works Wight's Lane Kingston Georgetown Guyana
Activity:	Installation of 0.65 MW Solar Photovoltaic Grid-Connected System

Hinterland Electrification Company Inc. (HECI), hereinafter referred to as the "Permit Holder", is hereby authorised in accordance with the Environmental Protection Act, Cap. 20:05, Laws of Guyana, the Environmental Protection (Amendment) Act, 2005, and the Environmental Protection (Authorisations) Regulations, 2000, to undertake the construction/installation of Photovoltaic systems at Primelands, Mahdia, Region 8, hereinafter referred to as the "Project", in the manner indicated in the Application submitted in the Application for Environmental Authorisation submitted on February 07, 2020, and subject to the terms and conditions set forth herein and any forthcoming regulations, best practices, guidelines and standards relevant to this project.

**Terms and Conditions to be adhered to by the Permit Holder shall:**

### 1.0 General

- 1.0 Notify the Agency in writing of any proposed changes in the construction phase **at least 14 days** prior to making the change. The notification shall contain a description of the proposed change. It is not necessary to make such a notification if an application to vary this permit has been made and the application contains a description of the proposed change. In this condition 'change in construction' means a change in the nature or functioning, or an extension, or any additional installation, which may have consequences for the environment. Changes to construction may include but are not



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limited to the following:

- a. Changes in construction, structure, or layout of the facility, plant or building;
  - b. Installation of new equipment and/or changes to equipment, machine, apparatus, mechanism, system or technology serving the facility or operation;
  - c. Any technology used or installed at the facility from which effluent may be discharged; and
  - d. Any other variance prescribed by Regulation 20(3) of the Environmental Protection (Authorisations) Regulations.
- 1.1 Ensure fire protection equipment is appropriate for all construction activities and is strategically placed as recommended by Guyana Fire Service (GFS).
  - 1.2 Provide a first aid kit equipped according to the Red Cross standard and proportionate to the requisite number of employees at the work site and ensure that communication and transportation systems are in place to respond to emergencies.
  - 1.3 Consult and coordinate with contractors and the relevant/affected utility companies and local government (M&CC, NDC, CH&PA, etc.) to establish schedules and mechanisms for implementation of service interruptions. Additionally, ensure that utilities/relevant authorities are consulted on the location of their facilities such as sewers, cables, pipelines, etc., to ensure that appropriate actions are taken such as relocation of utilities, markings, temporary shut off of utilities, etc., prior to the commencement of works.
  - 1.4 Ensure appropriate barriers, equipment/material staging areas, and all supporting infrastructure, facilities and equipment associated with the Project are provided, maintained and removed upon completion of works. Once works are completed, rehabilitation measures must be implemented to restore any disturbances to the environment.
  - 1.5 Ensure that access is provided to all properties adjacent to the site for the duration of the project construction.
  - 2.0 **EMPLOYEES & OCCUPATIONAL HEALTH AND SAFETY**
    - 2.1 Ensure that construction workers at all times wear Personal Protective Equipment (PPE) such as protective head gear, respirators, safety vests, construction boots, etc., relevant to the construction phase. When night works are required, ensure that adequate lighting at and around worksites is provided.
    - 2.2 Ensure that adequate rest room/areas, waste disposal and sanitary facilities are provided at all construction sites for workers.



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- 2.3 Employ or designate an employee the Occupational Health and Safety (OHS)/Environmental Officer who would be responsible for the implementation and coordination of all safety requirements and terms and conditions stipulated in this Permit, as well as monitoring, compliance and making all required reports to the EPA. The name, designation and contact details of the Occupational Health and Safety (OHS)/Environmental Officer shall be submitted to the EPA within fourteen days of the issuance of this Permit, and continuously maintained thereafter.
- 2.4 Ensure employees adhere to Company's Occupational Health and Safety guidelines and maintain records of all OH&S training and activities. These records are to be included within the Annual Report.

**3.0 NOISE ABATEMENT AND AIR QUALITY MANAGEMENT**

- 3.1 Adhere to the provisions of the Environmental Protection (Air Quality) Regulations 2000 and the Environmental Protection (Noise Management) Regulations, 2000.
- 3.2 Comply with the Guyana National Bureau of Standards (GNBS) Interim Guidelines for Noise Emission into the Environment at a distance of 50 ft (15 m) from the source or at the property boundary, whichever is closer. Noise levels shall not exceed:  
Construction Limits – **90 dB**(Day-time (06:00 – 18:00 h)) and  
**75 dB** (Night-time 18:00 – 06:00 h)).

Sound levels from noise-making devices should not exceed the limits stipulated herein at a distance of 15 metres (50 ft) from the source of emission or at the location of the nearest receptor.

- 3.3 Ensure all significant noise-producing equipment, e.g. generators, machinery, etc., are equipped with appropriate silencers or mufflers and/or are enclosed in suitable acoustic enclosures where necessary to reduce noise levels impacting the surrounding environment to achieve compliance with the GNBS requirement.
- 3.4 Ensure that the exhaust stack of generator is at an appropriate height to minimize adverse fumes/soot impacts to contiguous areas.
- 3.5 Ensure all significant noise-producing equipment are placed on foundation properly designed to ensure effective dampening of vibrations. Additionally, ensure adequate equipment maintenance to function effectively and prevent noise above GNBS levels.
- 3.6 Implement dust control measures at source point to minimize dust pollution during construction.
- 3.7 Ensure that loads of gravel, sand or any other construction material should be covered



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with suitable materials during transport on trucks or any other vehicle, as well as during storage at the construction site.

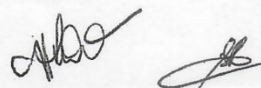
**4.0 WATER AND SOIL QUALITY MANAGEMENT**

- 4.1 Adhere to the provisions of the Environmental Protection (Water Quality) Regulations, 2000.
- 4.2 Take necessary precautions to avoid soil compaction, erosion, siltation and sedimentation during construction by limiting the size of the disturbed area, slope length and gradient and the duration of soil exposure.
- 4.3 Store temporary stockpiles of construction materials including excavated waste in a secure, designated area that is protected from wind and water erosion. Materials should not be placed within 10m of a watercourse or drain.
- 4.4 Avoid soil and water contamination from fuel, grease, waste oils and other petroleum products. Store all oils, fuel, paints and chemicals in a designated enclosed area, 10 m away from watercourses on an impervious base to minimize adverse impacts to the environment in the event of spillage.
- 4.5 Limit the removal of vegetation to the extent necessary for works to proceed. In areas where soils are not to be removed, the grassed vegetation layer shall be maintained, where possible, to protect the soil from erosion and compaction.
- 4.6 Should there be any contamination or siltation of any watercourse or drain during construction, procedures for the removal, reversal, and clearing of these impacts should be implemented.

**5.0 MEASURES SPECIFIC TO THE PHOTOVOLTAIC SYSTEM**

- 5.1 Ensure photovoltaic system panels are installed in accordance with the manufacturer's installation instructions.
- 5.2 Clearly identify on the site plan the point of interconnection with the utility supplied wiring system and provide details on main breaker and photovoltaic (PV) breaker.
- 5.3 Provide a fire certificate with specifications detailing chemicals and hazardous materials in the batteries to make sure that the fire safety response plan is effective to curtail fire emergencies relative to the photovoltaic panel system.

**6.0 HAZARDOUS WASTE MATERIAL/WASTE MANAGEMENT**



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- 6.1 Adhere to the provisions of the Environmental Protection (Litter Enforcement) Regulations, 2013 and the Environmental Protection (Hazardous Wastes Management Regulations 2000).
- 6.2 Promote good sanitation and solid waste disposal practices at the site. In particular, dispose of waste, including liquid/septic wastes at an approved landfill site. Covered garbage receptacles must be placed at strategic locations on site.
- 6.3 Promote waste minimization and the reuse and/or recycling of waste materials and other suitable materials where practical. Topsoil/overburden and other inert construction wastes/materials should be reused, e.g. for reclamation/landscaping after construction works are completed.
- 6.4 Ensure that all wastes are sorted in order to separate reusable and recyclable materials.
- 6.5 Ensure that waste materials are not burnt on site. Waste materials that cannot be reused should be taken for disposal at an approved disposal facility during construction.
- 6.6 Solid and liquid waste shall not be discharged directly into watercourse, without prior treatment.
- 6.7 Establish and maintain a register of hazardous materials or chemicals used or generated as a result of the construction of the Solar Photovoltaic Grid System.
- 6.8 There shall be no release of any pollutants (i.e. fuel, waste oil, chemicals) to ground water or soil from the permitted installation. Accidental release of pollutants to soil and ground water shall be recorded and reported **within twenty (24) hrs** to the Agency for further investigation.
- 6.9 Hazardous wastes must be properly stored in segregated, leak proof containers at an appropriate on-site facility until ready for disposal. Disposal of hazardous waste shall be done in a manner approved by the EPA.
- 6.10 Promote the reuse of waste oil, for example, lubrication of equipment, where practical.
- 6.11 Where applicable, prepare and submit to the Agency no later than **forty-five (45) days** after the end of the constructing year, a report relating to the activities for the previous year. The report shall include:
  - a) The identification information of the facility.
  - b) Type and quantities of hazardous waste generated.
  - c) Data concerning off-site shipments of waste.
  - d) Any applied treatment standards.



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- e) A summary of any accidents that may have occurred and any action taken.
  - f) Any waste minimization efforts undertaken by the generator.
  - g) Any other matter the Agency may require.
- 6.12 The Agency considers all materials listed in Schedule I and II of the Environmental Protection (Hazardous Wastes Management) Regulations, 2000, to be hazardous.
- 6.13 Ensure that all fuel is stored away from ignition sources and ‘**No Smoking**’ signs must be erected in conspicuous areas where fuel is handled or stored.
- 6.14 Store any contaminated fuel in enclosed leak-proof containers and label slop tanks ‘waste gasoline’ or ‘waste fuel’.
- 6.15 Ensure that an appropriate spill containment kit is located at the Photovoltaic Grid-Connected System. The kit should contain absorbent material, drain seals, disposal containers and other appropriate tools to absorb spilt oil and other spilt liquids.
- 6.16 Construct and maintain an impervious secondary containment bund which must have at least 110% containment capacity around all fuel storage tanks, creating a temporary holding area in the event of spillage.
- 6.17 Ensure that used oil/fuel containment adsorbent materials are appropriately stored in double wrapping heavy duty garbage bags and disposed of at an approved waste disposal company. Hazardous contaminated absorbent pads can be disposed of in an incineration operation by an approved waste disposal company.
- 6.18 Store used oil in a covered, bunded area to minimize adverse impacts to the environment in the event of spillage. The bunded area must be able to provide containment for the maximum volume of used oil on site.

**7.0 COMPLIANCE MONITORING AND REPORTING**

- 7.1 Notify the Agency in writing of any change of name or ownership of the Permit Holders’ facility within thirty (30) days after the change occurs.
- 7.2 Comply with any lawful directions given by the EPA from time-to-time in furtherance of the implementation of any international or other obligation for the Environmental Protection of Guyana.
- 7.3 Make all employees, and third parties under your direction, aware of the conditions of the Permit and provide training on good environmental management practices and in the areas of occupation health and safety, first aid response, and emergency response. Prepare and maintain a training file for employees which should be available upon



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Officers' request during Compliance Inspection.

- 7.4 Monitor the implementation of the conditions of this Permit, insofar as they involve adherence by your employees and all third parties under your direction.
- 7.5 Notify the EPA within twenty-four (24) hours of the occurrence of any environmental emergencies, i.e., any accidental release of contaminants or incidence of pollution into the environment. The Permit Holder shall provide the financial, equipment and technical capacity to adequately respond to any emergency that may occur on site and respond to any emergency immediately.
- 7.6 Report to the Agency any non-compliance with the Construction Permit as follows:
- I. Within twenty-four (24) hours of the time the Holder of the Construction Permit becomes aware of the non-compliance, the anticipated manner in which it may endanger human health or the environment.
  - II. Within seventy-two (72) hours, submit to the Agency a written report containing a description of the non-compliance, its cause and the period of non-compliance including exact dates and time.
  - III. Submit a report to the Agency indicating the reasons and the anticipated time it is expected to continue if the non-compliance has not been corrected.
- 7.7 Maintain records of the maintenance of equipment, to be included in the Annual Environmental Report and available for Officers of the EPA during inspections.
- 7.8 Establish and maintain an Occupational Health and Safety Committee, to train staff in safety procedures and monitor and keep records of occurrences of unintentional injuries at the facility.
- 7.9 Submit **Annual Reports** to the EPA on the progress of the construction and compliance with the conditions under which this Permit was granted on or before **March 31** of each year.
- 7.10 Failure to comply with all terms and conditions, under which this Permit is granted, may result in the Permit Holder being liable for any loss or damage which arises from the breach.

