CAMDEN I SOLAR (RF) (PTY) LTD

CAMDEN I SOLAR ENERGY FACILITY

DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

DFFE REFERENCE NUMBER: 14/12/16/3/3/2/2136

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CAMDEN I SOLAR ENERGY FACILITY

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CAMDEN I SOLAR (RF) (PTY) LTD

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DOCUMENT DESCRIPTION

APPLICANT

Camden I Solar (RF) (Pty) Ltd

PROJECT NAME

Proposed Camden I Solar Energy Facility, Mpumalanga, South Africa

PRE-APPLICATION REFERENCE NUMBER

2021-10-0008

DFFE REFERENCE NUMBER

14/12/16/3/3/2/2136

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Draft Environmental Impact Assessment Report

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Senior Consultant	Megan Govender
Traffic Specialist	Christo Bredenhann
Groundwater Specialist	Adam Sanderson
Air Quality Specialist	Brad Keiser

SPECIALISTS

Heritage and Palaeontology Specialist	Jaco van der Walt (Beyond Heritage)
Agriculture Specialist	Johan Lanz
Ecology Specialist	David Hoare (David Hoare Consulting (Pty) Ltd
Aquatic Specialist	Brian Colloty (EnviroSci Pty Ltd)
Avifauna Specialist	Chris van Rooyen (Chris van Rooyen Consulting)
Social Specialist	Tony Barbour (Tony Barbour Environmental Consulting)
Visual Specialist	Kerry Schwartz (SLR Consulting (Pty) Ltd))
Risk Specialist	Debra Mitchell (Ishecon cc)
Bats Specialist	Werner Marais (Animalia Consultants (Pty) Ltd)

Geotechnical Specialist	Muhammad Osman (SLR Consulting)

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

1 INTRODUCTION

1.1 PURPOSE OF THIS REPORT

This environmental impact report (EIR) documents the processes and findings of the impact assessment phase of the Scoping and Environmental Impact Reporting (S&EIR) process for the proposed Camden I Solar Energy Facility (SEF), located approximately 10km south of Ermelo (near Camden) in the Mpumalanga Province of South Africa.

The EIR aims to provide stakeholders with information on the proposed development including location, layout and technological alternatives, the scope of the environmental assessment and key impacts to be addressed in the environmental assessment, and the consultation process undertaken through the environmental impact assessment (EIA) process.

1.2 BACKGROUND INFORMATION

The proponent is proposing the development of a Camden Renewable Energy Complex within the vicinity of the Camden Power Station in Mpumalanga. The Complex consists of eight distinct projects referred to as:

- Camden I Wind Energy Facility (up to 200MW) (subject to a S&EIR process);
- Camden I Wind Grid Connection (up to 132kV) (subject to a Basic Assessment (BA) Process);
- Camden Grid Connection and Collector substation (up to 400kV) (subject to a S&EIR process);
- Camden I Solar (up to 100MW) (subject to a S&EIR process);
- Camden I Solar Grid Connection (up to 132kV) (subject to a BA Process);
- Camden II Wind Energy Facility (up to 200MW) (subject to a S&EIR process);
- Camden II Wind Energy Facility up to 132kV Grid Connection (subject to a BA Process); and
- Camden Green Hydrogen and Ammonia Facility, including grid connection infrastructure (subject to a S&EIR process).

The Complex (except for the Green Hydrogen and Ammonia project) is being developed in the context of the Department of Mineral Resources and Energy's (DMRE Integrated Resource Plan, and the Renewable Energy Independent Power Producer Procurement Programme (REIPPP).

The focus of this Environmental Impact Assessment Report is the proposed Camden I SEF project (DFFE Reference Number: 14/12/16/3/3/2/2136).

The proposed project will be operated under a Special Purpose Vehicle (SPV), and the Project Applicant is Camden I Solar (RF) (Pty) Ltd. The proposed SEF will connect to the nearby Camden Collector substation through an up to 132kV powerline either single or double circuit (subject to a separate BA process, as mentioned above) between the grid on-site IPP substation for the solar facility and that of the Camden Collector substation. The broader Camden developments (i.e. seven of the abovementioned subprojects) will connect to the Camden Power Station substation through an up to 400kV powerline (either single or double circuit) (subject to a separate Scoping and EIR process).

In order for the proposed project to proceed, it will require an Environmental Authorisation (EA) from the Competent Authority (CA) (i.e. the National Department of Forestry, Fisheries and Environment, (DFFE)).

1.3 KEY ROLE PLAYERS

1.3.1 PROJECT PROPONENT

Camden I Solar (RF) (Pty) Ltd is the project proponent (Applicant) with regards to this application for the construction and operation of the SEF and associated infrastructure. **Table 1.1** provides the relevant details of the project proponent.

Table 1.1: Details of Project Proponent

PROPONENT:	**CAMDEN I SOLAR (RF) (PTY) LTD**
Contact Person:	Mercia Grimbeek
Postal Address	Suite 104, Albion Springs, 183 Main Road, Rondebosch, Cape Town, South Africa 7700
Telephone:	071 752 8033
Email:	Gideon.raath@enertrag.com

1.3.2 COMPETENT AUTHORITY

Section 24C(2)(a) of NEMA stipulates that the Minister of Forestry, Fisheries, and the Environment ("the Minister") must be identified as the CA if the activity has implications for international environmental commitments or relations. GN 779 of 01 July 2016 identifies the Minister as the CA for the consideration and processing of environmental authorisations and amendments thereto for activities related the Integrated Resource Plan (IRP) 2010 – 2030.

The CA (i.e., DFFE) was confirmed during the Pre-Application Meeting held on **19 October 2021**.

Table 1.2 provides the relevant details of the competent authority on the Project.

Table 1.2: Competent Authority

ASPECT	**COMPETENT / COMMENTING AUTHORITY**	**CONTACT DETAILS**
Competent Authority: Environmental Authorisation	Department of Forestry, Fisheries, and the Environment (DFFE)	Case Officer: Makhosi Yeni Integrated Environmental Authorisations MYeni@dffe.gov.za DFFE Reference: 14/12/16/3/3/2/2136

1.3.3 COMMENTING AUTHORITIES

The following commenting authorities have been identified for this application:

— Department of Mineral Resources and Energy (DMRE);
— DFFE: Biodiversity and Conservation;
— DFFE: Protected Areas;
— Mpumalanga Department Agriculture, Rural Development, Land and Environmental Affairs (MDARDLEA);
— Department of Water and Sanitation (DWS);

— Vaal Water Management Area (WMA) Authority;
— South African Heritage Resource Agency (SAHRA);
— Mpumalanga Heritage Resources Authority (MHRA);
— Mpumalanga Tourism and Parks Agency (MTPA);
— Civil Aviation Authority (CAA);
— Air Traffic and Navigation Services (ATNS);
— Department of Defence (SA Army) (DD);
— Astronomy Management Authority (AMA);
— South African Weather Services (SAWS);
— South African National Roads Agency Limited (SANRAL);
— Gert Sibande District Municipality;
— Msukaligwa Local Municipality; and
— Dr Pixley Ka Seme Local Municipality.

1.3.4 ENVIRONMENTAL ASSESSMENT PRACTITIONER

WSP Group Africa (Pty) Ltd (WSP) has been appointed in the role of Independent Environmental Assessment Practitioner (EAP) to undertake the S&EIR processes for the development of the Project. The CV of the EAP is available in **Appendix A**. The EAP declaration of interest and undertaking is included in **Appendix B**. **Table 1.3** details the relevant contact details of the EAP. In order to adequately identify and assess potential environmental impacts, a number of specialists will support the EAP.

Table 1.3: Details of the Environmental Assessment Practitioner

ENVIRONMENTAL ASSESSMENT PRACTITIONER	WSP GROUP AFRICA (PTY) LTD
Contact Person:	Ashlea Strong
Postal Address:	Building C, Knightsbridge, 33 Sloane Street, Bryanston, 2191, South Africa
Telephone:	011 361 1392
Fax:	011 361 1381
E-mail:	Ashlea.Strong@wsp.com
EAP Qualifications:	— Masters in Environmental Management, University of the Free State — B Tech, Nature Conservation, Technikon SA — National Diploma in Nature Conservation, Technikon SA
EAPASA Registration Number:	EAPASA (2019/1005)

STATEMENT OF INDEPENDENCE

Neither WSP nor any of the authors of this Report have any material present or contingent interest in the outcome of this Report, nor do they have any business, financial, personal or other interest that could be reasonably regarded as being capable of affecting their independence. WSP has no beneficial interest in the outcome of the assessment.

1.3.5 SPECIALISTS

Specialist input was required in support of this application for EA. The details of the specialists are provided in **Table 1.4** below. The specialist declarations are included in **Appendix C**.

Table 1.4: Details of Specialists

ASSESSMENT	NAME OF SPECIALIST	COMPANY	SECTIONS IN REPORT
Agriculture	Johann Lanz	Independent consultant	Section 7.1.4 Section 8.4 **Appendix H-1**
Aquatic	Brian Colloty	EnviroSci Pty Ltd	Section 7.1.5 Section 7.2.1 Section 8.5 **Appendix H-2**
Geotechnical	Muhammad Osman	SLR Consulting	Section 7.1.7 Section 7.1.8 Section 7.1.9 **Appendix H-3**
Terrestrial Ecology	David Hoare	David Hoare Consulting (Pty) Ltd	Section 7.2.2 Section 7.2.6 Section 8.7 **Appendix H-4**
Terrestrial Plants	David Hoare	David Hoare Consulting (Pty) Ltd	Section 7.2.4 Section 8.8 **Appendix H-5**
Terrestrial Animals	David Hoare	David Hoare Consulting (Pty) Ltd	Section 7.2.5 Section 8.9 **Appendix H-6**
Avifauna	Chris van Rooyen	Chris van Rooyen Consulting	Section 7.2.7 Section 8.10 **Appendix H-7**
Bats	Werner Marais	Animalia Consultants (Pty) Ltd	Section 7.2.8 Section 8.11 **Appendix H-8**
Traffic	Christo Bredenhann	WSP Group Africa (Pty) Ltd	Section 7.3.2 Section 8.12 **Appendix H-9**
Heritage	Jaco van der Walt	Beyond Heritage	Section 7.3.3 Section 8.13 **Appendix H-10**
Palaeontology	Prof Marion Bamford	Independent consultant	Section 7.3.4 Section 8.14 **Appendix H-11**
Visual	Kerry Schwartz	SLR Consulting (Pty) Ltd	Section 7.3.5 Section 8.15 **Appendix H-12**

ASSESSMENT	NAME OF SPECIALIST	COMPANY	SECTIONS IN REPORT
Socio-economic	Tony Barbour	Tony Barbour Environmental Consulting	Section 7.3.6 Section 8.16 **Appendix H-13**
SHE Risk	Debra Mitchell	Ishecon CC	Section 7.4 Section 8.18 **Appendix H-14**

1.4 IMPACT ASSESSMENT TERMS OF REFERENCE

The 2014 Environmental Impact Assessment (EIA) Regulations (GNR 982), as amended, identifies the proposed Camden I SEF development as an activity being subject to an S&EIR process due to the applicability of the EIA Listing Notices 1 and 2 (GNR 983 and 984, as amended). In order for the project to proceed it will require an Environmental Authorisation (EA) from DFFE.

WSP has been appointed as the independent EAP to carry out the S&EIR process in accordance with the EIA Regulations, 2014, as amended in 2017.

The Scoping Process has been completed and involved consultation with interested and affected parties and the drafting of the Plan of Study (PoS) for EIA, which culminated in the submission of a Final Scoping Report (FSR) to the DFFE. The DFFE acceptance of the FSR and authorisation to proceed with the EIR was received on **25 May 2022** (**Appendix G**). A request for extension to the submission deadline of the FEIR was submitted to the DFFE in terms of EIA Regulation 3(7). A 60-day extension was approved on 24 June 2022. The final EIR is due to the DFFE on 02 November 2022.

This draft EIAR will be made available for public comment from 07 September 2022 to 10 October 2022.

As defined in Appendix 3 of GNR 982, as amended, the objective of the impact assessment process is to, through a consultative process:

- Determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context;
- Describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location;
- Identify the location of the development footprint within the preferred site based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment;
- Determine the—
  - Nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and
  - Degree to which these impacts-
    - Can be reversed;
    - May cause irreplaceable loss of resources, and
    - Can be avoided, managed or mitigated;
- Identify the most ideal location for the activity within the preferred site based on the lowest level of environmental sensitivity identified during the assessment;
- Identify, assess, and rank the impacts the activity will impose on the preferred location through the life of the activity;
- Identify suitable measures to avoid, manage or mitigate identified impacts; and
- Identify residual risks that need to be managed and monitored.

Public participation is a requirement of the S&EIR process; it consists of a series of inclusive and culturally appropriate interactions aimed at providing stakeholders with opportunities to express their views, so that these can be considered and incorporated into the S&EIR decision-making process. Effective public participation requires the prior disclosure of relevant and adequate project information to enable stakeholders to understand the risks, impacts, and opportunities of the Proposed Project. The objectives of the public participation process can be summarised as follows:

— Identify relevant individuals, organisations and communities who may be interested in or affected by the Proposed Project;
— Clearly outline the scope of the Proposed Project, including the scale and nature of the existing and proposed activities;
— Identify viable Proposed Project alternatives that will assist the relevant authorities in making an informed decision;
— Identify shortcomings and gaps in existing information;
— Identify key concerns, raised by Stakeholders that should be addressed in the subsequent specialist studies;
— Highlight the potential for environmental impacts, whether positive or negative; and
— To inform and provide the public with information and an understanding of the Proposed Project, issues and solutions.

1.5 IMPACT ASSESSMENT REPORT STRUCTURE

Table 1.5 cross-references the sections where the legislated requirements as per Appendix 3 of GNR 982 of 2014 can been located within the EIR.

Table 1.5: Legislated Report Requirements as detailed in GNR 982

APPENDIX 3	LEGISLATED REQUIREMENTS AS PER THE NEMA GNR 982	RELEVANT REPORT SECTION
(a)	Details of	
	the EAP who compiled the report; and	Section 1.3.4 **Appendix A**
	the expertise of the EAP, including a Curriculum Vitae	**Appendix A**
(b)	The location of the activity, including-	
	The 21-digit Surveyor code for each cadastral land parcel;	Section 6.1
	Where available, the physical address and farm name	Section 6.1
	Where the required information in terms of (i) and (ii) is not available, the coordinates of the boundary of the property.	N/A
(c)	A plan which locates the proposed activities applied for at an appropriate scale, or, if it is-	
	A linear activity, a description of the corridor in which the proposed activity or activities is to be undertaken; or	N/A
	On land where the property has not been defined, the coordinates within which the activity is to be undertaken.	N/A
(d)	A description of the proposed activity, including-	
	All listed and specified activities triggered and being applied for;	Section 2.1
	A description of the associated structures and infrastructure related to the development;	Section 6

APPENDIX 3	LEGISLATED REQUIREMENTS AS PER THE NEMA GNR 982	RELEVANT REPORT SECTION
(e)	A description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context;	Section 2
(f)	A motivation for the need and desirability for the proposed development including the need and desirability of the activity in the context of the preferred location;	Section 5
(h)	A full description of the process followed to reach the proposed development footprint within the approved site, including-	
	Details of the development footprint alternatives considered;	Section 6.5
	Details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs;	Section 4.3
	A summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them;	**Appendix D**
	The environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Section 7
	The impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts- (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated.	Section 7.4
	The methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks;	Section 4.2
	Positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Section 7.4
	The possible mitigation measures that could be applied and level of residual risk;	Section 7.4
	If no alternative development locations for the activity were investigated, the motivation for not considering such; and	Section 6.5
	A concluding statement indicating the preferred alternative development location within the approved site.	Section 6.5
(i)	A full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred location through the life of the activity, including-	
	A description of all environmental issues and risks that were identified during the environmental impact assessment process; and;	Section 8
	An assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures.	Section 8
(j)	An assessment of each identified potentially significant impact and risk, including-	

APPENDIX 3	LEGISLATED REQUIREMENTS AS PER THE NEMA GNR 982	RELEVANT REPORT SECTION
	Cumulative impacts;	Section 9
	The nature, significance and consequences of the impact and risk;	Section 8
	The extent and duration of the impact and risk;	Section 8
	The probability of the impact and risk occurring;	Section 8
	The degree to which the impact and risk can be reversed;	Section 8
	The degree to which the impact and risk may cause irreplaceable loss of resources; and	Section 8
	The degree to which the impact and risk can be mitigated.	Section 8
(k)	Where applicable, a summary of the findings and recommendations of any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report.	Section 10.3
(l)	An environmental impact statement which contains-	
	A summary of the key findings of the environmental impact assessment:	Section 10
	A map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers; and	Section 10
	A summary of the positive and negative impacts and risks of the proposed activity and identified alternatives.	Sections 6.5 and 10.4
(m)	Based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation.	**Appendix I**
(n)	The final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment.	Section 6.5
(o)	Any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation;	Section 8
(p)	A description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed.	Section 1.7
(q)	A reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation.	Section 10.6
(r)	Where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised.	N/A
(s)	An undertaking under oath or affirmation by the EAP in relation to-	
	The correctness of the information provided in the report;	**Appendix B**
	The inclusion of comments and inputs from stakeholders and I&APs;	**Appendix B**
	The inclusion of inputs and recommendations from the specialist reports where relevant; and	**Appendix B**

APPENDIX 3	LEGISLATED REQUIREMENTS AS PER THE NEMA GNR 982	RELEVANT REPORT SECTION
	Any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties.	**Appendix B**
(t)	where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts	N/A
(u)	An indication of any deviation from the approved scoping report, including the plan of study, including-	N/A
	any deviation from the methodology used in determining the significance of potential environmental impacts and risks; and	N/A
	a motivation for the deviation	N/A
(v)	Any specific information required by the competent authority; and	N/A
(w)	Any other matter required in terms of section 24(4)(a) and (b) of the Act	N/A

1.6 ADDITIONAL PERMITS AND AUTHORISATIONS

Table 1.6 outlines the additional permits and authorisations required for the proposed development, as well as the relevant Competent Authorities responsible.

Table 1.6: Additional Permits and Authorisations required for the proposed development

PERMITS/AUTHORISATION	LEGISLATION	RELEVANT AUTHORITY	STATUS
Water Use Licence / General Authorisation	National Water Act (Act No. 36 of 1998)	Department of Water and Sanitation	Application process will run concurrently with the EIA Phase.
Section 50 Approval	National Environmental Management: Protected Areas Act (Act No. 57 of 2003)	DFFE: Protected Areas Directorate	In Process It is important to note that further investigation and engagement with the MTPA has been conducted. The MTPA have furthermore confirmed their intent to de-proclaim the nature reserve and the process is currently in the early stages.
Section 38 Notification	National Heritage Resource Act (Act No. 25 of 1999)	Mpumalanga Heritage Resources Authority	In Process
Section 53 Approval	Minerals and petroleum Resources Development Act (No. 28 of 2002)	Department of Mineral Resources and Energy	Application submitted 13 May 2022. DMR Ref: MP30/5/4/2/11093SU
Subdivision of Agricultural Land Act (SALA) Consent / Change of Land Use (re-zoning)	Subdivision of Agricultural Land Act (Act No. 70 of 1970) / Spatial Planning and Land Use Management Act (Act No. 16 of 2013) (SPLUMA)	Department of Agriculture, Land Reform and Rural Development (DALRRD) / Msukaligwa Municipality	Given that the project is proposed on land zoned for Agriculture, SALA requires that any long-term lease associated with the renewable energy facility be

PERMITS/AUTHORISATION	LEGISLATION	RELEVANT AUTHORITY	STATUS
			approved by the DALRRD. Subdivision and consolidation of land are also regulated as part of municipal planning, and will therefore be subject to municipal by-laws and provincial legislation. The SALA consent and Land use zoning are separate processes from the Application for EA, and needs to be applied for and obtained separately from the EA and S&EIR process. It is however noted that a rezoning application is already underway for the proposed project, however, can only be complete once the EA is issued. The proponent will ensure all municipal approvals and zoning requirements are met prior to commencement of construction.

1.7 ASSUMPTION AND LIMITATIONS

General assumptions and limitations:

- The EAP hereby confirms that they have undertaken to obtain project information from the client that is deemed to be accurate and representative of the project;
- Site visits have been undertaken to better understand the project and ensure that the information provided by the client is correct, based on site conditions observed;
- The EAP hereby confirms their independence and understands the responsibility they hold in ensuring all comments received are accurately replicated and responded to within the EIA documentation;
- The comments received in response to the public participation process, will be representative of comments from the broader community; and
- Based on the Pre-Application meeting and subsequent minutes, the CA would not require additional specialist input, in order to make a decision regarding the application.

Aquatic Ecology:

- To obtain a comprehensive understanding of the dynamics of both the flora and fauna of communities within a study site, as well as the status of endemic, rare or threatened species in any area, assessments should always consider investigations at different time scales (across seasons/years) and through replication. However, due to time constraints these long-term studies are not feasible and are thus mostly based on instantaneous sampling.
- Therefore, due to the scope of the work presented in this report, a long-term investigation of the proposed site was not possible and as such not perceived as part of the Terms of Reference – EIA Phase. However, a concerted effort was made to sample and assess as much of the potential site, as well as make use of any supporting literature, species distribution data and aerial photography.
- This limitation is common to many impact assessment type studies, but the findings are deemed adequate for the purposes of decision-making support regarding project acceptability in this Phase, unless otherwise stated.

- It should be emphasised that information, as presented in this document, only has reference to the study area as indicated on the accompanying maps. Therefore, this information cannot be applied to any other area without detailed investigation.

Terrestrial Biodiversity:

The following assumptions, limitations, uncertainties are listed regarding the ecological assessment of the Project site:

- The assessment is based on a field survey conducted 3-7 February 2020. The current study is based on an extensive site visit as well as a desktop study of the available information. The time spent on site was adequate for understanding general patterns across affected areas. The seasons in which the fieldwork (peak summer flowering period) was conducted was ideal for assessing the composition and condition of the vegetation.
- The vegetation was in good condition for sampling at the time of the field assessment, and the species lists obtained are considered reliable and relatively comprehensive.
- Compiling the list of species that could potentially occur on site is limited by the paucity of collection records for the area. The list of plant species that could potentially occur on site was therefore taken from a wider area and from literature sources that may include species that do not occur on site and may miss species that do occur on site. In order to compile a comprehensive site-specific list of the biota on site, studies would be required that would include different seasons, be undertaken over a number of years and include extensive sampling. Due to time constraints inherent in the EIA process, this was not possible for this study. However the comprehensive field survey is sufficient for the purposes of this report and towards sufficiently informing the decision making process by the Competent Authority.

Terrestrial Plant Species:

The purpose of the fieldwork undertaken for this Project to characterize the habitat of the study area, compile species checklists from as diverse a variety of habitats as possible, and to map habitats within the entire collection of farms within which the Project is situated. The proposed project layout was provided during the EIA process, therefore no development footprint areas were assessed for the Project, only the general area in which the project is located. A final walk-through to survey conducted in Spring or Summer, where possible, is therefore recommended to check for potential species of conservation concern within footprints of the development.

Avifauna:

This study made the basic assumption that the sources of information used are reliable and accurate. The following must be noted:

- The SABAP2 dataset is a comprehensive dataset which provides a reasonably accurate snapshot of the avifauna which could occur at the proposed site. For purposes of completeness, the list of species that could be encountered was supplemented with personal observations, general knowledge of the area, and the results of the pre-construction monitoring which was conducted over 12 months.
- Conclusions in this report are based on experience of these and similar species at solar facility developments in different parts of South Africa. However, bird behaviour can never be predicted with absolute certainty.
- The impact of solar installations on avifauna is a new field of study, with only one published scientific study on the impact of PV facilities on avifauna in South Africa (Visser et al. 2019). Strong reliance was therefore placed on expert opinion and data from existing monitoring programmes at solar facilities in the USA where monitoring has been ongoing since 2013. The pre-cautionary principle was applied throughout as the full extent of impacts on avifauna at solar facilities is not presently known.

Bats:

- Distribution maps of South African bat species still require further refinement, thus the bat species proposed to occur on the site (and not detected in the area yet) should be considered precautionary. If a species has a distribution marginal to the site, it was assumed to occur in the area.
- The sensitivity map is based partially on satellite imagery and from detailed site visits, although given the large extent of the site, there is always the possibility that what has been mapped may differ slightly to what is on the ground.

Traffic:

- Assumptions were made to estimate the expected trip generation of the construction phase.

Heritage

— The authors acknowledge that the brief literature review is not exhaustive on the literature of the area. Due to the nature of heritage resources and pedestrian surveys, the possibility exists that some features or artefacts may not have been discovered/recorded and the possible occurrence of graves and other cultural material cannot be excluded. This limitation is successfully mitigated with the implementation of a Chance Find Procedure and monitoring of the study area by the Environmental Control Officer (ECO). This report only deals with the footprint area of the proposed development and consisted of non-intrusive surface surveys. This study did not assess the impact on medicinal plants and intangible heritage as it is assumed that these components will be highlighted through the public consultation process if relevant. It is possible that new information could come to light in future, which might change the results of this Impact Assessment.

Palaeontology:

— Based on the geology of the area and the palaeontological record as we know it, it can be assumed that the formation and layout of the dolomites, sandstones, shales and sands are typical for the country and only some do contain fossil plant, insect, invertebrate and vertebrate material. The site visit and walk through confirmed that there are no fossils present on the land surface. It is not known if there are any fossils below the land surface. The sands of the Quaternary period and the Jurassic dolerite would not preserve fossils.

Visual:

— Given the nature of the receiving environment and the height of the proposed PV panels and on-site infrastructure elements, the study area or visual assessment zone is assumed to encompass an area of 5km from the proposed SEF project area– i.e. an area of 5km from the boundary Portion 1 of the Farm Welgelegen No 322. This limit on the visual assessment zone relates to the fact that visual impacts decrease exponentially over distance. Thus although the SEF may theoretically still be visible beyond 5km, the degree of visual impact would diminish considerably. As such, the need to assess the impact on potential receptors beyond this distance would not be warranted.

— The identification of visual receptors involved a combination of desktop assessment as well as field-based observation. Initially Google Earth imagery was used to identify potential receptors within the study area. Where possible, these receptor locations were verified and assessed during a site visit which was undertaken in mid-September 2019. Due to the extent of the study area however and the number of receptors that could potentially be sensitive to the proposed development, it was not possible to visit or verify every potentially sensitive visual receptor location. As such, a number of broad assumptions have been made in terms of the likely sensitivity of the receptors to the proposed development.

— It should be noted that not all receptor locations would necessarily perceive the proposed development in a negative way. This is usually dependent on the use of the facility, the economic dependency of the occupants on the scenic quality of views from the facility and on people's perceptions of the value of "Green Energy". Sensitive receptor locations typically include sites such as tourism facilities and scenic locations within natural settings which are likely to be adversely affected by the visual intrusion of the proposed development. Thus, the presence of a receptor in an area potentially affected by the proposed development does not necessarily mean that any visual impact will be experienced.

— The potential visual impact at each sensitive visual receptor location was assessed using a matrix developed for this purpose. The matrix is based on three main parameters relating to visual impact and, although relatively simplistic, it provides an indicative assessment of the degree of visual impact likely to be experienced at each receptor location as a result of the proposed development. It is however important to note the limitations of quantitatively assessing a largely subjective or qualitative type of impact and as such the matrix should be seen merely as a representation of the likely visual impact at a receptor location.

— As stated, the exact status of all the receptors could not be verified during the field investigation and as such the receptor impact rating was largely undertaken via desktop means. Where details of the levels of leisure / tourism activities on different sectors of the relevant farms are not known, the impact rating matrix for these receptors is based on the assumed location of the main accommodation complex on each property.

— Based on the updated project description provided by the proponent, all analysis for this VIA is based on a worst-case scenario where PV panel heights are assumed to be 10m. On-site substations, Battery Energy Storage (BESS) facilities and office building heights are assumed to be less than 25m in height.

— Due to the varying scales and sources of information; maps may have minor inaccuracies. Terrain data for this area, derived from the National Geo-Spatial Information (NGI)'s 25m Digital Elevation Model (DEM), is fairly coarse and somewhat inconsistent and as such, localised topographic variations in the landscape may not be reflected on the DEM used to generate the viewshed(s) and visibility analysis conducted in respect of the proposed development.

— In addition, the viewshed / visibility analysis does not take into account any existing vegetation cover or built infrastructure which may screen views of the proposed development. This analysis should therefore be seen as a conceptual representation or a worst-case scenario.

— No feedback regarding the visual environment has been received from the public participation process to date. Any feedback from the public during the review period of the Draft EIA Report (DEIR) will however be incorporated into further drafts of this report, if relevant.

— At the time of undertaking the visual study no information was available regarding the type and intensity of lighting that will be required for the proposed SEF and therefore the potential impact of lighting at night has not been assessed at a detailed level. However, lighting requirements are relatively similar for all SEFs and as such, general measures to mitigate the impact of additional light sources on the ambiance of the nightscape have been provided.

— At the time of undertaking the visual study no *detailed* information was available regarding the design and layout of services and infrastructure associated with the proposed development. The potential visual impact of the *typical* infrastructure associated with a SEF has therefore been assessed.

— In the light of the fact that the renewable energy industry is still relatively new in South Africa, this report draws on international literature and web material to describe the generic impacts associated with SEFs.

— At the time of writing this report, the proposed PV layout was still in the preliminary design phase and as such, no visualisation modelling was undertaken for the proposed development. This can however be provided should the Public Participation process identify the need for this exercise.

— This study includes an assessment of the potential cumulative impacts of other renewable energy and infrastructural / mining developments on the existing landscape character and on the identified sensitive receptors. This assessment is based on the information available at the time of writing the report and where information has not been available, assumptions have been made as to the likely impacts of these developments.

— It should be noted that the fieldwork for this study was undertaken in mid-September 2019, during late winter which is characterised by low levels of rainfall and reduced vegetation cover. In these conditions, increased levels of visual impact will be experienced from receptor locations in the surrounding area.

— The overall weather conditions in the study area have certain visual implications and are expected to affect the visual impact of the proposed development to some degree. In clear weather conditions, the PV panels would present a greater contrast with the surrounding environment than they would on an overcast day. Although the field investigation was conducted during clear weather conditions however, localised pollution in the study area results in relatively hazy skies which would reduce the visibility of the PV panels.

Social:

— Technical suitability: It is assumed that the development site represents a technically suitable site for the establishment of the proposed development.

— Strategic importance of the project: The strategic importance of promoting renewable and other forms of energy is supported by the national and provincial energy policies.

— Fit with planning and policy requirements: Legislation and policies reflect societal norms and values. The legislative and policy context therefore plays an important role in identifying and assessing the potential social impacts associated with a proposed development. In this regard, a key component of the SIA process is to assess the proposed development in terms of its fit with key planning and policy documents. As such, if the findings of the study indicate that the proposed development in its current format does not conform to the spatial principles and guidelines contained in the relevant legislation and planning documents, and there are no significant or unique opportunities created by the development, the development cannot be supported.

