ENVIRONMENTAL IMPACT ASSESSMENT

Final Environmental Assessment Scoping Report and Environmental Management Plan for the construction and operation of a Solar PV Power Plant at Erf 1865, Aimablaagte, Mariental.

Prepared for (Proponent):

Mariesol Pty Ltd

MarieSol ENERGY PTY Ltd

Prepared by (Environmental Consultant):

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Project location:	Mariental Townlands At Erf 1865, Aimablaagte, Mariental 24° 38' 37" S 17° 57' 31" E
Document Title:	Environmental Assessment Scoping Report and Environmental Management Plan for the construction and operation of a Solar PV Power Plant at Erf 1865, Aimablaagte, Mariental.
Listed Activity:	Energy Generation, Transmission and Storage Activities.

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List of Abbreviations and Acronyms

BID:	Background Information Document
°C:	Degrees Celcius
CO_2:	Carbon Dioxide
Db:	Decibels
EAP:	Environmental Assessment Practitioner
EIA:	Environmental Impact Assessment
EMA:	Environmental Management Act
EMP:	Environmental Management Plan
Ha:	Hectare
I&AP:	Interested and Affected Parties
MEFT:	Ministry of Environment, Forestry and Tourism
MSDS:	Material and Safety Data Sheet
O&M:	Operations and Maintenance
PPE:	Personal Protective Equipment
PV:	Photovoltaic

Executive Summary

Mariesol (Pty) Ltd (Project Proponent), is a Namibian renewable energy solutions provider and aims to construct a Solar PV Power Plant at Erf 1865, Aimablaagte, Mariental, to provide the town of Mariental with an economic, locally produced, renewable source of electricity. Mariental Municipal Council is in the process of finalizing an agreement to lease the proposed site measuring 14.6448 Ha to Mariesol (Pty) Ltd for a period of 25 years for the purposes of constructing and operating a Solar PV Power Plant.

Namibia has the highest average theoretical PV Power Potential in the world. This immense potential in combination with the known environmental benefits of solar power (reduction of; CO_2 emissions; carbon footprints; and over reliance on fossil fuels) is worthy rationalization for the construction and operation of the proposed Solar PV Power Plant, amongst others; 172 jobs for local youths; and increased investment attraction for Mariental could be realised.

Identified Environmental Impacts are summarised in the table below and range from low to high in their respective Environmental Impact Significance rating. Various mitigation strategies are recommended in the Environmental Management Plan. It is the view of the Environmental Consultant that the project is given environmental clearance from the authorities on condition that the Environmental Management Plan is implemented and adhered, and possibly further enhanced with the implementation of a functioning Health, Safety and Environmental Management System.

Environmental Impact	Construction Phase	Operational Phase	Decommissioning Phase	Rehabilitation Phase
	6.2.1 Impacts on Plants & Animals, Social Impacts and Cultural Heritage.	**6.3.1** Impacts on Plants & Animals, Social Impacts and Cultural Heritage.	**6.4.1** Decommissioning of Solar PV Power Plant infrastructure.	**6.5.1** Environmental Restoration Fund.
	6.2.2 Trattic and Site Access.	**6.3.2** Trattic and Site Access.	**6.4.2** Health and Safety of Personnel.	
	6.2.3 Pollution and Fire Hazards.	**6.3.3** Waste Management.	**6.4.2** Waste Management.	
	6.2.4 Waste Management.	**6.3.4** Health and Safety of Personnel.		
	6.2.5 Health and Safety of Construction Personnel.	**6.3.5** Hydrological Flood Risk		
	6.2.6 HIV/AIDS and Employee wellness.	**6.3.6** HIV/AIDS and Employee wellness.		
	6.2.7 Noise during construction.			

1. Introduction

Mariesol (Pty) Ltd (Project Proponent), is a renewable energy solutions provider with interests in the engineering, procurement, construction, operation and maintenance of renewable energy projects. Ecolab Environmental cc, has been appointed by Mariesol (Pty) Ltd to conduct an Environmental Assessment for the construction and operation of a proposed Solar PV (photovoltaic) Power Plant in Mariental. Mariesol (Pty) Ltd, as an independent power producer aims to construct a Solar PV Power Plant at Erf 1865, Aimablaagte, in Mariental. The purpose of the proposed Solar Power Plant shall be to provide the town of Mariental with an economic, locally produced, renewable source of electricity. This Environmental Assessment Report and Environmental Management Plan is aimed at providing information on the environmental consequences that will guide decision makers as well as stakeholders on the proposed development.

1.1 The Environmental Assessment Practitioner (EAP).

EcoLab Environmental cc was established in 2014 and is based in Walvis Bay. The firm has a number of skilled and experienced EAP's. Detailed curriculum vitae of EAP for this project can be found in **Appendix A.**

1.2 Limitations of the Assessment

Information provided to the EAP Team by the proponent included the following: Valuation Report on Erf 1865 Aimablaagte, Marintal. Dated: 5 November 2019 (**Appendix B**).

The assessment was fundamentally based on secondary data from various sources as well as on stakeholder input throughout the process as explained in Section 4 of this document. Furthermore, the assessment was limited to activities to be carried out onsite, as described in Section 2.2 of this document.

2. Project Description

2.1 Nature of the listed activity under assessment

The proposed project requires an Environmental Clearance Certificate in terms of the Environmental Management Act, (Act No.7 of 2007) and the Environmental Impact Assessment (EIA) Regulations (2012). The Listed activities that thus make this specific project subject to Environmental Assessment as quoted from Government Notice No. 29 of 2012 are as follows:

Table 1: Summary of Listed Activity.

Activity	Description of Relevant Activity	Relevance to Proposed Development
Activity 1: Energy Generation, Transmission and Storage Activities.	1. The construction of facilities for – (a) the generation of electricity; (b) the transmission and supply of electricity	The construction and operation of the proposed Solar PV Power Plant will be an activity that would lead to the generation, transmission and supply of electricity.

2.2 Proposed Site and Surrounding Land Use

Mariental is located in central-southern Namibia within the Hardap Region. Mariental, can be found along the B1 national road, at about 232 kilometres north of Keetmanshoop and 274 kilometres southeast of the capital, Windhoek. It lies at an elevation of about 1,090 metres [1].

[1] https://www.britannica.com/place/Mariental

Figure 1: Location of Mariental within the Hardap Region.

The exact project site is within the Mariental Townlands on Erf 1865, Aimablaagte. Currently, the site is zoned as "Special", for the sole purpose of establishing a Solar PV Power Plant onsite. The proposed construction and operation of a Solar PV Power Plant thus a permissible activity under the current zoning. Mariental Municipal Council is in the process of finalizing an agreement to lease the proposed site measuring 14.6448 Ha, to Mariesol (Pty) Ltd for a period of 25 years for the sole purpose of constructing and operating a Solar PV Power Plant (See **Appendix B:** Valuation Report on Erf 1865 Aimablaagte, Marintal. Dated: 5 November 2019).

Table 2: Summary of Proposed Location

Site Name	Size	Land Owner	Zoning
Erf 1865, Aimablaagte, Mariental Townlands	14.6448 Ha	Mariental Municipality. (MarieSol (Pty) Ltd. to lease the land From the Mariental Municipality/Council)	Special: For the purposes of establishing a Solar Plant.

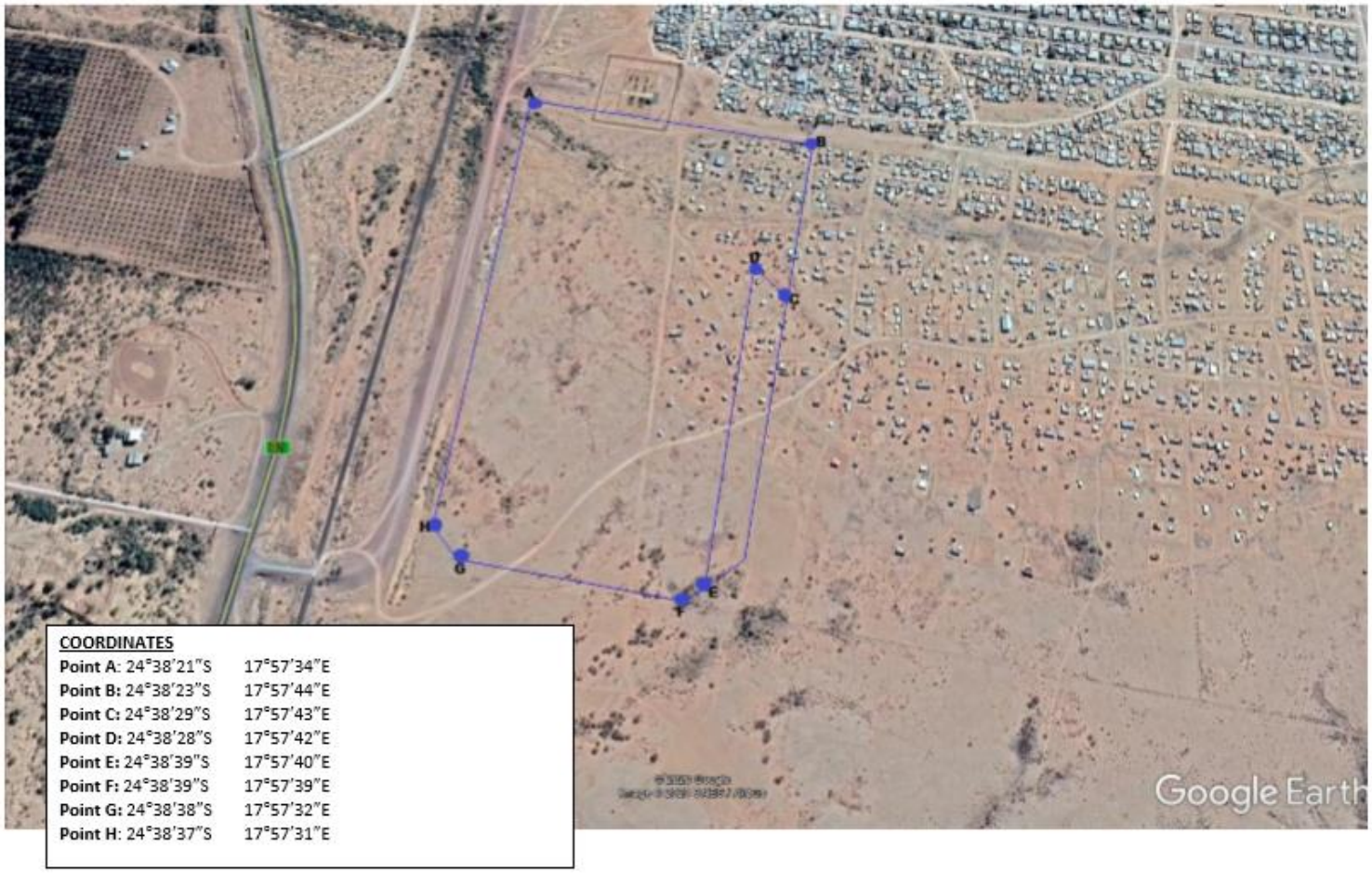

Figure 2: Locality of the proposed 14.6 448 Ha site on Erf 1865, Aimablaagte, Mariental.