**8.0 INSTITUTIONAL AUTHORITY/ LIABILITIES**

- 1.1 The Permit Holder, his Servants and/or Agents shall be strictly jointly and severally liable as follows:



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Issued under the Environmental Protection Act, Cap. 20:05, Laws of Guyana, the Environmental Protection (Amendment) Act, 2005, and the Environmental Protection (Authorisations) Regulations, 2000.

- a. For any activity that causes, or is likely to cause pollution of the environment, unless the person takes all reasonable and practicable measures to prevent or minimise any resulting adverse effect, in accordance with Section 19(1)(a) of the Environmental Protection Act, Cap. 20:05, Laws of Guyana.
- b. For any activity which results in the discharge, release or entry into the environment of any contaminant in any amount, concentration or level in excess of that prescribed by the regulations or stipulated by this Permit, in accordance with Section 19(1)(b) of the Environmental Protection Act, Cap. 20:05 Laws of Guyana.
- c. The discharge or release of contaminants, such as hydraulic fluids, lubricants, fuel, or other industrial contaminants relative to the Project, which are not stipulated herein are strictly prohibited. Any such discharge or release shall be a violation of Section 19(1)(a) and/or (b) of the Environmental Protection Act, Cap. 20:05, Laws of Guyana.
- d. For the compensation of any Party who suffers any loss or damage as a result of the project. (s.19(3)(e)) Environmental Protection Act, Cap. 20:05, Laws of Guyana.
- e. For any material or serious environmental harm caused by pollution of the environment, whether intentionally or recklessly, in accordance with section 39 (1), (2), (3) and (4) of the Environmental Protection Act, 20:05, Laws of Guyana.
- f. Any gross negligence or wilful misconduct resulting in serious risk, or adverse effects to the environment, biodiversity, protected species and natural habitat with respect to any release or discharge, spill, contaminant fluids, oil, or lubricants from any facilities permitted under this project.
- g. For the payment of all costs and expenses related to the assessment of damage and investigations required, as result of any pollution incidents attributable to the activity for which this Permit has been issued.

- 8.1 The Agency (EPA) shall notify the Permit Holder immediately of any written claim or notice sent by any Complainant seeking loss or damage for negligence as a result of the Permit Holder lack of due care and diligence.





**Construction Permit - Ref. No.: 20200207-MDHEP**

Issued under the Environmental Protection Act, Cap. 20:05, Laws of Guyana, the Environmental Protection (Amendment) Act, 2005, and the Environmental Protection (Authorisations) Regulations, 2000.

- 8.2 Where the Permit Holder contravenes or is likely to contravene any condition of this Permit, the Agency (EPA) shall serve on him an Enforcement Notice, in accordance with Section 26 of the Environmental Protection Act, Cap. 20:05, Laws of Guyana.
- 8.3 Where it appears to the Agency that the Permit Holder is engaged in any activity that may pose serious threat to natural resources or serious pollution of the Environment or any damage to public health, the EPA shall issue to the Permit Holder a Prohibition Notice, which may order him to immediately cease the offending activity, in accordance with Section 27 of the Environmental Protection Act, Cap. 20:05, Laws of Guyana.
- 8.4 The EPA reserves the right to conduct regular inspections of the Permit Holder's operation as part of its monitoring and enforcement requirements under the Environmental Protection Act, Cap. 20:05, and the Environmental Protection (Amendment) Act, 2005, and Environmental Protection (Authorizations) Regulations, 2000.
- 8.5 The Permit Holders shall at all times, allow entry to the permitted facility to any Officer designated by the EPA for the purposes of conducting inspections or any other legitimate business of the Agency. Pursuant to Section 38 of the Environmental Protection Act, Cap. 20:05, Laws of Guyana, it is an offence to **assault, obstruct or hinder** an authorised person in the execution of his/her duty under the said Act or its Regulations and the Permit Holder shall be liable to penalties prescribed under paragraph (c) of the Fifth Schedule for doing so.
- 8.6 The EPA shall have the right to cancel or suspend this Permit for breach of any of the terms and conditions contained herein.
- 8.7 The Permit Holder is obligated to ensure that the project is permitted by other relevant authorities. All requisite approvals must be submitted and updated at the EPA.
- 8.8 This Construction Permit is effective for the period stipulated herein, **December, 2020 to November, 2021.**
- 8.9 This **Construction Permit** shall remain valid until **November 30, 2021**, unless otherwise suspended, cancelled, modified or varied, in accordance with the provisions of this Permit or the Environmental Protection Act, Cap. 20:05, Laws of Guyana, Environmental Protection (Amendment) Act, 2005, and the Environmental Protection (Authorisations) Regulations, 2000.
- 8.10 This Permit must be renewed by submitting a completed *Application Form for Renewal of Environmental Authorisation* to the Agency at least six months before this Permit expires, that is no later than **May 31, 2021.**
- 8.11 Any late submission of renewal application(s) after the specified date as stated above,

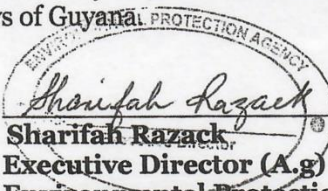


**Construction Permit - Ref. No.: 20200207-MDHEP**

Issued under the Environmental Protection Act, Cap. 20:05, Laws of Guyana, the Environmental Protection (Amendment) Act, 2005, and the Environmental Protection (Authorisations) Regulations, 2000.

shall require the Permit Holder to pay, in addition to the renewal fee, a late penalty fee (accruing at the time such obligation was first owed for renewal) at a rate of **two thousand dollars Guyana dollars (GYD\$2,000.00) per day** for every day late, until such renewal application is submitted to the Agency, without prejudice to any other rights of the Permit Holder in connection therewith.

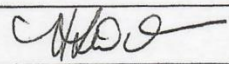
- 8.12 Failure to comply with the requirements of this Permit or with applicable laws and regulations, whether existing or forthcoming, shall render the Permit Holder liable to prosecution and to penalties, inclusive of civil penalties, injunctive relief and imprisonment, as prescribed under the Environmental Protection Act, Cap. 20:05, Laws of Guyana, the Environmental Protection Regulations and any other applicable laws of Guyana.

Signed by  on behalf of the Environmental Protection Agency

**Sharifah Razack**  
**Executive Director (A.g)**  
**Environmental Protection Agency**

Date 2020. 11. 30

I hereby accept the above terms and conditions upon which this Permit is granted and agree to abide by the Environmental Protection Act, Cap 20:05, Laws of Guyana, the Environmental Protection (Amendment) Act, 2005, and the Environmental Protection (Authorizations) Regulations, 2000, and any forthcoming regulations, best practices, guidelines and standards made under this Act.

NAME:	HORACE Williams
DESIGNATION:	Chief executive OFFICER
SIGNATURE:	
DATE :	Jan. 25, 2021



## Appendix D – Minutes and Reports of Stakeholders Engagements

### Stakeholder Engagements – ESAR for the Mahdia Solar Farm Project

#### Consultant Personal Communication 01 – Notes of the Discussions with Existing Occupants of Mahdia Solar Farm Project Site

**Date:** March 10, 2021

**Time:** 13:48 hrs

**Venue:** Mahdia Solar Farm Proposed Project Site

**Consultant Team:**

Mr. Khalid Alladin

Ms. Kandila Ramotar

Ms. Stella Madete

**Representative of the Guyana Energy Agency:**

Mr. Mfon Akpan                      Guyana Energy Agency (GEA)

Ms. Sanasha Perreira              Guyana Energy Agency (GEA)

Mr. Kyle Lewis                      Guyana Energy Agency (GEA)

**Existing Occupants:**

Mr. Tyrone Edwards              Existing Occupant of Mahdia Solar Farm Proposed Project Site

Ms. Claudette James              Existing Occupant of Mahdia Solar Farm Proposed Project Site

Mr. Martin Rodriguez              Existing Occupant of the Mahdia Solar Farm Proposed Project Site

### Introduction

On March 10, 2021, the Consultant team and representatives from the Guyana Energy Agency (GEA) visited the proposed site of the Mahdia Solar Farm Project to conduct a reconnaissance exercise to facilitate planning a field exercise at the site for baseline data collection on the following day. During the visit, some members of the Consultant's team and GEA representatives interacted with three existing occupants of the land to understand the types of activities that are being conducted as well as their claims of tenure.

### Summary of Discussions

The following is a summary of the key points of discussions with the existing occupants of the land.

#### **Mr. Tyrone Edwards (Miner, Farmer, Contractor, Baker and Taxi Driver)**

- **Existing Activities at the Project Site:** Mr. Edwards is constructing a permanent residential property on a section of the proposed project location and also has a temporary camp structure which is used for various purposes, including storing of construction materials and for workers to rest during construction. According to Mr. Edwards, his family is already residing in a finished section of the permanent structure. Mr. Edwards' wife is of mixed indigenous descent and they have seven children. Mr. Edwards indicated that he and his family has put a significant amount of effort into clearing and preparing the lands for construction.
- **Tenure:** Mr. Edwards indicated that he applied for a lease for the land sometime between the 2017 to 2018 period. He stated that the land was vacant when he applied for it and the Guyana Lands and Surveys Commission (GLSC) conducted a survey and showed him the boundaries of the area he has applied for. He indicated that he is aware that lands for residential uses

were also allocated on either side of his location and therefore, asserts that he has not misunderstood the location of the land he applied for. Mr. Edwards questioned how the GLSC would allocate the same land to Guyana Energy Agency (GEA), given that he has an application to lease the said land, and why the GEA did not consult or engage him before seeking to acquire the property.

Mr. Edwards indicated that receiving leases from the GLSC takes a prolonged period of time in Mahdia. As such, he requested permission from the Mahdia Town Council to commence construction at the current location using documentation he had received from the GLSC (payment receipt and the inspection/processing documents). He commenced construction of the property around October to November 2020 after receiving the requisite permission from the Mahdia Town Council.

- **Land Use Conflict:** Mr. Edwards explained that when the GEA team visited the site in November 2020 and observed his construction activities, he was escorted to the Mahdia Police Station on the allegation that he was using the land illegally. However, he indicated that after the Police consulted with the Mahdia Town Council he was released from custody after being informed that the construction was approved by the Town Council.

The GEA team indicated that after holding discussions with Mr. Edwards and the Town Council in November 2020, Mr. Edwards was requested to suspend construction until the relevant authorities resolved the land dispute. However, the GEA observed that construction had continued since that time.

Mr. Edwards also shared his belief that the area he applied for intersects with lands being used by Ms. James but he would not ask her to relocate because he respects the value of her labour and the long duration of time she has been active at the site.

- **Relocation:** Mr. Edwards shared his reluctance to relocate from this existing site because the current location is his preferred place of residence and lands are not readily available for residential uses in proximity. He also indicated that his family, especially his wife, likes the location. However, he is willing to consult with his family on relocating and will consider a fair settlement. He questioned why another location could not be found for the solar farm because lands are readily available in Mahdia.

#### **Ms. Claudette James (Farmer)**

- **Existing Activities at and in Proximity to the Project Site:** Ms. James is a farmer of indigenous descent and is farming a range of cash crops and permanent crops at five different plots within and outside of the proposed project location. She has also erected a camp structure at which her brother recently commenced staying during the evenings as a security measure. The farm is Ms. James only source of livelihood as her husband is disabled. The Farm also provides livelihoods for Ms. James' brother and his family (who previously resided in a satellite community of Campbelltown). Ms. James has six adult children and seven grandchildren who all visit the site regularly. Ms. James shared that she expended significant manual effort to clear the lands and prepare them for farming activities.
- **Land Tenure:** Ms. James indicated that she has been farming on the land for approximately 18 years. She explained that she was given permission to use the land by Brother Royston Kelly who had a legal claim to the land but who is now deceased. She explained that she only became aware of the land allocation for the Project when the billboard was erected and subsequently, visited the GLSC during one of their outreaches to Mahdia in 2020 to obtain formal legal rights to the land. However, the GLSC explained that a representative of Mr. Kelly

would be required to corroborate her claims and she requested that Mr. Kelly's nephew visit the GLSC but he was not available during the outreach.

- **Relocation:** Ms. James shared her reluctance to relocating because she can access her place of residence as well as markets in Mahdia on foot from the current location of her farm. Nonetheless, she is willing to relocate, if needed, if a suitable location can be found and she is fairly compensated, including payments for her efforts to clear the lands.

#### **Mr. Martin Rodriguez (Miner and Farmer)**

- **Existing Activities at the Project Location:** Mr. Rodriguez has erected a camp structure in which he resides. He indicates that he has a dredge in the back dams and also assists Ms. James with farming activities occasionally.
- **Tenure:** Mr. Rodriguez is a remigrant Guyana who returned from Venezuela. He has been residing in the camp on the site for approximately one year. He has no claims of tenure but erected the camp structure with support from Ms. James.
- **Relocation:** Mr. Rodriguez is willing to relocate if he receives compensation.