— Assessment of components: The potential social impacts associated with the battery energy storage systems (BESS) and internal substations are negligible and do not have a bearing on the findings of the SIA. The focus of the SIA is therefore on the SEF and associated PV panels.

— Demographic data: Some of the provincial documents do not contain data from the 2011 Census and or 2016 Household Community Survey. However, where required the relevant 2011 and 2016 data has been provided.

Geotechnical:

The interpretation of the overall geotechnical conditions across the site is based on a review of available information on the project area. Subsurface and geotechnical conditions have been inferred at a desktop level from the available information, past experience in the project area and professional judgement. The information and interpretations are given as a guideline only and there is no guarantee that the information given is totally representative of the entire area in every respect. No responsibility will be accepted for consequences arising out of the fact that actual conditions vary from those inferred. The information must be verified by the undertaking of a detailed geotechnical site investigation.

Notwithstanding these assumptions and limitations, it is the view of WSP that this EIR provides a good description of the issues associated with the project..

2 GOVERNANCE FRAMEWORK

2.1 NATIONAL ENVIRONMENTAL LEGAL FRAMEWORK

The South African regulatory framework establishes well-defined requirements and standards for environmental and social management of industrial and civil infrastructure developments. Different authorities at both national and regional levels carry out environmental protection functions. The applicable legislation and policies are shown in **Table 2.1**.

Table 2.1: Applicable National Legislation[1]

LEGISLATION	DESCRIPTION OF LEGISLATION AND APPLICABILITY
The Constitution of South Africa (No. 108 of 1996)	The Constitution cannot manage environmental resources as a stand-alone piece of legislation hence additional legislation has been promulgated in order to manage the various spheres of both the social and natural environment. Each promulgated Act and associated Regulations are designed to focus on various industries or components of the environment to ensure that the objectives of the Constitution are effectively implemented and upheld in an on-going basis throughout the country. In terms of Section 7, a positive obligation is placed on the State to give effect to the environmental rights.
National Environmental Management Act (No. 107 of 1998)	In terms of Section 24(2) of the NEMA, the Minister may identify activities, which may not commence without prior authorisation. The Minister thus published GNR 983 (as amended) (Listing Notice 1), GNR 984 (as amended) (Listing Notice 2) and GNR 985 (as amended) (Listing Notice 3) listing activities that may not commence prior to authorisation. The regulations outlining the procedures required for authorisation are published in the EIA Regulations of 2014 (GNR 982) (as amended). Listing Notice 1 identifies activities that require a BA process to be undertaken, in terms of the EIA Regulations, prior to commencement of that activity. Listing Notice 2 identifies activities that require an S&EIR process to be undertaken, in terms of the EIA Regulations, prior to commencement of that activity. Listing Notice 3 identifies activities within specific areas that require a BA process to be undertaken, in terms of the EIA Regulations, prior to commencement of that activity. WSP undertook a legal review of the listed activities according to the proposed project description to conclude that the activities listed in in this section are considered applicable to the development: A S&EIR process must be followed. An EA is required and will be applied for with the DFFE.
Listing Notice 1: GNR 983	***Activity 11(i)*** *The development of facilities or infrastructure for the transmission and distribution of electricity—* *(i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts; or* *(ii) inside urban areas or industrial complexes with a capacity of 275 kilovolts or more;* **Description**: The Facility is located outside urban areas. Furthermore, internal distribution electrical infrastructure required to connect the respective electrical components related to the Facility, and the onsite substation, including cabling (buried or overhead) will be between 33kV and 132kV. The onsite substation will be rated 33/132kV whereas internal cabling will be up to 33kV.

[1] It should be noted that all dimensions outlined in relation to Listing Notice 1, 2 and 3 are provisional and are subject to final design.

LEGISLATION	DESCRIPTION OF LEGISLATION AND APPLICABILITY
Listing Notice 1: GNR 983	***Activity 12(ii)(a)(c)*** *The development of—* *(i) dams or weirs, where the dam or weir, including infrastructure and water surface area, exceeds 100 square metres; or* *(ii) infrastructure or structures with a physical footprint of 100 square metres or more;* *where such development occurs—* *(a) within a watercourse;* *(b) in front of a development setback; or* *(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse;* **Description***:* Internal access roads (total physical footprint of approximately 40 000m^2) will be required for access to the Facility. The physical footprint of internal access roads, substation infrastructure and/or electrical cabling required to connect the various components of the Facility will either traverse the delineated watercourses on site or be located within 32m of the outer extent of the delineated watercourses on site and is estimated at ~ 5.5ha subject to detail design, thereby exceeding the threshold value and triggering this activity.
Listing Notice 1: GNR 983	***Activity 14*** *The development and related operation of facilities or infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic metres or more but not exceeding 500 cubic metres.* **Description***:* The Facility will require storage and handling of dangerous goods, including fuel, cement and chemical storage onsite, that will be greater than 80m^3 but not exceeding 500m^3. The following estimated maximum capacities of dangerous good will be stored on site: — Concrete Batching: ~145 m^3 — Fuel stores (Petrol and/or Diesel): ~250m^3 — Paint, grease, transformer oils, construction chemicals, lubricants: ~100m^3
Listing Notice 1: GNR 983	***Activity 19*** *The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse;* **Description***:* Internal access roads, substation infrastructure and/or stormwater control infrastructure, as well as electrical cabling required to connect the various components of the Facility will collectively require the excavation, infilling or removal of soil exceeding 10m^3 from delineated watercourses on site however, these will be within the thresholds relevant to this Listed Activity and therefore within the threshold values and triggering this activity.
Listing Notice 1: GNR 983	***Activity 24(ii)*** *The development of a road—*

LEGISLATION	DESCRIPTION OF LEGISLATION AND APPLICABILITY
	(i) for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Government Notice 545 of 2010; or *(ii) with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres;* **Description***:* Internal access roads required by the Facility will be between 5m and 6m wide, and approximately 8km in length. Where required for turning circle/bypass areas, however, access or internal roads may be up to 20m to allow for larger component transport. The exact values will be confirmed once final designs have been provided, however, these will be within the thresholds relevant to this Listed Activity and therefore within the threshold values and triggering this activity.
Listing Notice 1: GNR 983	***Activity 28(ii)*** *Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture, game farming, equestrian purposes or afforestation on or after 01 April 1998 and where such development:* *(i) will occur inside an urban area, where the total land to be developed is bigger than 5 hectares; or* *(ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare;* **Description***:* The Facility is considered a commercial and/or industrial development, and is located on several farm portions outside an urban area, used for agricultural purposes. The total area to be developed for the Facility (buildable area) is approximately 280ha (i.e. greater than 1 hectare) within agricultural use land.
Listing Notice 1: GNR 983	***Activity 30*** *Any process or activity identified in terms of section 53(1) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).* **Description***:* The Facility infrastructure is located within, and will require vegetation clearance or disturbance of, Eastern Highveld Grassland, Eastern Temperate Freshwater Wetlands and Chrissiesmeer Panveld. All three ecosystems are confirmed to be listed in the National List of Ecosystems that are Threated and in Need of Protection (as indicated in GNR 1002 of 9 December 2011). Due to the fact that these ecosystems are listed as threatened it is assumed that various threatened or protected species may be found within the development area. The restricted activity of "cutting, chopping off, uprooting, damaging or destroying, any specimen" has been identified in terms of NEM:BA and is therefore applicable to the vegetation clearance that will be required to construct the development. In light of this, Activity 30 is considered applicable.
Listing Notice 1: GNR 983	***Activity 48(i)(a)(c)*** *The expansion of—* *(i) infrastructure or structures where the physical footprint is expanded by 100 square metres or more; or* *(ii) dams or weirs, where the dam or weir, including infrastructure and water surface area, is expanded by 100 square metres or more;* *where such expansion occurs—*

LEGISLATION	DESCRIPTION OF LEGISLATION AND APPLICABILITY
	(a) within a watercourse; *(b) in front of a development setback; or* *(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse;* **Description***:* Transport of large infrastructure components related to the facility will require the expansion of existing access and/or internal roads, culverts or similar drainage crossing infrastructure collectively exceeding 100m^2 or more beyond existing road or road reserves located within delineated watercourses on site, or within 32m of the outer extent of the delineated watercourses on site. Expansion of ~ 2 000m^2 is anticipated, subject to detail design, thereby exceeding the threshold value and triggering this activity.
Listing Notice 1: GNR 983	***Activity 56(ii)*** *The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre—* *(i) where the existing reserve is wider than 13,5 meters; or* *(ii) where no reserve exists, where the existing road is wider than 8 metres;* **Description***:* Transport of large infrastructure components related to the facility will require the widening of existing access and/or internal roads where no reserve exists and where such road is wider than 8m. The Facility is located within a rural area. Subject to detail design widening up to 14m, collectively exceeding 1km in length is anticipated, thereby exceeding the threshold value and triggering this activity.
Listing Notice 2: GNR 984	***Activity 1*** *The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more* **Description***:* The project comprises a Solar Energy Facility of up to 100MW, allowing for up to 100MW export from the Facility.
	Activity 15 *The clearance of an area of 20 hectares or more of indigenous vegetation* **Description***:* The clearance required for the Facility will be approximately 280ha (subject to detailed design) of indigenous vegetation. Development activities planned thereby exceeding the activity threshold and this activity is considered applicable.
Listing Notice 3: GNR 985	***Activity 4(f)(i)(aa)(bb)(cc)(ee)(gg)*** *The development of a road wider than 4 metres with a reserve less than 13,5 metres.* *f. Mpumalanga* *i. Outside urban areas:*

LEGISLATION	DESCRIPTION OF LEGISLATION AND APPLICABILITY
	(aa) A protected area identified in terms of NEMPAA, excluding disturbed areas; *(bb) National Protected Area Expansion Strategy Focus areas;* *(cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;* *(dd) Sites or areas identified in terms of an international convention;* *(ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;* *(ff) Core areas in biosphere reserves; or* *(gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve, excluding disturbed areas, where such areas comprise indigenous vegetation; or* *ii. Inside urban areas:* *(aa) Areas zoned for use as public open space; or* *(bb) Areas designated for conservation use in Spatial Development Frameworks adopted by the competent authority or zoned for a conservation purpose.* **Description***:* Internal access roads required by the Facility will be between 5m and 6m wide, and approximately 8km in length. Where required for turning circle/bypass areas, however, access or internal roads may be up to 20m to allow for larger component transport. The exact values will be confirmed following detailed design. Development activities planned thereby exceeding the activity threshold within the following areas: The Facility is located in the Mpumalanga Province outside urban areas, and on Portion 1 of Farm No. 322 (Welgelegen), which is a declared Private Nature Reserve (Langcarel Private Nature Reserve) under the Game Ordinance, 1949 (No. 23 of 1949) and the Native Flora Protection Ordinance, 1940 (No. 9 of 1940). It should be noted that abovementioned Private Nature Reserve is not being managed as a nature reserve and a separate process is underway to have it withdrawn or deproclaimed (partially or wholly) as part of ongoing province-wide reserve verification efforts by the provincial authorities. The facility is therefore currently both located within the extent (aa), and within 5km of the abovementioned private nature reserve (gg). In addition, and on the basis of the DFFE Screening Tool output identifying the study area within the "Protected Areas Expansion Strategy" (Low Priority - Mpumalanga Protected Area Expansion Strategy), the development activity occurs within NPAES focus area thereby triggering this activity (bb). Furthermore, roads required for the Facility will be located within, and will require vegetation clearance or disturbance of, Eastern Highveld Grassland, Eastern Temperate Freshwater Wetlands and Chrissiesmeer Panveld, all three ecosystems of which are listed in the National List of Ecosystems that are Threatened and in need of Protection (GNR 1002 of 9 December 2011), and subsequently listed in terms of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)(cc). Similarly, roads required for the Facility will be located within, and will require vegetation clearance or disturbance within Critical Biodiversity Areas (CBA) and Ecological Support Areas (ESA)(ee).
Listing Notice 3: GNR 985	***Activity 12(f)(i)(ii)(iii)*** *The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan.* *f. Mpumalanga*

LEGISLATION	DESCRIPTION OF LEGISLATION AND APPLICABILITY
	i. Within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004; *ii. Within critical biodiversity areas identified in bioregional plans; or* *iii. On land, where, at the time of the coming into effect of this Notice or thereafter such land was zoned open space, conservation or had an equivalent zoning or proclamation in terms of NEMPAA* **Description***:* The clearance required for the Facility will be approximately 280ha (subject to detailed design) of indigenous vegetation. Development activities planned thereby exceeding the activity threshold within the following areas: Clearance required will be in excess of $300m^2$ and be partly located within Eastern Highveld Grassland, Eastern Temperate Freshwater Wetlands and Chrissiesmeer Panveld, all three ecosystems of which are listed in the National List of Ecosystems that are Threatened and in need of Protection (GNR 1002 of 9 December 2011), and subsequently listed in terms of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)(i). Similarly, vegetation clearance required for the Facility will be located within CBA and ESA, in excess of $300m^2$ (ii). Furthermore, the clearance contemplated above will all occur within the Mpumalanga Province outside urban areas, and on Portion 1 of Farm No. 322 (Welgelegen), which is a declared Private Nature Reserve (Langcarel Private Nature Reserve) under the Game Ordinance, 1949 (No. 23 of 1949) and the Native Flora Protection Ordinance, 1940 (No. 9 of 1940)(iii). It should be noted that abovementioned Private Nature Reserve is not being managed as a nature reserve and a separate process is underway to have it withdrawn or deproclaimed (partially or wholly) as part of ongoing province-wide reserve verification efforts by the provincial authorities.
Listing Notice 3: GNR 985	***Activity 14(ii)(a)(c)(f)(i)(aa)(bb)(dd)(ff)(hh)*** *The development of—* *(i) dams or weirs, where the dam or weir, including infrastructure and water surface area exceeds 10 square metres; or* *(ii) infrastructure or structures with a Physical footprint of 10 Square metres or more;* *where such development occurs—* *(a) within a watercourse;* *(b) in front of a development setback; or* *(c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse;* *f. Mpumalanga* *i. Outside urban areas:* *(aa) A protected area identified in terms of NEMPAA, excluding conservancies;* *(bb) National Protected Area Expansion Strategy Focus areas;* *(cc) World Heritage Sites;* *(dd) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;* *(ee) Sites or areas identified in terms of an international convention;* *(ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;* *(gg) Core areas in biosphere reserves; or*

LEGISLATION	DESCRIPTION OF LEGISLATION AND APPLICABILITY
	(hh) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve, where such areas comprise indigenous vegetation; **Description***:* The Facility will require the development of internal roads (total physical footprint of approximately 4ha). The physical footprint of internal access roads, stormwater control infrastructure, substation and/or electrical cabling required to connect the various components of the Facility will either traverse the delineated watercourses on site, or be located within 32m of the outer extent of the delineated watercourses on site and is estimated at ~ 5.5ha subject to detail design, thereby exceeding the threshold value and triggering this activity. In addition, the development activity contemplated is located in the Mpumalanga Province outside urban areas, and on Portion 1 of Farm No. 322 (Welgelegen), which is a declared Private Nature Reserve (Langcarel Private Nature Reserve) under the Game Ordinance, 1949 (No. 23 of 1949) and the Native Flora Protection Ordinance, 1940 (No. 9 of 1940). It should be noted that abovementioned Private Nature Reserve is not being managed as a nature reserve and a separate process is underway to have it withdrawn or deproclaimed (partially or wholly) as part of ongoing province-wide reserve verification efforts by the provincial authorities. The facility is therefore currently both located within the extent(aa), and within 5km of the above mentioned private nature reserve(hh). In addition, and on the basis of the DFFE Screening Tool output identifying the study area within the "Protected Areas Expansion Strategy" (Low Priority - Mpumalanga Protected Area Expansion Strategy), the development activity occurs within NPAES focus area thereby triggering this activity (bb). Furthermore, the development activity contemplated will be located within Eastern Highveld Grassland, Eastern Temperate Freshwater Wetlands and Chrissiesmeer Panveld, all three ecosystems of which are listed in the National List of Ecosystems that are Threatened and in need of Protection (GNR 1002 of 9 December 2011), and subsequently listed in terms of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)(dd). Finally, the development activity contemplated will exceed 10m2 within delineated watercourses on site, or within 32m of the outer extent of the delineated watercourses on site, located within CBA and ESA (ff).
Listing Notice 3: GNR 985	***Activity 15 (d)(ii)*** *The transformation of land bigger than 1000 square metres in size, to residential, retail, commercial, industrial or institutional use, where, such land was zoned open space, conservation or had an equivalent zoning, on or after 02 August 2010.* *d. Mpumalanga* *i. Inside urban areas; or* *ii. A protected area identified in terms of NEMPAA, excluding conservancies.* **Description***:* The Facility is considered a commercial and/or industrial development and will require the transformation of a footprint of approximately 280ha within several farm portions outside an urban area zoned for agriculture, while being located on Portion 1 of Farm No. 322 (Welgelegen), which is a declared Private Nature Reserve (Langcarel Private Nature Reserve) under the Game Ordinance, 1949 (No. 23 of 1949) and the Native Flora Protection Ordinance, 1940 (No. 9 of 1940). It should be noted that abovementioned Private Nature Reserve is not being managed as a nature reserve and a separate process is underway to have it withdrawn or deproclaimed (partially or wholly) as part of ongoing province-wide reserve verification efforts by the provincial authorities.

LEGISLATION	DESCRIPTION OF LEGISLATION AND APPLICABILITY
	The facility is therefore currently located within the extent of the above mentioned private nature reserve (ii).
Listing Notice 3: GNR 985	***Activity 18(f)(i)(aa)(bb)(cc)(ee)(gg)*** *The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre.* *f. Mpumalanga* *i. Outside urban areas:* *(aa) A protected area identified in terms of NEMPAA, excluding conservancies;* *(bb) National Protected Area Expansion Strategy Focus areas;* *(cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;* *(dd) Sites or areas identified in terms of an international convention;* *(ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;* *(ff) Core areas in biosphere reserves; or* *(gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve, where such areas comprise indigenous vegetation;* **Description***:* Transport of large infrastructure components related to the facility will require the widening of existing access and/or internal roads where by more than 4m or in excess of 1km within the Mpumalanga Province and outside urban areas. Subject to detail design widening up to 14m, collectively exceeding 1km in length is anticipated, thereby exceeding the threshold value and triggering this activity. Such widening will be occur on Portion 1 of Farm No. 322 (Welgelegen), which is a declared Private Nature Reserve (Langcarel Private Nature Reserve) under the Game Ordinance, 1949 (No. 23 of 1949) and the Native Flora Protection Ordinance, 1940 (No. 9 of 1940). It should be noted that abovementioned Private Nature Reserve is not being managed as a nature reserve and a separate process is underway to have it withdrawn or deproclaimed (partially or wholly) as part of ongoing province-wide reserve verification efforts by the provincial authorities. The facility is therefore currently both located within the extent (aa), and within 5km of the above mentioned private nature reserve (gg). In addition, and on the basis of the DFFE Screening Tool output identifying the study area within the "Protected Areas Expansion Strategy" (Low Priority - Mpumalanga Protected Area Expansion Strategy), the development activity occurs within NPAES focus area thereby triggering this activity (bb). Furthermore, such widening will occur within Eastern Highveld Grassland, Eastern Temperate Freshwater Wetlands and Chrissiesmeer Panveld, all three ecosystems of which are listed in the National List of Ecosystems that are Threatened and in need of Protection (GNR 1002 of 9 December 2011), and subsequently listed in terms of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)(cc). Finally, such widening will be located within CBA and ESA (ee).
Listing Notice 3: GNR 985	***Activity 23(ii)(a)(c)(f)(i)(aa)(bb)(cc)(ee)(gg*** *The expansion of—* *(i) dams or weirs where the dam or weir is expanded by 10 square metres or more; or*

LEGISLATION	DESCRIPTION OF LEGISLATION AND APPLICABILITY
	(ii) infrastructure or structures where the physical footprint is expanded by 10 square metres or more; *where such expansion occurs —* *(a) within a watercourse;* *(b) in front of a development Setback adopted in the prescribed manner; or* *(c) if no development setback has been adopted,* *within 32 metres of a watercourse, measured* *from the edge of a watercourse;* *f. Mpumalanga* *i. Outside urban areas:* *(aa) A protected area identified in terms of NEMPAA, excluding conservancies;* *(bb) National Protected Area Expansion Strategy Focus areas;* *(cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;* *(dd) Sites or areas identified in terms of an international convention;* *(ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;* *(ff) Core areas in biosphere reserves;* *(gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve, where such areas comprise indigenous vegetation;* **Description***:* Transport of large infrastructure components related to the facility will require the expansion of existing access and/or internal roads, culverts or similar drainage crossing infrastructure collectively exceeding 10m2 or more beyond existing road or road reserves located within delineated watercourses on site, or within 32m of the outer extent of the delineated watercourses on site. Expansion of ~ 2 000m2 is anticipated, subject to detail design, thereby exceeding the threshold value and triggering this activity. In addition, the Facility is located in the Mpumalanga Province outside urban areas, and on Portion 1 of Farm No. 322 (Welgelegen), which is a declared Private Nature Reserve (Langcarel Private Nature Reserve) under the Game Ordinance, 1949 (No. 23 of 1949) and the Native Flora Protection Ordinance, 1940 (No. 9 of 1940). It should be noted that abovementioned Private Nature Reserve is not being managed as a nature reserve and a separate process is underway to have it withdrawn or deproclaimed (partially or wholly) as part of ongoing province-wide reserve verification efforts by the provincial authorities. The facility is therefore currently both located within the extent (aa), and within 5km of the above mentioned private nature reserve (gg). In addition, and on the basis of the DFFE Screening Tool output identifying the study area within the "Protected Areas Expansion Strategy" (Low Priority - Mpumalanga Protected Area Expansion Strategy), the development activity occurs within NPAES focus area thereby triggering this activity (bb). Furthermore the development activity contemplated will be located within Eastern Highveld Grassland, Eastern Temperate Freshwater Wetlands and Chrissiesmeer Panveld, all three ecosystems of which are listed in the National List of Ecosystems that are Threatened and in need of Protection (GNR 1002 of 9 December 2011), and subsequently listed in terms of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)(cc).

LEGISLATION	DESCRIPTION OF LEGISLATION AND APPLICABILITY
	Finally the development activity contemplated will either traverse the delineated watercourses on site, or be located within 32m of the outer extent of the delineated watercourses on site, located within CBA and ESA(ee).
National Environmental Management: Waste Act (59 of 2008) (NEM:WA)	This Act provides for regulating waste management in order to protect health and the environment by providing reasonable measures for the prevention of pollution and ecological degradation. The Act also provides for the licensing and control of waste management activities through GNR. 921 (2013): List of Waste Management Activities that Have, or are Likely to Have, a Detrimental Effect on the Environment. The proposed project does not constitute a Listed Activity requiring a Waste Management Licence (WML) as defined in GNR 921. However, the contents of this EIR will include reasonable measures for the prevention of pollution and good international industry practice (GIIP).
National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)	The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA) was promulgated in June 2004 within the framework of NEMA to provide for the management and conservation of national biodiversity. The NEMBA's primary aims are for the protection of species and ecosystems that warrant national protection, the sustainable use of indigenous biological resources, the fair and equitable sharing of benefits arising from bioprospecting involving indigenous biological resources. In addition, the NEMBA provides for the establishment and functions of a South African National Biodiversity Institute (SANBI). SANBI was established by the NEMBA with the primary purpose of reporting on the status of the country's biodiversity and conservation status of all listed threatened or protected species and ecosystems. The biodiversity assessment identifies CBAs which represent biodiversity priority areas which should be maintained in a natural to near natural state. The CBA maps indicate the most efficient selection and classification of land portions requiring safeguarding in order to meet national biodiversity objectives. Based on the preliminary desktop assessment and the terrestrial ecology report, a significant part of the Project Area falls within CBA (Irreplaceable and Optimal) and a large wetland area adjacent and to the north of the Vaal River (near the southern part of the site) is mapped as an Ecological Support Area (ESA). According to the description for the MBSP Terrestrial Assessment categories, CBAs are areas that are required to meet biodiversity targets (for biodiversity pattern and ecological process features). The management approach is that they should remain in a natural state. CBAs are areas of high biodiversity value which are usually at risk of being lost and usually identified as important in meeting biodiversity targets, except for Critically Endangered Ecosystems or Critical Linkages. CBAs in the Province can be divided into two sub-categories: — Irreplaceable (parts of the site are within this sub-category), and — Optimal (northern parts of the site are within this sub-category). Supplementary baseline terrestrial ecology studies will be undertaken during the EIA phase to inform the assessment of impacts and will include flora surveys of the project footprint to determine the presence of flora species of concern (SoC), and bird surveys of the area to define the potential risks to bird SoC. The Conservation of Agricultural Resources Act (No. 43 of 1983) (CARA) Regulations with regards to alien and invasive species have been superseded by the National Environmental Management: Biodiversity Act, 2004 (Act no. 10 of 2004) – Alien and Invasive Species (AIS) Regulations which became law on 1 October 2014. Specific management measures for the control of alien and invasive plants have been included in the Environmental Management Programme (EMPr).
National Environmental Management	The purpose of the National Environmental Management Protected Areas Act (No. 57 of 2003) (NEMPAA) is to, inter alia, provide for the protection and conservation of ecologically viable areas

LEGISLATION	DESCRIPTION OF LEGISLATION AND APPLICABILITY
Protected Areas Act (No. 57 of 2003)	representative of South Africa's biological diversity and its natural landscapes and seascapes. To this end, it provides for the declaration and management of various types of protected areas. Section 50(5) of NEMPAA states that "*no development, construction or farming may be permitted in a nature reserve or world heritage site without the prior written approval of the management authority*." According to the National Parks Area Expansion Strategy (NPAES), there are no areas within the study area that have been identified as priority areas for inclusion in future protected areas. The study area is therefore outside the NPAES focus area. The Facility is located in the Mpumalanga Province outside urban areas, partly within a National Protected Area Expansion Strategy Focus area and within 5km of Portion 1 & 2 of Farm No. 322 (Welgelegen), which are declared as Private Nature Reserve (Langcarel Private Nature Reserve) under the Game Ordinance, 1949 (No. 23 of 1949) and the Native Flora Protection Ordinance, 1940 (No. 9 of 1940). This reserve is noted as having farming activity present, and is currently managed and actively utilised for agriculture. The land owner further was not aware of any protected area on these properties and intends to utilise any suitable legal avenues available to continue operation of the properties for the current land use of agriculture, in conjunction with the planned Renewable Energy land use subject to this application. The protected area and has undergone similar levels of degradation as surrounding areas due primarily to overgrazing, but also partially due to alien invasive plants. In addition, no conservation management activities were evident on site during the ecological field assessment. This pattern of over-utilization affects all grasslands on site, resulting in them being in moderate to poor condition. The habitat has been used for livestock production and is impacted by this land-use. The biodiversity specialist concluded that, on the basis of the current land use and levels of modification, the private nature reserve does not align with the objective and purpose of the protected area status. It is important to also note that the Project Proponent is engaging with the MTPA and the Management Authority (Landowner/s) to investigate the best way forward regarding the Langcarel Nature Reserve. The MTPA has undertaken a site visit on 01 June 2022. The MTPA has submitted a letter to the Department (letter dated, 20 June 2022) of the intent to issue a notice to withdraw the declaration of the Langcarel Private Nature Reserve in terms of the Mpumalanga Nature Conservation Act (Act No. 10 of 1998). A separate process is therefore underway to have it (or part thereof) withdrawn or de-proclaimed, as part of ongoing province-wide nature reserve verification efforts by the provincial authorities. Subject to the successful conclusion of this process, a Section 50 approval is not required for this project. Available information on the Nature Reserve (i.e., de-proclamation or removal of Nature Reserve status) and/or relevant approval (i.e., Section 50 Approval where applicable) will be submitted to the Department once available, possibly together with the FEIR, to date Section 50 Approval has been received for the affected land portions.
The National Water Act (No. 36 Of 1998)	The National Water Act, 1998 (Act No. 36 of 1998) (NWA) provides the framework to protect water resources against over exploitation and to ensure that there is water for social and economic development, human needs and to meet the needs of the aquatic environment. The Act defines water source to include watercourses, surface water, estuary or aquifer. A watercourse is defined in the Act as a river or spring, a natural channel in which water flows regularly or intermittently, a wetland, lake or dam into which or from which water flows, and any collection of water that the Minister may declare a watercourse. Section 21 of the Act outlines a number of categories that require a water user to apply for a Water Use License (WUL) and Section 22 requires water users to apply for a General Authorisation (GA) with the Department of Water and Sanitation (DWS) if they are under certain thresholds or meet certain criteria. The list of water uses applicable to the proposed Project include: *a) Taking water from a water resource;* *c) Impeding or diverting the flow of water in a watercourse;* *g) Disposing of waste in a manner which may detrimentally impact on a water resource;* *i) Altering the bed, banks, course or characteristics of a watercourse;* The DWS will make the final decision on water uses that are applicable to the project through a pre-application meeting after which a Water Use Authorisation Application (WUA) as determined

LEGISLATION	DESCRIPTION OF LEGISLATION AND APPLICABILITY
	by the risk assessment will be undertaken in compliance with procedural regulations published by the DWS within General Notice 267 (GN267). These regulations specify required information per water use and the reporting structure of required supporting technical information.
The National Heritage Resources Act (No. 25 Of 1999)	The National Heritage Resource Act (Act No. 25 of 1999) (NHRA) serves to protect national and provincial heritage resources across South Africa. The NHRA provides for the protection of all archaeological and palaeontological sites, the conservation and care of cemeteries and graves by the South African Heritage Resources Agency (SAHRA), and lists activities that require any person who intends to undertake to notify the responsible heritage resources agency and furnish details regarding the location, nature, and extent of the proposed development. Part 2 of the NHRA details specific activities that require a Heritage Impact Assessment (HIA) that will need to be approved by SAHRA. Parts of Section 35, 36 and 38 apply to the proposed project, principally: — Section 35 (4) - No person may, without a permit issued by the responsible heritage resources authority- — destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite; — destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite. — Section 38 (1) Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorised as- — any development or other activity which will change the character of a site— (i) exceeding 5 000 m^2 in extent, must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development. In terms of Section 38(8), approval from the heritage authority is not required if an evaluation of the impact of such development on heritage resources is required in terms of any other legislation (such as NEMA), provided that the consenting authority ensures that the evaluation of impacts fulfils the requirements of the relevant heritage resources authority in terms of Section 38(3) and any comments and recommendations of the relevant resources authority with regard to such development have been taken into account prior to the granting of the consent. However, should heritage resources of significance be affected by the proposed Camden I SEF, a permit is required to be obtained prior to disturbing or destroying such resources as per the requirements of Section 48 of the NHRA, and the SAHRA Permit Regulations (GN R668). A Heritage Assessment Report (**Appendix H-10**) has been carried out by a suitably qualified specialist, revealing: — No Stone Age or Iron Age archaeological sites are on record within the immediate study area but this could be due to a lack of focused research in the area. — A small cemetery is situated on the southern portion of the proposed solar project area. The cemetery contains mainly stone packed graves that are partially enclosed by a low stone wall. — According to the SAHRA Paleontological map the study area is of zero to very high paleontological significance and an independent study was conducted for this aspect. Bamford (2022) concluded that based on the fossil record but confirmed by the site visit and walk through, there are NO FOSSILS of the *Glossopteris* flora even though fossils have been recorded from rocks of a similar age and type in South Africa. — The study area is in a rural setting and characterised by cultivation and agricultural activities with a historical layering consisting of burial sites and the remnants of stone packed structures/ settlements. A more recent industrial element is introduced by the Camden Power Station that was commissioned in 1967, along with the development of coal-mining in the broader region. — The project area has been cultivated from prior to 1968 as indicated on historical maps and has remained under cultivation until present these activities would have impacted on surface indicators of heritage sites if any were ever present in the area. The proposed project will be loaded onto the SAHRIS portal for comment by SAHRA.