The immediate surrounding land-use of the proposed site comprises of; an informal settlement; a NamPower Substation; as well as the B1 Highway.

2.3 Rationale for project

According to the World Bank report on Photovoltaic Power Potential by Country (Published June 2020), Namibia has among the highest average theoretical Solar PV Power Potential of all countries in the world. This immense potential in combination with the known environmental benefits of solar power (reduction of; CO_2 emissions; carbon footprints; and over reliance on fossil fuels) is worthy rationalization for construction and operation of the proposed Solar PV Power Plant by MarieSol (Pty) Ltd. Equally, the proposed Solar PV Power Plant also offers Namibia the opportunity to further diversify its energy mix to more clean domestic energy sources.

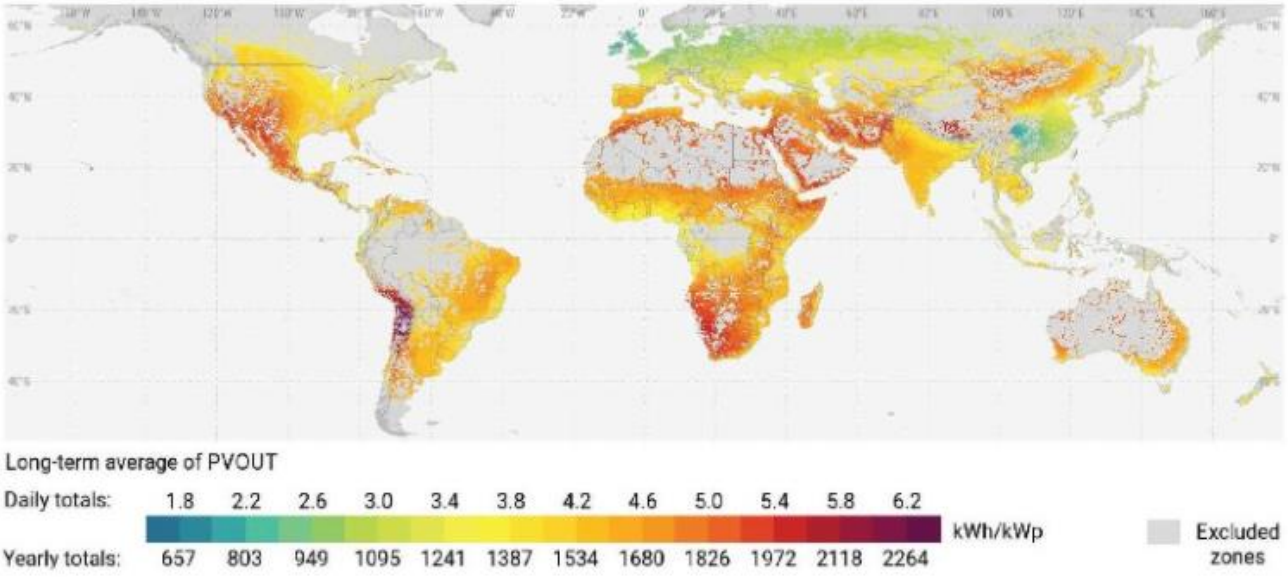

Figure 3: Global map showing Practical Solar Energy Potential after excluding for physical, environmental and other factors (Source: World Bank, 2020).

The business objectives of MarieSol (Pty) Ltd is the provision of renewable energy in Namibia, specializing in PV Solar; grid-tied, off-grid and hybrid systems. Thus, in-line with its business objectives, MarieSol (Pty) Ltd intends on setting up a Solar PV Power Plant that will contribute to the power supply of the Municipality of Mariental. As an independent power producer, MarieSol (Pty) Ltd is in the process of entering into a 25-year Power Purchasing agreement with the Mariental Municipal Council. The key objective of MarieSol (Pty) Ltd in terms of the proposed development is the sustainable provision of electricity to the Municipality of Mariental. This would thus capacitate the Municipality to attract more investors to the town as there will be a much more stable and locally produced supply of electricity at Mariental.

It is the view of the proponent that during the construction of proposed Solar PV Power Plant, about 148 jobs will be created, and once the Power Plant becomes operational, a total of 24

permanent jobs will be created. The jobs that are to be created are specified in Table 3 and 4 and are exclusively reserved for Namibians, particularly local youths. This may be an essential factor for justification if one considers that youth unemployment (15-35 years old age bracket) in Namibia stood at 43.4 %[2] prior to the Covid-19 pandemic.

Table 3: Summary of Jobs to be created during the construction of the proposed Solar PV Power Plant.

Jobs to be created during the construction of the proposed Solar PV Power Plant		
Position	**Nationality**	**Number of Staff**
Project Manager	Namibian	1
Senior Management on Project	Namibian	7
Senior Site Supervision	Namibian	5
Junior Site Supervision	Namibian	11
Team Leaders (Local Citizens)	Namibian	31
General Workers (local citizens)	Namibian	93
Total Workforce during construction	**100% Namibian**	**148**

Table 4: Summary of Jobs to be created during the operation of the proposed Solar PV Power Plant.

Jobs to be created during the operation of the proposed Solar PV Power Plant		
Position	**Nationality**	**Number of Staff**
O&M Manager	Namibian	1
Technician	Namibian	1
Monitor Person	Namibian	1
Team Leader	Namibian	1
General Workers (local citizens)	Namibian	20
Total Workforce during operation	**100% Namibian**	**24**

[2]https://www.newera.com.na/2017/07/14/nsa-explains-youth-unemployment-statistics/ (retrieved 18 July 2017)

2.4 Alternatives and No-Go Alternative

The proponent has not deliberated any alternatives to the proposed site, so this assessment did not consider any other alternatives other than The "No Project" alternative, which assumes that the project as proposed does not go ahead. The implications of the "No Project" alternative are:

- the land use potential remains unlocked;
- there is no further development of solar energy facilities at this location;
- there is no change in the aesthetics of the landscape;
- CO2 emissions; carbon footprints; and over reliance on fossil fuels not reduced;
- All environmental impacts described in section 6 of this assessment report would not be realised.

2.5 Proposed Activities

The main activities to be carried out onsite predominantly entail the construction as well as the operation of the proposed Solar PV Power Plant.

A. Construction of Solar PV Power Plant

Construction of PV solar plants entails the mounting of solar panels on supporting structures made of aluminium profiles and stainless steel fasteners. In general, there are four main types of foundations that are commonly used: driven piles, helical piles, earth-screws, and ballasted foundations. Concrete strip foundations can also be used, made of concrete blocks or constructed on site. Aluminium supports are then fastened to the foundations which carry crossbeams to which the PV modules are fastened. In certain instances, panels are equipped with trackers that allow for optimal utilization of solar irradiation. Figure 5 summarizes the construction process (Solar DAO, 2020).

Figure 4: Illustration summarising the construction of a typical Solar PV Power Plant (Source: Solar DAO, 2020)

B. Operation of Solar PV Power Plant

A typical Solar PV Power Plant, is designed to supply usable solar power by means of photovoltaics. It consists of an arrangement of several components, including solar panels/modules to absorb and convert sunlight into electricity, a solar inverter to convert the output from direct to alternating current, as well as mounting, cabling, and other electrical accessories to set up a working system. The Proposed Solar Photovoltaic Power Plant shall consist of an array of panels and associated infrastructure covering an area of less than 16 hectares of land as well as a small O&M office building.

Figure 7 exemplifies the arrangement of a typical megawatt-scale grid connected solar PV power plant, similar to that of the proposed development.

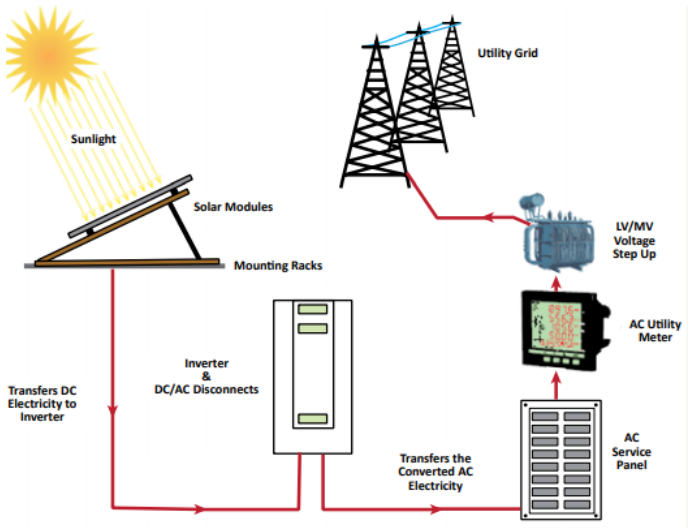

Figure 5: Typical Overview of a Solar PV Power Plant (Source: World Bank: International Finance Corporation, 2015).

C. Water and Energy Requirements:

- Water Sewage; Municipal connections will be established onsite.
- Energy: During construction, energy will be sourced from onsite generators.

3. Legal and Administrative Background

This section shall outline and briefly discuss all the various laws, policies, and national developmental plans that have been considered in the preparation of this scoping report for the proposed development.

3.1 The Namibian Constitution

Articles 91, 95 and 144 of the Namibian constitution are of particular relevance to the Scoping Exercise of the planned development.