#### **Conclusion**

Mr. Akpan indicated that they are aware of the issues surrounding the project site land and want it resolved efficiently and amicably to ensure that all parties' concerns are satisfied. The GEA team stated that because the main issue was land allocation, the GLSC would be the best party to resolve it in close collaboration with all parties involved and key stakeholders like the Mahdia Town Council. The GEA team indicated that they would liaise with the GLSC, Mahdia Town Council, Mr. Edwards, and Ms. James to determine the way forward.

The discussions ended at 14:40 hrs.



## **Consultant Personal Communication 02 – Notes of the Public Meeting for Community Members**

**Date:** March 10, 2021

**Time:** 15:25 hrs.

**Venue:** Regional Democratic Council Boardroom, Mahdia

### **Consultant Team:**

Mr. Khalid Alladin  
Ms. Kandila Ramotar  
Mr. Michael Philander  
Ms. Stella Madete  
Mr. Raeburn Jones  
Mr. Hance Thompson  
Mr. Enrique Monize  
Mr. Omar Persaud

### **Representatives of the Guyana Energy Agency:**

Mr. Mfon Akpan	Guyana Energy Agency (GEA)
Ms. Sanasha Perreira	Guyana Energy Agency (GEA)
Mr. Kyle Lewis	Guyana Energy Agency (GEA)

### **Stakeholders:**

Mr. Paul Tyrell	Regional Democratic Council, Region 8
Mr. Julian Melville	Mahdia Town Council

### **Introduction**

Mr. Mfon Akpan, Guyana Energy Agency (GEA), thanked the community members for participating in the Mahdia Solar Farm Project discussions, and introductions were made. Mr. Akpan indicated that the meeting's purpose was to provide an overview and update of the proposed project being implemented by the GEA and receive feedback from stakeholders. Mr. Akpan explained that an Environmental and Social Assessment Report (ESAR) was already prepared for this Project. However, the proposed project location has since change and as such, a new (ESAR) is required by the Inter-American Development Bank (IDB) which is providing funding for the Project. Mr. Khalid Alladin of the Consultant team provided an overview of the purpose of the ESAR and the activities that will be conducted to prepare the ESAR.

### **Summary of Discussions**

The following areas and issues were discussed by the community members and the Consultant team:

- **Land Allocation Dispute:** Mr. Melville mentioned that he noticed the Mahdia Solar Farm Project sign was erected on the project land and inquired whether the GEA had resolved the land dispute.

The GEA team explained that the Guyana Lands and Surveys Commission (GLSC) demarcated and allocated the land to GEA in 2019, and at that time, there was no construction taking place on the site. However, upon a visit to the site towards the end of 2020, a foundation for the current property was observed. The GLSC also visited the site to conduct a survey and place palls marking the proposed Project location. The GEA team added that since November 2020, construction has continued. The structure progressed to a two-story house, despite requests to suspend construction until the relevant authorities resolved the dispute. The GEA

team said they met with the person responsible for the construction, and they also indicated that they have a claim to the same piece of land, with documentation to support those claims. The GEA team expressed concern that requests by two different parties lease the land may have been given consideration. They added that they would consult with the GLSC, Town Council, and the claimants to resolve the issues amicably.

- **Land Ownership:** Mr. Melville indicated that the Mahdia Town Council was aware of the dispute and was also under the impression that the land was privately owned by the current occupant.

Mr. Akpan responded that the GEA also has rights to the land based on permission granted by the GLSC and will have to engaged with the Commission to find a resolution and explore amicable solutions so that the Project can proceed.

- **Mahdia Solar Farm Project:** Mr. Melville and Mr. Tyrell stated that Mahdia residents pay the highest electricity rate in Guyana. They added that residents welcome the project because of the possibility of reduced rates. Mr. Melville mentioned that residents are excited about the project and keep asking for updates and timelines, especially since the sign was erected on the project site.

The GEA team indicated that the project's main purpose was to provide clean, sustainable, and affordable energy to the residents and businesses of Mahdia. They, however, reiterated that GEA is not responsible for the tariff controls and that Mahdia Power and Light (MPL) will determine the rate.

- **Community Attendance:** Mr. Melville expressed his disappointment in the low turnout for the meeting. He explained that the best time to hold community discussions is late in the afternoon when residents return from the mines or finish work. He also explained that it is likely that there were no representatives from Campbelltown because most people were gold mining at a recently discovered deposit.

The meeting closed at 16:15 hrs.

### **Consultant Personal Communication 03 – Notes of the Discussion with the Mahdia Town Council**

**Time:** 08:15 hrs

**Date:** March 11, 2021

**Venue:** Mahdia Town Council Office, Mahdia

**Consultant Team:**

Mr. Khalid Alladin

Ms. Kandila Ramotar

Ms. Stella Madete

**Representatives of the Guyana Energy Agency:**

Mr. Mfon Akpan                      Guyana Energy Agency (GEA)

Ms. Sanasha Perreira              Guyana Energy Agency (GEA)

**Representatives of the Mahdia Mayor and Town Council:**

Ms. Juewayne Burrowes              Deputy Mayor, Mahdia Mayor and Town Council

Ms. Alisa Mootoo                      Mahdia Mayor and Town Council

Ms. Molica Adams                      Mahdia Mayor and Town Council

Mr. Julian Melville                      Mahdia Mayor and Town Council

Mr. R. Ramphet                      Mahdia Mayor and Town Council

Mr. Harley Joseph                      Mahdia Mayor and Town Council

Mr. Juan Hunter                      Mahdia Mayor and Town Council

### **Introduction**

Mr. Mfon Akpan, Guyana Energy Agency (GEA), thanked the Town Council for facilitating the meeting and participating in the Mahdia Solar Farm Project discussions, and introductions were made. Mr. Akpan indicated that the meeting's purpose was to provide an overview and update of the proposed project implemented by the GEA and receive feedback from stakeholders. Mr. Akpan explained that an Environmental and Social Assessment Report (ESAR) was already prepared for this Project. However, the proposed project location has since change and as such, a new (ESAR) is required by the Inter-American Development Bank (IDB) which is providing funding for the Project. Mr. Khalid Alladin of the Consultant team provided an overview of the purpose of the ESAR and the activities that will be conducted to prepare the ESAR.

### **Summary of Discussions**

The following areas and issues were discussed by the Mahdia Mayor and Town Council, the GEA representatives and the Consultant team:

- **Land Disputes:** Ms. Burrowes enquired about the status of the land dispute on the Mahdia Solar Farm Project Land. The last update received by the municipality is that the Guyana Lands and Surveys Commission (GLSC) was expected to have played a central role in resolving the issue. Mr. Akpan stated that a final decision from the GLSC is still pending. He explained that there was no construction taking place on the site when GEA was allocated the land in 2019 but that construction commenced until December 2020. The occupant has continued to build despite being requested to stop activities until the GLSC provides a resolution. Mr. Akpan stated that GEA would consult GLSC to reach an amicable resolution to the issue.

Ms. Burrowes agreed that the GLSC is needed to provide clarity on the issue. She added that Ms. Claudette James, another occupant of the project land, asked the Town Council about the fate of her farm, and the Town Council could not give her a response because of the lack of clarity from the GLSC.

Mr. Akpan mentioned that Ms. James has no title and will require a different approach and solution to Mr. Tyrone Edwards, who claims to have an application with the GLSC to lease the land. Mr. Akpan added that although GEA wants to provide clean, sustainable, and affordable energy to the residents and businesses of Mahdia, it does not want to disenfranchise anyone in the process. The GEA will consult with the GLSC to find an amicable resolution to the issue.

- **Challenges in Obtaining Leases:** Ms. Burrowes explained that some of the confusion and resultant disputes stem from the delays in processing lease agreements in the GLSC system. She stated that residents could apply for the lease, pay for the land inspection, and obtain receipts of payments but have to wait for years for a lease. Ms. Burrowes opined that if lease agreements were required to show land ownership in Mahdia, most of its residents would be deemed squatters.
- **Town Council Building Approvals and Land Use Conflicts:** Ms. Burrowes indicated that the Town Council approves construction for residents who proffered receipts that showed payment for application to lease the area so that residents may build their homes while they await the final documentation of the lease. The Town Council provided Mr. Edwards with permission to commence construction using this system. However, she stated that this system resulted additional confusion because the receipts do not indicate the boundaries of the land for which the lease is being processed. Sometimes, multiple parties claimed ownership of one piece of land, as is the case with the land earmarked for the Mahdia Solar Farm Project site. Ms. Burrowes indicated that the Town Council was not aware that the GLSC had allocated the land to the Project and approved Mr. Edward's construction request.

Ms. Burrowes reiterated that the GLSC could have resolved these issues in early stages of the Project. In addition, in later 2020, a team from the GLSC was in Mahdia for three weeks but did not meet with the Town Council or with Mr. Edwards. Subsequently, Mr. Edwards explained to the Town Council that he believes the GLSC refused to meet with him because it was the same team who conducted the survey for his property. She agreed that the issue is growing more complicated as construction continues on the land. Ms. Burrowes indicated that the Town Council would serve Mr. Edwards with a Cease-and-Desist Order to stop any further construction until the issue is resolved.

Ms. Burrowes explained that there are significant issues of land ownership in Mahdia and only the GLSC can assist in addressing this situation and to identify alternative lands in instances where conflicts arise. Ms. Burrowes stated that to remedy the situation and prevent reoccurrences, the Town Council has asked GLSC to set up a Help Desk to handle land issues and claims specifically and to inspect and investigate land claims before approving construction. This is especially important since the GLSC Office which is responsible for the area is based till at Linden.

- **Land Ownership at Ms. James' Farm:** Some members of the Town Council also indicated that they are aware that the land on which Ms. James is farming was issued to Brother Kelly as a mining claim.
- **Mining Claims:** The Town Council advised the GEA team to consult with the Guyana Geology and Mines Commission (GGMC) to ensure that there were no mining claims on the land as

mining leases are very prevalent in the area. They also indicated that there are mining claims on some of the lands surrounding the project location.

- **Project Delays:** Mr. Joseph asked whether the land disputes with Mr. Edwards and Ms. James can hold up the project. Mr. Akpan explained that these issues could delay a project because IDB has strict safeguards. This means that even if GEA obtains the lease to the land, they will not release project funds until all disputes are resolved satisfactorily.
- **Electricity in Mahdia and Expectations of the Project:** Ms. Burrowes stated that Mahdia Power and Light supplies most of the electricity in the Town. She added that some businesses in Mahdia, and households on the outskirts of the town use generators as a backup, that mines mostly use generators, and that very few households use solar panels.

Ms. Burrowes mentioned that although Mahdia has a steady power supply, 24-hours every day, the electricity rates are the highest in the country. She added that residents have complained about the high cost of energy to the Town Council on many occasions and are looking forward to paying reduced rates when the Project is operational. Ms. Burrowes welcomed the Mahdia Solar Farm Project and the benefits it would bring to the town, like cheaper electricity and increased employment opportunities for young residents in other sectors outside of mining.

Ms. Burrowes explained that electricity is one of key factors for development in Mahdia and the other factors include road infrastructure and water supply. She indicated that existing businesses would expand and lower electricity rates may attract additional investments in Mahdia. She explained that development follows services and that if the electric grid is expanded, so would businesses and development. Ms. Burrowes added that some areas in Mahdia are looking for development opportunities but do not have access to electricity to do so. This includes the proposed housing developing in the vicinity of the airstrip. The new Town Hall building is also being constructed in this area.

- **Cultural and Religious Sites:** The Town Council indicated that there were no cultural or religious sites within the Project site.
- **Population:** The population in Mahdia as of 2012 was 2,563 people. Ms. Burrowes indicated that this number has significantly increased since then, even doubling to present because of migration into the town by coast landers, islanders, other neighboring countries like Brazil and Venezuela, and increased births.
- **Economic Activities:** The main economic activity in Mahdia is mining, with approximately 75 percent of the population directly dependent on the sector. The Town Council indicated that around 25 percent of the population earn their livelihoods from private businesses, the commercial sector and government employment.
- **Water:** Guyana Water Incorporated (GWI) provides water in Mahdia, and residents on the outskirts of the town access water through wells, creeks, and rainwater harvesting. Many Creeks near mining sites are contaminated, but there are some creeks near the project site with water safe for use.
- **Waste Management:** The Regional Democratic Council (RDC) established a dumpsite before the Mahdia Township was declared and this is still in use. However, a resident has produced a mining claim for that area and the dumpsite will have to be relocated. She indicated that the EPA had also visited Mahdia and identified an alternative dumpsite but investigations revealed that there is also a mining claim on this area. The identification of another site is ongoing. The



GEA team indicated that IDB requires that there is an approved municipal dumpsite for Project waste before implementation commences.