LEGISLATION	DESCRIPTION OF LEGISLATION AND APPLICABILITY
Mineral and Petroleum Resources Development Act (No. 28 of 2002)	The aim of the Mineral and Petroleum Resources Development Act (No. 28 of 2002) (MPRDA) is to make provision for equitable access to and sustainable development of the nation's mineral and petroleum resources. Section 53(1) of the MPRDA provides that any person who intends to use the surface of any land in any way that may be contrary to any object of the MPRDA, or which is likely to impede any such object, must apply to the Minister of Mineral Resources (the Minister) for approval. Section 53 of the MPRDA provides a mechanism for ensuring that, inter alia, the mining of mineral resources is not detrimentally affected through the use of the surface of land and which may, for example, result in the sterilisation of a mineral resource. A Section 53 approval will be required due to the fact that the project is located on various mining right areas. The Amendment Regulations (GNR 420 of 27 March 2020) introduced a template for section 53 applications (Form Z) and the specific information that applicants will need to provide as part of a section 53 application.
Noise Control Regulations in terms of the Environmental Conservation, 1989 (Act 73 of 1989)	In South Africa, environmental noise control has been in place for three decades, beginning in the 1980s with codes of practice issued by the South African National Standards (formerly the South African Bureau of Standards, SABS) to address noise pollution in various sectors of the country. Under the previous generation of environmental legislation, specifically the Environmental Conservation Act 73 of 1989 (ECA), provisions were made to control noise from a National level in the form of the Noise Control Regulations (GNR 154 of January 1992). In later years, the ECA was replaced by the National Environmental Management Act 107 of 1998 (NEMA) as amended. The National Environmental Management: Air Quality Act 39 of 2004 (NEMAQA) was published in line with NEMA and contains noise control provisions under Section 34: *(1) The minister may prescribe essential national standards –* *(a) for the control of noise, either in general or by specific machinery or activities or in specified places or areas; or* *(b) for determining –* *(i) a definition of noise; and* *(ii) the maximum levels of noise.* *(2) When controlling noise, the provincial and local spheres of government are bound by any prescribed national standards.* Under NEMAQA, the Noise Control Regulations were updated and are to be applied to all provinces in South Africa. The Noise Control Regulations give all the responsibilities of enforcement to the Local Provincial Authority, where location specific by-laws can be created and applied to the locations with approval of Provincial Government. Where province-specific regulations have not been promulgated, acoustic impact assessments must follow the Noise Control Regulations. Furthermore, NEMAQA prescribes that the Minister must publish maximum allowable noise levels for different districts and national noise standards. These have not yet been accomplished and as a result all monitoring and assessments are done in accordance with the South African National Standards (SANS) 10103:2008 and 10328:2008.
Conservation of Agricultural Resources Act (No. 43 of 1983)	The Conservation of Agricultural Resources Act (Act 43 of 1983) (CARA) provides for the implementation of control measures for soil conservation works as well as alien and invasive plant species in and outside of urban areas. In terms of the amendments to the regulations under the CARA, landowners are legally responsible for the control of alien species on their properties. Various Acts administered by the DFFE and the DWS, as well as other laws (including local by-laws), spell out the fines, terms of imprisonment and other penalties for contravening the law. Although no fines have yet been placed against landowners who do not remove invasive species, the authorities may clear their land of invasive alien plants and other alien species entirely at the landowners' cost and risk.

LEGISLATION	DESCRIPTION OF LEGISLATION AND APPLICABILITY
	The CARA Regulations with regards to alien and invasive species have been superseded by NEMBA Alien and Invasive Species (AIS) Regulations which became law on 1 October 2014.
Civil Aviation Act (No. 13 of 2009)	Civil aviation in South Africa is governed by the Civil Aviation Act (Act 13 of 2009). This Act provides for the establishment of a stand-alone authority mandated with controlling, promoting, regulating, supporting, developing, enforcing and continuously improving levels of safety and security throughout the civil aviation industry. This mandate is fulfilled by South African Civil Aviation Authority (SACAA) as an agency of the Department of Transport (DoT). SACAA achieves the objectives set out in the Act by complying with the Standards and Recommended Practices (SARPs) of the International Civil Aviation Organisation (ICAO), while considering the local context when issuing the South African Civil Aviation Regulations (SA CARs). As of the 1st of May 2021, Air Traffic and Navigation Services (ATNS) has been appointed as the new Obstacle application Service Provider for Windfarms and later Solar Plants. Their responsibility would pertain to the assessments, maintenance, and all other related matters in respect to Windfarms and in due time Power Plant assessments. The DFFE Screening Tool Report identified Civil Aviation as having low sensitivity for the proposed Camden I SEF, and no major or other types of civil aviation aerodromes located nearby. An Application for the Approval of Obstacles will also be submitted to ATNS. SACAA was included on the project stakeholder database and informed of the proposed Project. Comments received from this stakeholder to date have been captured and responded to within the Comments and Responses Report (CRR) included in the SER (**Appendix D**) of this EIR.
Occupational Health and Safety Act (No. 85 of 1993)	The National Occupational Health and Safety Act (No. 85 of 1993) (OHSA) and the relevant regulations under the Act are applicable to the proposed project. This includes the Construction Regulations promulgated in 2014 under Section 43 of the Act. Adherence to South Africa's OHSA and its relevant Regulations is essential.
National Energy Act (No. 34 of 2008)	The National Energy Act aims to ensure that diverse energy resources are available, in sustainable quantitates, and at affordable prices, to the South African economy in support of economic growth and poverty alleviation, taking into account environmental management requirements and interactions amongst economic sectors. The main objectives of the Act are to: — Ensure uninterrupted supply of energy to the Republic; — Promote diversity of supply of energy and its sources; — Facilitate effective management of energy demand and its conservation; — Promote energy research; — Promote appropriate standards and specifications for the equipment, systems and processes used for producing, supplying and consuming energy; — Ensure collection of data and information relating to energy supply, transportation and demand; — Provide for optimal supply, transformation, transportation, storage and demand of energy that are planned, organised and implemented in accordance with a balanced consideration of security of supply, economics, consumer protection and a sustainable development; — Provide for certain safety, health and environment matters that pertain to energy; — Facilitate energy access for improvement of the quality of life of the people of Republic; — Commercialise energy-related technologies; — Ensure effective planning for energy supply, transportation, and consumption; and — Contribute to sustainable development of South Africa's economy. In terms of the act, the Minister of Energy is mandated to develop and, on an annual basis, review and publish the Integrated Energy Plan (IEP) in the Government Gazette. The IEP analyses current energy consumption trends within different sectors of the economy (i.e. agriculture, commerce, industry, residential and transport) and uses this to project future energy requirements, based on different scenarios. The IEP and the Integrated Resource Plan are intended to be updated

LEGISLATION	DESCRIPTION OF LEGISLATION AND APPLICABILITY
	periodically to remain relevant. The framework is intended to create a balance between energy demand and resource availability so as to provide low-cost electricity for social and economic development, while taking into account health, safety and environmental parameters.
Electricity Regulation Act (No. 4 of 2006)	The Electricity Regulation Act (No. 4 of 2006) (ERA) aims to: — Achieve the efficient, effective, sustainable and orderly development and operation of electricity supply infrastructure in South Africa; — Ensure that the interests and needs of present and future electricity customers and end users are safeguarded and met, having regard to the governance, efficiency. effectiveness and long-term sustainability of the electricity supply industry within the broader context of economic energy regulation in the Republic: — Facilitate investment in the electricity supply industry; — Facilitate universal access to electricity; — Promote the use of diverse energy sources and energy efficiency; — Promote competitiveness and customer and end user choice; and — Facilitate a fair balance between the interests of customers and end users, licensees, investors in the electricity supply industry and the public. The Act establishes a National Energy Regulator as the custodian and enforcer of the National Electricity Regulatory Framework. The Act also provides for licenses and registration as the manner in which generation, transmission, distribution, trading and the import and export of electricity are regulated.

2.2 POLICIES AND PLANS

Table 2.2 summarised key policies and plans as an outline of the governance framework for the project.

Table 2.2: Applicable Regional Policies and Plans

APPLICABLE POLICY	DESCRIPTION OF POLICY
National Development Plan	The National Development Plan aims to eliminate poverty and reduce inequality by 2030. The NDP identifies a number of enabling milestones. Of relevance to the proposed development the NDP refers to the need to produce sufficient energy to support industry at competitive prices and ensure access for poor households, while reducing carbon emissions per unit of power by about one-third. In this regard the infrastructure is not just essential for faster economic growth and higher employment. It also promotes inclusive growth, providing citizens with the means to improve their own lives and boost their incomes. Infrastructure is essential to development. Chapter 3, Economy and Employment, identifies some of the structural challenges specific to South Africa, including an energy constraint that will act as a cap on growth and on options for industrialisation. The NDP notes that from an environmental perspective South Africa faces several related challenges. The reduction of greenhouse gas emissions and shift to a green low-carbon economy, is one of these challenges. In terms of implementation the NDP identifies three phases. The first two are of specific relevance to the proposed project. The first phase (2012–2017) notes that ensuring the supply of energy and water is reliable and sufficient for a growing economy. The second phase (2018–2023) involves building on the first phase to lay the foundations for more intensive improvements in productivity. The provision of affordable and reliable energy is a key requirement for this to take place. Chapter 4, Economic infrastructure, notes that economic infrastructure provides the foundation for social and economic development. In this regard South Africa must invest in a strong network of economic infrastructure designed to support the country's medium- and

APPLICABLE POLICY	DESCRIPTION OF POLICY
	long-term economic and social objectives. The plan envisages that, by 2030, South Africa will have an energy sector that promotes: — Economic growth and development through adequate investment in energy infrastructure. The sector should provide reliable and efficient energy service at competitive rates, while supporting economic growth through job creation. — Environmental sustainability through efforts to reduce pollution and mitigate the effects of climate change. More specifically, South Africa should have adequate supply security in electricity and in liquid fuels, such that economic activity, transport, and welfare are not disrupted. The plan sets out steps that aim to ensure that, in 20 years, South Africa's energy system looks very different to the current situation. In this regard coal will contribute proportionately less to primary-energy needs, while gas and renewable energy resources, will play a much larger role.
Integrated Resource Plan 2010 – 2030	The IRP is an electricity capacity plan which aims to provide an indication of the country's electricity demand, how this demand will be supplied and what it will cost. On 6 May 2011, the then Department of Energy (DoE) released the Integrated Resource Plan 2010-2030 (IRP 2010) in respect of South Africa's forecast energy demand for the 20-year period from 2010 to 2030. The promulgated IRP 2010–2030 identified the preferred generation technology required to meet expected demand growth up to 2030. It incorporated government objectives such as affordable electricity, reduced greenhouse gas (GHG) emissions, reduced water consumption, diversified electricity generation sources, localisation and regional development. The IRP recognises that solar PV, wind and CSP with storage present an opportunity to diversify the electricity mix, to produce distributed generation and to provide off-grid electricity. Renewable technologies also present huge potential for the creation of new industries, job creation and localisation across the value chain.
New Growth Path	Government released the New Economic Growth Path Framework on 23 November 2010. The aim of the framework is to enhance growth, employment creation and equity. The policy's principal target is to create five million jobs over the next 10 years and reflects government's commitment to prioritising employment creation in all economic policies. The framework identifies strategies that will enable South Africa to grow in a more equitable and inclusive manner while attaining South Africa's developmental agenda. Central to the New Growth Path is a massive investment in infrastructure as a critical driver of jobs across the economy. In this regard the framework identifies investments in five key areas namely: energy, transport, communication, water, and housing.
National Infrastructure Plan	The South African Government adopted a National Infrastructure Plan (NIP) in 2012. The NIP aims to transform the South African economic landscape while simultaneously creating significant numbers of new jobs and strengthening the delivery of basic services. It outlines the challenges and enablers which needs to be addressed in the building and developing of infrastructure. The Presidential Infrastructure Coordinating Commission (PICC) was established by the Cabinet to integrate and coordinate the long-term infrastructure build. The plan also supports the integration of African economies. In terms of the plan Government will invest R827 billion over the next three years to build new and upgrade existing infrastructure. The aim of the investments is to improve access by South Africans to healthcare facilities, schools, water, sanitation, housing and electrification. The plan also notes that investment in the construction of ports, roads, railway systems, ***electricity plants***, hospitals, schools and dams will contribute to improved economic growth.
Integrated Energy Plan	The development of a National IEP was envisaged in the White Paper on the Energy Policy of the Republic of South Africa of 1998 and, in terms of the National Energy Act, 2008 (Act No. 34 of 2008), the Minister of Energy is mandated to develop and, on an annual basis, review and publish the IEP in the Government Gazette. The purpose of the IEP is to provide a roadmap of the future energy landscape for South Africa which guides future energy infrastructure investments and policy development.

APPLICABLE POLICY	DESCRIPTION OF POLICY
	The IEP notes that South Africa needs to grow its energy supply to support economic expansion and in so doing, alleviate supply bottlenecks and supply-demand deficits. In addition, it is essential that all citizens are provided with clean and modern forms of energy at an affordable price. As part of the Integrated Energy Planning process, eight key objectives are identified, namely: — Objective 1: Ensure security of supply. — Objective 2: Minimise the cost of energy. — Objective 3: Promote the creation of jobs and localisation. — Objective 4: Minimise negative environmental impacts from the energy sector. — Objective 5: Promote the conservation of water. — Objective 6: Diversify supply sources and primary sources of energy. — Objective 7: Promote energy efficiency in the economy. — Objective 8: Increase access to modern energy. The IEP provides an assessment of current energy consumption trends within different sectors of the economy (i.e., agriculture, commerce, industry, residential and transport) and uses this information to identify future energy requirements, based on different scenarios. The scenarios are informed by different assumptions on economic development and the structure of the economy and also take into account the impact of key policies such as environmental policies, energy efficiency policies, transport policies and industrial policies, amongst others. Based on this information the IEP then determines the optimal mix of energy sources and technologies to meet those energy needs in the most cost-effective manner for each of the scenarios. The associated environmental impacts, socio-economic benefits and macroeconomic impacts are also analysed. The IEP is therefore focused on determining the long-term energy pathway for South Africa, taking into account a multitude of factors which are embedded in the eight objectives. As part of the analysis four key scenarios were developed, namely the Base Case, Environmental Awareness, Resource Constrained and Green Shoots scenarios: — The Base Case Scenario assumes that existing policies are implemented and will continue to shape the energy sector landscape going forward. It assumes moderate economic growth in the medium to long term. — The Environmental Awareness Scenario is characterised by more stringent emission limits and a more environmentally aware society, where a higher cost is placed on externalities caused by the supply of energy. — The Resource Constrained Scenario in which global energy commodity prices (i.e. coal, crude oil and natural gas) are high due to limited supply. — The Green Shoots Scenario describes an economy in which the targets for high economic growth and structural changes to the economy, as set out in the National Development Plan (NDP), are met. The IEP notes that South Africa should continue to pursue a diversified energy mix which reduces reliance on a single or a few primary energy sources. In terms of existing electricity generation capacity, the IEP indicates that existing capacity starts to decline notably from 2025, with significant plant retirement occurring in 2031, 2041 and 2048. By 2050 only 20% of the current electricity generation capacity remains. As a result, large investments are required in the electricity sector in order to maintain an adequate supply in support of economic growth. By 2020, various import options become available, and some new coal capacity is added along with new wind, solar and gas capacity. The mix of generation capacity technologies by 2050 is considerably more diverse than the current energy mix, across all scenarios. The main differentiating factors between the scenarios are the level of demand, constraints on emission limits and the carbon dioxide externality costs. In all scenarios the energy mix for electricity generation becomes more diverse over the period to 2050, with coal reducing its share from about 85% in 2015 to 15–20% in 2050 (depending on the scenario). Solar, wind, nuclear, gas and electricity imports increase their share. The Environmental Awareness and Green Shoots scenarios take on higher levels of renewable energy.

APPLICABLE POLICY	DESCRIPTION OF POLICY
	An assessment of each scenario against the eight objectives with reference to renewable energy notes while all scenarios seek to ensure that costs are minimised within the constraints and parameters of each scenario, the Base Case Scenario presents the least cost followed by the Environmental Awareness, Resource Constrained and Green Shoots scenarios respectively when total energy system costs are considered. In terms of promoting job creation and localisation potential the Base Case Scenario presents the greatest job creation potential, followed by the Resource Constrained, Environmental Awareness and Green Shoots scenarios respectively. In all scenarios, approximately 85% of total jobs are localisable. For electricity generation, most jobs result from solar technologies followed by nuclear and wind, with natural gas and coal making a smaller contribution. The Environmental Awareness Scenario, due to its stringent emission constraints, shows the lowest level of total emissions over the planning horizon. This is followed by the Green Shoots, Resource Constrained and Base Case scenarios. These trends are similar when emissions are considered cumulatively and individually by type.
National Protected Area Expansion Strategy, 2010	The National Protected Area Expansion Strategy 2010 (NPAES) areas were identified through a systematic biodiversity planning process. They present the best opportunities for meeting the ecosystem-specific protected area targets set in the NPAES and were designed with strong emphasis on climate change resilience and requirements for protecting freshwater ecosystems. These areas should not be seen as future boundaries of protected areas, as in many cases only a portion of a particular focus area would be required to meet the protected area targets set in the NPAES. They are also not a replacement for fine scale planning which may identify a range of different priority sites based on local requirements, constraints and opportunities (NPAES, 2010). According to the NPAES, there are no areas within the study area that have been identified as priority areas for inclusion in future protected areas. The study area is therefore **outside the NPAES focus area**.

2.3 PROVINCIAL AND MUNICIPAL LEGAL AND REGULATORY FRAMEWORK

Table 2.3: Provincial Plans

APPLICABLE PLAN	DESCRIPTION OF PLAN
Mpumalanga Growth and Development Path	The primary objective of the Mpumalanga Economic Growth and Development Path (MEGDP) (2011) is to foster economic growth that creates jobs, reduce poverty and inequality in the Province. The MEGDP identifies supporting the development of clean forms of energy such as wind and hydro power generation opportunities, as well as opportunities including gas production from landfill and organic waste, as one of the key interventions to facilitate growth and job creation in the manufacturing sector. A focal point of the MEGDP is massive investments in infrastructure as a key driver of job creation across the economy, with alternative energy production identified as one of the key opportunities in the Mpumalanga Economic sectors.
Mpumalanga Spatial Development Framework (MSDF), 2019	The Mpumalanga Spatial Development Framework (SDF) (2019) identifies that tourism is an important economic sector and has emerged as a robust driver of growth for emerging economies. The SDF also notes that a significant portion of Mpumalanga's land area is classified as Moderate to High-Very High agricultural potential which can be utilised for agricultural production. However, there are other factors affecting the agricultural sector including loss of agricultural land to other activities, availability of water, contamination of the water used for irrigation by other economic activities, and access to the market. The SDF further notes that mining is the largest economic sector in the province and has assisted other sectors such as manufacturing and power generation, to grow in the province. However, the mining sector has posed some key challenges, including soil and water contamination and environmental pollution, development of mines on good agricultural soil thus threatening

APPLICABLE PLAN	DESCRIPTION OF PLAN
	food security, restriction of animal movement due to open cast mining thus affecting the ecosystem etc. It also notes that Mpumalanga's manufacturing plants and coal fired power plants are the key polluters of air, with climate change also identified as a key challenge in the province. Therefore, the province must carefully design interventions that provide a gradual shift from mining oriented sectors to the sustainable economic sectors to maintain sustained growth of the provincial economy. The SDF notes that a significant amount of the country's electricity comes from coal-fired stations in Mpumalanga. It also observes that there is a steady increase in the demand for electricity in the province, mostly attributed to residential, commercial and industrial development, including mining and heavy industry. The Provincial SDF also notes that the abundance of coal has led to the development of many coal-fired power stations in the province, however these coalfields are depleting, therefore making it necessary to consider renewable power sources in Mpumalanga. The SDF also recognises that Mpumalanga's Coal Mining and Coal Fired Power Plant region (mainly the Highveld area) will be under immense pressure for environmental considerations and as a result, the region will witness a possible decline in demand of coal and large-scale employment. The SDF proposes to diversify the regional economy and facilitate the gradual transition of economic activities in the region. According to the SDF, power stations using renewable sources (such as wind and solar) can be developed on the unused fallow lands.
Mpumalanga Industrial Development Plan	In terms of industry, the purpose of the Mpumalanga Industrial Development Plan (MIDP) (2015) is to promote the establishment of new industries and promote growth of existing industries in the province. It is however noted that the Msukaligwa Municipality (within which the project falls under) is not directly impacted by the 2025 MIDP and its proposed priority hubs.
Mpumalanga Conservation Act (No. 10 of 1998)	This Act provides for the sustainable utilisation of wild animals, aquatic biota and plants; provides for the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora; provides for offences and penalties for contravention of the Act; provides for the appointment of nature conservators to implement the provisions of the Act; and provides for the issuing of permits and other authorisations. Amongst other regulations, the following may apply to the current project: — Various species are protected; — The owner of land upon which an invasive species is found (plant or animal) must take the necessary steps to eradicate or destroy such species. The Act provides lists of protected species for the Province. According to the Mpumalanga Nature Conservation Act, a permit is required for the removal of any species on this list.

Table 2.4: District and Local Municipality Plans

APPLICABLE PLAN	DESCRIPTION OF PLAN
Gert Sibande Municipality Integrated Development Plan	According to the Municipal Systems Act (Act 32 of 2000) (MSA), all municipalities have to undertake an Integrated Development Plan (IDP) process. The IDP is a legislative requirement thus it has legal status and supersedes all other plans that guide development at local government level. The Gert Sibande Municipality (GSM) IDP Review(2019/ 2020) and Final IDP (2020/2021) has identified the following development priorities: — Municipal Transformation and Organisational Development — Basic Service Delivery and Infrastructure Development — Local Economic Development — Municipal Financial Viability and Management

APPLICABLE PLAN	DESCRIPTION OF PLAN
	— Good Governance and Public Participation — Spatial Development Analysis and Rationale The main goal and strategic objective of the Basic Service Delivery and Infrastructure Development priority is a reliable and sustainable service. One of the main strategic objectives for reaching the goal is the provision of basic services such as water and electricity to an approved minimum level of standards in a sustainable manner; as per the national guidelines.
Msukaligwa Local Municipality IDP	The Msukaligwa Local Municipality Revised IDP (2020/2021) has identified the following key Municipal priorities: — Revenue collection. — Access to basic services by communities. — Job creation and economic development. — Infrastructure maintenance and upgrading. — Community participation in the affairs of the municipality. — Fight against fraud and corruption. — Capable and responsive organizational structure. — Capabilities of the municipal ICT. — Integrated human settlements One of the main strategic objectives for the access to basic services priority is to provide sustainable and reliable services to communities. Most of the basic services are rendered within the municipality, however some rural areas are still faced with some challenges in the provision water, sanitation and electricity. The Municipality, through the IDP, aims to facilitate the provision of electricity, with a number of key projects planned to be implemented over the period of five years linked to the Municipal IDP.
Msukaligwa Spatial Development Framework	The Msukaligwa SDF is informed by a number of spatial objectives, including: — Providing a spatial structure that facilitates access to services for all communities. — Protecting strategic water sources and sensitive eco-systems. — Providing space for the diversification of the local economy. — Eliminating past spatial settlement patterns. The provision of space of the diversification of the local economy is of specific relevance to the proposed development. The SDF highlights the key role and spatial extent of mining in the Msukaligwa Municipality, including reference to the Camden coal-fired power station located in proximity to the proposed development. Over the longer term the rehabilitation of mining areas and a range of alternative peri-urban uses should be considered for the impacted areas in view of the decrease reliance on coal. Commercial Agriculture also represents a key economic activity in the Municipality.

2.4 INTERNATIONAL ENVIRONMENTAL AND SOCIAL STANDARDS

2.4.1 IFC PERFORMANCE STANDARDS

The International Finance Corporation (IFC) is an international financial institution that offers investment, advisory, and asset management services to encourage private sector development in developing countries. The IFC is a member of the World Bank Group (WBG) and is headquartered in Washington, D.C., United States. It was established in 1956 as the private sector arm of the WBG to advance economic development by investing in strictly for-profit and commercial projects that purport to reduce poverty and promote development.

The IFC's stated aim is to create opportunities for people to escape poverty and achieve better living standards by mobilizing financial resources for private enterprise, promoting accessible and competitive markets, supporting businesses and other private sector entities, and creating jobs and delivering necessary services to those who are poverty-stricken or otherwise vulnerable. Since 2009, the IFC has focused on a set of development goals that its projects are expected to target. Its goals are to increase sustainable agriculture opportunities, improve health and education, increase access to financing for microfinance and business clients, advance infrastructure, help small businesses grow revenues, and invest in climate health.

The IFC is owned and governed by its member countries but has its own executive leadership and staff that conduct its normal business operations. It is a corporation whose shareholders are member governments that provide paid-in capital and which have the right to vote on its matters. Originally more financially integrated with the WBG, the IFC was established separately and eventually became authorized to operate as a financially autonomous entity and make independent investment decisions. It offers an array of debt and equity financing services and helps companies face their risk exposures, while refraining from participating in a management capacity. The corporation also offers advice to companies on making decisions, evaluating their impact on the environment and society, and being responsible. It advises governments on building infrastructure and partnerships to further support private sector development.

The IFC’s Sustainability Framework articulates the Corporation’s strategic commitment to sustainable development and is an integral part of IFC’s approach to risk management. The Sustainability Framework comprises IFC’s Policy and Performance Standards on Environmental and Social Sustainability, and IFC’s Access to Information Policy. The Policy on Environmental and Social Sustainability describes IFC’s commitments, roles, and responsibilities related to environmental and social sustainability. IFC’s Access to Information Policy reflects IFC’s commitment to transparency and good governance on its operations and outlines the Corporation’s institutional disclosure obligations regarding its investment and advisory services. The Performance Standards (PSs) are directed towards clients, providing guidance on how to identify risks and impacts, and are designed to help avoid, mitigate, and manage risks and impacts as a way of doing business in a sustainable way, including stakeholder engagement and disclosure obligations of the client in relation to project-level activities. In the case of its direct investments (including project and corporate finance provided through financial intermediaries), IFC requires its clients to apply the PSs to manage environmental and social risks and impacts so that development opportunities are enhanced. IFC uses the Sustainability Framework along with other strategies, policies, and initiatives to direct the business activities of the Corporation to achieve its overall development objectives. The PSs may also be applied by other financial institutions (FIs).

The Project is considered a Category B project in terms of the IFC Policy on E&S Sustainability (2012), having the potential to cause limited adverse environmental or social risks and/or impacts that are few in number, generally site specific, largely reversible, and readily addressed through mitigation measures.