Part of Article 95 recites: "The State shall actively promote and maintain the welfare of the people by adopting policies aimed at...The maintenance of ecosystems, essential ecological processes and biological diversity of Namibia and utilization of living natural resources on a sustainable basis for the benefit of all Namibians, both present and future..." Part of Article 91 recites "The functions of the Ombudsman shall be defined and prescribed by an Act of Parliament and shall include the following... the duty to investigate complaints concerning the over-utilization of living natural resources, the irrational exploitation of non-renewable resources, the degradation and destruction of ecosystems and failure to protect the beauty and character of Namibia". Article 144 Recites "Unless otherwise provided by this Constitution or Act of Parliament, the general rules of public international law and international agreements binding upon Namibia under this Constitution shall form part of the law of Namibia."

3.2 Namibia's Environmental Assessment Policy (1995).

The Environmental Assessment Policy of Namibia declares that: "...Achieving and maintaining sustainable development on all policies, programs and projects undertaken within Namibia. In particular, the wise utilization of the country's natural resources, together with the responsible management of the biophysical environment, must be for the benefit of both present and future generations Namibia shall place a high priority on: (i) maintaining ecosystems and related ecological processes, in particular those important for water supply, food production, health, tourism and sustainable development; (ii) observing the principle of optimum sustainable yield in the exploitation of living natural resources and ecosystems, and the wise utilization of non-renewable resources; (iii) maintaining representative examples of natural habitats; (iv) maintaining maximum biological diversity by ensuring the survival and promoting the conservation in their natural habitat of all species of fauna and flora, in particular those which are endemic,

threatened, endangered, and of high economic, cultural, educational, scientific and conservation interest." The policy also outlines an EA procedure.

3.3 Environmental Management Act of Namibia (Act 7 of 2007) and its Regulations (2012).

The Environmental Management Act (2007) aims to: promote the sustainable management of the environment and the use of natural resources by establishing principles for decision making on matters affecting the environment; to establish the Sustainable Development Advisory Council; to provide for the appointment of the Environmental Commissioner and environmental officers; to provide for a process of assessment and control of activities which may have significant effects on the environment; and to provide for incidental matters.

The Act further sets out a number of environmental objectives that; guide the implementation of the Act and any other law relating to the protection of the environment; serve as the general framework within which environmental plans must be formulated; and serve as guidelines for any organ of state when making any decision in terms of this Act or any other law relating to the protection of the environment. These Environmental Objectives include (non-exhaustive list):

- The option that provides the most benefit or causes the least damage to the environment as a whole, at a cost acceptable to society, in the long term as well as in the short term must be adopted to reduce the generation of waste and polluting substances at source;
- A person who causes damage to the environment must pay the costs associated with rehabilitation of damage to the environment and to human health caused by pollution, including costs for measures as are reasonably required to be implemented to prevent further environmental damage;
- Damage to the environment must be prevented and activities which cause such damage must be reduced, limited or controlled.

The Environmental Management Act Regulations specifies scheduled activities that may not be under taken without an Environmental Clearance Certificate from the Environmental Commissioner.

3.4 Local Authorities Act (Act No. 23 of 1992).

Powers, duties and functions of local authority councils includes the supply electricity to the residents in its area. Subject to the provisions of Part X and the Electricity Act, 2000 (Act No.2 of 2000).

3.5 Electricity Act, 2000 (Act No.2 of 2000)

The aim of the act is for the establishment the Electricity Control Board and provide for its powers and functions; to provide for the requirements and conditions for obtaining licences for the provision of electricity; to provide for the powers and obligations of licensees; and to provide for incidental matters.

3.6 Labour Act (Act No. 11 of 2007)

Provides for Labour Law and the protection and safety of employees. Labour Act, 1992: Regulations relating to the health and safety of employees at work (Government Notice No. 156 of 1997).

3.7 Hazardous Substances Ordinance (No. 14 of 1974)

The Ordinance applies to the manufacture, sale, use, disposal and dumping of hazardous substances, as well as their import and export and is administered by the Minister of Health and Social Welfare. Its serves to prevent hazardous substances from causing injury, ill-health or the death of human beings.

3.8 Nature Conservation Ordinance (No. 4 of 1975)

To consolidate and amend the laws relating to the conservation of nature; the establishment of game parks and nature reserves; the control of problem animals; and to provide for matters incidental thereto.

3.9 Water Resources Management Act (Act No. 11 of 2013)

The Act aims to provide for the management, protection, development, use and conservation of water resources; to provide for the regulation and monitoring of water services and to provide for incidental matters.

3.10 Public and Environmental Health Act (Act No. 1 of 2015)

To provide a framework for a structured uniform public and environmental health system in Namibia; and to provide for incidental matters.

3.11 National Heritage Act (Act No. 27 of 2004)

To provide for the protection and conservation of places and objects of heritage significance and the registration of such places and objects; to establish a National Heritage Council; to establish a National Heritage Register; and to provide for incidental matters.

3.12 The Convention on Biological Diversity (CBD), 1992.

The CBD has three main goals: the conservation of biological diversity (or biodiversity); the sustainable use of its components; and the fair and equitable sharing of benefits arising from genetic resources. Its objective is to develop national strategies for the conservation and sustainable use of biological diversity, and it is often seen as the key document regarding sustainable development.

3.13 United Nations Convention to Combat Desertification (UNCCD), 1994.

The UNCCD is a Convention to combat desertification and mitigate the effects of drought through national action programs that incorporate long-term strategies supported by international cooperation and partnership arrangements.

3.14 Namibia's 5th National Development Plan (NDP 5)

The fifth National Development Plan is the fifth of a series of seven 5-year national development plans that outline the objectives and aspirations of Namibia's long-term vision as expressed in Vision 2030.

4. Public Consultation

The public participation phase is an integral part of the EIA process, and continues throughout this process. Public Consultation is a dynamic process whereby diverse societal interests, needs and values are recognised and managed. This requires that public consultation provides an opportunity for participation in an open and transparent manner that would add meaningful value to the planning of the proposed project.

The EAP gave notices to all potential interested and affected parties (I&APs) as per the public consultation process requirements by doing the following:

a) Producing Background Information Document (BID) **(Appendix C).**
b) 21 Day public consultation period from 3 July 2023 to 24 July 2023.
c) Advertisements placed in two (2) different newspapers that are widely distributed in Namibia in accordance with the Environmental Management Act (2007) and it's Regulations (2012). The actual copies of these newspaper adverts can be found in **Appendix D**.

Table 5: Newspaper adverts & dates.

Newspaper	Dates
The Namibian	Monday, 3 July 2023 Monday, 10 July 2023
Windhoek Observer	

d) Distribution of the BID to the adjacent land users (see **Appendix G**: Register of all hand delivered BID's) and also to all the registered I&APs.
e) A site notice was also placed at a conspicuous location at the site during the 21 day public consultation period. A similar notice was placed at the Nampower substation at the neighboring informal settlement (See photo's in **Appendix E**).
f) Distribution of the Draft Scoping report to all I&APs and a comment period of seven (7) days was awarded, from 26 July 2023, to 2 August 2023.
g) Stakeholders were actively identified by EcoLab Environmental and were also afforded a copy of the background Information document. Stakeholder/I&AP for the project ranged from various individuals representing a diverse multitude of institutions, such as:
    - Municipality of Mariental
    - Hardap Regional Council
    - Adjacent land users/owners
    - Ministry of Environment, Tourism and Forestry

- Ministry of Mines and Energy
- NAMPOWER
- NAMWATER
- Roads Authority
- Electricity Control Board

A full list of all I&AP can be found in **Appendix F**. No comments were received following the distribution of the BID.

5. Description of the Environment

The surrounding land use of the proposed site comprises; an informal settlement, a Nampower Substation and the B1 Highway. (See Section 2.2: Proposed Site and Surrounding Land Use, as well as Figure 1 & 2). This chapter will elaborate on the Socio-Economic as well as the Natural receiving environments in the broader milieu of Mariental as a town.

5.1 Socio-Economic Environment

Mariental is the most populace town in the Hardap Region with a total population of around 16 000 inhabitants, translating to over 3500 private households which are mostly headed by males (61%). The town has a literacy rate of about 94%, while the unemployment rate among the labour force at the town is around 36%. Around 60% of households at Mariental do not have electricity for lighting. The main sources of income for households at Mariental are Wages and Salaries (NSA 2011).

Table 6: Summary of Selected Demographic indicators of the Mariental Urban constituency as per the 2011 census (Source Namibia Statistics Agency: Hardap Regional Profile, 2011)

Population Size		**Labour force, 15+ years (%)**	
Total	15 557	In labour force	71
Male	7 586	Employed	64
Female	8 051	Unemployed	36
Sex ratio: Males per 100 females	107	Outside Labour force	18
		Student	42
		Homemaker	13
		Retired etc.	45
Age composition, (%)		**Households with (%)**	
Under 5 years	12	Safe Water	97
5 – 14 years	21	No toilet facility	42
15 – 59 years	62	Electricity for lighting	40
60+ years 5 5	5	Wood/Charcoal for cooking	32

Marital status: 15+ years, %		**Household main source of income**	
Never married	59	Farming	3
Married with Certificate	22	Wages & Salaries	75
Married Traditionally	2	Cash Remittance	3
Maried consensually	12	Business, non-farming	7
Divorced/Separated	1	Pension	7
Widowed	3		
Private Households		**Persons Living with Disability %**	
Number	3 585	With Disability	3.7
Average Size	4.1		
Literacy Rate, 15+years			
Never attended school	8		
Currently at school	25		
Left School	64		

5.2 Natural Environment

5.2.1 Climatic Conditions

According to the Köppen Climate Classification system, a widely used climate classification systems, Mariental has a Hot Desert Climate (BWh), with hot summers and cool winters (with mild days and chilly nights)[3]. Hot desert climates (BWh) are typically found under the subtropical ridge in the lower middle latitudes or the subtropics, often between 20° and 33° north and south latitudes[4].

5.2.2 Temperature

Average high day-time temperatures in Mariental range between 33 and 21 degrees Celsius. With the hottest days experienced in the months of January, February, November and December.

Average low daily low temperatures in Mariental range between 4 °C and 18 °C. With the coldest days experienced in the months of June and July each year.

3 https://www.namibweb.com/mariental.htm#:~:text=Mariental%20has%20a%20desert%20climate,annual%20precipitation%20is%20194%20mm.