- **Government Facilities:** Government infrastructure in Mahdia includes a police station, a post office, RDC, GGMC, GWI, and Mahdia District Hospital.
- **Communications:** Mahdia Town has access to good Digicel and GTT cellular service. There are no landlines or cable internet services.
- **Financial Services:** There are no banks or financial services in Mahdia. Ms. Burrowes indicated that their absence is a major challenge for businesses, the Government, and employers who require them to transact, safely store money and pay salaries.
- **Crime:** The crime rate in Mahdia is low. Ms. Burrowes mentioned that some individuals tried to set up a criminal gang and cause trouble but were arrested by the police or ran out of town. She added that petty crimes are reported in the back dam, but not a high number.
- **Recreational Activities:** Ms. Burrowes indicated that there are no dedicated recreational facilities in Mahdia. Residents usually use the Mahdia Monument field to play football and cricket and the football field in Campbelltown. She stated that the Town Council is developing an area for recreational activities and events.
- **Infrastructure:** Ms. Burrowes indicated that the road networks within central Mahdia are widely used and in good condition. She indicated that plans are underway to upgrade the road to the airstrip, develop new roads, and repair damaged ones.
- **Consultation:** Ms. Burrowes expressed gratitude for the meeting and the opportunity to consult on the proposed Mahdia Solar Farm Project. Ms. Burrowes reiterated that the Town Council and Mahdia's residents welcomed the potential investment and boost to its economy.

The meeting closed at 09:04 hrs.

### **Consultant Personal Communication 04 – Notes of the Discussion with the Regional Democratic Council (RDC) in Mahdia**

**Date:** March 11, 2021

**Time:** 09:15 hrs.

**Venue:** Regional Democratic Council Boardroom, Mahdia

**Consultant Team:**

Mr. Khalid Alladin

Ms. Kandila Ramotar

Ms. Stella Madete

**Representative of the Regional Democratic Council:**

Mr. Carlos James

Representative of the Regional Executive Officer (REO), Regional Democratic Council (RDC)

### **Introduction**

Mr. Khalid Alladin thanked Mr. James, Representative of the Regional Executive Officer (REO), for participating in the discussions on the Mahdia Solar Farm Project, and introductions were made. Mr. Alladin indicated that the meeting's purpose was to provide an overview of the proposed project implemented and receive feedback from stakeholders in the region. Mr. Alladin provided an overview of the purpose of the ESAR and the activities that will be conducted to prepare the ESAR.

### **Summary of Discussions**

The following areas and issues were discussed by the REO and the Consultant team:

- **Population:** Mr. James estimated the population of Mahdia to be around 4,000 to 5,000 people. He added that the number is increasing because of migration, including from Georgetown, for mining and business opportunities as well as by increased births. He indicated that Brazilians and Venezuelans are coming to do mining but only in small numbers.
- **Food Sources:** Most food and supplies are imported into Mahdia and Region 8 from Georgetown. He mentioned that agriculture is not practiced commercially but added that some households practice small-scale farming. Residents in Sub-Region 1 do not practice fishing for subsistence or commercial sale. However, residents in Sub-Region 2 are engaged in fishing. He explained that Sub-Region 2 covers all communities between Mango Landing and Mahdia while Sub-Region 1 includes other communities in the Pakaraimas.
- **Water:** The main water sources in Region 8 are harvested rainfall and the Guyana Water Incorporated (GWI) water network. GWI's sources water from wells as well as from the Salbora Creek, which is located close to the airstrip.
- **Electricity:** Mr. James indicated that Mahdia Power and Light (MPL) supplies electricity to residents and businesses in Mahdia for 24-hour each day. However, every day there is a 10-to-15-minute power cut at midday to switch between generators. He added that the current supply is adequate but that the GY\$ 100/kWh cost is prohibitive for most businesses and residents. He further stated that residents and businesses outside the MPL grid, on the outskirts of Mahdia and in back dam areas use generators, but none use solar systems.
- **Healthcare:** The REO stated that Region 8 has ten health centers and the Mahdia District Hospital. He shared that although the hospital was well staffed and equipped, it still faced

challenges and has to refer emergency cases to Georgetown. The REO shared that plans are in place to upgrade the Hospital to provide emergency services and address any service delivery gaps. He added that the biggest health concern in Region 8 and Mahdia is Malaria. The REO stated that Region 8 had managed the COVID-19 virus well, with eight cases at the height of the pandemic and no current cases. He indicated that COVID-19 vaccines have arrived in the Region and immunization will commence soon.

- **Government Facilities:** Government main facilities in Mahdia include the police station, Town Council, Post Office, Regional Democratic Council, Guyana Geology and Mines Commission (GGMC), GWI, and Mahdia District Hospital.
- **Schools:** The REO shared that Mahdia has a nursery school, and primary and secondary schools. He added that Mahdia Secondary School has Dormitories that cater for all students of Sub-Region 2 of Region 8.
- **Waste Management:** The Town Council provides waste management services. Garbage is collected from residents and business premises twice per week at a fee. Most homes in Mahdia use septic tanks to manage sewage waste.
- **Environmental Concerns:** Mr. James stated that the main environmental concern in Mahdia and Region 8 as a whole is water contamination by mining activities. He explained that this was not a major issue as residents did not drink water from the contaminated creeks.
- **Social Concerns:** Mr. James stated that the main societal problems in Mahdia and Region 8 were excessive alcohol consumption and the lifestyle that is attached to it. The REO indicated that crime is very low in Mahdia and Region 8 in general.
- **Stakeholder Consultations:** Mr. James expressed concern that relevant parties did not consult the RDC about the Mahdia Solar Farm Project. He explained that this is a constraint because the RDC will have a role to monitor and report on progress once the Project is up and running. As such, the RDC needs to be involved in all aspects of its execution. He emphasized that the RDC would like to receive more information on the Project, frequent progress updates and be more involved in its implementation.

He reiterated that parties involved should expand their consultations and enlighten the public and business owners about the process and potential benefits the project will provide them.

- **Project Expectations:** The RDC welcomed the new Mahdia Solar Farm Project and its potential to contribute to development in Mahdia. He also shared expectations of lowered electricity costs when the Project is operational.

The meeting closed at 09:44 hrs.

## **Consultant Personal Communication 05 – Notes of the Discussion with the Mahdia Power and Light**

**Date:** March 11, 2021

**Time:** 10:05 hrs

**Venue:** Mahdia Power and Light Office, Mahdia

### **Consultant Team:**

Mr. Khalid Alladin

Ms. Kandila Ramotar

Ms. Stella Madete

### **Representatives of the Guyana Energy Agency:**

Mr. Mfon Akpan                      Guyana Energy Agency (GEA)

Ms. Sanasha Perreira              Guyana Energy Agency (GEA)

### **Stakeholders:**

Mr. Dexter Prince                      General Manager, Mahdia Power and Light (MPL) – via Zoom

Ms. Brittany Harmon                      Accounts Supervisor, Mahdia Power and Light (MPL)

## **Introduction**

Mr. Mfon Akpan thanked the representative from Mahdia Power and Light (MPL) for participating in the discussions about the Mahdia Solar Farm Project, and introductions were made. Mr. Akpan explained that MPL is one of the GEA's key partners in the Project and has been involved since its inception. Mr. Akpan also stated that the Mahdia Solar Farm Project land will be leased to MPL and the utility company will manage the project once it is completed. Mr. Khalid Alladin of the Consultant team provided an overview of the purpose of the ESAR and the activities that will be conducted to prepare the ESAR.

## **Summary of Discussions**

The following areas and issues were discussed by Ms. Brittany Harmon and the Consultant team:

- **Transmission Boundaries:** Ms. Harmon indicated that MPL provides electricity to residents and businesses in Campbelltown, Pepper Hill, Airstrip, Central Mahdia, and Seven Miles. MPL meets all the current electricity needs in Mahdia. She mentioned the only power cuts occur when there is a switch between generators; half an hour switch when one generator is working, and 15 minutes when two are working. Ms. Harmon added that the demand for electricity is increasing and MPL will be expanding the transmission and distribution system to Coop Town in the vicinity of Princeville. However, the line will not go as far as Princeville.
- **Electricity Cost:** The cost of electricity is GY\$ 100/kWh, with the first 15kW of power used being subsidized by the Government.
- **Fuel Source:** Ms. Harmon stated that MPL sourced its fuel from GUYOIL twice per month, which is transported to Mahdia from Georgetown via road. MPL has an on-site fuel storage capacity of 75,000-liter. This prevents power outages from fuel shortages during the rainy season when the road is in poor condition. She explained that about a decade ago, there were circumstances where MPL could not generate power for weeks at a time because fuel could not be transported into Mahdia due to the roads being impassable.

- **Staffing:** Ms. Harmon shared that MPL currently has 22 staff, local hires from Mahdia and Campbelltown, eight of whom are women. Ms. Harmon indicated that MPL would require additional staff to manage the Mahdia Solar Farm Project. She added that at least two people would be required at the Solar Farm on a permanent basis. Ms. Harmon mentioned that MPL provides capacity building and training to staff. All staff are also trained in Health and Safety. MPL also provides opportunities for work-study and placements for students.
- **Challenges:** For the preceding three weeks, only one of the generators has been functional and if this generator malfunctions there could be widespread blackouts. However, this issue is expected to be addressed soon. Another significant issue is generator maintenance and malfunction, as it requires specialized expertise not found locally, and theft of equipment. Finally, electricity theft is also a challenge for the company.
- **Follow-Up:** Mr. Prince agreed to a follow-up discussion with the Consultants to help them to better understand MPL's activities.

The meeting closed at 10:31 hrs.



## **Consultant Personal Communication 06 – Notes of the Discussion with the Campbelltown Village Council**

**Date:** March 11, 2021

**Time:** 10:58 hrs.

**Venue:** Campbelltown Market, Campbelltown Village

### **Consultant Team:**

Mr. Khalid Alladin

Ms. Kandila Ramotar

Ms. Stella Madete

### **Representatives of the Guyana Energy Agency:**

Mr. Mfon Akpan                      Guyana Energy Agency (GEA)

Ms. Sanasha Perreira              Guyana Energy Agency (GEA)

### **Stakeholders:**

Ms. Samantha Edwards-John      Toshao, Campbelltown Village Council

Ms. Karen Anthony              Campbelltown Village Council

Ms. Meavis George              Campbelltown Village Council

Mr. Vincent Xavier              Councilor, Campbelltown Village Council

Mr. Wilfred Williams              Councilor, Campbelltown Village Council

Mr. Marcello Gabriel              Councilor, Campbelltown Village Council

Mr. Barnett Kenlune              Councilor, Campbelltown Village Council

Ms. Margaret John              Campbelltown Village Council

### **Introduction**

Mr. Mfon Akpan, Guyana Energy Agency (GEA), thanked the Village Council for facilitating the meeting and participating in the Mahdia Solar Farm Project discussions, and introductions were made. Mr. Akpan indicated that the meeting's purpose was to provide an overview and update of the proposed project being implemented by the GEA and receive feedback from stakeholders. Mr. Akpan explained that an Environmental and Social Assessment Report (ESAR) was already prepared for this Project. However, the proposed project location has since change and as such, a new (ESAR) is required by the Inter-American Development Bank (IDB) which is providing funding for the Project. Mr. Khalid Alladin of the Consultant team provided an overview of the purpose of the ESAR and the activities that will be conducted to prepare the ESAR.

### **Summary of Discussions**

The following areas and issues were discussed by the Campbelltown Village Council and Consultant team:

- **Project Awareness:** The Toshao stated that she was aware of the Mahdia Solar Farm Project and welcomed it, as it would improve access to affordable electricity for the community and increase development in the village. She indicated that she, and other Council members, attended a public meeting at the Boardroom of the Regional Democratic Council and contributed to the identification of the site which was previously earmarked. However, there were no subsequent updates on the Project, and she is only aware of the new location because of the sign-board that was erected. In addition, The Toshao explained that she believed that Project had already started and that the building under construction adjacent to the public roadway belonged to the Project.

- **Electricity Access:** The Toshao explained that only some households in Campbelltown receive electricity from the MPL grid. The Village Council stated that MPL had indicated that there is not enough generation capacity or an existing transmission and distribution system to provide power to all the homes in Campbelltown. Campbelltown's satellite villages of Princeville and Muruwa are not connected to the electric grid. The Village Council has been requesting MPL to expand the provision of electricity for more than two years, including an expansion to Princeville.
- **Electricity Cost:** The Village Council indicated that the cost of electricity from MPL was very high and is probably the highest in the country. The Village Council claimed that the costs of electricity increased over time and has been at the current high level since 2015. The Village Council asked whether the costs of electricity will be reduced when the Solar Farm is operational. Mr. Akpan indicated that the costs of generating electricity are expected to be reduced. However, MPL will be responsible for setting the tariffs that will determine the cost of electricity when the project is operational.