The objectives and applicability of the eight PSs are outlined in **Table 2.5.**

Table 2.5: IFC Performance Standards Applicability to the Project

<table>
<tr><th>REFERENCE</th><th colspan="2">REQUIREMENTS</th><th>PROJECT SPECIFIC APPLICABILITY</th></tr>
<tr><td colspan="4">Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts</td></tr>
<tr><td>Overview</td><td colspan="3">Performance Standard 1 underscores the importance of managing environmental and social performance throughout the life of a project. An effective Environmental and Social Management System (ESMS) is a dynamic and continuous process initiated and supported by management, and involves engagement between the client, its workers, local communities directly affected by the project (the Affected Communities) and, where appropriate, other stakeholders.</td></tr>
<tr><td>Objectives</td><td colspan="3">— To identify and evaluate environmental and social risks and impacts of the project.
— To adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimize, and, where residual impacts remain, compensate/offset for risks and impacts to workers, Affected Communities, and the environment.
— To promote improved environmental and social performance of clients through the effective use of management systems.
— To ensure that grievances from Affected Communities and external communications from other stakeholders are responded to and managed appropriately.
— To promote and provide means for adequate engagement with Affected Communities throughout the project cycle on issues that could potentially affect them and to ensure that relevant environmental and social information is disclosed and disseminated.</td></tr>
<tr><td rowspan="9">Aspects</td><td>1.1</td><td>Policy</td><td rowspan="9">The IFC Standards state under PS 1 (Guidance Note 23) that “the breadth, depth and type of analysis included in an ESIA must be proportionate to the nature and scale of the proposed project’s potential impacts as identified during the course of the assessment process.” This document is the draft EIR deliverable from the Scoping and EIA process undertaken for the proposed Project. The impact assessment comprehensively assesses the key environmental and social impacts and complies with the requirements of the South African EIA Regulations. In addition, an EMPr (Appendix I) has been compiled during the EIA phase of the project. A formal project specific ESMS will be compiled in the event that the project is developed in the future. Management and monitoring plans outlines in the EMPr will serve as the basis for an ESMS for the proposed Project.</td></tr>
<tr><td>1.2</td><td>Identification of Risks and Impacts</td></tr>
<tr><td>1.3</td><td>Management Programmes</td></tr>
<tr><td>1.4</td><td>Organisational Capacity and Competency</td></tr>
<tr><td>1.5</td><td>Emergency Preparedness and Response</td></tr>
<tr><td>1.6</td><td>Monitoring and Review</td></tr>
<tr><td>1.7</td><td>Stakeholder Engagement</td></tr>
<tr><td>1.8</td><td>External Communication and Grievance Mechanism</td></tr>
<tr><td>1.9</td><td>Ongoing Reporting to Affected Communities</td></tr>
<tr><td colspan="4">Performance Standard 2: Labour and Working Conditions;</td></tr>
<tr><td>Overview</td><td colspan="3">Performance Standard 2 recognises that the pursuit of economic growth through employment creation and income generation should be accompanied by protection of the fundamental rights of workers.</td></tr>
<tr><td>Objectives</td><td colspan="3">— To promote the fair treatment, non-discrimination, and equal opportunity of workers.
— To establish, maintain, and improve the worker-management relationship.
— To promote compliance with national employment and labour laws.
— To protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties, and workers in the client’s supply chain.
— To promote safe and healthy working conditions, and the health of workers.
— To avoid the use of forced labour.</td></tr>
</table>

REFERENCE	REQUIREMENTS		PROJECT SPECIFIC APPLICABILITY
Aspects	2.1	— Working Conditions and Management of Worker Relationship — Human Resources Policy and Management — Working Conditions and terms of Engagement — Workers organisation — Non- Discrimination and Equal Opportunity — Retrenchment — Grievance Mechanism	The construction activities will require contractors for completion. A safe working environment and fair contractual agreements must be in place. The operational phase will have permanent employees for day-to-day activities as well as contractors who will all need a safe working environment and fair contractual agreements. Whilst PS2 will be applicable to the Project, it is not intended to be addressed in detail at this stage. Recommendations are provided concerning development of a detailed Human Resources (HR) and Occupational Health and Safety (OHS) system by the developer and its partners as the Project moves towards implementation. In addition, measures to address the Interim Advice for IFC Clients on Supporting Workers in the Context of COVID-19 are referenced. The EMPr (**Appendix I**) has incorporated the requirements for compliance with Labour and Working legislation and good practice on the part of the contractors .
	2.2	— Protecting the Workforce — Child Labour — Forced Labour	
	2.3	Occupational health and Safety	
	2.4	Workers Engaged by Third Parties	
	2.5	Supply Chain	
Performance Standard 3: Resource Efficiency and Pollution Prevention			
Overview	Performance Standard 3 recognises that increased economic activity and urbanisation often generate increased levels of pollution to air, water, and land, and consume finite resources in a manner that may threaten people and the environment at the local, regional, and global levels. There is also a growing global consensus that the current and projected atmospheric concentration of greenhouse gases (GHG) threatens the public health and welfare of current and future generations. At the same time, more efficient and effective resource use and pollution prevention and GHG emission avoidance and mitigation technologies and practices have become more accessible and achievable in virtually all parts of the world.		
Objectives	— To avoid or minimise adverse impacts on human health and the environment by avoiding or minimising pollution from project activities. — To promote more sustainable use of resources, including energy and water. — To reduce project related GHG emissions.		
Aspects	3.1	— Policy Resource Efficiency — Greenhouse Gases — Water Consumption	PS3-related impacts, such as the management of construction waste, hazardous substances, and stormwater are assessed in **Section 8.17** of this report. There are no material resource efficiency issues associated with the Project. Section 6 of the EMPr includes general resource efficiency measures. The project is not GHG emissions intensive and a climate resilience study or a GHG emissions-related assessment is not deemed necessary for a project of this nature. However, the Camden I SEF seeks to facilitate resource efficiency and pollution prevention by contributing to the South African green economy. Dust air pollution in the construction phase has been addressed in Section 6 of the EMPr (**Appendix I**). The Project will not result in the release of industrial effluents. Potential pollution associated with sanitary wastewater is low and mitigation measures have been included in Section 6 of the EMPr (**Appendix I**).
	3.2	— Pollution Prevention — Air Emissions — Stormwater — Waste Management — Hazardous Materials Management — Pesticide use and Management	

			Land contamination of the site from historical land use (i.e. low intensity agricultural / grazing) is not considered to be a cause for concern. The waste generation profile of the project is not complex. Waste mitigation and management measures have been included in Section 7.1 of EMPr (**Appendix I**). Hazardous materials are not a key issue; small quantities of construction materials (oil, grease, diesel fuel etc.) are the only wastes expected to be associated with the project. The EMPr has taken these anticipated hazardous materials into account and recommend relevant mitigation and management measures (Refer to Section 7.1 of the EMPr (**Appendix I).**
Performance Standard 4: Community Health, Safety, and Security			
Overview	Performance Standard 4 recognizes that project activities, equipment, and infrastructure can increase community exposure to risks and impacts.		
Objectives	— To anticipate and avoid adverse impacts on the health and safety of the Affected Community during the project life from both routine and non-routine circumstances. — To ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to the Affected Communities.		
Aspects	4.1	— Community Health and Safety — Infrastructure and Equipment Design and Safety — Hazardous Materials Management and Safety — Ecosystem Services — Community Exposure to Disease — Emergency Preparedness and Response	The requirements included in PS 4 has been addressed in this S&EIA process and the development of the EMPr. During the construction phase there will be an increase in vehicular traffic along public roads, largely due to the need for importation of construction material. Pedestrian and road safety risks have been qualitatively evaluated in the S&EIA process and the clients' standard safety and security measures, as well as potential additional measures recommended by WSP, is detailed in Section 6 the EMPr (**Appendix I**).
	4.2	Security Personnel	
Performance Standard 5: Land Acquisition and Involuntary Resettlement			
Overview	Performance Standard 5 recognises that project-related land acquisition and restrictions on land use can have adverse impacts on communities and persons that use this land. Involuntary resettlement refers both to physical displacement (relocation or loss of shelter) and to economic displacement (loss of assets or access to assets that leads to loss of income sources or other means of livelihood) as a result of project-related land acquisition and/or restrictions on land use.		
Objectives	— To avoid, and when avoidance is not possible, minimise displacement by exploring alternative project designs. — To avoid forced eviction. — To anticipate and avoid, or where avoidance is not possible, minimise adverse social and economic impacts from land acquisition or restrictions on land use by (i) providing compensation for loss of assets at replacement cost and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected. — To improve, or restore, the livelihoods and standards of living of displaced persons. — To improve living conditions among physically displaced persons through the provision of adequate housing with security of tenure at resettlement sites.		

REFERENCE	REQUIREMENTS		PROJECT SPECIFIC APPLICABILITY
Aspects	5.1	— Displacement — Physical Displacement — Economic Displacement — Private Sector Responsibilities under Government Managed Resettlement	PS5 is not applicable to the proposed Camden I SEF as no physical or economic displacement or livelihood restoration will be required. The proposed Camden I SEF is located on privately owned land that is utilised for agriculture by the landowners. The impact of the proposed development on the agricultural production capability of the site has been assessed by the Agriculture Specialist as being acceptable.
Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources			
Overview	Performance Standard 6 recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources are fundamental to sustainable development.		
Objectives	— To protect and conserve biodiversity. — To maintain the benefits from ecosystem services. — To promote the sustainable management of living natural resources through the adoption of practices that integrate conservation needs and development priorities.		
Aspects	6.1	Protection and Conservation of Biodiversity	The Project Area falls within CBAs (Irreplaceable and Optimal) and a large wetland area adjacent and to the north of the Vaal River (near the southern part of the site) is mapped as an ESA. A Biodiversity Impact Assessment (**Appendix H-4**) as well as an Avifaunal Impact Assessment (**Appendix H-7**) and Freshwater Ecology Impact Assessment (**Appendix H-2**) have been conducted. The methodologies for the specialist assessments include a combination of literature review, in-field surveys and sensitivity mapping. This substantively complies with the PS 6 general requirements for baseline and impact assessment for determination of biodiversity and ecosystem services issues. The determination of habitat sensitivity was undertaken within the legal and best practice reference framework for South Africa. The prevalence of invasive alien species has been determined, and mitigation and management measures have been included in Section 7.2 of the EMPr (**Appendix I**).
Performance Standard 7: Indigenous People			
Overview	Performance Standard 7 recognizes that Indigenous Peoples, as social groups with identities that are distinct from mainstream groups in national societies, are often among the most marginalized and vulnerable segments of the population. In many cases, their economic, social, and legal status limits their capacity to defend their rights to, and interests in, lands and natural and cultural resources, and may restrict their ability to participate in and benefit from development. Indigenous Peoples are particularly vulnerable if their lands and resources are transformed, encroached upon, or significantly degraded.		
Objectives	— To ensure that the development process fosters full respect for the human rights, dignity, aspirations, culture, and natural resource-based livelihoods of Indigenous Peoples. — To anticipate and avoid adverse impacts of projects on communities of Indigenous Peoples, or when avoidance is not possible, to minimize and/or compensate for such impacts. — To promote sustainable development benefits and opportunities for Indigenous Peoples in a culturally appropriate manner. — To establish and maintain an ongoing relationship based on Informed Consultation and Participation (ICP) with the Indigenous Peoples affected by a project throughout the project's life-cycle. — To ensure the Free, Prior, and Informed Consent (FPIC) of the Affected Communities of Indigenous Peoples when the circumstances described in this Performance Standard are present. — To respect and preserve the culture, knowledge, and practices of Indigenous Peoples.		

REFERENCE	REQUIREMENTS		PROJECT SPECIFIC APPLICABILITY
Aspects	7.1	General — Avoidance of Adverse Impacts — Participation and Consent	As per the international instruments under the United Nations (UN) Human Rights Conventions, no indigenous peoples are present within the study area. The Project does not involve displacement. PS7 will not be triggered.
	7.2	Circumstances Requiring Free, Prior, and Informed Consent — Impacts on Lands and Natural Resources Subject to Traditional Ownership or Under Customary Use — Critical Cultural Heritage — Relocation of Indigenous Peoples from Lands and Natural Resources Subject to Traditional Ownership or Under Customary Use	
	7.3	Mitigation and Development Benefits	
	7.4	Private Sector Responsibilities Where Government is Responsible for Managing Indigenous Peoples Issues	
Performance Standard 8: Cultural Heritage			
Overview	Performance Standard 8 recognizes the importance of cultural heritage for current and future generations.		
Objectives	— To protect cultural heritage from the adverse impacts of project activities and support its preservation. — To promote the equitable sharing of benefits from the use of cultural heritage.		
Aspects	8.1	Protection of Cultural Heritage in Project Design and Execution	A Heritage Report (**Appendix H-10**) has been carried out by a suitably qualified specialist, revealing: — No Stone Age or Iron Age archaeological sites are on record within the immediate study area but this could be due to a lack of focused research in the area. — A small cemetery is situated on the southern portion of the proposed solar project area. The cemetery contains mainly stone packed graves that are partially enclosed by a low stone wall. — According to the SAHRA Paleontological map the study area is of zero to very high paleontological significance and an independent study was conducted for this aspect. Bamford (2022) concluded that based on the fossil record but confirmed by the site visit and walk through, there are NO FOSSILS of the *Glossopteris* flora even though fossils have been recorded from rocks of a similar age and type in South Africa. — The study area is in a rural setting and characterised by cultivation and agricultural activities with a historical layering consisting of burial sites and the remnants of stone packed structures/ settlements. A more recent industrial element is introduced by the Camden Power Station that was commissioned in 1967, along with the development of coal-mining in the broader region.

REFERENCE	REQUIREMENTS		PROJECT SPECIFIC APPLICABILITY
			— The project area has been cultivated from prior to 1968 as indicated on historical maps and has remained under cultivation until present these activities would have impacted on surface indicators of heritage sites if any were ever present in the area. A Chance Find Procedure has been included in Section 7.13.1 of the EMPr (**Appendix I**).

2.4.2 WORLD BANK GROUP ENVIRONMENTAL HEALTH AND SAFETY GUIDELINES

In support of the Performance Standards, the World Bank Group (WBG) has published a number of Environmental Health and Safety (EHS) Guidelines. The EHS Guidelines are technical reference documents that address IFC's expectations regarding the industrial pollution management performance of its projects. They are designed to assist managers and decision makers with relevant industry background and technical information. This information supports actions aimed at avoiding, minimising, and controlling EHS impacts during the construction, operation, and decommissioning phase of a project or facility. The EHS Guidelines serve as a technical reference source to support the implementation of the IFC Performance Standards, particularly in those aspects related to PS3: Pollution Prevention and Abatement, as well as certain aspects of occupational and community health and safety.

Where host country regulations differ from the levels and measures presented in the EHS Guidelines, projects seeking international funding may be expected to achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, a full and detailed justification for any proposed alternatives is required.

The following IFC / WBG EHS Guidelines have been generally consulted during the preparation of the EIA in order to aid the identification of EHS aspects applicable to the project:

— *Electric Power Transmission and Distribution (2007)* - information relevant to power transmission between a generation facility and a substation located within an electricity grid, in addition to power distribution from a substation to consumers located in residential, commercial, and industrial areas;

— *General EHS Guidelines* – this includes a section on a range of environmental, occupational health and safety, community health and safety, and construction activities that would apply to the project. The guideline also contains recommended guidelines adopted form the World Health Organisation (WHO) for ambient air and water quality, which are referred to in the relevant impact assessment sections in the ESIA report.

2.4.3 EQUATOR PRINCIPLES

The Equator Principles (EPs) is a risk management framework, adopted by financial institutions, for determining, assessing, and managing environmental and social risk in projects and is primarily intended to provide a minimum standard for due diligence to support responsible risk decision-making.

The EPs apply globally to all industry sectors and to five financial products 1) Project Finance Advisory Services, 2) Project Finance, 3) Project-Related Corporate Loans, 4) Bridge Loans and 5) Project-Related Refinance and Project-Related Acquisition Finance. The relevant thresholds and criteria for application is described in detail in the Scope section of the EP. Currently 125 Equator Principles Financial Institutions (EPFIs) in 37 countries have officially adopted the EPs, covering the majority of international project finance debt within developed and emerging markets. EPFIs commit to implementing the EPs in their internal environmental and social policies, procedures and standards for financing projects and will not provide Project Finance or Project-Related Corporate Loans to projects where the client will not, or is unable to, comply with the EPs.

While the EPs are not intended to be applied retroactively, EPFIs apply them to the expansion or upgrade of an existing project where changes in scale or scope may create significant environmental and social risks and impacts, or significantly change the nature or degree of an existing impact. The EPs have greatly increased the attention and focus on social/community standards and responsibility, including robust standards for indigenous peoples, labour standards, and consultation with locally affected communities within the Project Finance market.

The EPs have also helped spur the development of other responsible environmental and social management practices in the financial sector and banking industry and have supported member banks in developing their own Environmental and Social Risk Management Systems.

The requirements and applicability of the EPs are outlined in **Table 2.6**.

It should be noted that Principles 8 and 10 relate to a borrower's code of conduct and are therefore not considered relevant to the S&EIA process and have not been included in this discussion.

Table 2.6: Requirements and Applicability of the Equator Principles

<table>
<tr><th colspan="2">REQUIREMENT</th><th>PROJECT SPECIFIC APPLICABILITY</th></tr>
<tr><td colspan="3">Principle 1: Review and Categorisation</td></tr>
<tr><td>Overview</td><td>When a project is proposed for financing, the EPFI will, as part of its internal social and environmental review and due diligence, categorise such project based on the magnitude of its potential impacts and risks in accordance with the environmental and social screening criteria of the IFC.
Using categorisation, the EPFI's environmental and social due diligence is commensurate with the nature, scale, and stage of the Project, and with the level of environmental and social risks and impacts.
The categories are:
— Category A: Projects with potential significant adverse environmental and social risks and/or impacts that are diverse, irreversible or unprecedented;
— Category B: Projects with potential limited adverse environmental and social risks and/or impacts that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures; and
— Category C: Projects with minimal or no adverse environmental and social risks and/or impacts.</td><td>Based upon the significance and scale of the Project's environmental and social impacts, the proposed project is regarded as a Category B project i.e. a project with potential limited adverse environmental or social risks and/or impacts that are few in number, generally site-specific, largely reversible, and readily addressed through mitigation measures.</td></tr>
<tr><td colspan="3">Principle 2: Environmental and Social Assessment</td></tr>
<tr><td>Overview</td><td>For all Category A and Category B Projects, the EPFI will require the client to conduct an appropriate Assessment process to address, to the EPFI's satisfaction, the relevant environmental and social risks and scale of impacts of the proposed Project (which may include the illustrative list of issues found in Exhibit II). The Assessment Documentation should propose measures to minimise, mitigate, and where residual impacts remain, to compensate/ offset/ remedy for risks and impacts to Workers, Affected Communities, and the environment, in a manner relevant and appropriate to the nature and scale of the proposed Project.
The Assessment Documentation will be an adequate, accurate and objective evaluation and presentation of the environmental and social risks and impacts, whether prepared by the client, consultants or external experts. For Category A, and as appropriate, Category</td><td>This document is the third deliverable (i.e. EIR) from the S&EIA process undertaken for the proposed Project. The assessment appropriately and comprehensively assessed the key environmental and social impacts and complies with the requirements of the South African EIA Regulations and this Principle. In addition, an EMPr has been compiled and is included in Appendix I. A formal project specific ESMS will be compiled in the event that the project is developed in the future. Management and monitoring plans outlines in the EMPr will serve as the basis for an ESMS for the proposed Project.</td></tr>
</table>

REQUIREMENT		PROJECT SPECIFIC APPLICABILITY
	B Projects, the Assessment Documentation includes an Environmental and Social Impact Assessment (ESIA). One or more specialised studies may also need to be undertaken. For other Category B and potentially C Projects, a limited or focused environmental or social assessment may be appropriate, applying applicable risk management standards relevant to the risks or impacts identified during the categorisation process. The client is expected to include assessments of potential adverse Human Rights impacts and climate change risks as part of the ESIA or other Assessment, with these included in the Assessment Documentation.	
Principle 3: Applicable Environmental and Social Standards		
Overview	The Assessment process should, in the first instance, address compliance with relevant host country laws, regulations and permits that pertain to environmental and social issues. The EPFI's due diligence will include, for all Category A and Category B Projects globally, review and confirmation by the EPFI of how the Project and transaction meet each of the Principles. For Projects located in Non-Designated Countries, the Assessment process evaluates compliance with the then applicable IFC PS and WBG EHS Guidelines. For Projects located in Designated Countries, compliance with relevant host country laws, regulations and permits that pertain to environmental and social issues.	As South Africa has been identified as a non-designated country, the reference framework for environmental and social assessment is based on the IFC PS. In addition, this S&EIA process has been undertaken in accordance with NEMA (the host country's relevant legislation).
Principle 4: Environmental and Social Management System and Equator Principles Action Plan		
Overview	For all Category A and Category B Projects, the EPFI will require the client to develop or maintain an Environmental and Social Management System (ESMS). Further, an Environmental and Social Management Plan (ESMP) will be prepared by the client to address issues raised in the Assessment process and incorporate actions required to comply with the applicable standards. Where the applicable standards are not met to the EPFI's satisfaction, the client and the EPFI will agree on an Equator Principles Action Plan (EPAP). The EPAP is intended to outline gaps and commitments to meet EPFI requirements in line with the applicable standards.	A formal project specific ESMS will be compiled in the event that the project is developed in the future. Management and monitoring plans outlines in the EMPr will serve as the basis for an ESMS for the proposed Project.
Principle 5: Stakeholder Engagement		
Overview	EPFI will require the client to demonstrate effective Stakeholder Engagement as an ongoing process in a structured and culturally appropriate manner with Affected Communities Workers and, where relevant, Other Stakeholders. For Projects with potentially significant adverse impacts on Affected Communities, the client will conduct an Informed Consultation and Participation process. To accomplish this, the appropriate assessment documentation, or non-technical summaries thereof, will be made available to the public by the borrower for	The S&EIA process includes an extensive stakeholder engagement process which complies with the South African EIA Regulations. The process includes consultations with local communities, nearby businesses, and a range of government sector stakeholders (state owned enterprises, national, provincial and local departments). The stakeholder engagement process solicits interest from potentially interested parties through the placement of site notices and newspaper

REQUIREMENT		PROJECT SPECIFIC APPLICABILITY
	a reasonable minimum period in the relevant local language and in a culturally appropriate manner. The borrower will take account of and document the process and results of the consultation, including any actions agreed resulting from the consultation. Disclosure of environmental or social risks and adverse impacts should occur early in the Assessment process, in any event before the Project construction commences, and on an ongoing basis. All Projects affecting Indigenous Peoples will be subject to a process of Informed Consultation and Participation, and will need to comply with the rights and protections for Indigenous Peoples contained in relevant national law, including those laws implementing host country obligations under international law.	advertisements as well as written and telephonic communication. The stakeholder engagement process is detailed in **Section 4.3.**
Principle 6: Grievance Mechanism		
Overview	For all Category A and, as appropriate, Category B Projects, the EPFI will require the client, as part of the ESMS, to establish effective grievance mechanisms which are designed for use by Affected Communities and Workers, as appropriate, to receive and facilitate resolution of concerns and grievances about the Project's environmental and social performance. The borrower will inform the Affected Communities and Workers about the grievance mechanism in the course of the stakeholder engagement process and ensure that the mechanism addresses concerns promptly and transparently, in a culturally appropriate manner, and is readily accessible, at no cost, and without retribution to the party that originates the issue or concern.	The EMPr (**Appendix I**) includes a *Grievance Mechanism Process for Public Complaints and Issues* (Section 7.15). This procedure effectively allows for external communications with members of the public to be undertaken in a transparent and structured manner.
Principle 7: Independent Review		
Overview	For all Category A and, as appropriate, Category B Projects, an Independent Environmental and Social Consultant, not directly associated with the client, will carry out an Independent Review of the Assessment Documentation including the ESMPs, the ESMS, and the Stakeholder Engagement process documentation in order to assist the EPFI's due diligence, and assess Equator Principles compliance.	This principle will only become applicable in the event that that the project is developed in the future necessitating Independent Review.
Principle 9: Independent Monitoring and Reporting		
Overview	To assess Project compliance with the Equator Principles after Financial Close and over the life of the loan, the EPFI will require independent monitoring and reporting for all Category A, and as appropriate, Category B projects. Monitoring and reporting should be provided by an Independent Environmental and Social Consultant; alternatively, the EPFI will require that the client retain qualified and experienced external experts to verify its monitoring information, which will be shared with the EPFI in accordance with the frequency required.	This principle will only become applicable in the event that the project is developed in the future necessitating independent monitoring and reporting.

3 SCOPING PHASE SUMMARY

3.1 PROCEDURAL PROCESS

The application form was compiled and submitted to the DFFE on **22 February 2022**. The application form was acknowledged on **28 February 2022.** The application form was updated and submitted to the DFFE on **08 April 2022**.

The DFFE reference number allocated to this application is **14/12/16/3/3/2/2136**. This reference number will appear on all official correspondence with the authorities and the public regarding the Proposed Project. A copy of the acknowledgement of receipt of the application is included in **Appendix F**.

The Draft Scoping Report (DSR) was released for public review between 25 February and 28 March 2022. Subsequently the scoping report was finalised and submitted to the DFFE on 08 April 2022 for their review and approval. The submission of the final scoping report was within 44 days of receipt of the application by the DFFE as required by GNR 982.

The approval of the Final Scoping Report (FSR) and the plan of study for the environmental impact assessment was received on **25 May 2022** and is included in **Appendix G**.

3.2 AUTHORITY CONSULTATION

A pre-application meeting was held on 19 October 2021 with the DFFE in order to discuss the proposed project. The minutes of this meeting are included in **Appendix F**. In addition, WSP notified a number of commenting authorities of the Proposed Project via a notification letter, these included:

- DMRE;
- DFFE: Biodiversity and Conservation;
- DFFE: Protected Areas;
- MDARDLEA;
- DWS;
- Vaal WMA Authority;
- SAHRA;
- MHRA;
- MTPA;
- CAA;
- ATNS;
- DD (SA Army);
- AMA;
- SAWS;
- SANRAL;
- Gert Sibande District Municipality;
- Msukaligwa Local Municipality; and
- Dr Pixley Ka Seme Local Municipality.

WSP received comments on the DSR from the DFFE on 22 March 2022. The comments and responses have been outlined in **Table 3.1** and included in the SER **(Appendix D)**. The responses to the DFFE comments were applicable as at the time of final scoping submission and based on the project description included in the final scoping report. In addition to the above, WSP received comments on the FSR from the DFFE on **25 May 2022**. The comments and responses have been outlined in **Table 3.2** and included in the SER (**Appendix D**). A request for extension to the submission deadline of the FEIR was submitted to the DFFE in terms of EIA Regulation 3(7). A 60-day extension was approved on 24 June 2022.

Table 3.1: Comments received from the DFFE regarding the DSR

COMMENT	RESPONSE
Listed Activities The Department has noted that activity 14 of Listing Notice 1 and activity 10 of Listing Notice 3 are applied for as it relates to the installation of Battery Energy Storage System (BESS). Therefore, you are required to indicate whether the BESS will be assembled on site or pre-assembled. Additionally provide reasons for applying for the above mentioned activity even though the BESS is not regarded as a facility or infrastructure for the storage or storage and handling of a dangerous goods. In addition, it is noted that fuel, cement and chemical storage onsite will be greater than 80m³ but not exceeding 500m3. As such, please ensure that the environmental impacts of fuel, cement and chemical storage are fully assessed and mitigation measures are provided.	WSP can now confirm that the BESS components will be pre-assembled and not assembled on site. Therefore, reference to the BESS in Activity 14 of Listing Notice 1 and Activity 10 of Listing Notice 3 has been removed from the amended application to be submitted with the FSR. Furthermore, WSP confirm that the environmental impacts of fuel, cement and chemical storage will be fully assessed during the EIA phase (see Section 6.6 of the FSR) and mitigation measures will be provided in the EMPr.
It has been noted that words such as should have been used in the description of the portion of the proposed project to which the applicable listed activity relates. Please refrain from using these words.	WSP can confirm that the use of the word "Should" has been removed from the application form and the description of the portion of the proposed project to which the applicable listed activity relates.
It is noted that activity 30 of Listing Notice 1 has been applied for and the motivation is that the 'facility infrastructure is located within, and will require vegetation clearance or disturbance of, Eastern Highveld Grassland", etc. It is unclear as to which process or activity identified in terms of Section 53(1) of NEM:BA is required. As such, you are requested to clarify or provide information regarding the process or activity identified in terms of NEM:BA.	WSP confirm that the development will be located within the Eastern Highveld Grassland, Eastern Temperate Freshwater Wetlands and Chrissiesmeer Panveld. All three ecosystems are confirmed to be listed in the National List of Ecosystems that are Threatened and in Need of Protection (as indicated in GNR 1002 of 9 December 2011). Due to the fact that these ecosystems are listed as threatened it is assumed that various threatened or protected species may be found within the development area. The restricted activity of "cutting, chopping off, uprooting, damaging or destroying, any specimen" has been identified in terms of NEM:BA and is therefore applicable to the vegetation clearance that will be required to construct the development. In light of this, Activity 30 is considered applicable. WSP can confirm that protected species have been identified on site and are listed in the Terrestrial Ecology Scoping Study included in Appendix I of the FSR. Furthermore, the associated impacts on threatened and protected species will be assessed during the EIA Phase, and relevant mitigation and management measures provided in the EMPr.
Please ensure that all relevant listed activities are applied for, are specific and can be linked to the development activity or infrastructure as described in the project description. In addition, the onus is thus on the applicant and the Environmental Assessment Practitioner (EAP) to ensure that all the applicable listed activities are included in the application. Failure to do so may result in unnecessary delays in the processing of the application.	WSP can confirm that all relevant listed activities have been applied for. Furthermore, the descriptions of applicability in the amended application form and Table 3-1 of the FSR are specific and have been linked to the development activity or infrastructure as described in the project description.
If the activities applied for in the application form differ from those mentioned in the final SR, an amended application form must be submitted. Please note that the Department's application form template has been amended and can be	Although the activities do not differ, WSP can confirm that an amended application form has been submitted as the activity applicability descriptions have been updated as requested.

COMMENT	RESPONSE
BESS Alternative Page 6 of 37 of the application form included BESS as part of the component for the proposed development and trigger listed activity 14 of LN 1 and activity 10 of LN 3 is included on page 12 and 15 of 37. However, it has been noted on page 31 of the DSR that BESS technologies such as Lithium Battery Technologies, such as Lithium Iron Phosphate, Lithium Nickel Manganese Cobalt oxides or Vanadium Redox flow technologies will be considered as the preferred battery technology, however the specific technology will only be determined following Engineering, Procurement, and Construction (EPC). Therefore, you are advised to assess the risk associated with the technologies and indicate how impacts will be minimised.	WSP can confirm that the risks associated with the BESS technologies will be assessed through a Qualitative Risk Assessment to be undertaken in the EIA phase. This study will also indicate how impacts will be minimised.
Further note that the preferred alternative for the BESS must be clearly determined and give clear information on whether the BESS will be assembled on site or pre-assembled for this project.	WSP can confirm that the risks associated with the BESS technologies will be assessed through a Qualitative Risk Assessment to be undertaken in the EIA phase. This study will also indicate how impacts will be minimised. The preferred alternative for the BESS will be identified during the EIA phase.
Alternatives Appendix 7: Locality Map highlights 2 location alternatives for the substation and BESS, however they are not discussed in report. Please provide a description of any identified alternatives for the proposed activity that are feasible and reasonable, including the advantages and disadvantages that the proposed activity or alternatives will have on the environment and on the community that may be affected by the activity as per Appendix 2 of GN R.982 of 2014 (as amended).	WSP can confirm that two location alternatives for the substation and BESS have been identified. Both alternatives are considered feasible and reasonable with no apparent advantages and disadvantages. Additional text to this effect has been included in Section 2.5 of the FSR as required. Both alternatives will be assessed during the EIA Phase where the preferred alternative will be confirm.
Alternatively, you should submit written proof of an investigation and motivation if no reasonable or feasible alternatives exist in terms of Appendix 2.	WSP can confirm that two location alternatives for the substation and BESS have been identified. Both alternatives are considered feasible and reasonable with no apparent advantages and disadvantages. Additional text to this effect has been included in Section 2.5 of the FSR as required. Both alternatives will be assessed during the EIA Phase where the preferred alternative will be confirm.
Public Participation Process Please ensure that all issues raised and comments received during the circulation of the draft SR from registered I&APs and organs of state (including this Department's Biodiversity and Protected Areas Section), which have jurisdiction in respect of the proposed activity are adequately addressed in the final SR.	WSP can confirm that all issues raised and comments received during the circulation of the draft SR from registered I&APs and organs of state have been included in the SER and adequately addressed and responded to. WSP can confirm that comments from the Biodiversity Directorate of the DFFE were received and are included in the SER. Furthermore, consultation with the Protect Areas Directorate has been undertaken and they will be provided with a copy of the FSR. Any further comments from these two DFFE Directorates received post submission of the FSR will be considered and adequately addressed during the EIA Phase.
Proof of correspondence with the various stakeholders must be included in the final SR. Should you be unable to obtain	Proof of correspondence with the various stakeholders is included in Appendix B and Appendix D of the SER.