4 https://en.wikipedia.org/wiki/Desert_climate#Hot_desert_climates

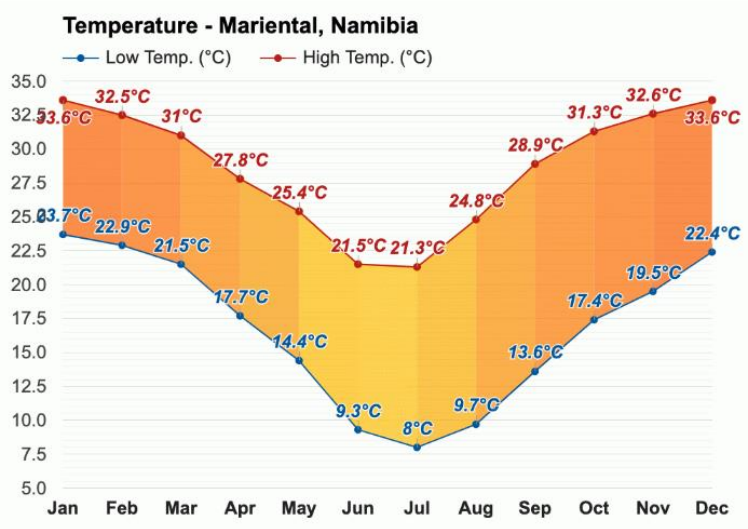

Figure 6: Annual average temperatures at Mariental, Namibia (Source: www.weather-atlas.com).

5.2.3 Rainfall and Humidity

The rainy season at Mariental runs from end October and peaks at around Februaryl where figures of about 30mm on average are experienced. The driest months are July and August. The total average annual rainfall at Mariental is around 95mm/anum.

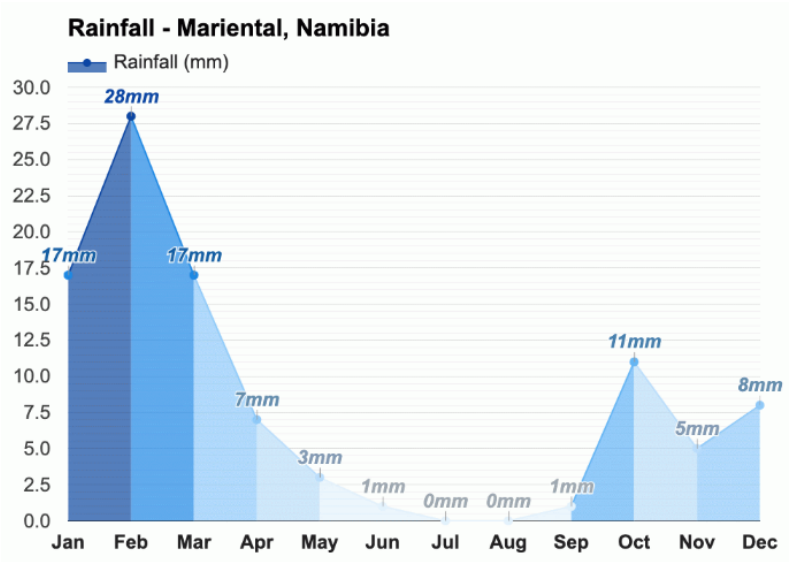

Figure 7: Annual average rainfall at Mariental, Namibia (Source: www.weather-atlas.com).

Average humidity in Mariental follows a similar trend to the precipitation figures, with higher humidity experienced during the rainy seasons.

5.2.4 Daylight Hours

The Mariental area receives many hours of daylight per year. The average amount of sunshine hours' per day ranges between 9.6 – 11.8 hrs/d throughout the year. This is a critical factor for the operation of a Solar PV Power Plant.

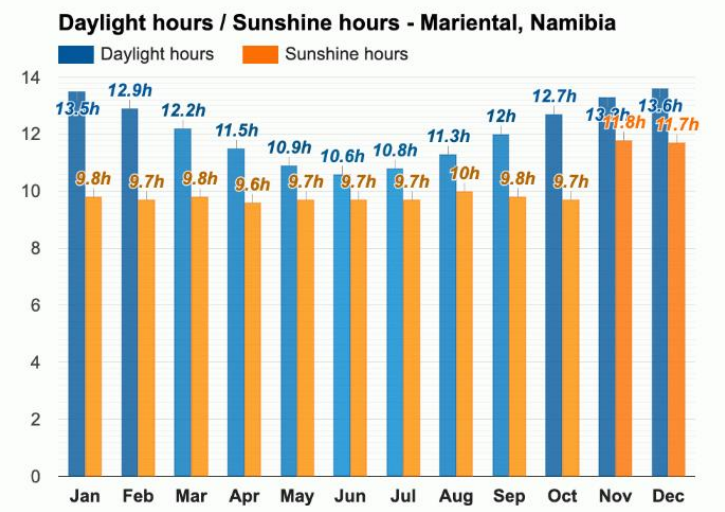

Figure 8: Annual daylight hours at Mariental, Namibia (Source: www.weather-atlas.com).

5.2.5 Geology, Hydrology and Hydraulic Structures

The regional geology of the area consists of formations of mainly the Kalahari Group. Within the Kalahari Group the following six lithological classifications are recognized: Duricrusts, Kalahari sand, Alluvium and lacustrine deposits, Sandstone, Marl, Basal conglomerate and gravel. The Karoo Supergroup is also present in the study area. (Christelis & Struckmeier 2011)

According to Christelis & Struckmeier (2011), the study area is within the Fish River – Aroab Basin. Groundwater is hosted in secondary features like faults and joints in sedimentary rocks of clastic origin (sandstone, quartzite and shale) and in solution features in limestones and dolomites

Hydraulic structures in closest proximity to the proposed site, include the Fish River at about 1km west of the proposed site, as well as the Hardap Dam at about 15km North-West of the proposed site. If the water level of the Hardap Dam rises to a level of 1,131.62 m (70%), water is released, and floods the area downstream. (ORASECOM, "infrastructure catalogue", retrieved 20 July 2023). The proponent would thus have to carry out flood risk assessment so as to design and construct the proposed power plant accordingly.

5.2.6 Plants and Animals

The Mariental Area is characterised as a combination of Tree and Scrub Savanna Biome and Nama Karoo Biome. The Mariental area in general contains a large diversity of annual and perennial grasses, it is estimated that there is up to 101 grass species. Four of these species are endemic namely Eragrostis omahekensis, Eragrostis scopelophila, Pennisetum foermeranum and Setaria finite (Mannheimer & Curtis, 2009). The savannah landscape, primarily a mix of bush land (dry and thorn bush savannah). Common species of flora typical of the area include: *Acacia Melifera, Acacia Hebeclada, Tarconanthus Camphoratus, Catophractes Alexandri, Rhus Ciliatia, Themeda Triandra, Brachiaria Serrata, Microchloa Caffra, Stipagrotis Uniplumi* and *Schmidtia Kalahariensis.*

Reptiles that may be present in the area include: Psammophis jallae, Mehelya Vernayi) Stigmochelys pardalis, *Varanus Albigularis,* Psammobates, Hemirhagerrhis viperrinus, Oculiferus, as well as members of the *Pachydactylus* genus. Mammals that may be present in the area include mongoose and baboons and rodents.

6. ENVIRONMENTAL ASSESSMENT

The Table below indicates a summary of identified environmental impacts. These impacts are categorized into the relevant stages of the life cycle of the proposed development, namely: Operational Phase, Decommissioning Phase and Rehabilitation Phase. The environmental assessment section of the Scoping Report and the consequent EMP shall also be compartmentalized into these into these phases.

Table 7: Summary of identified Environmental Impacts

Environmental Impact	Construction Phase	Operational Phase	Decommissioning Phase	Rehabilitation Phase
	6.2.1 Impacts on Plants & Animals, Social Impacts and Cultural Heritage.	**6.3.1** Impacts on Plants & Animals, Social Impacts and Cultural Heritage.	**6.4.1** Decommissioning of Solar PV Power Plant infrastructure.	**6.5.1** Environmental Restoration Fund.
	6.2.2 Traffic and Site Access.	**6.3.2** Traffic and Site Access.	**6.4.2** Health and Safety of Personnel.	
	6.2.3 Pollution and Fire Hazards.	**6.3.3** Waste Management.	**6.4.2** Waste Management.	
	6.2.4 Waste Management.	**6.3.4** Health and Safety of Personnel.		
	6.2.5 Health and Safety of Construction Personnel.	**6.3.5** Hydrological Flood Risk		
	6.2.6 HIV/AIDS and Employee wellness.	**6.3.6** HIV/AIDS and Employee wellness.		
	6.2.7 Noise during construction.			

6.1 Impact Evaluation Criterion used

The evaluation criterion used for the assessment of the impacts is taken from the Rhodes University, Department of Environmental Sciences in the Environmental Impact Assessment Short Course Training. The identified impacts were evaluated in terms of their magnitude, considering Temporal (Duration/Frequency) and Spatial (Local, National and Regional) scales as well Severity and Likelihood of occurrence as explained in *tables 6 to 9*. From the points scored by a particular impact in terms of its effect (*tables 5 to 7*) and Likelihood (*table 9*) the sum of these points were then used to determine the overall significance of the particular impact through the use of a Matrix as indicated in *Table 10*. From table 10, the colour category in which a particular impact falls under is then used in order to determine the significance of the impact as shown below in table 11, either; Low, Moderate, High, Very High. The entire process is repeated for each impact assuming suggested mitigation measures.

Table 8: Ranking evaluation criterion for the effects of impacts over temporal scales

Temporal Scale	Description	Score
Short term (ST)	Less than 5 years	1
Medium term (MT)	Between 5-20 years	2
Long term (LT)	Between 20 & 40 years (a generation) and from a human perspective also permanent	3
Permanent (P)	Over 40 years & resulting in a permanent lasting change that will always be there	4

Table 9: Ranking evaluation criterion for the effects of impacts over spatial scales

Spatial Scale	Description	Score
Localized (L)	At localized scale and a few hectares in extent	1
Study Area (S)	The proposed site and its immediate environments	2
Regional (R)	District and Regional level	3
National (N)	Country	4
International (I)	Internationally	5

Table 10: Ranking evaluation criterion for the Severity or Benefits of impacts.

Severity	Description (Severity / Beneficial effects)	Score
Slight (SL)	Slight impacts to the affected system(s) and/or party(ies)	1
Moderate (M)	Moderate impacts of the affected system(s) and/or party(ies)	2
Severe (SE)	Severe impacts of the affected system(s) and/or party(ies)	4
Very Severe (VS)	Very Severe impacts of the affected system(s) and/or party(ies)	8

Table 11: Ranking evaluation criterion for the likelihood of potential impacts.