The Village Council indicated that there were also two generators located in Campbelltown but are no longer operational due to a lightning strike.

- **Voltage Fluctuations:** The power provided by MPL is prone to voltage fluctuations which are worsened during the daily MPL power outages to facilitate switching of generators. Significant changes in voltage have resulted in damages, sometimes irreparable, to appliances and equipment and the customers have to pay this cost. MPL has previously informed villagers that they experience voltage swings because their homes are not properly earthed. Some members of the Village Council believe that MPL has two power lines: one that provides 110 volts and another than provides 240 volts which are the reason for the voltage swings.

The Village Council recommended that the GEA and MPL investigate the transmission line problems and resolve the fluctuation and low voltage issues before incorporating the new solar energy into the grid.

- **Operator of the Solar Farm:** The Village Council asked who would manage the new project and whether a Committee will be formed to oversee the management. Mr. Akpan stated that the project's main purpose was to provide clean, stable, sustainable, and affordable energy to the residents and businesses of Mahdia, including Campbelltown. He added that the project aims to expand the existing capacity by combining solar and diesel energy but explained that GEA is not responsible for the tariff controls. MPL will be the operator of the of the Solar Farm when construction is completed.
- **Project Commencement Date and Capacity:** The Councilors asked when the solar farm will begin transmitting electricity, if the project site can housed the required number of solar panels, and if Campbelltown will be affected by any of its activities. One Councilor indicated that there have been many consultations for different initiatives but only few have come to fruition while others failed because of corruption.

Mr. Akpan indicated that the project would be tendered by July 2021 if everything goes according to plan, and that the project site is adequate for the required infrastructure and equipment, and no adverse impacts to the Campbelltown village as a result of construction of the solar PV power plant are anticipated.

- **Technical Capacity of MPL:** When MPL was formed, there was a certified electrician on staff. However, the Village Council is unsure whether the current personnel are certified. A

recommendation was made to ensure that all personnel who will be recruited by the Project are appropriately trained and certified.

- **Campbelltown Village, Population and Demographics:** The Village Council indicated that a census is ongoing. Based on available data, Campbelltown and Princeville have a total population of 1,200 people and 224 households. Only 87 persons are residents of Muruwa. The village population is on the rise and is attributed to increased births and diaspora returning. Ms. Edwards-John explained that Campbelltown was established around 1940 and became a titled village in 2006.

The majority of residents are of indigenous descent from the Patamona nation and the rest from the Macushi, Wapishana, Akawaio, and Arawak nations. There are also a few Brazilian settlers who have assimilated into the village.

- **Economic Activities:** The main economic activities in Campbelltown are mining and small-scale/subsistence farming. Hunting is practiced by some households to meet domestic needs. Some residents also fish for subsistence and walk for four days to access the Potaro River, one of the boundaries of the Village, for this purpose.
- **Food:** The main foods consumed in Campbelltown are rice, flour, sugar, and cassava, all purchased from Mahdia or sourced from small-scale farmers in the village. Ms. Edwards-John added that most households use either gas, firewood or kerosene for cooking.
- **Tourism:** Currently, there were no tourism activities in the village. They explained that they had plans to develop tourism in Kangaruma/Three Miles Square where there is a waterfall and a small beach created by the work of a mining dredge in the area. The intention was to erect benches, a net for volleyball and to offer canoeing. However, mining activities has caused the destruction of the access road to the area.
- **Land Uses in the Village:** The Village Council shared that land investment and development in Campbelltown is guided by the Village Improvement Plan (VIP). The VIP includes a land use map which earmarked areas that have been reserved for particular land uses such as farming and logging amongst others.
- **Water:** Most residents use water supplied by Guyana Water Incorporated (GWI) from Salbora Creek. In addition, there are a few wells in the village. The Toshao complained that the water pressure is low and that the well operating times are too short but added that they never ran out of water. Previously, residents depended on Wariabe Creek and Kunuwa Creek for water and fetched this over long distances. She mentioned that Princeville and Muruwa use water from creeks and experience shortages or have to travel long distances to access water during the dry seasons.
- **Village Infrastructure, Vehicles and Equipment:** The Village Council operates the market, the village shop, the Village Council office, a guest house, a bond, a bench and a kitchen. The Council also has two pick-up trucks (only one of which is operational), two ATVs in Campbelltown, one ATV in Muruwa, a tractor, a canter, a bus and an excavator. Ms. Edwards-John explained that the Village Council funded these buildings and machinery from a ten percent mining tax charged to residents or outsiders conducting mining operations on Campbelltown land.
- **Health:** There are Health Post for use by residents of Muruwa but it is not staffed or equipped. The remote/isolated nature of these community make it challenging to find health workers to be stationed there. Residents of Campbelltown use the Mahdia District Hospital for treatment.

She added that the village followed recommended health and safety guidelines to prevent the spread of COVID-19 but nonetheless, there were a few cases of coronavirus amongst villagers. Malaria is the biggest health concern in Campbelltown.

- **Schools:** There are both nursery and primary schools in Princeville and Muruwa while secondary school students attended Mahdia Secondary stay in the dormitory. There is only a nursery school in Campbelltown and students attended primary and secondary school in Mahdia.
- **Cell and Internet Service:** Digicel and GTT cellular service and internet connectivity are available in Campbelltown and some parts of Princeville. She added that Campbelltown also benefits from free government wireless internet. There is no cell phone or internet service in Muruwa.
- **Transport:** The main forms of transport in and outside of Campbelltown are walking, cycling, and driving. She explained that a taxi ride within Campbelltown costs around GYD\$1,000, to Mahdia GYD\$2,000, and to Princeville up to GYD\$ 5,000. She added that to travel to Muruwa requires an ATV.
- **Culture and Religion:** Campbelltown residents practice indigenous religions, dances, prayers, use indigenous medicines and speak indigenous languages (mainly Patamona, Wapishan and Machusi). It was indicated that no religious or spiritual sites are located within the project site but some sacred sites are located by the Potaro River.
- **Recreation:** The main recreation in Campbelltown is a playfield where cricket, football and other sports events are conducted. Village celebrations are usually held at the benab.
- **Waste Management:** The Village Council manages a dumpsite in Campbelltown but Mahdia residents and business owners use it, even though they are not supposed to do so. Business operators in Mahdia also dump their waste on Campbelltown land, despite efforts by the Village Council and the Mahdia Town Council to stop them.
- **Environmental Concerns:** Ms. Edwards-John stated that mining activities have polluted most water sources and destroyed some land in the area, although GGMC has tried to monitor and control mining sites destruction and promote restoration. The Village Council has reserved some sites in Princeville for the reclamation of mined out areas. The reclamation area is also included in the land use map within the VIP.

The Village Council enquired whether any biodiversity will be affected by the project. Mr. Alladin stated that the current project site contained no significant biodiversity or intact forest given that some of it is currently used for farming. He added that the only significant impact foreseen at this time was its occupation by two residents that needed to be resolved; one farming on the land and the other constructing a residence.

- **Social Concerns:** The Toshao expressed frustration at NGOs implementing projects and activities in Campbelltown without consulting the Village Council. She said she welcomed projects that benefit the community but stressed that they must be implemented using the right channels.

The Toshao also complained about contactors and companies that extract Campbelltown resources without permission from the Village Council. Recently, laterite from the Village was extracted without permission to be used for road repairs. She reiterated that she welcomes

investments into the village, but only if they are carried out correctly, through the right channels, following the correct procedures.

Ms. Edwards-John expressed concern about the rising alcohol and drug problem in Campbelltown. She stated that the Village Council has tried to address it with support from the police and Mahdia Town Council, but the problem persists. She also added that various parties are taking advantage of Amerindians in the area, targeting them for arrests and sex work in the back dam.

- **Expectations:** The Village Council anticipates easy access to electricity at an affordable rate to save on energy costs, as Mahdia pays the highest rate for electricity in Guyana. The Village Council expects the new project to expand the service that is provided to Campbelltown. The Village Council also emphasized that qualified village residents should be prioritized for jobs and capacity-building opportunities created by the solar project. They gave examples of employees being brought from Georgetown for jobs which could have been filled locally such as cooks, security personnel and saw operators among others. Low levels of accountability to locals contributed low quality work and service provision.

The Village Council indicated that the excavator owned by the Village could be rented by the Project.

The Toshao reiterated that she welcomes the investment in the power grid but recommended that the GEA prioritize and more frequently consult with the Village. In the future, guidelines for free, prior and informed consent (FPIC) should be followed. Concerns raised by indigenous stakeholders should be carefully listened to, and concerns and recommendations to improve electricity supply service delivery should be documented and seriously considered. The Village Council should be provided with adequate time to allow villagers to be informed about meetings as some villages express disagreement with positions taken by the Village Council in such meetings.

Mr. Akpan assured the residents that the GEA and MPL would consult with the Village Council about employment and training opportunities and update them on the project's progress. He emphasized the importance of residents reviewing the skills and qualifications required, and added that although the upcoming project will create new jobs, community members must understand that only the most qualified candidates will be employed.

Mr. Alladin indicated that concerns and recommendations raised in the meetings would be reflected in the ESAR, and Mr. Akpan stated that GEA would work to ensure that they are addressed.

The meeting closed at 12:30 hrs.



## **Consultant Personal Communication 07 – Notes of the Discussion with Claudette James**

**Date:** March 11, 2021

**Time:** 14:10 hrs.

**Venue:** Mahdia Solar Farm Project Site, Mahdia

### **Consultant Team:**

Mr. Khalid Alladin

Ms. Kandila Ramotar

Ms. Stella Madete

### **Guyana Energy Agency Representative:**

Mr. Mfon Akpan

Guyana Energy Agency (GEA)

### **Stakeholder:**

Ms. Claudette James

Occupant of Mahdia Solar Farm Project Site

## **Introduction**

On March 11, 2021 representatives of the Guyana Energy Agency (GEA) and the Consultant team visited the proposed location of the Solar Farm to further engage with Ms. Claudette James to enhance understanding of her farming activities within and around the project location.

## **Summary of Discussions**

The following areas and issues were discussed by Ms. Claudette James and the Consultant team:

- **Overview of Activities Within and Around the Project Location:** Ms. James is uncertain of the location of her farming activities relative to the boundaries of the proposed project location. She explained that she is in the process of relocating her camping structure to the west of where it is currently situated because the existing grounds become slushy when it rains. Ms. James explained that her brother, his wife and their six children recently moved from a Campbelltown satellite community in search of a livelihood and she offered them the opportunity of helping on the farm. Her brother now resides in the camp as a security measure. She also agreed that a Venezuela remigrant, Mr. Rodriguez, could also set up a camp as his residence approximately one year previously and she is uncertain of how long he plans to remain at this location.

She has five active farming areas one of which is north of her existing camp which is approaching a time of harvest and the other four located to the west of the existing camping area. The farm which is approaching harvesting time may be the only one on the proposed project site. She practices shifting cultivation and does not replant in the same areas for more than one harvest cycle. Ms. James indicated that she does not use any fertilizers on her crops. She also catches fishes like patwa and houri from the waterways surrounding the farm.

Based on observations of Ms. James' activities, Mr. Akpan shared his belief that, when the relocation of the camping area is complete, most activities will fall outside the boundaries of the Solar Farm. He advised Ms. James to discontinue farming activities north of the current camp site after harvesting the current crop in that location.

- **Crops and Products:** Ms. James plants a variety of ground provisions, cash crops and fruits including cassava, plantain, eddo, turmeric, coconut, lemon, sugar cane, bora, ochro, pumpkin, corilla, leafy vegetables, bananas, Brazilian whitee, corn, soursop and malaka. Ms.

James also makes by-products of cassava at the camp site including cassareep, cassava bread, cassava water, farine and kasiri which is an alcoholic beverage. Ms. James indicated she may also plant black potatoes to make fly, which is another alcoholic beverage. She sells most of her crops in Mahdia.

- **Earnings from Farming Activities:** Ms. James indicated that she has never calculated her weekly or monthly earnings nor the quantity of produce sold but provided estimates of earning for a few of the crops she grows:
  - Turmeric is in high demand and is sold for GYD\$10,000 to 15,000 per parcel.
  - A day of earnings from cassava is valued between GYD\$8,000 to 10,000.
  - Plantains are sold for GYD\$180 per pound.
  - Bananas are sold for GYD\$130 per pound and approximately 70 to 80 pounds are harvested in each crop.
  - Farine is sold for GYD\$12,000 per pail.
  - Cassareep is sold for GYD\$3,500 per liter.
- **Alternative Livelihoods:** Ms. James indicated that she has no other source of livelihood and is the sole breadwinner in her family because her husband is disabled. The farm is also the only source of livelihood for Ms. James' brother and his family.
- **Relocation:** Ms. James indicated that she lives in proximity to both her farm and market and is unwilling to relocate as the farm and markets in Mahdia are within walking distance to her home, and she has no vehicle or means to pay for transport. She also explained that she has intimate knowledge of the land and knows how to farm at this location. She asked whether the Project could be sited elsewhere.
- **Tenure:** Ms. James explained that she will continue to pursue getting legal rights to land. She explained that she would like to erect an enclosed wooden structure instead of a camp for security. She shared one incident in the past of a jaguar coming to the camp site and clawing on poles of the camp.
- **Employment:** Ms. James stated that she hopes that she and her family members, including grandchildren who finished secondary school, can be employed once the project is finished since they live close to the site.