COMMENT	RESPONSE
comments, proof should be submitted to the Department of the attempts that were made to obtain comments.	
The Public Participation Process must be conducted in terms of Regulations 39, 40 41, 42, 43 & 44 of the EIA Regulations 2014, as amended.	WSP confirm that the Public Participation Process is being conducted in terms of Regulations 39, 40, 41, 42, 43 & 44 of the EIA Regulations 2014, as amended
A comments and response trail report (C&R) must be submitted with the final SR. The C&R report must incorporate all historical comments for this development. The C&R report must be a separate document from the main report.	WSP can confirm that all issues raised and comments received during the circulation of the draft SR from registered I&APs and organs of state have been included in a comment of response report included in Section 2.3 of the SER. WSP can confirm that the SER will also be submitted as a separate report.
Please refrain from summarising comments made by I&APs. All comments from I&APs must be copied verbatim and responded to clearly. Please note that a response such as “Noted” is not regarded as an adequate response to I&AP’s comments.	WSP confirm that all comments from I&APs have been copied verbatim and responded to clearly. Furthermore the response “Noted” has not been utilised.
The final SR must provide evidence that all identified and relevant competent authorities have been given an opportunity to comment on the proposed development particularly the Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs (MDARDLEA), South African Heritage Resources Agency (SAHRA), the District and Local Municipalities.	WSP confirms that the FSR provides evidence that all identified and relevant competent authorities have been given an opportunity to comment on the proposed development including Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs (MDARDLEA), South African Heritage Resources Agency (SAHRA), the District and Local Municipalities.
Layout & Sensitivity Maps A copy of the layout and environmental sensitivity map must be submitted with the final SR and all available biodiversity information must be used in the finalisation of these maps.	A layout (Figure 2.2) and environmental sensitivity map (Figure 5-28) have been included in the FSR.
The layout map must indicate the following: — Positions of the solar facility and all associated infrastructure (includes the coordinates of each infrastructure); — All supporting onsite infrastructure e.g. roads (existing and proposed); — Permanent laydown area footprint; — Substation(s) and/or transformer(s) sites including their entire footprint; — Proposed infrastructure related to the proposed development; — Connection routes (including pylon positions) to the distribution/transmission network; and — All existing infrastructure on the site.	A layout map of the development is included in Figure 2-2 of the FSR. The co-ordinates of the development area and relevant infrastructure are included in Table 2-2 and Table 2-3 of the FSR. This layout map will be updated as require in the EIA phase. Please note that corridors have been included for the connection routes as pylon positions will only be confirmed subject to micro-siting and final design.
The environmental sensitivity map must indicate the following: — The location of sensitive environmental features on site e.g. CBAs, heritage sites, wetlands, drainage lines etc. that will be affected; — Buffer areas; and — All “no-go” areas.	An environmental sensitivity map (Figure 5-28) has been included in the FSR.

COMMENT	RESPONSE
The above layout maps must have a clear legend with information communicating with that on the map, be overlain with the sensitivity map which shows neighbouring energy developments and existing grid infrastructure.	WSP can confirm that both the layout and sensitivity map have clear legends. Furthermore, both maps include the relevant requested information.
According to the Biodiversity map on page 100 of the DSR, the proposed development is located within the Protected Area National Park and Nature Reserve. You are required to provide details of the National Park or Nature Reserve. Furthermore, proof of approval in terms of Section 50 of NEM:PA obtained before submission of the application of the proposed development must be submitted with the final SR.	The Protected Area reference on page 100 of the DSR refers to the Langcarel Private Nature Reserve. It has been confirmed that this Nature Reserve was gazetted with no 3256 of 1967 and notice 61. This reserve is however noted as having farming activity present, and is currently managed actively and entirely for livestock and crop agriculture. The management and land use thereof is therefore inconsistent with the Private Nature Reserve status and has not, and continues to not be, managed and utilised as a private nature reserve. The landowner further disputes the nature reserve status of the properties and intends to utilise any suitable legal avenues available to continue operation of the properties for the current land use of agriculture, in conjunction with the planned Renewable Energy land use subject to this application. WSP can confirm that the relevant approval is being obtained in terms of Section 50 of NEM:PAA. As agreed during the consultation meeting dated 31 March 2022 with the Competent Authority, this approval will be available during the course of the EIA phase. The minutes of the meeting have been included in Appendix C-2 of this SER.
It has been noted that the location of the proposed development is situated in an area with Eastern Highveld Grassland, which is endangered and or vulnerable. Therefore, you are required to explain why the site is considered suitable for the proposed development.	It should be noted that even though the development is located within the vulnerable Eastern Highveld Grassland, the conditions on site are not considered pristine. The proposed development area is largely utilised for agricultural activities with large portions being cultivated, and others subject to cattle grazing. Section 2.6 of the FSR outlines the need and desirability of the project which includes the benefits of the location close to the Camden Power Station and ash dump including other collieries in the area, which has been listed for decommissioning in the coming years. The location of the development will also allow for the use of the existing power transmission infrastructure that would otherwise become defunct post decommissioning. The terrestrial ecologist notes that the project study area consists largely of natural habitat within a rural area. Currently, the rates of transformation within the vegetation in this general region is moderately high, although on-site habitats have not been transformed to as high degree as surrounding areas. The ecologist further noted that it is possible that sensitive habitats on site can be minimised or avoided with the application of appropriate mitigation or management measures, and therefore that the development is not considered fatally flawed and should be subjected to further study in accordance with the specialist Plan of Study. Subsequently, the layout of the development will be updated such that high sensitivity areas and buffers are avoided as far as possible in consideration of the specialist sensitivity findings. Considering all of the above and in conjunction with layout consideration of the highly sensitive areas determined by the ecological specialist, suitable area

COMMENT	RESPONSE
	within the Eastern Highveld Grassland habitats may be utilised towards development.
The delineated water-bodies (Figure 5-16) on page 95 of the DSR indicate the sensitive areas with buffer according to the legend, however, the buffers of those areas are not indicated on the map. Please ensure that the legend of the maps are clear and communicate with the details of the maps.	It must be noted that the sensitive areas reflected on Figure 5-16 outline the relevant delineated surface water structure inclusive of the buffer, thereby indicating that the surface water body together with the buffer is considered the sensitive area. The legend therefore correctly communicates the detail of the map and is inclusive of the buffer.
According to figure 5-14, the site is located within the Freshwater Ecosystem Priority Areas (FEPA), therefore, you are required to indicate the impacts of the area by the proposed development.	Potential impacts on the Aquatic Environment are indicated in Section 6.4 of the FSR. These impacts will be assessed during the EIA Phase.
Specialist Assessments The EAP must ensure that the terms of reference for all the identified specialist studies must include the following: A detailed description of the study's methodology; indication of the locations and descriptions of the development footprint, and all other associated infrastructures that they have assessed and are recommending for authorisation.	WSP can confirm that the specialist studies to be undertaken in the EIA phase will be undertaken in line with Appendix 6 of the EIA Regulations, 2014, as amended, or as required under the gazetted specialist protocols (GNR 320 of 20 March 2020 and GNR 1150 of 30 October 2020). Therefore, the requested information will be included.
Provide a detailed description of all limitations to the studies. All specialist studies must be conducted in the right season and providing that as a limitation will not be allowed.	All relevant specialist assumptions and limitations have been included Section 1.6. These will be updated as required during the EIA Phase.
Please note that the Department considers a 'no-go' area, as an area where no development of any infrastructure is allowed; therefore, no development of associated infrastructure including access roads is allowed in the 'no-go' areas.	WSP acknowledge the DFFE's definition of 'No-go' areas. No-go areas will be re-evaluated and assessed during the EIA phase, based on further specialist field assessments. Where specialist definitions of 'no-go' areas differ from the Department's definition; these will be clearly indicated. To date, specialists have clearly indicated where it is suitable for linear infrastructure (water pipelines, roads, powerline infrastructure etc.) to traverse a no-go area where required.
Should the specialist definition of 'no-go' area differ from the Department's definition; this must be clearly indicated. The specialist must also indicate the 'no-go' area's buffer if applicable.	
All specialist studies must be final, and provide detailed/practical mitigation measures for the preferred alternative and recommendations, and must not recommend further studies to be completed post EA.	All specialist studies to be appended to the Final EIA Report will be final. Specialist reports will provide detailed/practical mitigation measures for the preferred alternative and recommendations and will not recommend further studies to be completed post EA with the exception of pre-construction walkthroughs, search and rescue and micro-siting. The Specialist Studies will sufficiently inform the EA decision phase.
Should a specialist recommend specific mitigation measures, these must be clearly indicated.	All specific mitigation measures, will be clearly indicated and included in the EMPr during the EIA Phase.
Should the appointed specialists specify contradicting recommendations, the EAP must clearly indicate the most reasonable recommendation and substantiate this with defendable reasons; and were necessary, include further expertise advice.	In the EMPr, WSP will clearly indicate the most reasonable recommendation and substantiate this with defendable reasons should any specialist recommendations be contradictory. To date no contradictory recommendations have been received.

COMMENT	RESPONSE
It is further brought to your attention that Procedures for the Assessment and Minimum Criteria for Reporting on identified Environmental Themes (as per the Screening Report), which were promulgated in Government Notice No. 320 of 20 March 2020 and in Government Notice No. 1150 of 30 October 2020 (i.e. "the Protocols"), have come into effect. Please note that specialist assessments must be conducted in accordance with the requirements of these protocols.	WSP can confirm that the Procedures for the Assessment and Minimum Criteria for Reporting on identified Environmental Themes (as per the Screening Report), which were promulgated in Government Notice No. 320 of 20 March 2020 and in Government Notice No. 1150 of 30 October 2020 (i.e. "the Protocols") are being considered as applicable.
In addition, the Specialist Declaration must also indicate the name of scientific organisation/council and member number and the status of the registration/membership of each specialist.	Specialist Declarations included in the FSR do indicate the name of scientific organisation/council and member number and the status of the registration/membership of each specialist.
Cumulative Impact Assessment Should there be any other similar projects within a 30km radius of the proposed development site and or in this case all the proposed Camden Energy Facilities, the cumulative impact assessment for all identified and assessed impacts must be refined to indicate the following: Identified cumulative impacts must be clearly defined, and where possible the size of the identified impact must be quantified and indicated, i.e. hectares of cumulatively transformed land.	Through the use of the DFFE web-based environmental screening tool as well as the Environmental Geographical Information System (E-GIS), WSP have confirmed that there are no similar projects within 30km radius of the development to date. WSP confirm that cumulative impacts will be considered in the EIA phase. This will be re-affirmed during the EIA Phase.
Detailed process flow and proof must be provided, to indicate how the specialist's recommendations, mitigation measures and conclusions from the various similar developments in the area were taken into consideration in the assessment of cumulative impacts and when the conclusion and mitigation measures were drafted for this project.	This information will be included in the EIA Report to be compiled in the EIA Phase, along with the related impact and cumulative assessments, and concluding remarks.
The cumulative impacts significance rating must also inform the need and desirability of the proposed development.	This information will be included in the EIA Report to be compiled in the EIA Phase, along with the related impact and cumulative assessments, and concluding remarks.
A cumulative impact environmental statement on whether the proposed development must proceed.	This information will be included in the EIA Report to be compiled in the EIA Phase, along with the related impact and cumulative assessments, and concluding remarks.
Environmental Management Programme (EMPr) Ensure that the generic EMPr is submitted for the management of impacts of the substation that will be constructed as part of this development.	This information will be included in the EMPr to be compiled in the EIA Phase.
The EMPr for the facility must comply with the requirements of Appendix 4 in the EIA Regulation, as amended.	WSP confirm that the EMPrs to be submitted in the EIA phase, will comply with the requirements of Appendix 4 in the EIA Regulation, as amended
Specific comments You are requested to submit the application form signed by both the Environmental Assessment Practitioner (EAP) and the Applicant. The application form must be submitted with the final SR.	WSP confirm that a signed amended application form will be submitted with the FSR

COMMENT	RESPONSE
General You are further reminded to comply with Regulation 21(1) of the NEMA EIA Regulations 2014, as amended, which states that: *"If S&EIR must be applied to an application, the applicant must, within 44 days of receipt of the application by the competent authority, submit to the competent authority a scoping report which has been subjected to a public participation process of at least 30 days and which reflects the incorporation of comments received, including any comments of the competent authority"*	WSP confirms that the FSR will be submitted to the DFFE within 44 days of the receipt of the application, in line with the regulated timeframes.
You are further reminded that the final SR to be submitted to this Department must comply with all the requirements in terms of the scope of assessment and content of Scoping report in accordance with Appendix 2 and Regulation 21(1) of the EIA Regulations 2014, as amended.	WSP confirm that the FSR complies with all the requirements in terms of the scope of assessment and content of Scoping report in accordance with Appendix 2 and Regulation 21(1) of the EIA Regulations 2014, as amended. Please refer to Table 1-5 of the final Scoping Report for the checklist against the regulatory requirements.
Further note that in terms of Regulation 45 of the EIA Regulations 2014, as amended, this application will lapse if the applicant fails to meet any of the timeframes prescribed in terms of these Regulations, unless an extension has been granted in terms of Regulation 3(7).	WSP notes that the application will lapse if the applicant fails to meet any of the timeframes prescribed in terms of these Regulations.
You are hereby reminded of Section 24F of the National Environmental Management Act, Act No. 107 of 1998, as amended, that no activity may commence prior to an Environmental Authorisation being granted by the Department.	WSP and the Applicant take note of this reminder.
Provide a detailed description of all limitations to the studies. All specialist studies must be conducted in the right season and providing that as a limitation will not be allowed.	All relevant specialist assumptions and limitations have been included Section 1.6. These will be updated as required during the EIA Phase.

Table 3.2: Comments received from the DFFE regarding the FSR

COMMENT	RESPONSE
Listed Activities There are discrepancies identified regarding to the listed activities and sub-activities as well as the description of the activities in the application form and FSR that really need to be addressed. In the comments dated 25 March 2022, you were advised to ensure that only relevant listed activities are applied for, are specific and can be linked to the development activity or infrastructures as described in the project description. This is the responsibility of the EAP to ensure only relevant information is included in the report. Please ensure the EIAr reflect only listed activities and sub-activities applied for.	The Listed Activities captured in the FSR and amended Application Form were as set out in the relevant Listing Notices. However, based on this comment, these have been further evaluated and updated accordingly. It can be confirmed that only the applicable activities and sub-activities have been included in the draft EIR and amended Application Form, to ensure that the relevant sub-activities triggered by the project are applied for. Please refer to Section 2.1 of the draft EIR for the updated description of the activities and sub-activities applicable to the proposed development.
It is noted that on activity 11 of Listing Notice 1, the capacity of the onsite substation, including cabling (buried or overhead) will be between 33kV and 132kV. Please ensure that the exact	It is important to note that a detailed project description, particularly exact specifications of the project components will be based on the approved scope of EPC Contractor. and cannot be determined at this stage. It has been confirmed by

COMMENT	RESPONSE
capacity of the proposed onsite substation is clarified in the EIA phase.	the Proponent that the capacity of the on-site substation will be 33/132 kV. A condition to this effect has been incorporated into the EMPr for consideration during final design phase and site establishment.
For activity 12 of Listing Notice 1, you are required to provide the total footprint of the proposed infrastructure in square meters.	WSP can confirm that the total physical footprint has been provided in square metres as required and has been updated accordingly in the relevant Listed Activity contained in Section 2.1 as well as the amended Application Form.
On the comments of the draft SR dated 22 March 2022, bullet number 1 (Listed Activities) you were requested to assess the environmental impacts and provide mitigation measures of fuel, cement and chemical storage. In your response (Appendix G), dated April 2022 you indicated that the environmental impacts of fuel, cement and chemical storage will be fully assessed during the EIA phase and mitigation measures will be provided in the EMPr. Please ensure that the above is adhere with.	WSP can confirm that the risks associated with the storage and handling of hazardous materials/dangerous goods have been assessed through a Qualitative Risk Assessment undertaken as part of the EIA phase for this project. The Risk Assessment provides detailed preventative and mitigation measures for potential impacts associated with dangerous goods. Furthermore, the EMPr (included in Appendix I of the draft EIR) identifies anticipated impacts associated with hazardous materials and recommends relevant mitigation and management measures.
In activity 24 of Listing Notice 1, it is noted that the internal access road required by the facility will be between 5m and 8m. It is unclear whether this activity is listed or not, since the relevant listed activity require the width of the road to be wider than 8 metres and the exact values will be confirmed once final designs have been provided. Please clarify?	Please note the FSR indicated that Internal access roads required by the Facility will be between 5m and 8m wide, and approximately 8km in length. Where required for turning circle/bypass areas, however, access or internal roads may be up to 20m to allow for larger component transport. The exact values will be confirmed once final designs have been provided, but they will not exceed 20 m.
It is noted that for activity 23 of Listing Notice 3, in the initial application form included the threshold. However, the updated application form does not include the threshold (i.e. exceed 10m²), you are advised to provide updated information in the EIA Phase and ensure that the application form is updated/amended as well.	WSP can confirm that the total physical footprint has been provided in square metres as required and has been updated accordingly in the relevant Listed Activity contained in Section 2.1 as well as the amended Application Form.
Please ensure that all relevant listed activities are applied for, are specific and can be linked to the development activity or infrastructure as described in the project description. In addition, the onus is thus on the applicant and the environmental assessment practitioner (EAP) to ensure that all the applicable listed activities are included in the application. Failure to do so may result in unnecessary delays in the processing of the application.	The listed activities applied for have been further revised in the draft EIR to ensure that only applicable activities and sub-activities have been applied for. Furthermore, the descriptions of applicability have been updated and are specific (where possible) and have been linked to the development activity or infrastructure as described in the project description. Please refer to Section 2.1 of the draft EIR for the updated description of the proposed project to which the applicable listed activity relates.
If the activities applied for in the application form differ from those mentioned in the final EIAr, an amended application form must be submitted. Please note that the Department's application form template has been amended and can be downloaded from the following link https://www.environment.gov.za/documents/forms	The listed activities initially applied for have been further revised in the draft EIR to ensure that only applicable activities and sub-activities have been applied for. WSP can confirm that an amended Application Form has been submitted as the activity applicability descriptions have been updated as requested in these comments. WSP can confirm that the most recent application form template has been utilised.

COMMENT	RESPONSE
Project Description It is noted that the project description in the application form and FSR are not the same. For instance, page 7 of the application form included the following components "Fencing and lighting, Lightning protection, Telecommunication infrastructure, Storm water channels, Water pipelines, Offices, Operational control centre, Operation and Maintenance Area / Warehouse / workshop, Ablution facilities, a gate house, Control centre, offices, warehouses, Security building, a visitor's centre; and Substation building", whereas the FSR does not includes the components. Please ensure that the project description in the application and draft EIAr (including the final EIAr) are the same prior submitting to the CA for consideration.	WSP can confirm that an amended Application Form has been submitted as the project description has been updated as requested in these comments.
It is noted that listed activity 14 of Listing Notice 1 and activity 10 of Listing Notice 3 are applied for as it relates to the infrastructure for the storage and handling of dangerous goods, in which fuel, transformer oil, cement and chemical storage onsite will be greater than 80m³ but not exceeding 500m³. However, section 5 of the application form on page 6 of 36 does not provide any description of the infrastructure for the storage and handling of dangerous goods. As such, you are requested to provide the exact type and capacity of the dangerous goods applicable to the proposed development.	Please note that based on the comments on the FSR, the listed activities initially applied for have been reviewed. With regards to the description of infrastructure on the Application Form, additional text to this effect has been included in Section 5 of the Application Form, as well as in section 6.3 of the draft EIR. It is important to note that a detailed project description, particularly exact specifications of the project components will be based on the approved scope of EPC Contractor. and cannot be determined at this stage. It has been confirmed by the Proponent that the total combined storage capacity on site will not exceed 500 m^3. A condition to this effect has been incorporated into the EMPr for consideration during final design phase and site establishment.
BESS Alternative Page 31 of the FSR indicated, "It is proposed that Lithium Battery Technologies, such as Lithium Iron Phosphate, Lithium Nickel Manganese Cobalt oxides or Vanadium Redox flow technologies will be considered as the preferred battery technology however the specific technology will only be determined following Engineering, Procurement, and Construction (EPC) procurement". Please ensure that the final EIAr indicate the preferred BESS technology and the assessment of the risk associated with the preferred technology and indicate how impacts will be minimised.	The Proponent is considering two types of preferred battery technologies for the BESS. These are Vanadium Redox flow technologies and Lithium battery technologies. WSP can confirm that the risks and/or impacts associated with the two technologies being considered have been assessed through a Qualitative Risk Assessment undertaken as part of the EIA phase for this project. The Risk Assessment provides detailed preventative and mitigation measures for potential impacts associated with each preferred technology. The Qualitative Risk Assessment is included in **Appendix H-15** of the draft EIR. All mitigation measures recommended in the various Specialist studies for this project, including those applicable to the BESS, have been incorporated into the EMPr (included in Appendix I of the draft EIR). Both BESS technologies were assessed and no fatal flaws were identified. However, the SSL technology is preferred.
Public Participation Please ensure that all issues raised, and comments received during the circulation of the SR from registered I&APs and organs of state (including this Department's Biodiversity and Protected Areas Section), which have jurisdiction in respect of	WSP can confirm that all issues raised and comments received during the circulation of the DSR and draft EIR, as well as those received on the FSR, from registered I&APs and organs of state (including those mentioned in this comment) have been and will be included in the final EIR and adequately addressed and responded to.

COMMENT	RESPONSE
the proposed activity are adequately addressed in the final EIAr.	
Proof of correspondence with the various stakeholders must be included in the final EIAr. Should you be unable to obtain comments, proof should be submitted to the Department of the attempts that were made to obtain comments.	Proof of correspondence with the various stakeholders is included in Appendix B and Appendix D of the SER and will be included in the final EIR.
The Public Participation Process must be conducted in terms of Regulations 39, 40, 41, 42, 43 & 44 of the EIA Regulations 2014, as amended.	WSP confirm that the Public Participation Process is being conducted in terms of Regulations 39, 40, 41, 42, 43 & 44 of the EIA Regulations 2014, as amended.
A comments and response trail report (C&R) must be submitted with the final EIAr. The C&R report must incorporate all historical comments for this development. The C&R report must be a separate document from the main report.	WSP can confirm that all issues raised and comments received during the circulation of the draft SR from registered I&APs and organs of state have been included in a comment of response report included in Section 2.3 of the SER. WSP can confirm that the SER will also be submitted as a separate report.
Please refrain from summarising comments made by I&APs. All comments from I&APs must be copied verbatim and responded to clearly. Please note that a response such as “Noted” is not regarded as an adequate response to I&AP’s comments.	WSP confirm that all comments from I&APs have been copied verbatim and responded to clearly. Furthermore the response “Noted” has not been utilised.
The final EIAr must provide evidence that all identified and relevant competent authorities have been given an opportunity to comment on the proposed development particularly the Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs (MDARDLEA, Mpumalanga Tourism and Parks Agency (MTPA), Langcarel Private Nature Reserve, South African Heritage Resources Agency (SAHRA) and the District and Local Municipalities.	WSP can confirm that final EIR will provide evidence that all identified and relevant authorities have been given an opportunity to comment on the proposed development including Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs (MDARDLEA), Mpumalanga Tourism and Parks Agency (MTPA), Langcarel Private Nature Reserve (via the respective landowner), South African Heritage Resources Agency (SAHRA), the District and Local Municipalities.
Layout & Sensitivity Maps A copy of the layout and environmental sensitivity map must be submitted with the final EIAr and all available biodiversity information must be used in the finalisation of these maps.	A conceptual layout map (Scoping Phase), as well as the optimised/revised layout map (EIA Phase) have been included in the draft EIR. This layout map will be updated as required in the final EIR phase. A revised layout and environmental sensitivity map are included in Figure 6.2 and Figure 10.17 respectfully of the draft EIR.
The layout map must indicate the following: ➢ Positions of the facility and all associated infrastructure; ➢ All supporting onsite infrastructure e.g. roads (existing and proposed); ➢ Permanent laydown area footprint; ➢ Substation(s) and/or transformer(s) sites including their entire footprint; ➢ Proposed infrastructure related to the proposed development; ➢ Connection routes (including pylon positions) to the distribution/transmission network; and ➢ All existing infrastructure on the site	The revised layout and environmental sensitivity map are included in Figure 6.2 and Figure 10.15 respectfully of the draft EIR, and includes all the relevant detail as required in this comment. Please note that corridors have been included for the connection routes as pylon positions will only be confirmed subject to micro-siting and final design.

COMMENT	RESPONSE
The environmental sensitivity map must indicate the following: ➢ The location of sensitive environmental features on site e.g. CBAs, heritage sites, wetlands, drainage lines etc. that will be affected; ➢ Buffer areas; i.e., 1km of the Protected Area, etc, and ➢ All "no-go" areas.	A consolidated environmental sensitivity map has been compiled based on the sensitivities and buffers outlined in the relevant specialist studies. Please refer to Figure 10-15 of the draft EIR for the relevant sensitivity map.
The above layout map must have a clear legend with information communicating with that on the map, be overlain with the sensitivity map which shows neighboring energy developments and existing grid infrastructure.	WSP can confirm that both the layout and sensitivity map have clear legends. Furthermore, both maps include the relevant requested information.
Habitat sensitivity of the study area, including CBAs, with the Solar PV and avifaunal sensitivities as depicted respectively in Figure 5-22 (page 107) and 5-23 (page 116) of the FSR must be considered in the layout map. This must consider the buffer zone of the sensitive area as well.	An environmental sensitivity map (**Figure 10.17**) has been included in the Draft EIR.
It has been mentioned that development layout map will be confirmed in the EIA phase. Please ensure it considers the buffers of the sensitive areas.	The Proponent has revised the project layout based on findings and input in terms of sensitivity and associated buffer recommendations from the relevant Specialists during Scoping phase. Detailed maps indicating the revised layout and sensitivity are included in Figure 6.2 and Figure 10.15 respectfully of the draft EIR.
The colors used on page 129 (Figure 5-28) of the FSR, the Site Layout overlain onto a Preliminary Consolidated Environmental Sensitivity Map, are very similar, making it difficult to differentiate between High and medium high as well as medium- low and medium. Please ensure that different colours are used instead of similar colours.	The colours on the environmental sensitivity map (Figure 10.15 have been amended.
Specialist assessments The following Specialist Assessments will form part of the EIAr: ➢ Soils and Agricultural Potential Assessment; ➢ Archaeological and Cultural Heritage Assessment; ➢ Palaeontology Impact Assessment; ➢ Visual Impact Assessment; ➢ Biodiversity Impact Assessment (inclusive of terrestrial biodiversity, plant species and animal species); ➢ Freshwater Assessment; ➢ Avifauna Impact Assessment; ➢ Social Impact Assessment; ➢ Qualitative Risk Assessment (specific to the BESS); ➢ Desktop Geotechnical Assessment; and ➢ Desktop Traffic Assessment.	WSP can confirm that the Specialist Assessments, as outlined in this comment, have been included as part of the EIR. Please refer to Appendix H of the EIR for the relevant Specialist Reports.
It is further brought to your attention that Procedures for the Assessment and Minimum Criteria for Reporting on identified Environmental Themes (as per the Screening Report), which were promulgated in Government Notice No. 320 of 20 March 2020 and in Government Notice No. 1150 of 30 October 2020 (i.e. "the Protocols"), have come into effect. Please note that	WSP can confirm that all applicable Specialist Assessments were conducted in line with the Procedures for the Assessment and Minimum Criteria for Reporting on identified Environmental Themes (as per the Screening Report), which were promulgated in Government Notice

COMMENT	RESPONSE
specialist assessments must be conducted in accordance with the requirements of these protocols. For instance, Radio Frequency Interference (RFI) Theme is rated as high and Landscape sensitivities is rated as very high by the screening report dated 14 September 2021 this study is not included in the studies to be undertaken in the EIA phase.	No. 320 of 20 March 2020 and in Government Notice No. 1150 of 30 October 2020 (i.e. "the Protocols"). The South African Weather Service (SAWS) was consulted regarding the confirmation of any Radio Frequency Interference impact of the planned Camden I SEF. SAWS confirmed that there is no impact to their infrastructure or its operation and therefore has no objection to the planned SEF. The landscape study is covered under the Visual Impact Assessment (Appendix H-12).
The EAP must ensure that the terms of reference for all the identified specialist studies must include the following:	WSP can confirm that the specialist studies have been undertaken in line with Appendix 6 of the 2014 EIA Regulations, as amended, or, where relevant, in line with the gazetted specialist protocols of GNR 320 and GNR 1150. All specialist studies include a detailed description of the methodologies, project infrastructure descriptions and locations and recommendations for authorisations.
A detailed description of the study's methodology; indication of the locations and descriptions of the development footprint, and all other associated infrastructures that they have assessed and are recommending for authorisation.	
Provide a detailed description of all limitations to the studies. All specialist studies must be conducted in the right season and providing that as a limitation will not be allowed.	All specialist assessments include applicable limitations to the studies, as well as the timing/season of the field survey, where applicable, and relevance thereof to the studies/assessments.
Please note that the Department considers a 'no-go' area, as an area where no development of any infrastructure is allowed; therefore, no development of associated infrastructure including access roads is allowed in the 'no-go' areas.	WSP acknowledge the DFFE's definition of 'No-go' areas. The relevant specialist assessments have indicated 'No-go' areas, as well as areas where it is suitable for linear infrastructure (water pipelines, roads, powerline infrastructure etc.) to traverse a no-go area where required. Where specialist deviations or qualifications are applicable, these have been noted in Section 10. 1.
Should the specialist definition of 'no-go' area differ from the Department's definition; this must be clearly indicated. The specialist must also indicate the 'no-go' area's buffer if applicable.	
All specialist studies must be final, and provide detailed/practical mitigation measures for the preferred alternative and recommendations, and must not recommend further studies to be completed post EA.	All specialist studies conducted have been included in Appendix H of the EIR. The Specialist studies include detailed mitigation measures to prevent or avoid adverse impacts on the receiving environment, which have been incorporated into the EIR and EMPr. The Specialist recommendations and conclusions are included in Section 10.3 of the draft EIR. There are no recommendations or requirements from the Specialists to conduct further studies post EA. The Terrestrial Biodiversity Specialist has recommended a walk-through survey of footprint areas prior to the commencement of construction. The Avifauna Specialist has also recommended a pre-construction inspection (avifaunal walk-through) to identify SCC that may be breeding within the infrastructure footprints.
Should a specialist recommend specific mitigation measures, these must be clearly indicated.	All specific mitigation measures, will be clearly indicated and included in the EMPr during the EIA Phase.
Should the appointed specialists specify contradicting recommendations, the EAP must clearly indicate the most reasonable recommendation and substantiate this with defendable reasons; and were necessary, include further expertise advice.	The specialists have not specified contradicting recommendations. All recommendations are aligned and are considered practical and able to be implemented.