Likelihood	Description	Score
Unlikely (U)	The Likelihood of these impacts occurring is slight	1
May occur (M)	The likelihood of these impacts occurring is possible	2
Probable (P)	The likelihood of these impacts occurring is probable	3
Definite (D)	The likelihood that this impact will occur is definite	4

Table 12: Matrix used to determine the overall significance of the impact based on the likelihood and effect of the impact.

		Effect													
		3	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Likelihood	**1**	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	2	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	3	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	4	7	8	9	10	11	12	13	14	15	16	17	18	19	20

Table 13: Description of Environmental significance ratings and associated range of scores

Significance Rate	Description	Score
Low	Acceptable impact for which mitigation is desirable but not essential. The impact by itself is insufficient even in combination with other low impacts to prevent the development from being approved.	4 - 7
Moderate	An important impact which requires mitigation. The impact is insufficient by itself to prevent the implementation of the project but which in conjunction with other impacts may prevent project implementation. These impacts will usually result in either a positive or negative medium to long-term effect on the social and/or natural environment.	8 - 11
High	A serious impact if not mitigated, and may prevent the implementation of the project (if it's a negative impact). These impacts would be considered by society as constituting a major and usually a long-term change to the (natural and/or social) environment and result in severe effects.	12 – 15
Very High	A very serious impact which, if negative, may be sufficient by itself to prevent implementation of the project. The impact may result in permanent change. Very often these impacts are immitigable and usually result in very severe effects, or very beneficial effects.	16 - 20

6.2 Construction Phase Impacts

6.2.1 Impacts on Plants & Animals, Social Impacts and Cultural Heritage.

DESCRIPTION: During the construction of the proposed Solar PV Power Plant, impacts on fauna, flora, social and cultural heritage are likely to be expected and may emanate from the following: Site clearing and Grading that may cause dust and habitat loss; Establishment of a temporary construction camp and mobile site office; Community grievances; Archaeological Discoveries on site.

MITIGATION: It is recommended that Site clearing and Grading should be done with the assistance of the Ministry of Environment, Tourism and forestry so as to avoid habitat destruction and guidance with possible non-toxic dust suppression measures. Soil erosion may be caused by exposed surfaces and can be reduced by scheduling earthmoving works in a manner that avoids heavy rainfall periods as well as contouring and minimizing length and steepness of slopes as well as mulching to stabilize exposed areas. While the introduction of exotic plants onsite should be avoided as far as possible and should only be permitted with the express consent of the relevant authorities. Prior to commencement of construction, the proponent should agree on a Community Grievance mechanism with the local communities in conjunction with the authorities. In the unlikely event of any heritage or archaeological discoveries during the construction phase of the

project, the Local Authority and National Heritage Council (NHC) should be contacted immediately for guidance regarding the discovery. Cutting down trees for firewood and feeding of any wildlife should not be permitted.

	Temporal	Spatial	Severity	Likelihood	Significance Rate
Score Before Mitigation	(MT) 2	(S) 2	(M) 3	(P) 4	11 MODERATE
Score Considering Mitigation	(ST) 1	(L) 1	(SL) 1	(U) 1	4 LOW

The overall rating of this impact is moderate in unmitigated conditions and low under mitigated conditions. Mitigation is therefore recommended as best practice and as a means of remaining pro-active through construction as well as reducing impacts.

6.2.2 Traffic and Site Access.

DESCRIPTION: During the construction of the proposed Solar PV Power Plant, access roads to the construction site would have to be established.

MITIGATION: Planning of access roads needs to be done in consultation with the Local Authorities as well as the Roads Authority of Namibia. Planning of access roads should be mindful of limiting gradients in order to reduce run-off induced erosion. Existing roads that link the site to neighbouring areas should not be obstructed or damaged through construction endeavours. Transportation through community areas should be discouraged by all means. Operators of vehicles used during construction, particularly heavy equipment (Graders and trucks etc.) should be mindful of their limited fields of view and be on the lookout for possible pedestrians. The proponent should also restrict access to the site with a focus on high risk structures or areas depending on the site-specific situations through interventions such as; fencing, signage, and communication of risks to the local community. Hazardous conditions that cannot be controlled effectively through site access restrictions should be removed entirely. A visitor orientation program should be developed and all visitors to the site should comply with all safety protocols on site. Lastly, regular communication between the proponent and neighbouring land users and communities with regard to traffic matters should be agreed upon prior to construction, and communication in this regard should be ongoing with possible changing conditions during construction with such discussions documented and relevant recommendations followed up on.

	Temporal	Spatial	Severity	Likelihood	Significance Rate
Score Before Mitigation	(LT) 3	(S) 2	(M) 2	(D) 4	11 MODERATE
Score Considering Mitigation	(ST) 1	(L) 1	(SL) 1	(M) 2	5 LOW

The overall rating of this impact is moderate under unmitigated circumstances and low under mitigated conditions. Mitigation is therefore recommended as best practice and as a means of remaining pro-active through construction as well as reducing impacts.

6.2.3 Pollution and Fire hazards.

DESCRIPTION: Dealing with hazardous substances that may be kept and/or handled onsite, presents a pollution and fire risk that the proponent should not neglect and should take responsibility for and manage accordingly. These hazards include: paints, solvents, gases and hydrocarbons (non-exhaustive list).

MITIGATION: Initially, the proponent should develop a site specific Emergency Response Plan that is to be followed in the event of emergencies that may arise from the handling and storage of hazardous substances onsite. Material and Safety Data Sheets (MSDS) should be readily available onsite at all times and the contents of these documents should be adhered to. MSDS documents must also be considered in the development of the recommended site specific Emergency Response Plan. Drip trays should be placed under oil leaking vehicles/equipment and the contents of these trays should be disposed of in a manner that is approved by the local authority. Corrosive, oxidising and reactive chemicals present similar hazards and require similar control measures as flammable substances. The spillage of any hydrocarbon exceeding 200 litters should be reported to the Ministry of Mines and Energy without delay. All incidents with regard to Pollution and Fire hazards should be; documented, investigated the outcomes/corrective action implemented in order to prevent re-occurrence by all means.

There are a range measures that can be employed by the proponent to mitigate the impacts of pollution and fires. These include but are not limited to (non-exhaustive list):

- Detailed operational procedures for hazardous substance handling as well as related emergency protocols endorsed and supported by management. These need to be reviewed from time to time and must be complimented by regular drills to assess and improve upon their effectiveness.
- Provision of manual firefighting equipment that is easily accessible and easy to use. Training on the use of the equipment should be provided.
- Fire and emergency systems that are both audible and visible where practically possible.
- Storing of flammables away from ignition sources and oxidizing materials.
- No cell phones or Smoking allowed at high risk areas onsite to avoid distractions and unwanted ignition of fires.
- General good housekeeping practices as well as a culture of safety and compliance to procedures, rules and protocols within the construction team should be fostered.

	Temporal	Spatial	Severity	Likelihood	Significance Rate
Score Before Mitigation	(P) 4	(R) 3	(SE) 4	(P) 3	12 Moderate
Score Considering Mitigation	(ST) 1	(L) 1	(SL) 1	(M) 3	6 LOW

The overall rating of this impact is moderate under unmitigated circumstances and low under mitigated conditions. Mitigation is therefore strongly recommended as best practice and as a means of remaining pro-active through construction as well as reducing impacts.

6.2.4 Waste Management

DESCRIPTION: During the day-to-day activities of the construction of the proposed Solar PV Power Plant, different kinds of waste are expected to be generated. These include: general domestic waste, building rubble, site clearing debris, packaging, chemical/mobile toilets etc.

MITIGATION: All domestic waste onsite should be disposed of in receptacles that promote good housekeeping and can hold all waste until such a time that the waste is to be removed from the site without causing any pollution. All waste is to be removed from the site on a regular basis and should under no circumstances be allowed to accumulate to uncontrollable levels. Waste from site clearing shall have to be disposed of in a manner that is in line with national laws and to the satisfaction of the Municipality of Mariental. Contaminated products that cannot be re-used and domestic waste should be disposed of in accordance with Local Authority Requirements. Chemical/Mobile toilets to be used onsite should comply with applicable national and local authority requirements. Chemical/Mobile toilets that are to be used onsite should complement the number of people that would make use of them in accordance with national laws. No waste should be buried or burned onsite and littering should be strictly prohibited.

	Temporal	Spatial	Severity	Likelihood	Significance Rate
Score Before Mitigation	(LT) 3	(S) 2	(S) 4	(P) 4	13 HIGH
Score Considering Mitigation	(ST) 1	(L) 1	(SL) 1	(M) 1	4 LOW

The overall rating of this impact is high under unmitigated circumstances and low under mitigated conditions. Mitigation is therefore recommended as best practice and as a means of remaining pro-active through construction as well as reducing impacts.

6.2.5 Health and Safety of Construction Personnel

DESCRIPTION: All construction phase related activities require human labour, directly or indirectly, and thus pose an inherent health and safety risk to construction personnel.

MITIGATION: It is the responsibility of the proponent to comply with the provisions set forth in the Labour Act 11 of 2007, with special attention to Chapter 4 that primarily outlines Health and Safety in the work place, as well as all other national legislations in this regard.

Recommended mitigating measures include, but not limited to (Non-exhaustive list):

- Periodic internal safety compliance audits.
- Health and Safety training and speciality programs should be provided as needed to ensure workers are oriented to the specific hazards of individual work assignments and all other present hazards.
- Hazard Risk Identification within Job Profiles/Machinery/Equipment/Work Areas and Tasks that are to be performed.
- Appointment of Safety Officers as custodians of safety within the workplace. In addition to these, Peer Educators and Health and Safety Representatives can also be nominated in constituent working teams in order to foster a culture of health and safety at the construction site.
- Documented Safe Operational and Work Procedures as well as Emergency (including Medical) Procedures and drills. These need to be periodically reviewed for their effectiveness and should be constantly improved upon whenever the opportunity presents itself, particularly following an event of note (including near-misses).
- Daily crew safety talks prior to the commencement of every shift.
- Monthly/Weekly Peer education topics encouraging healthy lifestyle choices, safety at the construction site and outcomes of investigations into near-misses and incident investigations.
- Good housekeeping practices in order to avoid unforeseen hazards and obstructions.
- General permits to work and Personal Protective Equipment/Clothing
- Conspicuous signs displaying all potential hazards, PPE requirements, assembly points, waste receptacles of all kinds, emergency numbers for respective emergencies that may arise, MSDS Sheets etc.
- Communication of lessons learnt from previous incidents and corrective action taken to avoid re-occurrence as soon as these are known following an investigation.
- Investigations into the improvement of current practices from a health and safety perspective.