Mr. Akpan stated that once the project is operational, the Mahdia Power and Light will advertise for jobs, and qualified individuals will be hired. He encouraged Ms. James to apply for those she is interested in when the time comes.

The meeting closed at 15:15 hrs.

## **Consultant Personal Communication 08 – Notes of the Discussion with the Mahdia Power and Light**

**Date:** March 17, 2021

**Time:** 10:11 hrs.

**Venue:** Phone Call

**Consultant Team:**

Ms. Kandila Ramotar

Ms. Stella Madete

**Stakeholders:**

Mr. Dexter Prince

General Manager, Mahdia Power and Light (MPL)

### **Introduction**

Ms. Kandila Ramotar of the Consultant team thanked Mr. Dexter Prince of Mahdia Power and Light (MPL) to taking time to participate in follow-up discussions on MPL's activities and the Solar Farm Project.

### **Summary of Discussions**

The following areas and issues were discussed by Mr. Dexter Prince and the Consultant team:

- **MPL Staffing:** Mr. Prince stated that MPL currently employs approximately 24 staff, of which 90 percent is from Mahdia. The remaining person are migrants who settled in the Town.
- **MPL Capacity:** Mr. Prince indicated that MPL is financially stable. He, however, stated that the technical capacity at MPL needs to be developed. In particular, development is needed in:
  - Line Training for junior staff who need to learn about network construction and security.
  - Training for operators, particularly in the line and operation sections.

MPL also needs to establish an emergency crew and recruit more linesmen to increase reliability and response.

Mr. Prince shared that he has worked to improve staff capacities since he joined the company. He mentioned plans to introduce formal training for staff members since there is no formal training for staff and most existing staff members had to learn on the job. Many personnel have expressed the need for formal training and academic learning or certification. He added that student placements and internships are managed at the level of the Hinterland Electrification Company Inc. (HECI) which is located in the Office of the Prime Minister. He explained that MPL also previously benefited from staff transfer training when a staff member from the Port Kaituma Power Station provided support in accounting and record keeping.

- **Transmission Boundaries:** Mr. Prince indicated that HECI has the boundaries of MPL's transmission system and this could potentially be shared with the Consultant.
- **Boundary Expansion:** Mr. Prince explained that in December 2020 MPL completed expansion of the secondary transmission and distribution network. In addition, MPL recently added approximately 0.5 kilometers of transmission lines in the vicinity of Pepper Hill.

MPL also has plans to extend the transmission line a few hundred meters in White Hole and across the creek in Campbelltown.

He explained that MPL did not budget for expansion of the transmission and distribution network in the vicinity of the airstrip (where the new Town Hall will be located and where there are plans for the establishment of a new housing scheme) because this will require a significant investment. He suggested that if the new housing scheme will need to be electrified, the budget for expansion of the transmission and distribution system could be spread over several agencies including the Ministry of Local Government and Regional Development.

- **Installed Capacity:** MPL has an installed capacity of 1.5MW with two generators, one of which is 400MW and the other 600MW. For the previous three weeks only one generator has been operational. MPL purchased another generator with the goal of increasing MPL's installed capacity. This new generator will be coupled with the existing system so that MPL's installed capacity would soon revert to 1.5MW.

Mr. Prince further explained that the generator sets were installed in 2011. Since that time, one generator was replaced and this is this in the system. The other was rebuilt. The rebuilt generator has not been operational since 2016.

- **Baseload:** Mr. Prince indicated that the current maximum demand of the system is 0.37MW with a baseload of 140 kW per day, with a peak day-time demand of 280 kW. Although baseload is nominally lower than the installed capacity, it should be recognized that the generators do not always produce the stated maximum power output. For example, power generation is approximately 75 percent of installed capacity during off-peak hours of the day. However, transmission line loss is not significant because the network is small.
- **Forecast:** Mr. Prince stated that there are no previous records to inform load and demand forecasts but added that the company expects continuous growth in demand for electricity in Mahdia. Mr. Prince predicted that demand would grow exponentially in the next five to ten years, then taper off as more people are added to the grid. He explained that MPL's strategy is to increase the number of people connected to the grid thereby increasing demand. MPL has been conducting awareness building to advise locals of the advantages of joining the grid. As a result, there has been a significant increase in load demand in the past three years, by around 0.3 or 0.4 MW.

Mr. Prince added that many factors determine the load demand and that MPL needs to consider all of them before making a forecast, but added that economic growth in Mahdia and the country as a whole is expected. He explained that if the economy in Mahdia grows, then there will be an increase in demand for MPL's service and vice versa. Currently, given the transient nature of some of the business in Mahdia, there are periods of load shedding when power consumption from the grid decreases. This practice also makes forecasting challenging in Mahdia.

- **Electricity Cost:** Mr. Prince stated that Mahdia's electricity costs GY\$ 100/kWh and although this is high it is comparable with electricity rates in other hinterland regions of Guyana like Port Kaituma, Mabaruma and Lethem. More efficient power generation measures and grid diversification can help to reduce costs of generation and therefore, the costs borne by consumers. He mentioned that the Government subsidizes the cost of electricity in Mahdia. He indicated that the value of the subsidies is determined at the policy level and can be changed. He explained power is almost entirely subsidized in Kwakwani and only a few customers pay for electricity.

- **Fuel:** Mr. Prince stated that fuel is transported to MPL every fortnight at the cost of GYD\$ 450,000 per tanker load. He explained that the company ensures that there are at least 70,000 liters of fuel in storage at MPL which is a six-week supply of fuel so to prevent blackouts if fuel cannot be transported into Mahdia when the roads are impassable. He mentioned that in recent years, three trucks were left at the bottom of a Hill along the roadway for approximately three weeks but this did not affect the power generation capacity of MPL because of the fuel stored on-site.
- **Challenges:** Mr. Prince indicated that the main challenges faced by MPL are the lack of technical capacity. He also indicated that MPL aims to expand the network and wants to improve the company's reliability as well as the quality of service provided by the company. Maintenance of transformers and machines also presents a few challenges.
- **Recommendations:** Mr. Prince suggested that the transmission line for the Solar Farm should piggyback on new lines to help to ensure that electricity can be provided to unserved areas. This would ease the establishment of the secondary network.

Meeting closed at 10:41 hrs.



### GEA Mahdia Site Visit Report (June 23 to 25, 2021)

To: Dr. Mahender Sharma

Subject: Mahdia Site Visit Report (23<sup>rd</sup> – 25<sup>th</sup> June 2021)

A site visit was conducted on the 23<sup>rd</sup> of June 2021 with Energy Engineer, Kenny Samaroo, to Mahdia Region 8. This site visit was done to collect the *No Objections* from the Mayor and Town Council, Regional Democratic Council and the Campbelltown Village Council for approval of the installation of a transmission line network that will pass through the Campbelltown reserve. The visit was also meant to determine whether the site was prone to flooding due to the recent floods in the country.

The route was identified as the shortest route by the Energy Engineer (Kenny Samaroo), where minimal work would have to be done to construct the network.

After arriving in Mahdia, the *no-objection* request letters were submitted to the respective parties for their timely completion and submission of responses. A meeting was held with each party, firstly, the Mayor and Town Council was visited and informed by the team of the plans to have a transmission line built through the community of Campbelltown. During the discussion several matters were clarified. The letter requesting the *no objection* from the Town Council had a map that showed Mahdia being a part of the Campbelltown reserve, this was found to be inaccurate. Ms. Adams indicated that Campbelltown is contained within the boundaries of Mahdia, secondly, the mayor and town council was unaware of the resolution of the land issue with Mr. Tyrone Edwards. Details of the resurvey was communicated to her, and she then requested a letter of the resolution and the lease indicating that it was resolved.

A meeting was then held with the Regional Democratic Council, in attendance were Kenny Samaroo, Kyle Lewis, and Mr. Peter Ramotar (Regional Executive Officer Region 8). A lengthy discussion was had with the REO on the details of the solar farm and the associated transmission line network, since the REO was new, the discussion lasted approximately one hour. After the discussion the REO requested the *no objection* from the Campbelltown Village Council for his completion of a *no-objection*.

Lastly, a visit was made to the Campbelltown Village Council, the Toshao and one councilor met with the GEA. A detailed overview was given to the persons in attendance, and they were provided the *no-objection* request letter. The Toshao indicated that once a meeting was kept with the other councilors a *no-objection* would be completed and submitted to the GEA.

**GEA Mahdia Site Visit Internal Memo (July 14 to 16, 2021)**

**Internal Memo**

**Guyana Energy Agency  
(GEA)**

To: Dr. Mahender Sharma, Chief Executive Officer  
From: Mr. Mfon Akpan, Project Coordinator  
Subject: Report on Public consultation held with the residents of Campbelltown  
Date: August 24, 2021


**Report** on Public consultation held with the residents of Campbelltown during the first two quarters of 2021.

During March 10-12, 2021, a public consultation was held in the community of Campbelltown. Also in attendance was the consultant for the ESAR Mahdia. Initially, there were two farming families, without any legal entitlements to the land, but occupying part of the project area. A meeting was held with them during which they were fully informed of the Solar PV project on the site. Because of their shifting cultivation farming system, they expressed their willingness and agreement to voluntarily vacate the area immediately after their harvesting season.

During July 14-16, another visit to the project site was conducted by the Project Coordinator, and as an evidence to that informal agreement reached during the meeting held in March, one of the farming farmers would have already moved after the harvest. GEA had a meeting with the remaining (one) family, represented by Claudette James, who was preparing for their harvest soon. Again, they expressed their willingness to shift their cultivation to another location, once the harvesting season is over. It is clearly evident that there will be no occupant farming on the site by the time the Solar PV project commences.

Also, there is another resident by name Tyrone Edwards and family, who has a legal ownership to the land adjacent to the site for the Solar PV project. He was fully briefed of the project, and he expressed to have no objection to the project.

All for your information and guidance



Mfon Akpan

Project Coordinator

### GEA Mahdia Site Visit Report (August 18 to 20, 2021)

To: Dr. Mahender Sharma

Subject: Mahdia follow-up visit (18<sup>th</sup> – 20<sup>th</sup> August 2021)

A site visit was conducted on the 18<sup>th</sup> of August 2021 at Mahdia Region 8 for the collection of outstanding *no objections* from the land occupant (Tyrone Edwards), farmer (Claudette James), Mayor and Town Council and the Regional Democratic Council.

On the 18<sup>th</sup> of August 2021, upon arrival at Mahdia, the Social and Environmental Officer met with the land occupant Mr. Tyrone Edwards. The purpose of this meeting was to discuss the signing of a mutual agreement in recognition of the land resolution. Mr. Edwards was briefed on the contents of the letter to which he agreed. He then indicated that he would need to have the letter reviewed by his lawyer before officially signing. This was done and on the day of departure from Mahdia (20<sup>th</sup> August, 2021) the letter was signed.

The farmer of the land Ms. Claudette James was engaged in a meeting and informed of the letter of agreement between the GEA and herself. The contents of the letter were read to her in the presence of three family members, she then agreed to the contents and subsequently signed the letter.

A follow up meeting was held with the Mayor and Town Council and the Regional Democratic Council where all the relevant documentation they were requesting for the completion of their *no objections* were submitted and verified. The Mayor and Town Council upon reading the agreement between the GEA and Mr. Tyrone Edwards was satisfied and gave their *no objection* to the building of the transmission line from the solar farm to the Mahdia Power and Light Station.

A short meeting was held with Mr. Peter Ramotar, the Regional Executive Officer, where all the *no objections* received were submitted to him and his deputy. After verification of these documents a letter of no objection was drafted and signed by him.

### Report of Mahdia Public Consultation Meeting

**MEETING:** Mahdia Public Consultation  
**DATE:** November 2, 2021  
**LOCATION:** Campbelltown Village Shop  
**OBJECTIVE:** Update the Village Council and residents on the project and provide information on the expected social and environmental impacts of the Project.  
**IN ATTENDANCE:** Mr. Kenny Samaroo, Energy Engineer, GEA  
Mr. Kyle Lewis, Social and Environmental Officer, GEA  
Ms. Renata Anderson, Monitoring & Evaluation Assistant, GEA  
Mr. Dexter Prince, General Manager, Mahdia Power & Light (MPL)  
Residents of Campbelltown

#### A. REGISTRATION

Registration commenced at the Campbelltown Village Shop at 10:00 AM and continued throughout the duration of the meeting.