COMMENT	RESPONSE
It has been noted that the conclusions by the Terrestrial Ecological specialist on page 53 with the use of the word “may” and the Aquatic specialist on page 30 indicating that “once the layout design has been finalised, the EIA phase of the assessment will continue” indicate that at this stage adequate assessment has not been undertaken and the area is not suitable for the proposed development. Therefore, ensure detailed assessment is undertaken and submitted in the final report.	This comment is noted and relates to the Specialist inputs (reports) for the Scoping Phase of the proposed SEF project. Once the FSR was approved the proposed SEF project proceeded into a detailed EIA phase which involved detailed specialist assessments. WSP can confirm that detailed assessments (including terrestrial biodiversity and aquatic assessments) have been undertaken during the EIA Phase of the proposed SEF and the specialist assessments area included the draft EIR.
According to information contained on page 91 to 93 of the FSR, the aquatic environment for the study area has a High Sensitivity due to presence of Wetlands (as depicted on figure 5-13), Critical Biodiversity Areas (CBA) (as depicted on figure 5-15), Freshwater Ecosystem Priority Areas (FEPA) (as depicted on figure 5-14), therefore, you are required to indicate the impacts on the area by the proposed development as well as their mitigation measures.	The impact on the aquatic environment has been assessed in the Draft EIR (Section 8.6) and mitigation measures proposed by the specialist have been included.
Page 98 of the FSR indicated that the location of the proposed development is situated in an area with Eastern Highveld Grassland, Eastern Temperate Freshwater Wetlands and Chrissiesmeer Panveld, all three ecosystems of which are listed in the National List of Ecosystems that are threatened and in need of Protection (GNR 1002 of 9 December 2011), and subsequently listed in terms of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004). In addition, Figure 8 in the Terrestrial assessment report shows that the proposed development will occur within PA National Park and Nature Reserves. Therefore, you are required to explain why the site is considered suitable for the proposed development and specialists’ findings must be considered while addressing this issue.	It should be noted that even though the development is located within the vulnerable Eastern Highveld Grassland, the conditions on site are not considered pristine. The proposed development area is largely utilised for agricultural activities with large portions being cultivated, and others subject to cattle grazing. Section 2.6 of the FSR outlines the need and desirability of the project which includes the benefits of the location close to the Camden Power Station and ash dump including other collieries in the area, which has been listed for decommissioning in the coming years. The location of the development will also allow for the use of the existing power transmission infrastructure that would otherwise become defunct post decommissioning. According to the Terrestrial Biodiversity Assessment, the proposed layout for solar panels has a moderately small footprint area relative to the entire cluster of projects. Those natural areas that are affected are generally in relatively poor condition due to overgrazing. It has been calculated here that if all infrastructure components are placed within natural areas (worst-case scenario) then it affects a total of 117 hectares of natural habitat of a total of 3222 hectares of natural habitat on the site of the entire cluster of projects (approximately 3.5%). The solar project therefore potentially has a very small footprint area which results in a limited spatial impact. Furthermore, in terms of the assessed terrestrial impacts, the extent of the impact on the loss of indigenous natural vegetation is negligible. On this basis, the Ecological specialist deems the project as acceptable from a terrestrial biodiversity perspective and recommends that Environmental Authorisation is granted. It is important to note that further investigation and engagement with the MTPA regarding the Langcarel Private Nature Reserve has been conducted. The MTPA have furthermore confirmed

COMMENT	RESPONSE
	their intent to de-proclaim the nature reserve and the process is currently in the early stages.
Cumulative Impact Assessment The cumulative impacts of the proposed development must be undertaken as per the requirements of the EIA Regulations.	In assessing the cumulative impacts of the proposed Camden I SEF, renewable energy projects within a 30km radius of the proposed project, that have received an EA or have a Basic Assessment (BA) or EIA process in progress have been considered. Through the use of the DFFE web-based environmental screening tool as well as the Environmental Geographical Information System (E-GIS), WSP have confirmed that there are no similar projects within 30km radius of the development to date. Therefore, with the exception of the other proposed Camden developments forming part of the Camden Renewable Energy Complex, no other renewable energy projects within a 30km radius have been considered in this S&EIA process. Please refer to Section 9 of the EIR for the assessment of the cumulative impacts associated with the proposed development. The specialists assessments also include a detailed assessment of the identified cumulative impacts associated with the proposed Camden I SEF, as detailed in the relevant specialist reports.
Issues regarding S50 approval in terms of NEM: PAA In terms of the listed activities applied for as well as on Figure 8 on page 29 of the Terrestrial assessment report, it has been confirmed that the site falls within the a protected area identified in terms of NEMPAA. Hence, in the comments dated 25 March 2022, you were advised to obtain approval in terms of S50 of NEM: PAA to be submitted with the FSR, considering that Section 50 (5) of NEM: PAA says that "no development, construction or farming may not be permitted in a nature reserve without written approval of the management authority". Therefore, you are advised to obtain approval to be submitted with the final report.	At the time of lodging the Application for EA together with the DSR submission, the Landowner of the project properties declared as Private Nature Reserve (Langcarel Nature Reserve) was not aware of the Protected Area status of the properties. In addition, the Terrestrial Biodiversity Report did not confirm the proclamation status of the Nature Reserve. However, comments received on the DSR from the Mpumalanga Tourism and Parks Agency (MTPA) confirmed the gazetting of the Langcarel Nature Reserve. Furthermore, discussions with the DFFE Protected Areas Directorate, the Management Authority (Landowner) of the area declared as a Private Nature Reserve, as well as the MTPA were undertaken in confirming the validity of the Protected Area, as well as the requirements of approval in terms of Section 50 of NEMP:AA. It is important to note that the Project Proponent is engaging with the MTPA and the Management Authority (Landowner/s) to investigate the best way forward regarding the Langcarel Nature Reserve. The MTPA has undertaken a site visit on 01 June 2022. The MTPA has submitted a letter to the Department (letter dated, 20 June 2022) of the intent to issue a notice to withdraw the declaration of the Langcarel Private Nature Reserve in terms of the Mpumalanga Nature Conservation Act (Act No. 10 of 1998). Available information on the Nature Reserve (i.e., de-proclamation or removal of Nature Reserve status) will be submitted to the Department once available, possibly together with the FEIR
During the meeting held on 31 March 2022, you indicated that the landowner is not aware that the site is located within the Nature Reserves, notwithstanding the concerns raised even by	At the time of lodging the Application for EA together with the DSR submission, the Landowner of the project properties declared as Private Nature Reserve (Langcarel

COMMENT	RESPONSE
various specialists e.g. Visual Impact Specialist on page 61: “One formal protected area (Langcarel Private Nature Reserve) was identified within the study area, although there is some doubt as to the present status of this nature reserve”. The MTPA also mentioned in their comments dated 25 March 2022, that the site is located within the Nature Reserve, therefore, it is your responsibility (as an EAP on behalf of the Applicant) to determine whether the site falls within the Nature Reserve or not. You were further advised (by DFFE: Protected Area officials) that comments from MTPA would not be disregarded, therefore, this matter must be addressed accordingly prior submission of the EIA report.	Nature Reserve) was not aware of the Protected Area status of the properties. In addition, the Terrestrial Biodiversity Report did not confirm the proclamation status of the Nature Reserve. However, comments received on the DSR from the Mpumalanga Tourism and Parks Agency (MTPA) confirmed the gazetting of the Langcarel Nature Reserve. Furthermore, discussions with the DFFE Protected Areas Directorate, the Management Authority (Landowner) of the area declared as a Private Nature Reserve, as well as the MTPA were undertaken in confirming the validity of the Protected Area, as well as the requirements of approval in terms of Section 50 of NEMP:AA. It is important to note that the Project Proponent is engaging with the MTPA and the Management Authority (Landowner/s) to investigate the best way forward regarding the Langcarel Nature Reserve. The MTPA has undertaken a site visit on 01 June 2022. The MTPA has submitted a letter to the Department (letter dated, 20 June 2022) of the intent to issue a notice to withdraw the declaration of the Langcarel Private Nature Reserve in terms of the Mpumalanga Nature Conservation Act (Act No. 10 of 1998). Available information on the Nature Reserve (i.e., de-proclamation or removal of Nature Reserve status) will be submitted to the Department once available, possibly together with the FEIR
You further indicated when describing why listed activities are triggered, that the facility is located within a protected area identified in terms of NEMPAA and within 5km of Portion 1 of Farm No. 322 (Welgelegen), which is declared Private Nature Reserve (Langcarel Private Nature Reserve) under the Game Ordinance, 1949 (No. 23 of 1949) and the Native Flora Protection Ordinance, 1940 (No. 9 of 1940). As such, you are required to provide proof that the site is not located within the Nature Reserve or affected by such.	
Considering that the gazette dated 15 February 1967 (Gazette No 3256) confirmed that the area falls within the Nature Reserve, this shows that detailed investigation was not undertaken by the EAP on behalf of the Applicant, confirming that the site falls within the Nature Reserve.	
Environmental Management Programme (EMPr) Ensure that generic EMPr is submitted for the management of impacts of the infrastructure related to the transmission and distribution of energy	The generic EMPr for the development and expansion for overhead electricity transmission and distribution infrastructure has been included for the Camden I SEF powerlines; and the Development and Expansion of Substation Infrastructure for the Transmission and Distribution of Electricity, and overhead powerline infrastructure has been included for the Camden I SEF onsite substation. Please refer to Appendix D and Appendix E of the EMPr (Appendix I).
A construction and operational phase EMPr that includes mitigation and monitoring measures must be submitted with the final EIAr for the facility.	WSP confirm that the EMPr includes mitigation and monitoring measures specific to construction and operational phases in compliance with this requirement.
Additional Information Should there be a similar project in a close proximity, in terms of Appendix 2 (1) (h) (k) of the NEMA EIA Regulations 2014, as amended, you are required to provide information on the potential wake effects of the proposed development.	Through the use of the DFFE web-based environmental screening tool as well as the Environmental Geographical Information System (E-GIS), WSP have confirmed that there are no similar projects within 30km radius of the development to date. Furthermore, wake effect refers to wind energy. This application is for a Solar PV Facility.
General The applicant is hereby reminded to comply with the requirements of Regulation 45 of GN R982 of 04 December 2014, as amended, regarding the time allowed for complying with the requirements of the Regulations.	The reminder to meet timeframes stipulated Regulation 45 of GN R982 of 04 December 2014, as amended, is noted. An extension request, in terms of the provision within EIA Regulation 3(7), has been submitted to the Department and subsequently approved for extension to the submission

COMMENT	RESPONSE
	deadline of the FEIR by 60 days. The final EIR is due to the DFFE by 02 November 2022.
You are hereby reminded of Section 24F of the National Environmental Management Act, Act No. 107 of 1998, as amended, that no activity may commence prior to an environmental authorisation being granted by the Department.	WSP and the Applicant take note of this reminder.

3.3 STAKEHOLDER CONSULTATION

Stakeholders were identified and will continue to be identified through several mechanisms. These include:

— Utilising existing databases from other projects in the area;
— Networking with local business owners, non-governmental agencies, community based organisations, and local council representatives;
— Field work in and around the project area;
— Advertising in the press;
— Placement of community notices;
— Completed comment sheets; and
— Attendance registers at meetings.

All Stakeholders identified to date have been registered on the project stakeholder database. The EAP endeavoured to ensure that individuals/organisations from referrals and networking were notified of the Proposed Project. Stakeholders were identified at the horizontal (geographical) and vertical extent (organisations level).

A list of stakeholders captured in the project database is included in **Appendix A** of the SER (**Appendix D**).

Table 3.3 provides a breakdown of stakeholders currently registered on the database while **Figure 3.1** illustrates the number of stakeholders per representative sector.

Table 3.3: Breakdown of Stakeholders currently registered on the database

REPRESENTATIVE SECTOR	FURTHER EXPLANATION	NO. STAKEHOLDERS
Government Departments	All tiers of government, namely, national, provincial, local government and parastatal organisations including: — Department of Mineral Resources and Energy (DMRE); — DFFE: Biodiversity and Conservation; — DFFE: Protected Areas; — Mpumalanga Department Agriculture, Rural Development, Land and Environmental Affairs (MDARDLEA); — Department of Water and Sanitation (DWS); — Vaal Water Management Area (WMA) Authority; — South African Heritage Resource Agency (SAHRA); — Mpumalanga Heritage Resources Authority (MHRA); — Mpumalanga Tourism and Parks Agency (MTPA); — Civil Aviation Authority (CAA); — Air Traffic and Navigation Services (ATNS);	84

REPRESENTATIVE SECTOR	FURTHER EXPLANATION	NO. STAKEHOLDERS
	— Department of Defence (SA Army) (DD); — Astronomy Management Authority (AMA); — South African Weather Services (SAWS); — South African National Roads Agency Limited (SANRAL); — Gert Sibande District Municipality; — Msukaligwa Local Municipality; and — Dr Pixley Ka Seme Local Municipality	
Business and consultants	Local and neighbouring businesses in the area. Representatives of consulting organisations that provide services in the area. Prospecting/Mineral rights holders within the broader project area which may have an interest in the development. These include: — Langcarel (Pty) Ltd (Mooiplaats Colliery) MC Mining — ANKER COAL — Exxaro Coal Mpumalanga — South 32 — KANGRA COAL — Hoyohoyo Mining (Pty) Ltd — Bulemin Resources	21
Non-governmental organisations (NGOs) and community based organisations	Agricultural unions, churches, and environmental NGOs	24
General public	Local communities, farmers, and other such individuals who may have an interest in the project	5

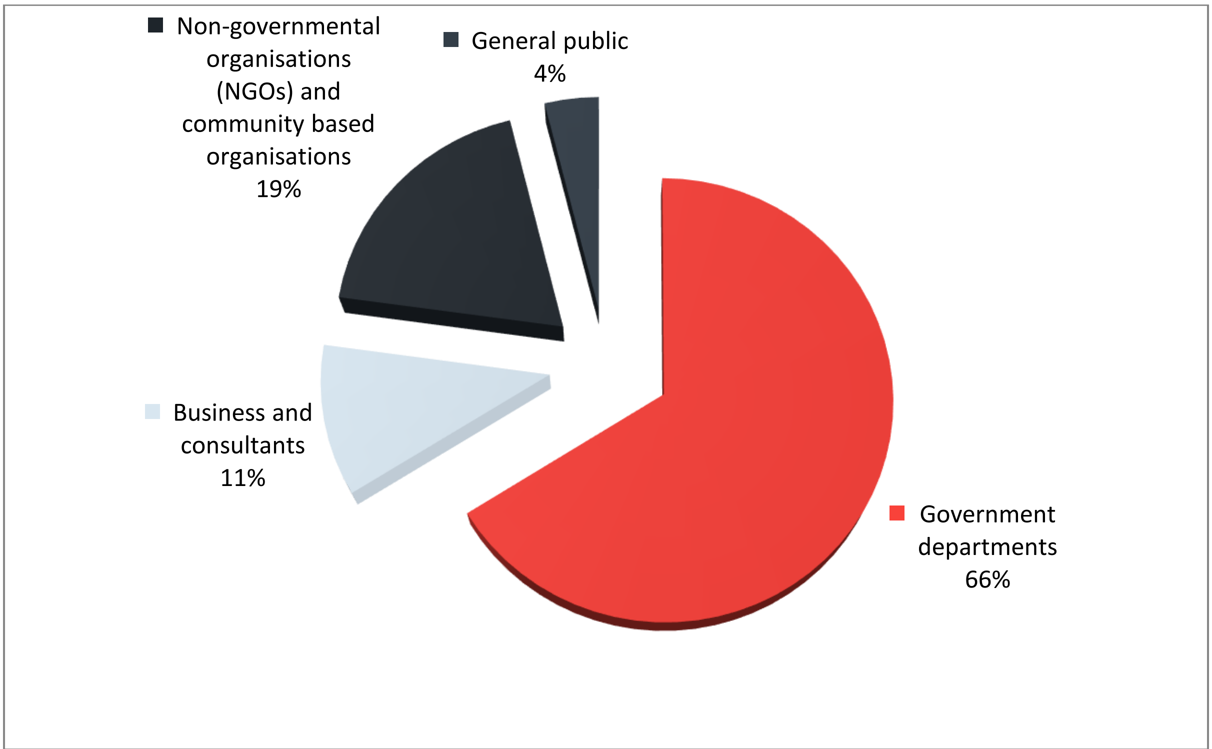


Figure 3.1: Pie chart showing the breakdown of the stakeholder currently registered on the database

All concerns, comments, viewpoints and questions (collectively referred to as 'issues') received to date have been documented and responded to in a Comment and Response Report included in **Appendix H**. The following key issues were highlighted during the scoping phase:

— Job creation for local residents; and
— Impacts on the biodiversity of the area with specific reference to Critical Biodiversity Areas and Langcarel Private Nature Reserve.

3.3.1 STAKEHOLDER NOTIFICATION

DIRECT NOTIFICATION

Notification of the proposed Project was issued to potential Stakeholders, via direct correspondence (i.e., site notices and e-mail) on **25 February 2022**. The notification letter circulated is included in **Appendix B-3** of the SER (**Appendix D**). Proof of notification is included in the SER (i.e. **Appendix D**).

NEWSPAPER ADVERTISEMENTS

In accordance with the requirements of GNR 982, as amended, the proposed project was advertised in two local newspapers. The purpose of the advertisement was to notify the public about the proposed project and to invite them to register as stakeholders. A copy of the advertisements are included in **Appendix B-1** of the SER (**Appendix D)**. The relevant scoping phase advertisement dates are listed in **Table 3.4**.

Table 3.4: Dates on which the Adverts were published

NEWSPAPER	PUBLICATION DATE	LANGUAGE
Standerton Advertiser	25 February 2022	English and Zulu

Highvelder	25 February 2022	Afrikaans

SITE NOTICES

The official site notices were erected as per GNR 982, as amended, on the boundary fence of the proposed site. In addition, general project notices, announcing the Proposed Project and inviting stakeholders to register, were be placed at various locations in and around the project area. A copy of the site notice is included in **Appendix B-2** of the SER (**Appendix D**).

3.4 SCOPING STUDY FINDINGS

The scoping phase identified a number of impacts associated with the proposed Camden I SEF. The findings of the preliminary significance ratings undertaken during the scoping phase for the construction phase and operational phase are included in **Table 3.5** and **Table 3.6**, respectfully.

Table 3.5: Construction Phase Impacts

ASPECT	IMPACT	NATURE	PROBABILITY	CONSEQUENCE	SIGNIFICANCE (BEFORE MITIGATION)	FURTHER ASSESSMENT REQUIRED
Air Quality	Dust Emissions	Negative	3	1	**Low**	**No**
Topography, & Geology	Constructability	Negative	3	1	**Low**	**No**
Soils, Land Capability and Agricultural Potential	Loss of agricultural potential by soil degradation	Negative	4	3	**High**	**Yes**
	Loss of agricultural potential by occupation of land	Negative	4	3	**High**	
Surface water	Loss of aquatic species of special concern	Negative	3	3	**Medium**	**Yes**
	Damage or loss of riparian and wetlands systems and disturbance of the waterbodies during construction	Negative	3	3	**Medium**	
	Potential impact on localised surface water quality	Negative	3	3	**Medium**	
	Impact on habitat change and fragmentation related to hydrological regime changes	Negative	3	3	**Medium**	

ASPECT	IMPACT	NATURE	PROBABILITY	CONSEQUENCE	SIGNIFICANCE (BEFORE MITIGATION)	FURTHER ASSESSMENT REQUIRED
Groundwater	Ground Contamination	Negative	3	1	**Low**	**No**
Hazardous Substances and Pollutants	Soil, groundwater and surface water contamination	Negative	3	3	**Medium**	**No**
Waste Generation	Generation of General Waste	Negative	3	2	**Medium**	**No**
	Generation of Hazardous Waste	Negative	3	2	**Medium**	
	Sanitation Waste	Negative	3	2	**Medium**	
Biodiversity	Loss and Fragmentation of Vegetation and Habitat	Negative	4	3	**High**	**Yes**
	Impacts on CBAs and broad-scale ecological processes	Negative	4	3	**High**	
	Loss and Displacement of Fauna	Negative	4	3	**High**	
	Proliferation of alien invasive plant species	Negative	4	3	**High**	
Avifauna	Displacement due to disturbance during the Construction Phase	Negative	4	3	**High**	**Yes**
	Displacement of priority species due to habitat transformation	Negative	3	3	**Medium**	
Visual and Landscape	Potential visual intrusion resulting from large construction vehicles and equipment	Negative	3	2	**Medium**	**Yes**
	Potential visual effect of construction laydown areas and material stockpiles.	Negative	3	2	**Medium**	

ASPECT	IMPACT	NATURE	PROBABILITY	CONSEQUENCE	SIGNIFICANCE (BEFORE MITIGATION)	FURTHER ASSESSMENT REQUIRED
	Potential impacts of increased dust emissions from construction activities and related traffic	Negative	3	2	**Medium**	
	Potential visual scarring of the landscape as a result of site clearance and earthworks	Negative	3	2	**Medium**	
	Potential visual pollution resulting from littering on the construction site	Negative	3	1	**Low**	
Heritage and Cultural Resources	Disturbance to known Cultural Resources	Negative	3	2	**Medium**	**Yes**
	Chance Find of Cultural Resources	Negative	3	2	**Medium**	
Palaeontology	Chance Find of Palaeontological resources	Negative	3	2	**Medium**	**Yes**
Traffic	Increased traffic generation around the study area by construction vehicles	Negative	3	1	**Low**	**Yes**
	Deterioration of the surrounding road network due to an increase of traffic around the site	Negative	3	2	**Medium**	
	Transportation of abnormal loads during the construction phase	Negative	4	1	**Medium**	
Socio-Economic	Creation of local employment, training, and business opportunities	Positive	2	3	**Medium**	**Yes**
	Impact of construction workers on local communities	Negative	3	3	**Medium**	
	Influx of job seekers	Negative	3	3	**Medium**	

ASPECT	IMPACT	NATURE	PROBABILITY	CONSEQUENCE	SIGNIFICANCE (BEFORE MITIGATION)	FURTHER ASSESSMENT REQUIRED
	Risk to safety, livestock, and farm infrastructure	Negative	3	3	**Medium**	
	Increased risk of grass fires	Negative	3	3	**Medium**	
	Nuisance impacts associated with construction related activities	Negative	3	3	**Medium**	
	Impacts associated with loss of farmland	Negative	3	3	**Medium**	
Climate Change	Greenhouse Gas Emissions	Negative	2	1	**Very Low**	**No**
	Climate Risks & Vulnerabilities	Negative	2	1	**Very Low**	

Table 3.6: Operational Phase Impacts

ASPECT	IMPACT	NATURE	PROBABILITY	CONSEQUENCE	SIGNIFICANCE (BEFORE MITIGATION)	FURTHER ASSESSMENT REQUIRED
Soils, Land Capability and Agricultural Potential	Enhanced agricultural potential through increased financial security for farming operations	Positive	3	3	**Medium**	**Yes**
	Interference with farming operations	Negative	4	3	**High**	
Surface Water	Increased runoff, sedimentation and erosion	Negative	3	3	**Medium**	**Yes**
Waste Generation	Generation of General Waste	Negative	3	2	**Medium**	**Yes**
	Generation of Hazardous Waste	Negative	3	2	**Medium**	
	Sanitation Waste	Negative	3	2	**Medium**	

ASPECT	IMPACT	NATURE	PROBABILITY	CONSEQUENCE	SIGNIFICANCE (BEFORE MITIGATION)	FURTHER ASSESSMENT REQUIRED
Biodiversity	Proliferation of alien invasive plant species	Negative	3	3	**Medium**	**Yes**
Avifauna	Displacement due to habitat loss	Negative	1	3	**Low**	**Yes**
	Entrapment of large-bodied birds in the double perimeter fence.	Negative	1	3	**Low**	
	Electrocution on the medium voltage network	Negative	4	3	**High**	
	Collisions with the medium voltage network	Negative	4	3	**High**	
Visual	Potential alteration of the visual character of the area	Negative	3	3	**Medium**	**Yes**
	Potential visual intrusion resulting resulting from PV arrays and associated infrastructure	Negative	3	3	**Medium**	
	Potential visual clutter caused by substation and other associated infrastructure on-site	Negative	3	3	**Medium**	
	Potential visual effect on surrounding farmsteads	Negative	3	3	**Medium**	
	Potential glint and glare impacts on passing motorists and nearby receptors	Negative	3	3	**Medium**	
	Potential alteration of the night time visual environment as a result of operational and security lighting as well as navigational lighting on top of the wind turbines	Negative	3	3	**Medium**	

ASPECT	IMPACT	NATURE	PROBABILITY	CONSEQUENCE	SIGNIFICANCE (BEFORE MITIGATION)	FURTHER ASSESSMENT REQUIRED
Social	Improve energy security and support the renewable energy sector	Positive	3	3	**Medium**	**Yes**
	Creation of employment and business opportunities	Positive	3	3	**Medium**	
	Generate income for affected landowners	Positive	3	3	**Medium**	
	Benefits associated with the socio-economic development contributions	Positive	3	3	**Medium**	
	Visual impact and impact on sense of place	Negative	3	3	**Medium**	
	Potential impact on property values	Negative	3	3	**Medium**	
	Potential impact on tourism	Negative	3	3	**Medium**	
Climate Change	Reduced GHG Emissions	Positive	4	3	**High**	**No**
	Contribution of cleaner energy to the National Grid	Positive	4	3	**High**	

3.5 SCOPING RECOMMENDATIONS

The scoping report identified and evaluated the feasibility of a range of site and technology options. **Table 3.7** provides a summary of the scoping phase alternatives assessment.

Table 3.7: Alternatives Summary

ALTERNATIVE CATEGORY	ALTERNATIVE IDENTIFIED IN SCOPING	ASSESSMENT IN EIA PHASE (YES / NO)
Project Alternatives	**Concept Level Alternatives for Layout** — On-Site Substation & BESS (Alternative 1) — On-Site Substation & BESS (Alternative 2) (Preferred Alternative)	Yes

ALTERNATIVE CATEGORY	ALTERNATIVE IDENTIFIED IN SCOPING	ASSESSMENT IN EIA PHASE (YES / NO)
	Concept Level Alternatives for BESS Technology — Solid-State Lithium (SSL) BESS — Vanadium Redox Flow (VRF) BESS	Yes

4 EIA METHODOLOGY

The EIA process was initiated in accordance with Appendix 3 of GNR 982 pertaining to applications subject to an S&EIR process.

4.1 DETAILED ENVIRONMENTAL ASSESSMENT

4.1.1 SPECIALIST STUDIES

Table 4.1 provides a list of the Specialist Studies that have been undertaken. The Specialist Declaration are included in **Appendix C**.

Table 4.1: Details of the Specialists

ASSESSMENT	NAME OF SPECIALIST	COMPANY	APPENDIX
Agriculture	Johann Lanz	Independent consultant	**Appendix H-1**
Aquatic	Brian Colloty	EnviroSci Pty Ltd	**Appendix H-2**
Geotechnical	Muhammad Osman	SLR Consulting	**Appendix H-3**
Terrestrial Ecology	David Hoare	David Hoare Consulting (Pty) Ltd	**Appendix H-4**
Terrestrial Plants	David Hoare	David Hoare Consulting (Pty) Ltd	**Appendix H-5**
Terrestrial Animals	David Hoare	David Hoare Consulting (Pty) Ltd	**Appendix H-6**
Avifauna	Chris van Rooyen	Chris van Rooyen Consulting	**Appendix H-7**
Bats	Werner Marais	Animalia Consultants (Pty) Ltd	**Appendix H-8**
Traffic	Christo Bredenhann	WSP Group Africa (Pty) Ltd	**Appendix H-9**
Heritage	Jaco van der Walt	Beyond Heritage	**Appendix H-10**
Palaeontology	Prof Marion Bamford	Independent consultant	**Appendix H-11**
Visual	Kerry Schwartz	SiVEST SA (Pty) Ltd / SLR Consulting (Pty) Ltd	**Appendix H-12**
Socio-economic	Tony Barbour	Tony Barbour Environmental Consulting	**Appendix H-13**
SHE Risk	Debra Mitchell	Ishecon CC	**Appendix H-14**

4.1.2 CUMULATIVE ASSESSMENT

Due to the number of renewable energy applications in the area, the specialist assessments include a detailed cumulative environmental impact statement. The cumulative impact statement is provided in **Section 9**.

4.2 IMPACT ASSESSMENT METHODOLOGY

The EIR uses a methodological framework developed by WSP to meet the combined requirements of international best practice and NEMA, Environmental Impact Assessment Regulations, 2014, as amended (GN No. 326) (the "EIA Regulations").

4.2.1 ASSESSMENT OF IMPACTS AND MITIGATION

The assessment of impacts and mitigation evaluates the likely extent and significance of the potential impacts on identified receptors and resources against defined assessment criteria, to develop and describe measures that will be taken to avoid, minimise or compensate for any adverse environmental impacts, to enhance positive impacts, and to report the significance of residual impacts that occur following mitigation.

The key objectives of the risk assessment methodology are to identify any additional potential environmental issues and associated impacts likely to arise from the proposed project, and to propose a significance ranking. Issues / aspects will be reviewed and ranked against a series of significance criteria to identify and record interactions between activities and aspects, and resources and receptors to provide a detailed discussion of impacts. The assessment considers direct[2], indirect[3], secondary[4] as well as cumulative[5] impacts.

A standard risk assessment methodology is used for the ranking of the identified environmental impacts pre-and post-mitigation (i.e., residual impact). The significance of environmental aspects is determined and ranked by considering the criteria[6] presented in **Table 4.2**.

Table 4.2: Impact Assessment Criteria and Scoring System

CRITERIA	SCORE 1	SCORE 2	SCORE 3	SCORE 4	SCORE 5
Impact Magnitude (M) The degree of alteration of the affected environmental receptor	Very low: No impact on processes	Low: Slight impact on processes	Medium: Processes continue but in a modified way	High: Processes temporarily cease	Very High: Permanent cessation of processes
Impact Extent (E) The geographical extent of the impact on a given environmental receptor	Site: Site only	Local: Inside activity area	Regional: Outside activity area	National: National scope or level	International: Across borders or boundaries
Impact Reversibility (R) The ability of the environmental receptor to rehabilitate or restore after the activity has caused environmental change	Reversible: Recovery without rehabilitation		Recoverable: Recovery with rehabilitation		Irreversible: Not possible despite action
Impact Duration (D) The length of permanence of the impact on the environmental receptor	Immediate: On impact	Short term: 0-5 years	Medium term: 5-15 years	Long term: Project life	Permanent: Indefinite

2 Impacts that arise directly from activities that form an integral part of the Project.
3 Impacts that arise indirectly from activities not explicitly forming part of the Project.
4 Secondary or induced impacts caused by a change in the Project environment.
5 Impacts are those impacts arising from the combination of multiple impacts from existing projects, the Project and/or future projects.
6 The definitions given are for guidance only, and not all the definitions will apply to all the environmental receptors and resources being assessed. Impact significance was assessed with and without mitigation measures in place.