	Temporal	Spatial	Severity	Likelihood	Significance Rate
Score Before Mitigation	(P) 4	(S) 2	(SE) 4	(D) 4	10 HIGH
Score Considering Mitigation	(ST) 1	(S) 2	(SL) 1	(M) 2	4 LOW

The overall rating of this impact is high under unmitigated and low under mitigated conditions. Thus mitigation is recommended as best practice and as a means of remaining pro-active through construction. The proponent is strongly recommended to devise an HSE Policy which should enjoy management commitment in its implementation.

6.2.6 HIV/AIDS and Employee Wellness

DESCRIPTION: The proposed development is expected to employ a large number of people (project staff as well as contractors). Should those recruited (particularly contractors) relocate to Mariental from other towns, it could contribute to the spread HIV/AIDS infections.

MITIGATION: The proponent should encourage and promote HIV/AIDS and health awareness among employees and contractors.

	Temporal	Spatial	Severity	Likelihood	Significance Rate
Score Before Mitigation	(P) 4	(N) 4	(SE) 4	(M) 2	12 HIGH
Score Considering Mitigation	(ST)1	(L) 1	(M) 2	(M) 2	3 LOW

The overall rating of this impact is high under unmitigated conditions and low under mitigated conditions. Mitigation is recommended as best practice and as a means of remaining pro-active through operations as well as reducing impacts.

6.2.7 Noise during construction

DESCRIPTION: The proposed development is expected to make use of earthmoving equipment and various kinds of machinery that may generate noise.

MITIGATION: The proponent should limit working hour's onsite to 07h00 to 19h00 and coordinate working high noise generating tasks in such a manner that provides the least nuisance to neighbouring land users. No employee should be exposed to a noise level greater than 85Db for a duration of more than 8 hours per day without hearing protection, and the use of hearing protection should be enforced actively.

	Temporal	Spatial	Severity	Likelihood	Significance Rate
Score Before Mitigation	(ST) 1	(S) 2	(SE) 4	(M) 4	10 MODERATE
Score Considering Mitigation	(ST)1	(L) 1	(M) 2	(M) 2	3 LOW

The overall rating of this impact is high under unmitigated conditions and low under mitigated conditions. Mitigation is recommended as best practice and as a means of remaining pro-active through operations as well as reducing impacts.

6.3 Operational Phase Impacts

All operational related impacts of the proposed development shall be discussed in this section in terms of the description of the impact as well as its effects (temporal, spatial & severity), as well as the likelihood of occurrence and proposed mitigation measures.

6.3.1 Impacts on Plants & Animals, Social Impacts and Cultural Heritage.

DESCRIPTION: During the operation of the proposed Solar PV Power Plant, impacts on fauna, flora, social and cultural heritage may occur.

MITIGATION: It is recommended that the proponent establishes an Environmental Management Auditing regime. Furthermore, the fence surrounding the site should be grey or green in colour in order to blend in with the surroundings and located as close as possible around the Solar PV Power Plant as practically possible. Lighting at the facility should be kept at a minimum to reduce light spillage and pollution. While the introduction of exotic plants onsite should be avoided as far as possible and should only be permitted with the express consent of the relevant authorities. In the unlikely event of any heritage or archaeological discoveries during the operation phase of the project, the Local Authority and National Heritage Council (NHC) should be contacted immediately for guidance regarding the discovery. Cutting down trees for firewood and feeding of any wildlife should not be permitted.

	Temporal	Spatial	Severity	Likelihood	Significance Rate
Score Before Mitigation	(MT) 2	(S) 2	(M) 3	(P) 3	6 MODERATE
Score Considering Mitigation	(ST) 1	(L) 1	(SL) 1	(U) 1	4 LOW

The overall rating of this impact is moderate in unmitigated conditions and low under mitigated conditions. Mitigation is therefore recommended as best practice and as a means of remaining pro-active through operations as well as reducing impacts.

6.3.2 Traffic and Site Access.

DESCRIPTION: During the operation of the proposed Solar PV Power Plant, access roads to the site that were established during the construction of the Solar PV Power Plant would be fully operational and would have to be managed.

MITIGATION: Any changes to the existing access roads needs to be done in consultation with the Local Authorities as well as the Roads Authority of Namibia. The proponent should also restrict access to the site with a focus on high risk structures or areas depending on the site-specific situations through interventions such as; fencing, signage, and communication of risks to the local community. Existing roads that link the site to neighbouring areas should not be obstructed or damaged through any endeavours of the operation of the Solar PV Power Plant. A visitor orientation program should be developed and all visitors to the site should comply with all safety protocols on site. Lastly, regular communication between the proponent and neighbouring land users with regard to traffic issues should be unending.

	Temporal	Spatial	Severity	Likelihood	Significance Rate
Score Before Mitigation	(LT) 3	(S) 2	(M) 2	(D) 4	11 MODERATE
Score Considering Mitigation	(ST) 1	(L) 1	(SL) 1	(M) 2	5 LOW

The overall rating of this impact is moderate under unmitigated circumstances and low under mitigated conditions. Mitigation is therefore recommended as best practice and as a means of remaining pro-active through construction as well as reducing impacts.

6.3.3 Waste Management

DESCRIPTION: During the day-to-day activities of the operation of the proposed Solar PV Power Plant, different kinds of waste are expected to be generated. These include: general domestic waste, packaging etc.

MITIGATION: It is recommended that the proponent establishes an Environmental Management Auditing regime. All domestic waste onsite should be disposed of in receptacles that promote good housekeeping and can hold all waste until such a time that the waste is to be removed from the site without causing any pollution. All waste is to be removed from the site on a regular basis and should under no circumstances be allowed to accumulate to uncontrollable levels. Waste from site clearing shall have to be disposed of in a manner that is in line with national laws and to the satisfaction of the Municipality of Mariental. Contaminated products that cannot be re-used and domestic waste should be disposed of in accordance with Local Authority Requirements. No waste should be buried and littering should be strictly prohibited.

	Temporal	Spatial	Severity	Likelihood	Significance Rate
Score Before Mitigation	(LT) 3	(S) 2	(S) 4	(P) 4	13 HIGH
Score Considering Mitigation	(ST) 1	(L) 1	(SL) 1	(M) 1	4 LOW

The overall rating of this impact is high under unmitigated circumstances and low under mitigated conditions. Mitigation is therefore recommended as best practice and as a means of remaining pro-active through operations as well as reducing impacts. Also, it is recommended that the proponent establishes an Environmental Management Auditing regime.

6.3.4 Health and Safety of Operation Personnel

DESCRIPTION: All operation phase related activities require human labour, directly or indirectly, and thus pose an inherent health and safety risk to O&M personnel.

MITIGATION: It is recommended that the proponent establishes a Health and Safety Auditing Regime. It is the responsibility of the proponent to comply with the provisions set forth in the Labour Act 11 of 2007, with special attention to Chapter 4 that primarily outlines Health and Safety in the work place, as well as all other national legislations in this regard. **Additionally, (Points discussed in section 6.2.5 of the environmental assessment are essential and note-worthy in this regard)**

Recommended mitigating measures include, but not limited to (Non-exhaustive list):

- Covid-19 regulations as set forth by the National Authorities should be adhered to on site for the duration of the construction phase without exception.
- Periodic internal safety compliance audits.
- Health and Safety training (Confined spaces, Working at heights, First Aid Courses, Toolbox Safety Talks etc.)
- Hazard Risk Identification within Job Profiles/Machinery/Equipment/Work Areas and Tasks that are to be performed.
- Personal Protective Equipment/Clothing (dust masks, gloves, overalls, safety boots, hardhats etc.).

	Temporal	Spatial	Severity	Likelihood	Significance Rate
Score Before Mitigation	(P) 4	(S) 2	(SE) 4	(D) 4	10 HIGH
Score Considering Mitigation	(ST) 1	(S) 2	(SL) 1	(M) 2	4 LOW

The overall rating of this impact is high under unmitigated and low under mitigated conditions. Thus mitigation is recommended as best practice and as a means of remaining pro-active through operations. The proponent is strongly recommended to devise an HSE Policy which should enjoy management commitment in its implementation.

Also it is recommended that the proponent establishes a Health and Safety Auditing Regime.

6.3.5 Hydrological Flood Risk

DESCRIPTION: It is known that. If the water level of the Hardap Dam rises to a level of 1,131.62 m (70% capacity), water is released, and floods the area downstream. This may pose a Hydrological Risk to infrastructure to downstream including the proposed Solar PV Power Plant.

MITIGATION: It is recommended that the proponent carries out a flood risk assessment so as to design and construct the proposed power plant accordingly in order to mitigate hydrological flood risks.

	Temporal	Spatial	Severity	Likelihood	Significance Rate
Score Before Mitigation	(LT) 3	(S) 2	(S) 4	(P) 4	13 HIGH
Score Considering Mitigation	(ST) 1	(L) 1	(SL) 1	(M) 1	4 LOW

The overall rating of this impact is high under unmitigated circumstances and low under mitigated conditions. Mitigation is therefore recommended as best practice and as a means of remaining pro-active through operations as well as reducing impacts.

6.2.6 HIV/AIDS and Employee Wellness

DESCRIPTION: The proposed development is expected to employ an O&M team during the operation phase. Should those recruited (O&M contractors) relocate to Mariental from other towns, it could contribute to the spread HIV/AIDS infections.

MITIGATION: The proponent should encourage and promote HIV/AIDS and health awareness among O&M employees and contractors.

	Temporal	Spatial	Severity	Likelihood	Significance Rate
Score Before Mitigation	(P) 4	(N) 4	(SE) 4	(M) 2	12 HIGH
Score Considering Mitigation	(ST)1	(L) 1	(M) 2	(M) 2	3 LOW

The overall rating of this impact is high under unmitigated conditions and low under mitigated conditions. Mitigation is recommended as best practice and as a means of remaining pro-active through operations as well as reducing impacts.