#### B. ATTENDANCE

The meeting witnessed 21 persons in attendance with 16 females and 5 males. For further information on the attendance, refer to the attendance register and photos in Annex 1.

#### C. CALL TO ORDER

The meeting was called to order by Ms. Anderson at 10:10 AM.

#### D. AGENDA ITEMS

- i. National Pledge.....All
- ii. Introduction of the Project Team and overview of Agenda..... Ms. Anderson
- iii. Distribution of Pamphlet (see Annex 2.1) .....Ms. Anderson
- iv. Overview of the Project
  - Technical .....Mr. Samaroo
  - Social and Environmental .....Mr. Lewis
- v. Plenary Session .....Mr. Samaroo and Mr. Lewis
- vi. Vote of Thanks/Closing .....Mr. Samaroo
- vii. Signing of Acknowledgment (see Annex 2.3) .....GEA, Village Toshao

### Report of the Public Consultation Meeting with the Campbelltown Village Council and Residents

The meeting commenced at 10:10AM with a summary of the Project identifying the project scope, boundaries and components. A printed Project Summary pamphlet was provided to the attendees (see Annex 2.1).

**Kenny Samaroo:** Mr. Samaroo gave a general introduction and proceeded to explain the purpose of the meeting to the village council and members of the community. He presented the transmission line route (see Annex 2.2) and the reason as to why this route was chosen. He then outlined there are currently 7 existing poles which will be upgraded or replaced along with an additional 12 new poles that will be planted (see Annex 2.2). The purpose of the transmission line and the number of households that can benefit from the new poles were also outlined. He further outlined the key

environmental and social issues associated with the installation of the transmission line. These issues include but are not limited to minor dust pollution that will be caused as a result of vehicular movement, minor dust disturbances from the digging and installation of poles, minimal soil disturbances from digging of holes for poles and minor noise disturbances from pole installation activities. Social issues may include but are not limited to movement of persons that are not native to the village in and around the village during pole installation activities and minor disruption such as pathway blocking due to installation of poles.

**Village Council and residents:** The group questioned whether or not persons along the roadway where the poles are being planted will receive electricity.

**Kenny Samaroo:** Mr. Samaroo explained to the group that since these poles are being planted next to 14 houses that are not receiving electricity at present, the Mahdia Power and Light (MPL) can use these poles to provide electricity to these additional households. He explained that MPL has been engaged to determine which households can receive electricity along with the budget and timelines.

**Village Council and residents:** The council noted the process involved and confirmed to discussing further. The council then expressed their concern on the cost of electricity in the village.

**Kenny Samaroo:** Mr. Samaroo advised that a tariff reduction is a matter for MPL. The solar PV farm once commissioned and operational will reduce the amount of diesel needed to generate electricity.

**Village Council and residents:** The council acknowledged the response and indicated that they will follow up on those matters with the MPL.

**Village Council and residents:** The residents asked about job opportunities in the community with the establishment of the new transmission line.

**Kyle Lewis:** Mr. Lewis indicated that the poles that will be planted are Wallaba Poles which will more than likely be sourced in the area by the contractor. He then advised that if persons/groups in the village are involved in logging, there exists a possibility that the contractor can engage them to harvest these poles. Mr. Lewis also indicated that aside from the harvesting of Wallaba Poles, there exists an opportunity for skilled and unskilled persons to be employed to assist with pole planting activities such as digging of the holes and planting of the poles. He also indicated that persons could possibly be employed at the solar farm project once they possess the required skill set and experience.

**Village Council and residents:** The villagers asked how grievances can be communicated to the GEA, if there are any.

**Kyle Lewis:** Mr. Lewis noted that there is a grievance and redress mechanism currently in place and that grievances can be communicated through this mechanism. He outlined the process that is currently in place for Bartica and Lethem and indicated that the same will be done in Mahdia. Mr. Lewis spoke to the use of signs and grievance boxes in Mahdia as a means of voicing any concerns. He then explained that once grievances are received, they will be managed by the grievance committee consisting of the Social and Environmental Officer, Monitoring and Evaluation Officer and Finance Specialist of the GEA after which redress efforts will be initiated.

**Village Council and residents:** The village council and community members acknowledge this response and further questioned whether there will be any social or environmental impacts related to the planting of the poles.

**Kyle Lewis:** Mr. Lewis explained that there will be some impacts associated with the establishment of the transmission lines in the village. He explained that there will be some disturbances as it relates to



noise and dust in the air because there will be heavy duty equipment and vehicles traversing the area during the installation process. He also indicated that persons from the contractor's side will be in the village assisting with the installation process and they should expect to see some unfamiliar faces during the installation period. There may be need for food and beverages during the construction period. Mr. Lewis reemphasized the purpose of the grievance and redress mechanism and encouraged the villagers to lodge any grievances through the grievance mechanism that will be set up at the project site and at the Mahdia Power and Light Company's Office.

**Village Council and residents:** Acknowledged this response and concluded with their thanks for the update that was provided. The council indicated that they are aware of the potential environmental and social impacts associated with the installation of the transmission line and recommended that the required measures be implemented to minimize or prevent these impacts from occurring. The Council also indicated that they are aware that not all of the households within the Community will benefit from the electricity to be supplied by the project but is hopeful that eventually the entire community will benefit.

**Meeting concluded 11:00 AM**

## Annex 1: Meeting Attendees

### 1.1 List of Attendees

No.	Name	Sex	Designation	Contact Number
1	Jillian Williams	F	Toshao	663-7144
2	Ron Williams	M	Sports Organizer	689-5697
3	Ann Skylar	F	Community Service Officer	-
4	Urine Abraham	F	Community Service Officer	668-1093
5	Aaliyah Andrews	F	Office Secretary	670-3799
6	Shallanna Williams	F	Community Service Officer	602-3091
7	Bonaventure Fredericks	F	Councillor	630-6162
8	Juliette Gouveia	M	Councillor	659-4682
9	Earl Gildharie	F	Resident	662-0162
10	Ingilizi Williams	M	Resident	679-0512
11	Sulton Smith	F	Resident	676-8536
12	Alexcio Decampo	M	Resident	604-9499
13	Joycelyn John	M	Resident	676-9533
14	Aveola Paticio	F	Resident	669-9217
15	Zilda David	F	Councillor	667-7399
16	Jean John	F	Resident	-
17	Minnial Andrew	F	Resident	-
18	Cheryl Andrew	F	Resident	686-9180
19	Rita Andrew	F	Resident	-
20	Ineez Gomes	F	Resident	691-2894
21	Natascia Baird	F	Teacher	676-2715

## Registration sheet for Campbelltown Public Consultation Meeting



### Stakeholder Engagement with the Campbelltown Village Council and Residents



#### Registration Sheet

Date: November 2, 2021

Location: Campbelltown Princeville Village Office/Shop

Time Started: 10:00 AM

Time Concluded: 11:00 AM

No.	Name	Designation	Contact Information	Signature
1	Ron W. (M)	Anti Organizer	689-5697	R. Williams
2	A. Skyles (F)	C.S.O	-	A. Skyles
3	Upline Abraham (F)	C.S.O	6681093	U. Abraham
4	Chalyah Edwards (F)	Office Secretary	670-3799	Chalyah Edwards
5	Shallana Williams (F)	C.S.O	602-3091	S. Williams
6	Jelvin Williams (F)	Tasha	663-7144	J. Williams
7	Gervanice Jacob (M)	Councillor	630-6162	G. Jacob
8	Julette Bouvier (F)	Councillor	659-4682	J. Bouvier
9	Evelyn Williams (M)	2019 TQSAO	662-0166	E. Williams
10	Ingiliz Williams (F)	Council	679-0312	I. Williams
11	Sasha Smith (M)		676-2536	S. Smith
12	Arccio Decampo (M)		604-9499	A. Decampo
13	Jaylyn John (F)		676-9533	J. John
14	Patricia (F)		669-9217	P. Patricia
15	Zilda David (F)	Council	667-7399	Z. David
16	Jean John (F)			J. John
17	Minnial Andrew (F)			M. A
18	Cheryl Edwards (F)		656-9150	C. Edwards
19	Rita Anderson (F)			M. Anderson
20	Inez Gomes (F)		6912394	I. Gomes



### Stakeholder Engagement with the Campbelltown Village Council and Residents



#### Registration Sheet

Date: November 2, 2021

Location: Campbelltown Princeville Village Office/Shop

Time Started: 10:00 AM

Time Concluded: 11:00 AM

No.	Name	Designation	Contact Information	Signature
1	Dr. Prince	General Mayor (M)	6576721	Dr. Prince
2	Natasha Baird (F)	Teacher	676-2715	N. Baird
3				
4				
5				
6				
7				
8				

## 1.2 Photographs from the Consultation Meeting held at the Campbelltown Village Office



Image 1: Registration area along with pamphlets and shopping bags distributed to sensitize the residents of Campbelltown, Mahdia and promote awareness of the programme.





Images 2 and 3: Depicting sections of the consultation meeting held at the Campbelltown Village Office




## Annex 2: Materials Utilised

### 2.1 Sensitization Pamphlet

  
 For more Information  
<https://gea.gov.gy/>  
 .....  
 Guyana Energy Agency (GEA)  
<https://gea.gov.gy/>  
 295 Quamina St. South Cummings-  
 burg, Georgetown, Guyana.  
 +592 226-0394  
 +592 624-5905





**Energy Matrix Diversification  
and Institutional Strengthening  
of the Department of Energy  
(EMISDE) - Mahdia**

*Solar Energy –  
Today's resource for a  
brighter tomorrow!*

**Energy Matrix Diversification and Institutional Strengthening of the Department of Energy (EMISDE)**

**Background of the project**

The Renewable Energy Solutions for the Hinterland Project under the Energy Matrix Diversification and Institutional Strengthening of the Department of Energy (EMISDE) ~~Project~~ is one of three components to help Guyana's energy diversification. The Project will install solar PV systems at Bartica (1.5 MW), Lethem (1 MW), and Mahdia (0.65 MW), totaling 3.15 MW along with some storage capacity to manage intermittence of these sources.

**How does the EMISDE project involve the Campbelltown community?**

The planned 0.65 mega watts (MW) Solar Photovoltaic Farm is expected to be completed in 2022. The farm is estimated to generate 968MWh annually, reducing carbon dioxide emissions CO<sub>2</sub> to an estimated 678 tons per year.



**What are the objectives of the project?**

- Promote socio-economic development through the supply of reliable and affordable electricity
- Reduce carbon dioxide (CO<sub>2</sub>) emissions from the power sector by utilizing an indigenous renewable energy source
- Increase energy security and access
- Support of Guyana's Low Carbon Development Strategy 2030, valuing the world's ecosystem services, and promoting sustainable global development



Photo showing location of the Mahdia PV Solar Farm

**Who are the key stakeholders of the project?**

- Beneficiaries**— The people of Campbelltown, Mahdia Power and Light Company (MPL)
- Implementing Agency**— Guyana Energy Agency (GEA)
- Supporting Agency**— Hinterland Electrification Company Inc.

**How will EMISDE project benefit the community?**

- Job creation** — The Campbelltown community will become the primary labour market for job opportunities associated with the project. Examples includes skilled and unskilled labour, cater, etc.
- Reduced government subsidies** — subventions are substantial and can be redirected towards other developmental agenda.
- Increased socio-economic development**— A reliable and affordable source of energy is a very powerful engine to stimulate growth and development, economically and socially.
- Local cottage industry growth** — Small businesses and micro-enterprises whose operations or services depend on electricity will be able to benefit from the addition of this renewable energy source to improve productivity and services.
- Improved Medical and Educational Service** — ICT infra-structure for information sharing, video streaming, distance learning, etc.
- Reduced Greenhouse Gas Emissions**— annual estimated CO<sub>2</sub> emission reduction of approximately 678 tons
- Reduced costly fossil fuel power generation**— Avoided Fuel Consumption: (estimated 1,570 barrels) Annual Avoided Fuel Costs: estimated at GY\$48,883,600 (50 - 55% Operational Cost)
- Increased Renewable Energy Power Generation**— Annual Energy to Consumers: estimated at 968MWh. Revenue from Solar PV Electricity: estimated at US\$517,779



## 2.2 Map showing Proposed Transmission Line



## 2.3 Acknowledgement of Stakeholder Engagement and Addressing of the Relevant Concerns



### Acknowledgement of Stakeholder Engagement



I, Jillian Williams, Toshao of  
Campbelltown Village hereby acknowledge that on the  
2<sup>nd</sup> November, 2021, I met with a team of officers from the Guyana Energy Agency  
(GEA) who held a Stakeholder Engagement meeting on the *Energy Matrix Diversification and Institutional  
Strengthening of the Department of Energy (EMISDE)- Installation of 0.65MW Solar PV Programme in  
Mahdia*.