CRITERIA	SCORE 1	SCORE 2	SCORE 3	SCORE 4	SCORE 5
Probability of Occurrence (P) The likelihood of an impact occurring in the absence of pertinent environmental management measures or mitigation	Improbable	Low Probability	Probable	Highly Probability	Definite
Significance (S) is determined by combining the above criteria in the following formula:	$[S = (E + D + R + M) \times P]$ $Significance = (Extent + Duration + Reversibility + Magnitude) \times Probability$				
IMPACT SIGNIFICANCE RATING					
Total Score	**4 to 15**	**16 to 30**	**31 to 60**	**61 to 80**	**81 to 100**
Environmental Significance Rating (Negative (-))	**Very low**	**Low**	**Moderate**	**High**	**Very High**
Environmental Significance Rating (Positive (+))	**Very low**	**Low**	**Moderate**	**High**	**Very High**

4.2.2 IMPACT MITIGATION

The impact significance without mitigation measures will be assessed with the design controls in place. Impacts without mitigation measures in place are not representative of the proposed development's actual extent of impact and are included to facilitate understanding of how and why mitigation measures were identified. The residual impact is what remains following the application of mitigation and management measures and is thus the final level of impact associated with the development. Residual impacts also serve as the focus of management and monitoring activities during Project implementation to verify that actual impacts are the same as those predicted in this report.

The mitigation measures chosen are based on the mitigation sequence/hierarchy which allows for consideration of five (5) different levels, which include avoid/prevent, minimise, rehabilitate/restore, offset and no-go in that order. The idea is that when project impacts are considered, the first option should be to avoid or prevent the impacts from occurring in the first place if possible, however, this is not always feasible. If this is not attainable, the impacts can be allowed, however they must be minimised as far as possible by considering reducing the footprint of the development for example so that little damage is encountered. If impacts are unavoidable, the next goal is to rehabilitate or restore the areas impacted back to their original form after project completion. Offsets are then considered if all the other measures described above fail to remedy high/significant residual negative impacts. If no offsets can be achieved on a potential impact, which results in full destruction of any ecosystem for example, the no-go option is considered so that another activity or location is considered in place of the original plan.

The mitigation sequence/hierarchy is shown in **Figure 4.1** below.

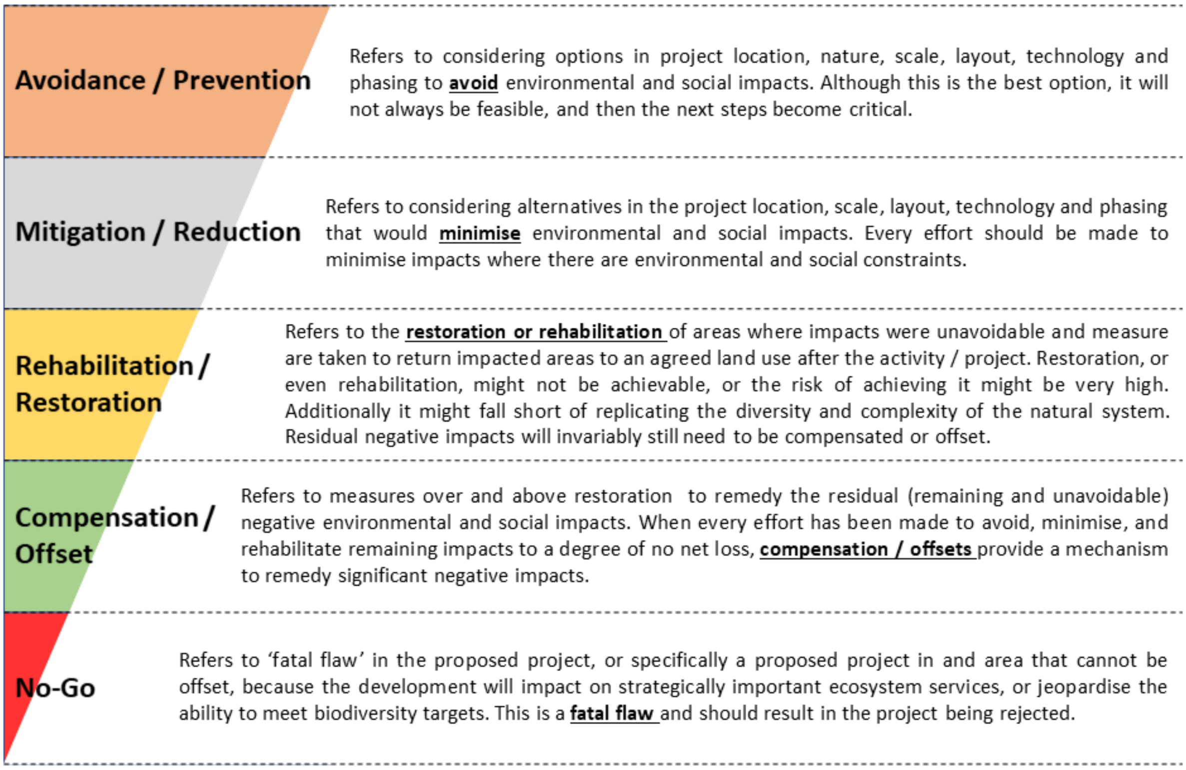


Figure 4.1: Mitigation Sequence/Hierarchy

4.3 STAKEHOLDER ENGAGEMENT

Stakeholder engagement (public participation) is a requirement of the S&EIA process. It consists of a series of inclusive and culturally appropriate interactions aimed at providing stakeholders with opportunities to express their views, so that these can be considered and incorporated into the S&EIA decision-making process. Effective engagement requires the prior disclosure of relevant and adequate project information to enable stakeholders to understand the risks, impacts, and opportunities of the proposed project. The objectives of the stakeholder engagement process can be summarised as follows:

- Identify relevant individuals, organisations and communities who may be interested in or affected by the proposed project;
- Clearly outline the scope of the proposed project, including the scale and nature of the existing and proposed activities;
- Identify viable proposed project alternatives that will assist the relevant authorities in making an informed decision;
- Identify shortcomings and gaps in existing information;
- Identify key concerns, raised by Stakeholders that should be addressed in the specialist studies;
- Highlight the potential for environmental impacts, whether positive or negative; and
- To inform and provide the public with information and an understanding of the proposed project, issues, and solutions.

It is important to note that since the proposed individual projects associated with the Camden Renewable Energy Complex, subject to a S&EIA Process, are located within the same geographical area, an integrated stakeholder engagement process (public participation) is being undertaken for these projects. A SER (**Appendix D**) has been compiled and included in the Draft EIR detailing the projects' compliance with Chapter 6 of the NEMA EIA Regulations 2014, as amended.

4.3.1 STAKEHOLDER AND AUTHORITY CONSULTATION

There will continue to be ongoing communication between WSP and stakeholders throughout the S&EIR process. These interactions include the following:

— Interactions with stakeholders will be recorded in the comment and response report;
— Feedback to stakeholders will take place both individually and collectively;
— Written responses (email, faxes or letters) will be provided to stakeholders acknowledging issues and providing information requested (dependent on availability) and
— A letter will sent out to all registered stakeholders notifying them of the outcome of the environmental authorisation process

As per the GNR 982, particular attention will be paid to landowners, and neighbouring communities, specifically where literacy levels and language barriers may be an issue.

4.3.2 PUBLIC REVIEW

The Draft EIR will be placed on public review for a period of 30 days from **07 September 2022** to **10 October 2022**, at the following public places:

— Gert Sibande District Municipality;
— Ermelo Public Library;
— Thusiville Public Library;
— Msukaligwa Local Municipality Ermelo Office;
— WSP website (https://www.wsp.com/en-ZA/services/public-documents); and
— Datafree Website (https://wsp-engage.com/).

All registered stakeholders and authorising/commenting state departments will be notified of the public review period as well as the locations of the draft EIR via email and SMS.

4.3.3 COMMENT AND RESPONSE REPORT

All concerns, comments, viewpoints and questions (collectively referred to as 'issues') will continue to be documented and responded to adequately in the Comment and Response Report. The Comment and Response Report records the following:

— List of all issues raised;
— Record of who raised the issues;
— Record of where the issues were raised;
— Record of the date on which the issue was raised; and
— Response to the issues.

The updated Comment and Response Report has been included in the SER in **Appendix D**.

4.3.4 SUBMISSION AND DECISION MAKING

The EAP must submit the final EIR to the competent authority within 106 days of the acceptance of the scoping report. A request for extension to the submission deadline of the FEIR was submitted to the DFFE in terms of EIA Regulation 3(7). A 60-day extension was approved on 24 June 2022. The final EIR is due to the DFFE on 02 November 2022. Once submitted, the delegated competent authority (i.e. the DFFE) will be allocated 107 days to review the final EIR in order to either grant or refuse and environmental authorisation.

The final EIR will be placed on stakeholder review for a reasonable time period during the DFFE's final review and decision-making process. All comments on the Final EIR should be submitted directly to the DFFE. The delegated competent authority must issue their decision within this specified timeframe.

4.3.5 NOTIFICATION OF ENVIRONMENTAL AUTHORISATION

All stakeholders will receive a letter at the end of the process notifying them of the authority's decision, thanking them for their contributions, and explaining the appeals procedure as outlined in the national Appeal Regulations, 2014 (GNR 993 of 2014).

4.4 DFFE WEB-BASED ENVIRONMENTAL SCREENING TOOL

DFFE has developed the National Web-based Environmental Screening Tool in order to flag areas of potential environmental sensitivity related to a site as well as a development footprint and produces the screening report required in terms of regulation 16 (1)(v) of the EIA Regulations (2014, as amended). The *Notice of the requirement to submit a report generated by the national web-based environmental screening tool in terms of section 24(5)(h) of the NEMA, 1998 (Act No 107 of 1998) and regulation 16(1)(b)(v) of the EIA regulations, 2014, as amended* (GN 960 of July 2019) states that the submission of a report generated from the national web-based environmental screening tool, as contemplated in Regulation 16(1)(b)(v) of the EIA Regulations, 2014, published under Government Notice No. R982 in Government Gazette No. 38282 of 4 December 2014, as amended, is compulsory when submitting an application for environmental authorisation in terms of regulation 19 and regulation 21 of the EIA Regulations, 2014 as of 04 October 2019.

The Screening Report generated by the National Web-based Environmental Screening Tool contains a summary of any development incentives, restrictions, exclusions or prohibitions that apply to the proposed development footprint as well as the most environmentally sensitive features on the footprint based on the footprint sensitivity screening results for the application classification that was selected.

A screening report for the proposed Camden I SEF was generated on 14 September 2021 and is attached as **Appendix E**. The Screening Report for the project identified various sensitivities for the site. The report also generated a list of specialist assessments that should form part of the S&EIA based on the development type and the environmental sensitivity of the site. Assessment Protocols in the report provide minimum information to be included in a specialist report to facilitate decision-making.

Table 4.3 below provides a summary of the sensitivities identified for the development footprint.

Table 4.3: Sensitivities identified in the screening report

THEME	VERY HIGH SENSITIVITY	HIGH SENSITIVITY	MEDIUM SENSITIVITY	LOW SENSITIVIY
Agricultural Theme	✓			
Animal Species Theme		✓		
Aquatic Biodiversity Theme	✓			
Archaeological and Cultural Heritage Theme				✓
Avian Theme		✓		
Bats Theme				✓
Civil Aviation (Solar PV) Theme				✓

THEME	VERY HIGH SENSITIVITY	HIGH SENSITIVITY	MEDIUM SENSITIVITY	LOW SENSITIVIY
Defence Theme				✓
Landscape (Solar) Theme	✓			
Palaeontology Theme	✓			
Plant Species Theme			✓	
RFI Theme		✓		
Terrestrial Biodiversity Theme	✓			

Based on the selected classification, and the environmental sensitivities of the proposed development footprint, the following list of specialist assessments have been identified for inclusion in the assessment report as determined by the screening tool (please refer to Section 4.2.1 below for the EAP motivation applicable to this list):

— Agricultural Impact Assessment
— Archaeological and Cultural Heritage Impact Assessment
— Palaeontology Impact Assessment
— Landscape/Visual Impact Assessment
— Terrestrial Biodiversity Impact Assessment
— Freshwater Impact Assessment
— Avifauna Impact Assessment
— Social Impact Assessment
— A Geotechnical Assessment
— Civil Aviation Impact Assessment
— Radio Frequency Interference (RFI) Assessment
— Plant Species Assessment
— Animal Species Assessment

4.4.1 MOTIVATION FOR SPECIALIST STUDIES

The report recognises that "it is the responsibility of the EAP to confirm this list and to motivate in the assessment report, the reason for not including any of the identified specialist study including the provision of photographic evidence of the footprint situation."

As summarised in **Table 1.4** above, the following specialist assessments have been commissioned for the project based on the environmental sensitivities identified by the Screening Report:

— Soils and Agricultural Potential Assessment;
— Archaeological and Cultural Heritage Assessment;
— Palaeontology Impact Assessment;
— Visual Impact Assessment;
— Biodiversity Impact Assessment (inclusive of terrestrial biodiversity, plant species and animal species);
— Freshwater Assessment;
— Avifauna Impact Assessment;
— Social Impact Assessment;

- Qualitative Risk Assessment (specific to the BESS);
- Desktop Geotechnical Assessment; and
- Desktop Traffic Assessment.

Four of the identified specialist studies will not be undertaken as part of the S&EIA process for the proposed Camden I SEF. Motivation for the exclusion of these specialist studies is provided below:

- **Detailed Geotechnical**

  A desktop Geotechnical Assessment has been commissioned and has been incorporated into this report (**Section 7.1.9** and **Appendix H-3**). No geotechnical fatal flaws were identified. However, a detailed Geotechnical Assessment will not be undertaken as part of the S&EIA Process as this will be undertaken during the detailed design phase.
- **RFI Assessment**

  A RFI Study will not be undertaken. The proposed development area is not located within any Astronomy Advantage Area. The South African Weather Service (SAWS) confirmed that there is no impact to their infrastructure or its operation and therefore SAWS has no objection to the planned Solar PV Facility. Other relevant telecommunications stakeholders will be engaged with as part of the Public Participation Process.
- **Civil Aviation**

  According to the DFFE Screening Tool Report, civil aviation is regarded as having low sensitivity. The proposed development site is located between 8 and 15 km of civil aviation aerodromes. A formal Civil Aviation Assessment will not be undertaken as part of the S&EIA Process. Nevertheless, the relevant Authorities have been included on the project stakeholder database. As of the 1st of May 2021, Air Traffic and Navigation Services (ATNS) has been appointed as the new Obstacle application Service Provider for Windfarms and later Solar Plants. Their responsibility would pertain to the assessments, maintenance, and all other related matters in respect to Windfarms and in due time Power Plant assessments. Where required, an Application for the Approval of Obstacles will also be submitted to ATNS and the required permits will be obtained prior to the development of the project. The South African Civil Aviation Authority (SACAA) was included on the project stakeholder database. Comments received from this stakeholder to date have been captured and responded to within the Comments and Responses Report (CRR) included in the SER (**Appendix D**) of this EIR.
- **Defence**

  According to the DFFE Screening Tool Report, defence is regarded as having low sensitivity. A compliance statement is therefore not required. The Department of Defence has been included on the project stakeholder database. They have been informed of the proposed Project and provided comment (Refer to the Stakeholder Engagement Report in **Appendix D**).

Specialist assessments were conducted in accordance with the *Procedures for the Assessment and Minimum Criteria for Reporting on identified Environmental Themes*, which were promulgated in Government Notice No. 320 of 20 March 2020 and in Government Notice No. 1150 of 30 October 2020 (i.e. "the Protocols"). The assessment protocols followed are indicated in **Table 4.4**.

Table 4.4: Assessment protocols followed

SPECIALIST ASSESSMENT	ASSESSMENT PROTOCOL
Agricultural Impact Assessment	Protocol for the specialist assessment and minimum report content requirements of environmental impacts on agricultural resources by onshore wind and/or solar photovoltaic energy generation facilities where the electricity output is 20 megawatts or more, gazetted on 20 March 2020 in GN 320 (in terms of Sections 24(5)(A) and (H) and 44 of NEMA, 1998).
Aquatic Impact Assessment	Protocol for specialist assessment and minimum report content requirements for the environmental impacts on aquatic biodiversity (Government Gazette 43110, 20 March 2020).

SPECIALIST ASSESSMENT	ASSESSMENT PROTOCOL
Terrestrial Biodiversity Assessment	Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species, terrestrial plant species and terrestrial biodiversity.
Terrestrial Plant Species Assessment	Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial plant species.
Terrestrial Animal Species Assessment	Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species.
Avifaunal Impact Assessment	The Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species.
Social Impact Assessment	As of September 2020, there are no sensitivity layers on the Screening Tool for Socio-economic- features. Part A has therefore not been compiled for this assessment.

5 NEED AND JUSTIFICATION

South Africa is faced with significant increases in electricity demand and a shortage in electricity supply. South Africa is the seventh coal producer in the world, with approximately 77% of the country's electricity generated from coal. This large dependence on coal and its use has also resulted in a variety of negative impacts on the environment, including the contribution to climate change. South Africa is also the highest emitter of greenhouse gases in Africa; attributed to the country's energy-intensive economy that largely relies on coal-based electricity generation.

Renewable energy development is regarded as an important contribution to meeting international and national targets of reducing reliance on fossil fuels, such as coal, which contribute towards greenhouse gas emissions and resultant climate change. The need and desirability of proposed Camden I SEF has been considered from an international, national and regional perspective.

5.1.1 INTERNATIONAL PERSPECTIVE

The proposed project will align with internationally recognised and adopted agreements, protocols and conventions. This includes the Kyoto Protocol (1997) which calls for countries internationally to reduce their greenhouse gas emissions through cutting down on their reliance on fossil fuels and investing in renewable energy technologies for electricity generation. The proposed SEF will therefore add capacity to the energy sector and generate electricity without greenhouse gas emissions and meet international requirements in this regard.

South Africa is also signatory to the United Nations' Development Programmes' (UNDP) Sustainable Development Goals (SDGs), particularly SGD 7 relating to affordable and clean energy. The proposed SEF qualifies as a clean technology that will generate 100MW of affordable energy to contribute to South Africa's energy mix.

The project will also greatly contribute to the countries' efforts to reduce their carbon emissions and play their role as part of the Paris Climate Accord. The Paris Agreement is a legally binding international treaty signed by 196 countries at the COP 21 in Paris, on the 12th of December 2015 to combat climate change. The goal of the Paris Accord is to limit global warming to well below 2 degrees Celsius, compared to industrial levels to avoid catastrophic natural disasters which are driven by the global temperature increase. Therefore, to achieve this long-term temperature goal, countries aim to reach global peaking of greenhouse gas emissions as soon as possible to achieve a climate-neutral world by 2050.

The authorization of the Project will further align with South Africa's National Climate Response White Paper which outlines the countries efforts to manage the impacts of climate change and to contribute to the global efforts to stabilize the Greenhouse gases concentrations in the atmosphere.

5.1.2 NATIONAL PERSPECTIVE

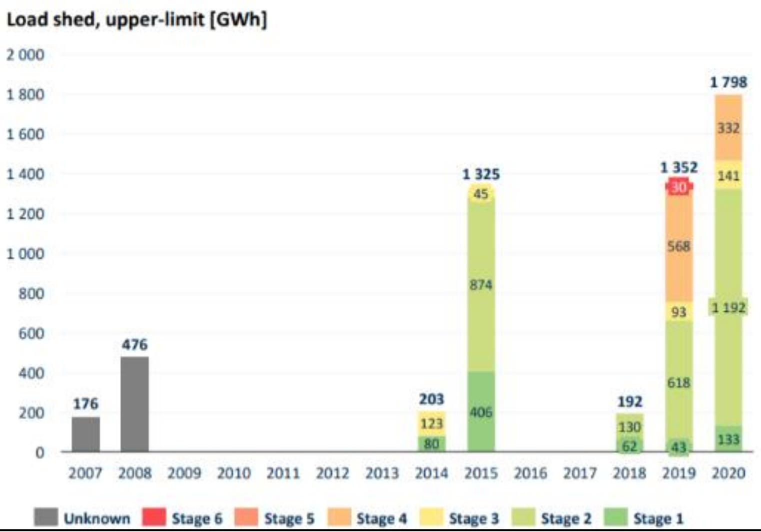
The South African Government, through the IRP, has set a target to secure 17 800 MW of renewable energy by 2030. This is an effort to diversify the country's energy mix in response to the growing electricity demand and promote access to clean sources of energy.

The National Development Plan (NDP) is aimed at reducing and eliminating poverty in South Africa by 2030. The NDP also outlines the need to increase electricity production by 2030, with 20 000 MW of electricity capacity generated from renewable sources in order to move to less carbon-intensive electricity production. The Plan also envisages that South Africa will have an energy sector that provides reliable and efficient energy service at competitive rates, while supporting economic growth through job creation.

The authorisation of the Camden I SEF will further align with South Africa's National Climate Response White Paper which outlines the countries efforts to manage the impacts of climate change and to contribute to the global efforts to stabilize the greenhouse gases concentrations in the atmosphere.

The proposed Camden Renewable Energy Complex, which includes the Camden I SEF, will pave the way for the Just Energy Transition (JET)[7] in South Africa and promote the transition from a fossil fuel-based economy to a low carbon economy. The proposed Camden I SEF aims towards the aforementioned national energy targets of diversification of energy supply and the promotion of clean energy. Wind and solar energy developments contribute to reduced emissions and subsequently climate change whilst promoting industrial development and job creation.

The proposed Camden I SEF will also aid in overcoming the power shortages that are currently faced in the country. In 2020, South Africa witnessed its longest recorded hours of load shedding, with the power being off for 859 hours of the year as shown in **Figure 5.1**. The South African Government has taken strides to try reducing these power cuts through the implementation of bid Windows in REIPPP and lifting the independent power generation threshold to 100MW, but it is still expected that the country will undergo more load shedding. Over the years the construction of Solar and Wind facilities has become cheaper, and less time-consuming. Thus, acting as a faster and more efficient method of meeting the ever-growing demand for electricity in the country.



Year	Duration of outages (hours)	Energy shed (GWh)
2007	-	176
2008	-	476
....	....	....
2014	121	203
2015	852	1325
2016	-	-
2017	-	-
2018	127	192
2019	530	1352
2020	859	1798

Figure 5.1: Load shedding hours over the years in South Africa

In addition, the Council for Scientific and Industrial Research (CSIR) reported that renewable energy assisted in relieving pressure on the constrained South African power system during load shedding in the first quarter of 2019. This indicates that renewable energy is a key factor in ensuring that the country does not face further load shedding in the future.

5.1.3 REGIONAL AND LOCAL PERSPECTIVE

JUST ENERGY TRANSITION

Coal power stations and the coal mining industry play a vital component in the economic and social components of the local Mpumalanga economy. Shifting to a low carbon economy will thus need to offset or exceed the benefits being realized by fossil fuels in the province. Thus, a key factor to ensuring the success of the Just Energy Transition is not only to focus on the transition from fossil fuels to renewable energy resources but to simultaneously ensure the Just Transition of jobs and skills.

The transition towards renewable energy will improve the socio-economic conditions of the Gert Sibande District Municipality. The Gert Sibande District Municipality recorded an unemployment rate of 26.7% in 2017, with the majority of its employed in the trade and community services sectors. The Project will aid in solving two of the

[7] The Just Transition is described as the transition towards a low-carbon and climate-resilient economy that maximizes the benefits of climate action while simultaneously improving the welfare of the workers and their communities.

leading challenges faced by the Gert Sibande District Municipality, namely the cost of electricity and lack of adequate employment opportunities. The Project will be the first large-scale solar energy facility being developed in Mpumalanga. The proponent G foresees this project as being the catalyst to realizing a true Just Energy Transition for Mpumalanga. As various career opportunities are presented by the solar industry, and these are divided into five pillars that are aligned with the value chain. These four pillars are project planning/development, manufacturing and procurement, installation and grid connection, operation and maintenance, and decommissioning as shown in **Table 5.1**.

Table 5.1 shows that the solar industry will create job opportunities throughout the supply chain. The solar industry will contribute to the Just transition in South Africa to ensure that there are no job losses but rather job transfers and skill exchange. For these opportunities to arise, renewable energy projects need to be approved in Mpumalanga to ensure that the transition from fossil fuels to renewable energy happens gradually and takes off effectively.

MULTIPLE LAND USE

Unlike opencast coal mining within the broader Camden study area, the Project facilitates multiple land use functions within the development area. As solar modules are clustered on surface developments this allows multiple land use functions. This will boost the economic activities in the area which will in turn increase job opportunities in that area and help improve the local community's welfare without jeopardizing the environment.

DESIRABILITY OF THE PROJECT SITE

As mentioned previously, four of Eskom's coal-fired power stations have been targeted for decommissioning in the short term: Komati, Camden, Grootvlei, and Hendrina. Eskom is looking to decommission 5 400MW of electricity from coal generation by the year 2022, increasing to 10 500MW by 2030 and 35 000MW by 2050. Simultaneously Eskom has been looking at options for repurposing these power stations with the core aims of reusing existing power transmission infrastructure, developing new generation capacity, providing ancillary services, and mitigating socio-economic impact. The proposed Camden I SEF, is ideally located to form part of this proposed repurposing of the Camden power station and will help Eskom achieve its diversification goal.

Table 5.1: ***Opportunities available along the solar value chain (Source: https://cleanenergysolutions.org/sites/default/files/documents/cesc_isa_32_maximizing-value-chain.pdf)***

PROJECT PLANNING	MANUFACTURING AND PROCUREMENT	INSTALLATION AND GRID CONNECTION	OPERATION AND MAINTENANCE	DECOMMISSIONING
Legal, energy regulation, real estate and taxation expects	Factory workers and technicians	Construction worker and technical personnel	Construction workers	Technical personnel and construction workers
Electrical, civil, mechanical and energy engineers	Industrial engineers	Civil engineers and foremen	Safety experts	Truck drivers and crane operators
Financial analysts	Administrative personnel	Health and safety experts	Industrial, electrical and telecommunications engineers	Industrial/mechanical/ electrical engineers
Logistic experts	Marketing and sales personnel	Electrical and mechanical engineers	Operators	Environmental experts
Environmental experts	Logistic experts	Environmental experts	Technical personnel	Safety experts
Health and safety experts	Quality control experts	Quality-control experts	Administrative and accountant personnel	Logistic experts
	Health and safety experts		Lawyers, experts in energy regulation	
	Regulation and standardisation experts		Management	
	Chemical engineers			

6 PROJECT DESCRIPTION

6.1 SITE LOCATION

The proposed Camden I SEF will be developed within a project area of approximately 695 hectares (ha). Within this project area the extent of the project footprint will be approximately 280 hectares (ha), subject to finalization based on technical and environmental requirements.

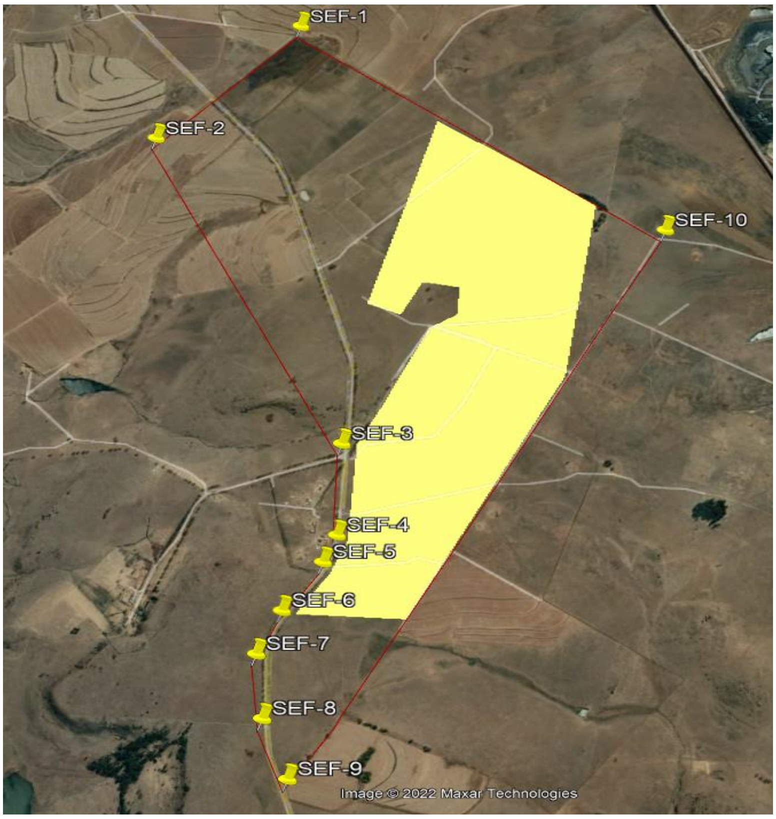
The proposed SEF is located south-west of Ermelo, in Mpumalanga and falls within the Msukaligwa Local Municipality and Gert Sibande District Municipality. The eight projects of the Camden Renewable Energy Complex are located adjacent each other and as such, the overall locality of the Camden Renewable Energy Complex is included in **Figure 6.1**. The Camden I SEF (*project under consideration for this EIR*) project site, including associated alternatives, is indicated in **Figure 6.2**. The details of the property associated with the proposed Camden I SEF, including the 21-digit Surveyor General (SG) codes for the cadastral land parcels are outlined in **Table 6.1.** The co-ordinates of the cadastral land parcel are included in **Table 6.2.** The coordinates of the centre points of the Solar facility and associated key infrastructure are provided in **Table 6.3** below.