6.4 Decommissioning Phase Impacts

All decommissioning phase impacts shall be discussed in this section in terms of the description of the impact as well as effects, likelihood and mitigation.

6.4.1 Decommissioning of Solar PV Power Plant infrastructure.

DESCRIPTION: It is expected that the proposed Solar PV may be operational for decades (considering the 25 year lease agreement currently under development) and as such may produce new habitats and ecological niches for plants and animals. Upon demolition and decommissioning of the facility, these newly established habitats and or niches will vanish.

MITIGATION: The proponent would have to ensure that no new habitats are created on site (**Points discussed in section 6.2.1 of the environmental assessment are essential and note-worthy in this regard**). Prior to decommissioning, inspections would have to be carried out to confirm that the taking apart and removal of established onsite infrastructure would not result in the unintended destruction of newly formed habitats and niches.

	Temporal	Spatial	Severity	Likelihood	Significance Rate
Score Before Mitigation	(ST) 2	(S) 2	(M) 2	(M) 2	8 MODERATE
Score Considering Mitigation	(SP) 1	(L) 1	(SL) 1	(U) 2	5 LOW

The overall rating of this impact is moderate under unmitigated conditions and low under mitigated conditions. Mitigation is recommended as best practice and as a means of remaining pro-active through operations as well as reducing impacts.

6.4.2 Health and Safety of Personnel.

DESCRIPTION: During the Decommissioning Phase similar risks to human beings as with the Operational Phase will be present. All other risks associated with demolitions must be considered.

MITIGATION: The decommissioning of onsite infrastructure can cause serious health and safety risks to workers on site i.e injuries and medical treatment incidents. For this reason, adequate measures must be put in place to ensure safety of staff on site, and includes:

- **Mitigation measures discussed in section 6.2.5 of the environmental assessment should be re-implemented in this regard.**

	Temporal	Spatial	Severity	Likelihood	Significance Rate
Score Before Mitigation	(P) 4	(S) 2	(SE) 4	(D) 4	10 HIGH
Score Considering Mitigation	(ST) 1	(L) 2	(SL) 1	(U) 2	4 LOW

The overall rating of this impact is high under unmitigated and low under mitigated conditions. Thus mitigation is recommended as best practice and as a means of remaining pro-active through decommissioning.

6.4.3 Waste Management.

DESCRIPTION: Upon decommissioning waste will be produced in the form of building rubble, old solar panels and associated structures.

MITIGATION: All waste should be disposed of appropriately considering the type of waste.

No waste should be piled up onsite once decommissioning is completed. The municipal dumpsite should be used for wastes that can be accommodated in this regard, waste that cannot be disposed of at the municipal dump site should be discarded off appropriately at such adequate facilities. No waste should be buried and littering should be strictly prohibited.

	Temporal	Spatial	Severity	Likelihood	Significance Rate
Score Before Mitigation	1	2	2	2	5 LOW
Score Considering Mitigation	1	2	1	1	4 LOW

The overall rating of this impact is low under unmitigated and mitigated conditions. Mitigation is recommended as best practice and as a means of remaining pro-active through operations as well as reducing impacts.

6.5 Rehabilitation Phase Impacts

Rehabilitation phase impacts shall be discussed in this section in terms of the description of the impact as well as effects, likelihood and mitigation.

6.4.1 Environmental Restoration Fund

DESCRIPTION: As a good corporate citizen, The Proponent has the responsibility to establish an Environmental Restoration fund for future environmental restoration once the project has reached the end of its life span, in order to fund for a responsible environmental legacy.

MITIGATION: The purpose of the Environmental Restoration Fund is to finance activities aimed at ecological restoration of the project site should project activities cease and the site is decommissioned and/or repurposed by the local authority.

	Temporal	Spatial	Severity	Likelihood	Significance Rate
Score Before Mitigation	4	4	4	2	12 HIGH
Score Considering Mitigation	1	1	2	2	3 LOW

The overall rating of this impact is high under unmitigated conditions and low under mitigated conditions. Mitigation is recommended as best practice and as a means of remaining pro-active through operations as well as reducing impacts.

7. Environmental Management Plan

7.1 The Environmental Management Plan

An Environmental Management Plan (EMP) is a site-specific plan developed to ensure that the developer/contractor/operator complies with the environmental conditions of approval for the project. The EMP essentially links environmental impacts assessed and project activities into environmental actions to be taken to mitigate assessed impacts.

It is further recommended that The Proponent establishes; 1) a Health and Safety Audit Regime 2) an Environmental Management Audit Regime, to be used in combination with this EMP for greater effectiveness.

7.2 Overall EMP Responsibility

Roles and responsibilities in the implementation of the planned Solar PV Power Plant are displayed bellow in Table 12:

Table 15: Responsibilities of roles players in the EMP.

Role Player	Obligation
Proponent	The Proponent is to ensure that mitigation recommendations within the EMP are adhered to, as far as reasonably practical. By checking that all approvals, licenses and permits as required by legislation are obtained before specific activities are carried out.
EAP	Compilation of Scoping Report and EMP. May be involved in external environmental audits.
Environmental Compliance Officer	Oversee the implementation of the EMP. Develop and document an Environmental Management System. Perform environmental compliance (internal) audits and follow-up on corrective actions from incidents to ensure compliance. Should be on the vigilant of emergent impacts not identified in the EMP. This role can be fulfilled by existing staff within the construction and operations organogram, i.e a supervisor or manager.

Ministry of Environment, Tourism and Forestry/ Municipality of Mariental	Enforcement of environmental regulations, EMP obedience inspectors and conduct regular project reviews on environmental and incident reports.

8. Construction Phase: EMP

Table 16: Proposed mitigation and monitoring measures for Environmental impacts during construction

Environmental Impact	Mitigation Measures	Monitoring	Responsibility
Impacts on Plants & Animals, Social Impacts and Cultural Heritage.	It is recommended that Site clearing and Grading should be done with the assistance of the Ministry of Environment, Tourism and forestry so as to avoid habitat destruction and guidance with possible non-toxic dust suppression measures. Soil erosion may be caused by exposed surfaces and can be reduced by scheduling earthmoving works in a manner that avoids heavy rainfall periods as well as contouring and minimizing length and steepness of slopes as well as mulching to stabilize exposed areas. While the introduction of exotic plants onsite should be avoided as far as possible and should only be permitted with the express consent of the relevant authorities. Prior to commencement of construction, the proponent should agree on a Community Grievance mechanism with the local communities in conjunction with the authorities. In the unlikely event of any heritage or archaeological discoveries during the construction phase of the project, the Local Authority and National Heritage Council (NHC) should be contacted immediately for guidance regarding the discovery. Cutting down trees for firewood and feeding of any wildlife should not be permitted.	Weekly/Monthly review of Monitoring should be done through Environmental Incidents / Non-conformities reported as well as corrective action taken and should be documented in a report for auditing purposes.	ECO / Proponent
Traffic and Site Access.	Planning of access roads needs to be done in consultation with the Local Authorities as well as the Roads Authority of Namibia. Planning of access roads should be mindful of limiting gradients in order to reduce run-off induced erosion. Existing roads that link the site to neighbouring areas should not be obstructed or damaged through construction endeavours. Transportation through community areas should be discouraged by all means. Operators of vehicles used during construction, particularly heavy equipment (Graders and trucks etc.) should be mindful of their limited fields of view and be on the lookout for possible pedestrians. The proponent should also restrict access to the site with a focus on high risk structures or areas depending on the site-specific situations through interventions such as; fencing, signage, and communication of risks to the local community. Hazardous conditions that cannot be controlled effectively through site access restrictions should be removed entirely. A visitor orientation program should be developed and all visitors to the site should comply with all safety protocols on site. Lastly, regular communication between the proponent and neighbouring land users and communities with regard to traffic matters should be agreed upon prior to construction, and	Weekly/Monthly review of Monitoring should be done through Environmental Incidents / Non-conformities reported as well as corrective action taken and should be documented in a report for auditing purposes.	ECO / Proponent

	communication in this regard should be ongoing with possible changing conditions during construction with such discussions documented and relevant recommendations followed up on.		
Pollution and Fire hazards.	Initially, the proponent should develop an Emergency Response Plan that is to be followed in the event of emergencies that may arise from the handling and storage of hazardous substances onsite. Material and Safety Data Sheets (MSDS) should be readily available onsite at all times and the contents of these documents should be adhered to. MSDS documents must also be considered in the development of the recommended Emergency Response Plan. Drip trays should be placed under oil leaking vehicles/equipment and the contents of these trays should be disposed of in a manner that is approved by the local authority. Corrosive, oxidising and reactive chemicals present similar hazards and require similar control measures as flammable substances. The spillage of any hydrocarbon exceeding 200 litters should be reported to the Ministry of Mines and Energy without delay. All incidents with regard to Pollution and Fire hazards should be; documented, investigated the outcomes/corrective action implemented in order to prevent re-occurrence by all means. There are a range of instruments/measures that can be used to bring a fire under control or avoid a fire entirely. These include but are not limited to (non-exhaustive list): • Detailed operational procedures for hazardous substance handling as well as related emergency protocols endorsed and supported by management. These need to be reviewed from time to time and must be complimented by regular drills to assess and improve upon their effectiveness. • Provision of manual firefighting equipment that is easily accessible and easy to use. Training on the use of the equipment should be provided. • Fire and emergency systems that are both audible and visible where practically possible. • Storing of flammables away from ignition sources and oxidizing materials. • No cell phones or Smoking allowed at high risk areas onsite to avoid distractions and unwanted ignition of fires. • General good housekeeping practices as well as a culture of safety and compliance to procedures, rules and protocols within the construction team should be fostered.	Weekly/Monthly review of Monitoring should be done through Environmental Incidents / Non-conformities reported as well as corrective action taken and should be documented in a report for auditing purposes.	ECO / Proponent
Waste Management	All domestic waste onsite should be disposed of in receptacles that promote good housekeeping and can hold all waste until such a time that the waste is to be removed from the site without causing any	Weekly/Monthly review of Monitoring should be done	ECO / Proponent