At the said meeting, the following topics were discussed and addressed:

1. The proposed transmission line route.
  - ☒ Map showing the proposed route along the existing roadway.
2. The number of poles that will be planted.
  - ☒ The number of existing poles and the new poles that will be required.
3. The number of households that can benefit from the new poles.
  - ☒ These poles can be used to provide electricity to households that are not receiving electricity at present.
  - ☒ Mahdia Power and Light would need to be consulted to activate the process for new connections required.
4. Key environmental and social issues associated with the installation of the transmission line:
  - ☒ Presence of workers, who may be new to the community.
  - ☒ Heavy equipment and vehicles traversing the roadways.
  - ☒ Noise and dust from traversing equipment/vehicle.
5. Possible benefits to the community.
  - ☒ Sourcing of poles locally from persons involved in logging.
  - ☒ Employment of skilled and unskilled persons.
  - ☒ Provision of services, such as, catering, lodging, etc.
6. Establishment of a grievance and redress mechanism.
  - ☒ The purpose of the grievance mechanism.

I hereby confirm that I understand the nature, scope and effects of the abovementioned project and have no objection to its implementation.

Jillian Williams

Stakeholder



Renata Anderson

Renata Anderson (GEA) – Monitoring & Evaluation Assistant

Kenny Samaroo

Kenny Samaroo (GEA) – Energy Engineer

[Signature]

## Appendix E – Water Quality Analyses Laboratory Report



### GUYANA SUGAR CORPORATION INC

#### CENTRAL LABORATORY

Research Centre, Agriculture Department, LBI Compound, E.C.D, Guyana, S.A.

Telephone #: 592-220-1978 Email: ganpatj@guysuco.com

Fax #: 592-220-4027

CAEMS SOP/RF No.: 013.1	Version: 2	Revision Status: 1	Date of Issue: September 6, 1996	Expiry Date:
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# Analysis Report

Report Number: 0036/03/2021-C

Date: 2021-03-19

To:  
Mr. Shyam Nokta  
60 Area H  
Ogle  
East Coast Demerara

From:  
Analyst

Tele: 222-4565

Fax #: 222-3172

Central Laboratory  
Agronomy and Analytical Services Department

Date Sample Received: 2021-03-18

Date Analysis Completed: 2021-03-18

SAMPLE TYPE: Water

Sample submitted by: Customer

SAMPLE DESCRIPTION BJG	PARAMETER			
	COD (mg/L)	Oil & Grease (mg/L)		
SW 1	5	N.d		
SW 2	N.d	N.d		

Analysed by: Tessa Stewart

Nd-Not detected

Method: Water & Waste Water  
20<sup>th</sup> Edition

Verified by:

Assistant Analyst

Approved by:

Analyst

C: Mr. Gavin Ramnarain-Head-Agric. Research  
Mr. Ashley Adams-Agronomy Research Manager



## Appendix F – No Objections/Permissions

### Permission from Guyana Lands & Surveys Commission

#### **GUYANA LANDS AND SURVEYS COMMISSION**

**File No. 821212/378**

**GEORGETOWN, DEMERARA**  
16th October, 2019

#### **PERMISSION TO OCCUPY STATE LAND**

**Issued under Section 3 (b) of the State Lands Act Chapter 62:01**

Permission is hereby granted to – **MAHDIA POWER AND LIGHT COMPANY INC.**, of 111 Miles Mahdia, under **Section 3 (b) of the State Lands Act Chapter 62:01** to occupy and commence work with effect from **01-10-2019** on a tract of approximately **11 acres** of State Land, situate at Mahdia, Left Bank of the Essequibo River. The tract commences at a point (E262657, N585835) being **No° 0' 0" (tr)** for 50 feet from the centre line of the Bartica Potaro Road, thence **No° 0' 0" (tr)** for 906 feet, thence **N342° 49' 10" (tr)** for 688 feet, thence **N301° 34' 51" (tr)** for 188 feet, thence **N180° 00' 00" (tr)** for 1545 feet, thence **N90° 00' 00" (tr)** for 181 feet, thence **N180° 00' 00" (tr)** for 168 feet, thence **N72° 32' 00" (tr)** for 188 feet to the point of commencement, as shown on GL&SC Map Sheet 43 NE, applied for on the **22-01-2019** for Industrial Purposes.

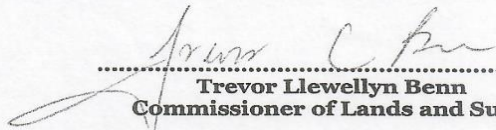
This permission is subject to the same condition and terms, wherever applicable, of a **LEASE**, which when issued shall be deemed to have commenced from the date of this Permission, and the conditions attached to such **LEASE** shall be deemed to have been in force as from the date hereof.

This permission may not be transferred before the tract is surveyed and all accumulated fees and rent of any excess are paid.

The annual rent is **\$290,000.00 per annum for Industrial Purposes** payable in advance and subject to revision at every three (3) years.

The **Permittee** shall within three (3) months from the date of this Permission, take all the necessary steps to define the area described herein by a Cadastral Survey which is a prerequisite to the issuance of the **LEASE** and beneficially occupy at least one-fifth part of the area approved within the first year.

The **Permittee** shall not sublet or give permission to anyone to occupy the land or part thereof.

  
.....  
**Trevor Llewellyn Benn**  
**Commissioner of Lands and Surveys**

#### **INDUSTRIAL PURPOSES**

I hereby agree to the Terms and Conditions of this Permission

  
.....  
**Mahdia Power & Light Company Inc.**  
**(PERMITTEE)**

No Objection from the Mahdia Town Council for the Construction of the Solar Farm



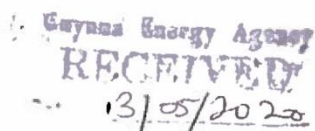
*Office of the Mahdia Town Council*

**Mahdia, 111 Miles Mahdia Town, Region No.8, Potaro/Siparuni.**

**Mayor- David Adams- Tel# 592-679-1660 Deputy Mayor- Juewayne Burrowes- Tel 592-671-7097**

27<sup>th</sup> April, 2020

Mr. Dexter Prince  
General Manager  
Mahdia Power and Light Co. Inc  
111 Miles Mahdia  
Potaro Siparuni  
Region #8



Dear Mr. Prince,

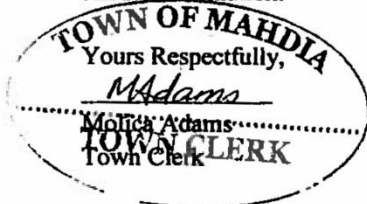
**RE: No Objection**

Reference is made to the caption above to your letter dated 20<sup>th</sup> April, 2020, with regards to the constructing of a Solar Farm in the Township.

The Mayor and Town Council of Mahdia has no objection for the construction of a Solar farm on a plot of land situated at Primelands Mahdia with GPS coordinates "E262657, N585835" and approximately 50ft from the center line of the Bartica Potaro Road.

Please be informed that this is granted providing that you adhere to all rules and regulations governing same.

All for information.





No Objection from the Mahdia Town Council for the Transmission Line Route



*The Mayor and Town Council of Mahdia*

Mahdia, 111 Miles Mahdia Town, Region No.8, Potaro/Siparuni.

Mayor- David Adams- Tel# 592-679-1660 Deputy Mayor- Juewayne Burrowes- Tel 592-671-7097

24<sup>th</sup> June, 2021

Dr. Mahender Sharma  
Chief Executive Office  
Guyana Energy Agency  
Quamina Street,  
Georgetown, Guyana.

**RE: No Objection**

Dear Sir,

With reference to a letter dated 22<sup>nd</sup> June, 2021, "Request for Approval of the Line Route for Mahdia Solar Transmission line." The Mayor and Town Council of Mahdia has No Objection towards the Line Route for the Solar Transmission Line for the execution of the Solar Farm Project within the Township providing that you adhere to all rules and regulation governing same.

Yours Respectfully,

*M Adams*

Mollica Adams

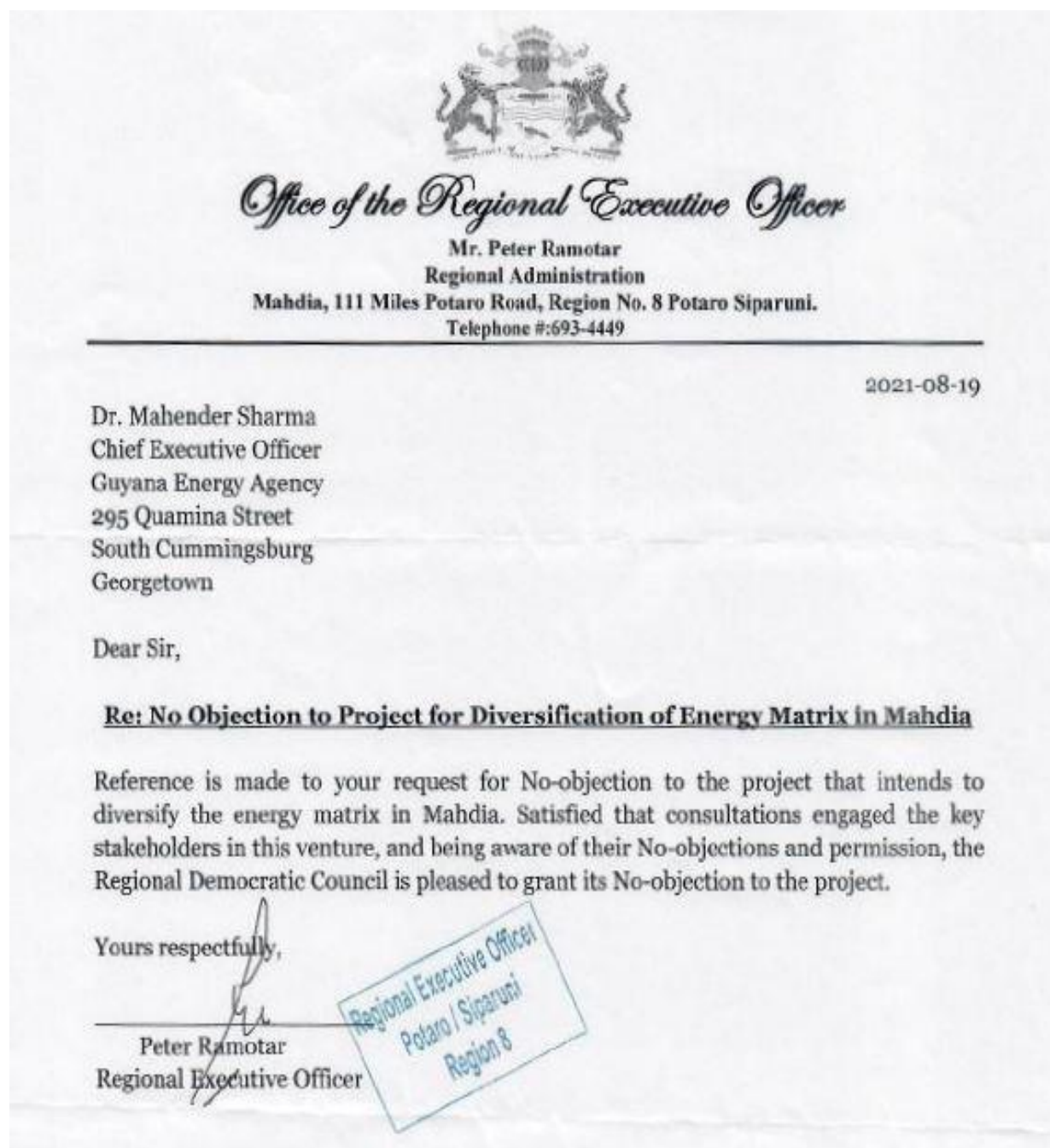
Town Clerk

**TOWN CLERK**

The Mayor and Town Council of Mahdia  
Mahdia Town  
Potaro / Siparuni

Sig: \_\_\_\_\_

No Objection from the Regional Democratic Council



Letter of Approval from the Campbelltown Village Council



Dr. Mahender Sharma  
Chief Executive Officer  
Guyana Energy Agency

10<sup>th</sup> July, 2021.

Dear Sir,

**Approval for the Line Route for Mahdia Solar PV Transmission Line**

We have received your request which involved the construction of a transmission line and further to allow your proposed route to traverse through the village of Campbelltown.

This letter serves to inform you that approval has been granted for you to use your proposed route through the village of Campbelltown.

Should you have any questions or queries, please feel free to contact us.

All for your information guidance.

Yours respectfully

*Jillian Williams*

Jillian Williams

(Toshao)