	pollution. All waste is to be removed from the site on a regular basis and should under no circumstances be allowed to accumulate to uncontrollable levels. Waste from site clearing shall have to be disposed of in a manner that is in line with national laws and to the satisfaction of the Municipality of Mariental. Contaminated products that cannot be re-used and domestic waste should be disposed of in accordance with Local Authority Requirements. Chemical/Mobile toilets to be used onsite should comply with applicable national and local authority requirements. Chemical/Mobile toilets that are to be used onsite should complement the number of people that would make use of them in accordance with national laws. No waste should be buried and littering should be strictly prohibited.	through Environmental Incidents / Non-conformities reported as well as corrective action taken and should be documented in a report for auditing purposes.	
Health and Safety of Construction Personnel	It is the responsibility of the proponent to comply with the provisions set forth in the Labour Act 11 of 2007, with special attention to Chapter 4 that primarily outlines Health and Safety in the work place, as well as all other national legislations in this regard. Recommended mitigating measures include, but not limited to (Non-exhaustive list): • Covid-19 regulations as set forth by the National Authorities should be adhered to on site without exception. • Periodic internal safety compliance audits. • Health and Safety training and speciality programs should be provided as needed to ensure workers are oriented to the specific hazards of individual work assignments and all other present hazards. • Hazard Risk Identification within Job Profiles/Machinery/Equipment/Work Areas and Tasks that are to be performed. • Appointment of Safety Officers as custodians of safety within the workplace. In addition to these, Peer Educators and Health and Safety Representatives can also be nominated in constituent working teams in order to foster a culture of health and safety at the construction site. • Documented Safe Operational and Work Procedures as well as Emergency (including Medical) Procedures and drills. These need to be periodically reviewed for their effectiveness and should be constantly improved upon whenever the opportunity presents itself, particularly following an event of note (including near-misses). • Daily crew safety talks prior to the commencement of every shift.	Weekly/Monthly review of Monitoring should be done through Environmental Incidents / Non-conformities reported as well as corrective action taken and should be documented in a report for auditing purposes.	ECO / Proponent

	• Monthly/Weekly Peer education topics encouraging healthy lifestyle choices, safety at the construction site and outcomes of investigations into near-misses and incident investigations. • Good housekeeping practices in order to avoid unforeseen hazards and obstructions. • General permits to work and Personal Protective Equipment/Clothing • Conspicuous signs displaying all potential hazards, PPE requirements, assembly points, waste receptacles of all kinds, emergency numbers for respective emergencies that may arise, MSDS Sheets etc. • Communication of lessons learnt from previous incidents and corrective action taken to avoid re-occurrence as soon as these are known following an investigation. • Investigations into the improvement of current practices from a health and safety perspective.		
HIV/AIDS and Employee Wellness	The proponent should encourage and promote HIV/AIDS and health awareness among employees and contractors.	Weekly/Monthly review of Monitoring should be done through Environmental Incidents / Non-conformities reported as well as corrective action taken and should be documented in a report for auditing purposes.	ECO / Proponent
Noise during construction	The proponent should limit working hours onsite to 07h00 to 19h00 and coordinate working high noise generating tasks in such a manner that provides the least nuisance to neighbouring land users. No employee should be exposed to a noise level greater than 85Db for a duration of more than 8 hours per day without hearing protection, and the use of hearing protection should be enforced actively.	Weekly/Monthly review of Monitoring should be done through Environmental Incidents / Non-conformities reported as well as corrective action taken and should be documented in a report for auditing purposes.	ECO / Proponent

9. Operational Phase: EMP

Table 17: Proposed mitigation and monitoring measures for Environmental impacts, aspects and risks during operation

Environmental Impact	Mitigation Measures	Monitoring	Responsibility
Impacts on Plants & Animals, Social Impacts and Cultural Heritage.	It is recommended that the proponent establishes an Environmental Management Auditing regime. Furthermore, the fence surrounding the site should be grey or green in colour in order to blend in with the surroundings and located as close as possible around the Solar PV Power Plant as practically possible. Lighting at the facility should be kept at a minimum to reduce light spillage and pollution. While the introduction of exotic plants onsite should be avoided as far as possible and should only be permitted with the express consent of the relevant authorities. In the unlikely event of any heritage or archaeological discoveries during the operation phase of the project, the Local Authority and National Heritage Council (NHC) should be contacted immediately for guidance regarding the discovery. Cutting down trees for firewood and feeding of any wildlife should not be permitted.	Weekly/Monthly review of Monitoring should be done through Environmental Incidents / Non-conformities reported as well as corrective action taken should be documented in a report for auditing purposes.	ECO / Proponent
Traffic and site access	Any changes to the existing access roads needs to be done in consultation with the Local Authorities as well as the Roads Authority of Namibia. The proponent should also restrict access to the site with a focus on high risk structures or areas depending on the site-specific situations through interventions such as; fencing, signage, and communication of risks to the local community. Existing roads that link the site to neighboring areas should not be obstructed or damaged through any endeavors of the operation of the Solar PV Power Plant. A visitor orientation program should be developed and all visitors to the site should comply with all safety protocols on site. Lastly, regular communication between the proponent and neighboring land users with regard to traffic issues should be unending.	Weekly/Monthly review of Monitoring should be done through Environmental Incidents / Non-conformities reported as well as corrective action taken should be documented in a report for auditing purposes.	ECO / Proponent
Waste Management	It is recommended that The Proponent establishes an Environmental Management Auditing regime. All domestic waste onsite should be disposed of in receptacles that promote good housekeeping and can hold all waste until such a time that the waste is to be removed from the site without causing any pollution. All waste is to be	Weekly/Monthly review of Monitoring should be done through Environmental Incidents / Non-conformities reported as well as corrective action taken should be	ECO / Proponent

	removed from the site on a regular basis and should under no circumstances be allowed to accumulate to uncontrollable levels. Waste from site clearing shall have to be disposed of in a manner that is in line with national laws and to the satisfaction of the Municipality of Mariental. Contaminated products that cannot be re-used and domestic waste should be disposed of in accordance with Local Authority Requirements. No waste should be buried and littering should be strictly prohibited.	documented in a report for auditing purposes.	
Health and Safety of Operation Personnel	It is recommended that The Proponent establishes a Health and Safety Auditing Regime. It is the responsibility of the proponent to comply with the provisions set forth in the Labour Act 11 of 2007, with special attention to Chapter 4 that primarily outlines Health and Safety in the work place, as well as all other national legislations in this regard. Additionally, (Points discussed in section 6.2.5 of the environmental assessment are essential and note-worthy in this regard) Recommended mitigating measures include, but not limited to (Non-exhaustive list): •Periodic internal safety compliance audits. •Health and Safety training (Confined spaces, Working at heights, First Aid Courses, Toolbox Safety Talks etc.) •Hazard Risk Identification within Job Profiles/Machinery/Equipment/Work Areas and Tasks that are to be performed. •Personal Protective Equipment/Clothing (dust masks, gloves, overalls, safety boots, hardhats etc.).	Weekly/Monthly review of Monitoring should be done through Environmental Incidents / Non-conformities reported as well as corrective action taken should be documented in a report for auditing purposes.	ECO / Proponent
Hydrological flood risk	It is known that. If the water level of the Hardap Dam rises to a level of 1,131.62 m (70% capacity), water is released, and floods the area downstream. This may pose a Hydrological Risk to infrastructure to downstream including the proposed Solar PV Power Plant. It is recommended that the proponent carries out a flood risk	N/A	Proponent

	assessment so as to design and construct the proposed power plant accordingly in order to mitigate hydrological flood risks.		
HIV/AIDS and Employee Wellness	The proponent should encourage and promote HIV/AIDS and health awareness among O&M employees and contractors.	Weekly/Monthly review of Monitoring should be done through Environmental Incidents / Non-conformities reported as well as corrective action taken should be documented in a report for auditing purposes.	ECO / Proponent

10. Decommissioning EMP

Table 18: Proposed mitigation and monitoring measures for Environmental impacts, aspects and risks during decommissioning

Environmental Impact	Mitigation Measures	Monitoring	Responsibility
Decommissioning of Solar PV Power Plant Infrastructure.	The proponent would have to ensure that no new habitats are created on site (Points discussed in section 6.2.1 of the environmental assessment are essential and note-worthy in this regard). Prior to decommissioning, inspections would have to be carried out to confirm that the taking apart and removal of established onsite infrastructure would not result in the unintended destruction of newly formed habitats and niches.	Weekly/Monthly review of Monitoring should be done through Environmental Incidents / Non-conformities reported as well as corrective action taken should be documented in a report for auditing purposes.	ECO / Proponent
Waste Management	All waste should be disposed of appropriately considering the type of waste. No waste should be piled up onsite once decommissioning is completed. The municipal dumpsite should be used for wastes that can be accommodated in this regard, waste that cannot be disposed of at the municipal dump site should be discarded off appropriately at such adequate facilities. No waste should be buried and littering should be strictly prohibited.	Weekly/Monthly review of Monitoring should be done through Environmental Incidents / Non-conformities reported as well as corrective action taken should be documented in a report for auditing purposes.	ECO / Proponent

11. Rehabilitation EMP

Table 19: Proposed mitigation and monitoring measures for Environmental impacts during rehabilitation

Environmental Impact	Mitigation Measures	Monitoring	Responsibility
Environmental Restoration Fund	The purpose of the Environmental Restoration Fund is to finance activities aimed at ecological restoration of the project site should project activities cease and the site is decommissioned and/or repurposed by the local authority.	Weekly/Monthly review of Monitoring should be done through Environmental Incidents / Non-conformities reported as well as corrective action taken should be documented in a report for auditing purposes.	ECO / Proponent

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12. Conclusion

All the identified risks to the proposed project can be well managed and mitigated through the implementation of the Environmental Management Plan.

Management and mitigation of risks can further be enriched through the establishment of a functioning Health, Safety and Environmental Management System.

13. References

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APPENDIX A: CURRICULUMN VITAE OF EAP

APPENDIX B: VALUATION REPORT ON ERF 1865 AIMABLAAGTE, MARINTAL. DATED: 5 NOVEMBER 2019

APPENDIX C: BACKGROUND INFORMATION DOCUMENT

APPENDIX D: NEWSPAPER ADVERTS

APPENDIX E: SITE NOTICE AND OTHER NOTICES PLACED

APPENDIX F: LIST OF I&AP'S

APPENDIX G: REGISTER OF HAND DELIVERED BID's.

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APPENDIX G: MUNICIPALITY CONSENT LETTER.

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