Table 6.1: Camden I SEF Affected Farm Portion

FARM NAME	21 DIGIT SG CODE OF EACH CADASTRAL LAND PARCEL
Portion 1 of Welgelegen Farm No. 322	T0IT00000000032200001

Table 6.2: Co-ordinate Points of the Cadastral Land Parcel

POINT	LONGITUDE	LATITUDE



POINT	LONGITUDE	LATITUDE
SEF-1	30° 4'2.75"E	26°38'23.53"S
SEF-2	30° 3'31.93"E	26°38'51.84"S
SEF-3	30° 4'13.02"E	26°40'6.02"S
SEF-4	30° 4'12.40"E	26°40'27.16"S
SEF-5	30° 4'9.69"E	26°40'33.23"S
SEF-6	30° 4'1.57"E	26°40'44.09"S
SEF-7	30° 3'56.64"E	26°40'53.64"S
SEF-8	30° 3'58.15"E	26°41'7.74"S
SEF-9	30° 4'3.39"E	26°41'20.80"S
SEF-10	30° 5'21.06"E	26°39'15.40"S

Table 6.3: Solar Facility and Associated Key Infrastructure Approximate Central Coordinates

INFRASTRUCTURE	LONGITUDE	LATITUDE
Solar Field	30° 4'40.47"E	26°39'50.34"S
SEF SS & BESS Alternative 1	30° 4'24.13"E	26°39'43.36"S
SEF SS & BESS Alternative 2	30° 4'25.28"E	26°39'36.01"S
Construction Camp 1	30° 4'9.24"E	26°39'16.82"S
Construction Camp 2	30° 4'7.61"E	26°39'30.26"S

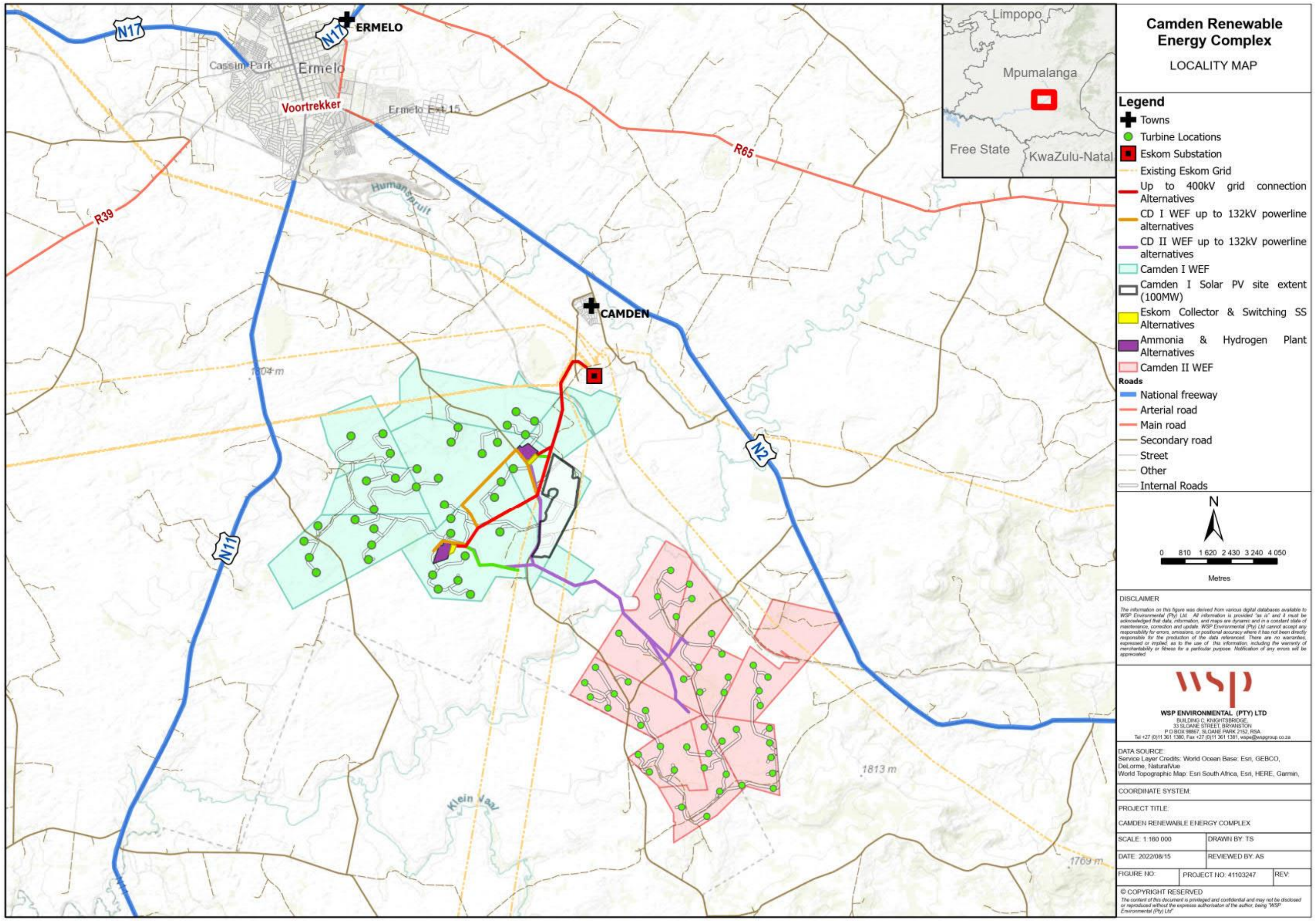


Figure 6.1: Locality map for the proposed Camden Renewable Energy Complex, near Camden in the Mpumalanga Province, showing the location and proximity of the respective projects to each other

Figure 6.2: Proposed Camden I SEF and associated main components

6.2 SOLAR POWER GENERATION PROCESS

South Africa experiences some of the highest levels of solar radiation in the world between 4.5 and 6.5kWh/m2/day) and therefore, possesses considerable solar resource potential for solar power generation.

In terms of large-scale grid connected applications the most commonly used technologies include PV and Concentrated Solar Power (CSP); these are described in some detail in the following sections.

It must be noted that this project is specific to solar power generation through the use of solar PV technology only.

PHOTOVOLTAIC (PV) SYSTEMS

Internationally, solar PV is the fastest-growing power generation technology. Approximately 139 GW was added to the installed capacity globally in 2020, increasing the installed capacity by 18% from the previous year. The total capacity from PVs was 760 GW globally, producing approximately 3% of the world's electricity[8]. In South Africa the solar PV installed capacity in 2020 grew by 37% compared to the previous year's value. As much as 3.6 GW of PV is planned to be installed by 2026, with approximately 1.48GW already installed as recorded in 2019. Utility-scale CSP plants were in operation long before solar PVs became widely commercialized, however PV has taken over the market, attributed to the declining costs of solar PV modules and associated system. In South Africa, this is also coupled with the supportive government policies. Global CSP capacity grew only 1.6 percent in 2020 to 6.2 GW.

Large-scale or utility-scale PV systems are designed for the supply of commercial power into the electricity grid. Large-scale PV plants differ from the smaller units and other decentralised solar power applications because they supply power at the utility level, rather than to local users.

PV cells are made from semi-conductor materials that are able to release electrons when exposed to solar radiation. This is called the photo-electric effect. Several PV cells are grouped together through conductors to make up one module and modules can be connected together to produce power in large quantities. In PV technology, the power conversion source is via PV modules that convert light directly to electricity. This differs from the other large-scale solar generation technology such as CSP, which uses heat to drive a variety of conventional generator systems.

Solar panels produce direct current (DC) electricity; therefore PV systems require conversion equipment to convert this power to alternating current (AC), that can be fed into the electricity grid. This conversion is done by inverters. **Figure 6.3** provides an illustration of the main components of a solar PV power plant.

There are two primary alternatives for inverters in large scale systems; being centralised and string inverters.

[8] https://www.c2es.org/content/renewable-energy/

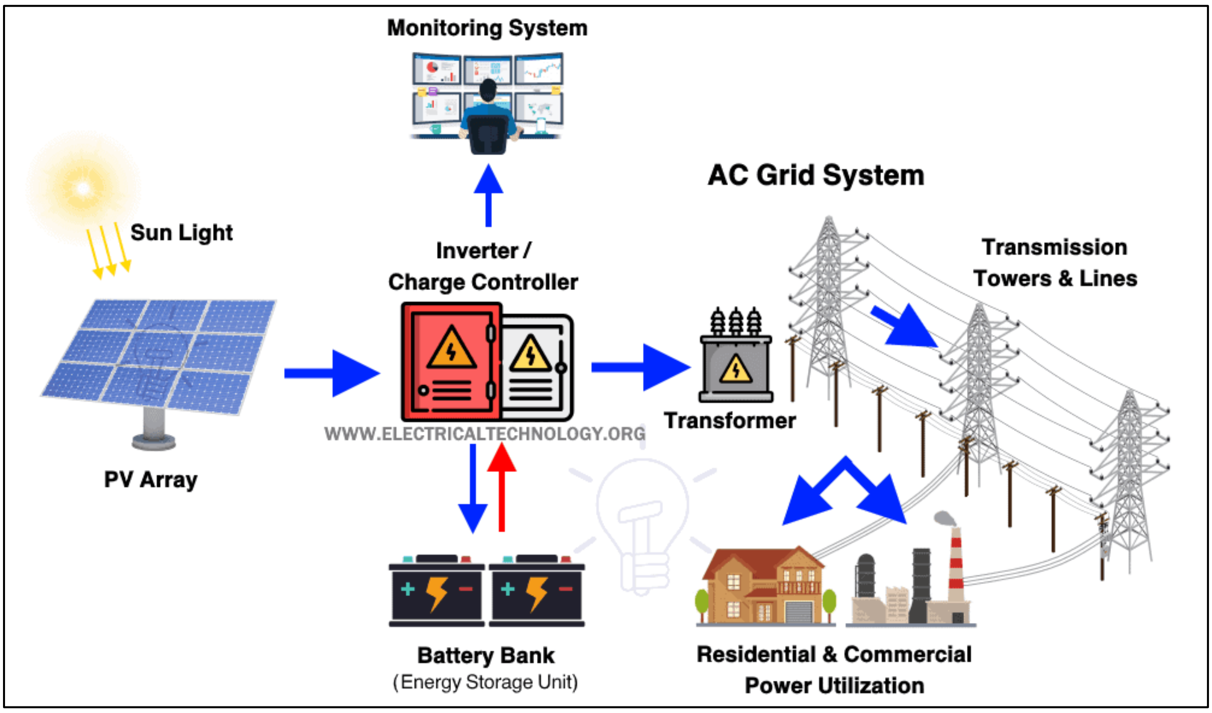


Figure 6.3: Illustration of the main components of a solar power plant (Source: www.electricaltechnology.org/2021/07/solar-power-plant.html)

CONCENTRATED SOLAR POWER

Concentrated solar power (also called concentrating solar power, concentrated solar thermal or CSP) systems use mirrors or lenses to concentrate a large area of sunlight, or solar thermal energy, onto a small area. Electrical power is produced when the concentrated light is converted to heat which is used to produce steam, which drives a heat engine, usually a steam turbine, connected to an electrical power generator.

The process of energy conversion in a CSP plant is illustrated in **Figure 6.4**. Since a thermal intermediary is always involved, a conventional steam power turbine generator can be coupled for power generation. Energy storage is possible usually in thermal form (e.g. steam, molten salt).

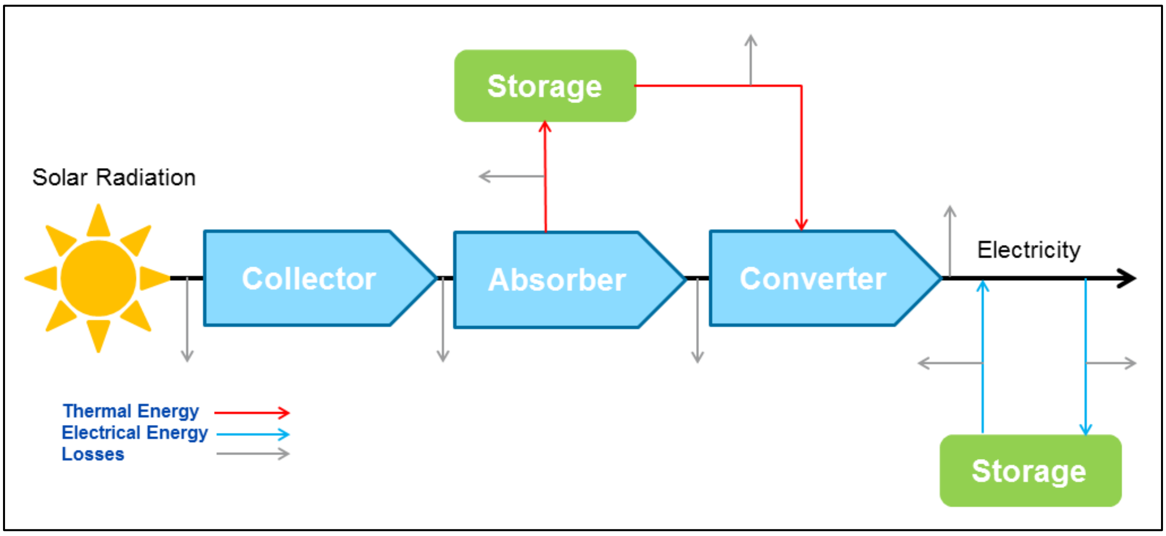


Figure 6.4: Process of Energy Conversion in a CSP Plant

The minimum Direct Normal Radiation (DNR) to justify a CSP plant is 1 800 kWh/m^2 per year. According to the South African Renewable Resource Database (RRDB), the area exceeding the minimum required DNR in South

Africa covers approximately 194 000km^2. The 2003 Renewable Energy White Paper calculates that South Africa may have a CSP potential of some 65GW, capable of providing 36 000 GWh/year.

The proposed Camden I SEF project will only be using Solar PV Technology. CSP is not being considered as a technology alternative.

AGRIVOLTAIC

Agrivoltaics proposes to combine PV and agricultural production on the same land. For that purpose, PV panels are mounted at sufficient heights to allow agricultural cultivation under them. One of the major concerns with Solar PV Systems is that the PV panels partially shade the crop and therefore reducing incident irradiance levels on it, affecting crop production.

Agrivoltaics is still new technology being investigated. Design principles include the conversion of photovoltaic installations with N-S horizontal trackers into Agrivoltaic installations by cultivating tree crops in hedgerows between the rows of collectors. (Casares de la Torre, et. al, 2022).

6.3 PROJECT INFRASTRUCTURE

The proposed Camden I SEF will be developed with a capacity of up to 100 megawatt (MW), thus allowing for up to 100 MW export from the facility. The proposed Camden I SEF will comprise of the following key components:

SOLAR FIELD

- PV Modules, which convert the solar radiation into direct current (DC);
- PV panels will have a maximum height of 5 m, and could be mounted on fixed tilt, single axis tracking or dual axis tracking mounting structures or Bifacial Solar Modules with a maximum combined height of up to 10m (i.e. total height of structure and panel will be up to 10m). Where desirable and feasible, Agri-Voltaic principles could be considered in the final design.

SITE SUBSTATION AND BATTER ENERGY STORAGE SYSTEM (BESS)

- IPP portion site substation of approximately 1.5ha. The substation will consist of a high voltage substation yard to allow for multiple up to 132kV feeder bays and transformers, control building telecommunication, and other substation components as required; and
- The Battery Energy Storage System (BESS) footprint will be up to 5 ha. The BESS storage capacity will be up to 100MW/400megawatt-hour (MWh) with up to four hours of storage. It is proposed that Lithium Battery Technologies, such as Lithium Iron Phosphate, Lithium Nickel Manganese Cobalt oxides or Vanadium Redox flow technologies will be considered as the preferred battery technology however the specific technology will only be determined following Engineering, Procurement, and Construction (EPC) procurement. The main components of the BESS include the batteries, power conversion system and transformer which will all be stored in various rows of containers. The BESS components will arrive on site pre-assembled.

OPERATION AND MAINTENANCE BUILDING INFRASTRUCTURE

- Operations and maintenance (O&M) building infrastructure will be required to support the functioning of the SEF and for services required by operations and maintenance staff. The O&M building infrastructure will be located in close proximity to the site substation and will include:
  - Operations building of approximately 200m^2;
  - Workshop and stores area of approximately 300m^2; and
  - Refuse area for temporary waste storage and septic and/or conservancy tanks to service ablution facilities.

CONSTRUCTION CAMP LAYDOWN

- Temporary infrastructure includes:
  - A construction camp area and concrete batching plant (up to 5ha footprint);

- The site will also accommodate a cement silo;
- Temporary laydown area (up to 2ha) for the storage of equipment, materials, fuels, cement, chemicals etc; and
- Sewage: septic and/or conservancy tanks and portable toilets.

ACCESS ROAD

- Access to the proposed Camden I SEF from the N11 is via two existing farm gravel roads; either via the D260 or the D1107 roads;
- Internal gravel roads of approximately 8km will be developed. The roads will be between 5m and 6m wide;
- Where required for turning circle/bypass areas, access or internal roads may be up to 20m to allow for larger component transport.

ASSOCIATED INFRASTRUCTURE

- The solar arrays are typically connected to each other in strings, which are in turn connected to converters/inverters that convert DC to AC. The medium voltage collector system will comprise of cables up to and including 33kV that run underground, except where a technical assessment suggest that overhead lines are required, within the facility connecting the solar PV arrays to the onsite substation;
- Fencing of up to 4m high around the construction camp, O&M building and Site substation and BESS areas; and
- Any other associated infrastructure, such as:
  - Fencing around the facility (or where required) and lighting,
  - Lightning protection
  - Telecommunication infrastructure
  - Storm water channels
  - Water pipelines
  - Offices
  - Operational control centre
  - Operation and Maintenance Area / Warehouse / workshop
  - Ablution facilities
  - A gate house
  - Control centre
  - Offices
  - Warehouses
  - Security building
  - A visitor's centre; and
  - Substation building

The proposed development footprint (buildable area) is approximately 280ha (subject to finalisation based on technical and environmental requirements), and the extent of the project area is approximately 695ha. The development footprint includes the solar PV arrays and all associated infrastructures as outlined above.

6.4 GENERAL CONSTRUCTION ACTIVITIES

The construction process will follow industry standard methods and techniques. Key activities associated with the construction phase are described in **Table 6.4.**

Table 6.4: Construction Activities

ACTIVITY	DESCRIPTION
Establishment access and internal roads	Access to the proposed Camden I SEF from the N11 is via two existing farm gravel roads; either via the D260 or the D1107 roads. Internal gravel roads of approximately 6km will be developed. The roads will be between 5m and 6m wide and may require widening to ensure that it is suitable for use.
Site preparation and establishment	Site establishment will include clearing of vegetation and any bulk earthworks that may be required.
Transport of components and equipment to site	All construction material (i.e. PV support structure materials), machinery and equipment (i.e. graders, excavators, trucks, cement mixers etc.) will be transported to site utilising the national, regional and local road network. Large components (such as substation transformers) may be defined as abnormal loads in terms of the Road Traffic Act (No. 29 of 1989). In such cases a permit may be required for the transportation of these loads on public roads.
Establishment of a laydown area on site	Construction materials, machinery and equipment will be kept at relevant laydown and/or storage areas. A laydown area of approximately 2ha has been proposed for this project. The laydown area will also be utilised for the assembly of the PV panels. The laydown area will limit potential environmental impacts associated with the construction phase by limiting the extent of the activities to one designated area.
Erection of PV Panels	The PV panels will be arranged in arrays. The frames will be fixed onto vertical posts that will be driven into ground utilising the relevant foundation method identified during the geotechnical studies, including potentially employing concrete foundations for the panel frames. PV panels will have a maximum height of 5m, and could be mounted on fixed tilt, single axis tracking or dual axis tracking mounting structures or Bifacial Solar Modules with a maximum combined height of up to 10m (i.e. total height of structure and panel up to 10m). Where desirable and feasible, Agri-Voltaic principles could be considered in the final design.
Construction of substation and inverters	The facility output voltage will be stepped up from medium voltage to high voltage in the transformer. The medium voltage cables will be run underground in the facility (except where a technical assessment suggest that overhead lines are applicable) to a common point before being fed to the onsite substation.
Establishment of ancillary infrastructure	Ancillary infrastructure will include a workshop, storage areas, office and a temporary laydown area for contractor's equipment.
Rehabilitation	Once all construction is completed on site and all equipment and machinery has been removed from the site, the site will be rehabilitated.

6.5 ALTERNATIVES

The EIA Regulations of 2014 (as amended) require that the S&EIA process must identify and describe alternatives to the proposed activity that were considered, or motivation for not considering alternatives. Different types or categories of alternatives could be considered including different locations, technology types, and project layouts. At the scoping level the evaluation of alternatives is provided at a high level in the absence of detailed environmental comparators for each alternatives; due to the two-staged nature of the S& EIA process it is more suitable to identify and describe the potential alternatives on a high level basis within scoping, and to perform a more detailed analysis of alternatives (with environmental comparators) in the EIA phase of the project. As such, the S&EIA will holistically assess the impacts and risks of each alternative in a comparative way, as suggested by Appendix 2 of the EIA Regulations of 2014 (as amended).

All alternatives outlined below are considered both feasible and reasonable.

6.5.1 SITE ALTERNATIVES

The selection of the Camden site is the outcome of a feasibility assessment by the proponent, which *inter alia* served to identify site options that would be optimal for energy production and grid interconnection. The Camden site was selected because it is strategically located due to the following factors:

1) **Proximity to the Eskom grid and collector substation** – The proposed SEF requires connection to the Eskom grid to transmit the generated electricity. As such, the location of the facility would benefit from being close to an existing substation (Camden Power Station substation). The proposed project location is adjacent to the Camden Power Station substation, consequently reducing the length of the powerline that will be constructed for connection. In addition, further existing powerlines are located within close proximity to the site, allowing for potential direct connection to these existing lines where insufficient allocation may be available at the Camden substation, or where Eskom planning indicates different future use. Furthermore, the location and proximity of the site to the Camden Power Station reduces environmental impacts associated with long connection lines.
2) **Land Availability** – The availability of land is a key feasibility criterion in the site selection process. The project site is of a suitable land size for the proposed development. The land available for the development of the Camden I SEF extends approximately 695 ha, providing land for a 280 ha development. Furthermore, this region is home to some of the biggest coal power stations in the country (Komati and Camden among many others), and most land parcels have been given mining rights for coal beneficiation to provide fuel stock supply these power stations. Thus, there is very limited land available for the development of renewable energy facilities. The proponent has however secured sufficient land for the development of the proposed Solar Energy Facility with landowners within the respective cadastral portions comprising the development footprint indicating their support and willingness for the project to proceed to development via entering into agreement with the developer
3) **Strategic Approach** – Five of Eskom's coal-fired power stations are targeted for decommissioning in the short term. These include the Komati, Camden, Grootvlei, Arnot, and Hendrina power stations. These power stations range between 50 - 60 years of age. According to the 2019 IRP, over a 11-year period Eskom are expected to decommission over 11GW of its coal fired capacity. The development site is therefore strategically located such that the megawatts generated from the SEF can replace those generated by the Camden Power Station in the event that Camden is decommissioned in the future.
4) **Road and labour pool accessibility** – The site is in close proximity to the N11 and N2 highways and the town of Ermelo, which will benefit construction logistics and provide a labour resource respectively. There is also an existing road that goes through the land parcels to allow for direct access to the project development area.
5) **Environment** - The environment is a key factor when it comes to the development of its projects. The proponent aims to ensure that its projects are developed in a sustainable manner. All the environmental factors were considered in the area when ESA was scoping for potential sites for the Project. After a thorough evaluation of the regional farms, the specific farms were selected because they were already heavily disturbed by agricultural and coal mining activities. Thus, it was concluded that the development of these farms would have a minimal impact on the region's flora, fauna and water resources.

There is no Site alternative for the Camden I SEF. The site is considered suitable for the reasons provided. The investigation of an alternative site is not currently proposed within this S&EIA.

6.5.2 TECHNOLOGY ALTERNATIVES

The Camden 1 SEF will utilize solar PV technology to generate power. Therefore, no technology alternatives are being considered for this project, however the motivation for the use of solar PV technology for this project is provided below.

SOLAR PV MOTIVATION

SOLAR RESOURCE

The Project site was also selected on the availability of solar resource in the Mpumalanga region. The availability of the solar resource is the main drivers of project viability. The Project site was identified by the proponent through a desktop pre-feasibility analysis based on the estimation of the solar energy resource. The site location provides sufficient solar resource to ensure the economic viability of a solar PV facility. This viable solar resource ensures the best value for money is gained from the project, allowing for competitive pricing and maximum generation potential, with the resulting indirect benefits for the South African economy. Furthermore, near the proposed Project site the proponent have also identified a suitable area to develop a complementary wind facility that will assist to balance the supply of electricity.

TOPOGRAPHY

The surrounding landscape has a relatively flat topography which is suitable for the development of a solar project. The Project site itself is located on the flattest ground near the Camden power station and thus in combination with suitable solar resource within the study area is optimized from a construction and technical perspective.

COMPETITION

With regards to renewable energy facilities, there is minimal competition in the area. Should the project proceed, it will be one of the first commercial scale solar PV facilities in the province and will act as one of the pioneering developments and open opportunities for other renewable developments. It will also serve as a case study for solar resource in the province, showing that commercially viable solar energy facilities are suitable for certain parts of Mpumalanga Province.

AGRIVOLTAICS

One of the major concerns with Solar PV Systems is that the PV panels partially shade the crop and therefore reducing incident irradiance levels on it, affecting crop production. The design of the Camden I SEF will consider Agrivoltaics where desirable and feasible in the final design. Agrivoltaic design principles include the conversion of photovoltaic installations with N-S horizontal trackers into Agrivoltaic installations by cultivating tree crops in hedgerows between the rows of collectors (Casares de la Torre, et. al, 2022).

BESS TECHNOLOGY

There are two types of BESS Technologies being considered at the proposed Camden I SEF namely; Solid-State Lithium (SSL) or Vanadium Redox Flow (VRF) BESS systems.

VRF BESS

These energy storage systems can be supplied either as containerized units or as a fixed installation within a building etc. Due to the proposed size of the facilities (100MW) the Camden facility is currently envisioned as having units possibly housed within a large battery building. If the units are housed within containers, then most of the risks remain valid, just possibly of smaller magnitude. Within each unit, battery cells assembled together to form stacks.

SSL BESS

A Solid-State Battery consists of multiple battery cells that are assembled together to form modules. The solid-state batteries that are being considered are Lithium-ion systems. Each cell contains a positive electrode, a negative electrode and an electrolyte. The BESS will comprise of multiple battery units or modules housed in shipping containers and/or an applicable housing structure which is delivered pre-assembled to the project site. Containers are usually raised slightly off the ground and layout out is rows. They can be stacked if required although this may increase the risk of events in one container spreading to another container. Supplementary infrastructure and equipment may include substations, power cables, transformers, power converters, substation buildings & offices, HV/MV switch gear, inverters and temperature control equipment that may be positioned between the battery containers.

The advantages and disadvantages of each type are presented in **Table 6.5**.

Table 6.5: Advantages and Disadvantages of BESS technology types

BESS TYPE	ADVANTAGES	DISADVANTAGES
Solid-State Lithium	— High specific energy and high load capabilities with power cells — Long cycle and extended shelf-life; maintenance-free — High capacity, low internal resistance, good coulombic efficiency — Simple charge algorithm and reasonably short charge times	— Need for protection circuit to prevent thermal runaway if stressed — Degradation at high temperature and when stored at high voltage — Impossibility of rapid charge at freezing temperatures (<0°C, <32°F) — Need for transportation regulations when shipping in larger quantities

Vanadium Redox Flow	— Long service life: RFBs have a system endurance period of 20 years, with an unlimited number of charge and discharge cycles available without degradation. In addition, the electrolytes can be used semipermanently. — Versatility: With the output and the capacity of a battery capable of being designed independently of each other, RFBs allow flexible design. In addition, the batteries allow a single system to address both short and long periods of output variation, enabling cost-effective power generation. — High safety: RFBs are capable of operating under normal temperatures and are composed of noncombustible or flame-retardant materials. The possibility of a fire with the batteries is extremely low.	— Complexity: RFB systems require pumps, sensors, flow and power management, and secondary containment vessels. — Low energy density: The energy densities of RFBs are usually low compared with those of other types of batteries.

It is important to note that the selection of specific technology will only be determined following EPC (i.e. no technology preference is specified and implementation of both are considered reasonable and feasible), therefore both types of battery technologies have been considered in the EIA. The potential risks and impacts of the proposed BESS at the Camden I SEF have been assessed as part of this EIA and the Risk Assessment is included in **Appendix H-14**. Both options have been investigated in **Section 7.4** of this report, and assessed in **Section 8.18**. Both BESS technologies were assessed and no fatal flaws were identified. However, the SSL technology is preferred.

From a safety and health point of view, the risk assessment shows that risks posed by VRF systems may be slightly lower than those of SSL facilities, particularly with respect to fire and explosion risks. From an environmental spill and pollution point of view the VRF systems present higher short-term risks than the SSL systems. However, the above conclusions may be due to the fact that the VRF technology is not as mature as SSL technology and therefore there is not as much operating experience and accident information available for the VRF.

6.5.3 LAYOUT ALTERNATIVES

No layout or design alternatives for the solar panels are available for assessment at this stage. However, two site locations have been identified for the on-site substation, which include the BESS, and are included in the layout map (**Figure 6.2**). Alternative 2 is preferred as it provides the shorter connection to the preferred collector substation. Both Alternatives are considered feasible and reasonable, and the preferred Alternative has been identified in **Section 10.5** (Alternatives Assessment).

The area of the site is approximately 695 ha in extent; this can adequately accommodate the up to 100 MW design capacity of the Camden I SEF.

The scoping phase aimed to identify potentially environmentally sensitive areas within the site which should be avoided by the proposed development. This information was used to inform the layout and design alternatives for the proposed project.

During the EIA further detailed studies were undertaken on the areas affected by the proposed layout and design alternatives in order to identify any further areas of sensitivity thereby allowing for further refinement of the final layout and design. The advantages and disadvantages of the layout and design alternatives are included in **Table 6.6.**

Table 6.6: Advantages and Disadvantages of substation locations

ALTERNATIVES	ADVANTAGES	DISADVANTAGES

Alternative Option 1		The Option 1 alternative location for the BESS borders on a stream that tributes to the Vaal River system. This proximity to an important water course is a disadvantage of this location 1.
Alternative Option 2	Shorter connection to the preferred collector substation	

6.5.4 'NO PROJECT' ALTERNATIVE

In the "no project" alternative, the Camden I SEF project will not be developed. In this scenario, there could be a missed opportunity to address the need for increase in renewable energy generation in an effort to mitigate against concerns of climate change and exploitation of non-renewable resources. The no-go alternative would not assist in responding to the growing electricity demand in South Africa and would not contribute to the reliability of electricity supply at a national scale. Conversely, negative environmental impacts of the project (as outlined in **Section 6**) associated with the development of the Camden I SEF would be avoided.

The "no project" alternative has been assessed in Section 10.5.

The primary goal of the Project is to assist in providing additional capacity to Eskom to assist in addressing the current energy supply constraints. The project also aims to reduce the carbon footprint associated with energy generation. As indicated above, energy supply constraints and the associated load shedding have had a significant impact on the economic development of the South African economy. South Africa also relies on coal-powered energy to meet more than 90% of its energy needs. South Africa is therefore one of the highest per capita producers of carbon emissions in the world and Eskom, as an energy utility, has been identified as the world's second largest producer carbon emissions.

The No-Development option would represent a lost opportunity for South Africa to improve energy security and supplement is current energy needs with clean, renewable energy. Given South Africa's current energy security challenges and its position as one of the highest per capita producers of carbon emissions in the world, this would represent a significant negative social cost.

7 DESCRIPTION OF BASELINE ENVIRONMENT

7.1 PHYSICAL ENVIRONMENT

7.1.1 CLIMATE AND METEOROLOGY

LOCAL METEOROLOGY OVERVIEW

According to the Köppen-Geiger Classification, the Camden area is defined as having a temperate climate with warm summers and dry winters. Meteorological variables for the region were sourced from the South African Weather Service's (SAWS) Ermelo station, located ~20 km to the northwest, as well as Eskom's ambient air quality monitoring station (AQMS) located ~6 km to the northeast. The datasets were analysed for the period January 2018 - December 2020 (i.e. three calendar years as required by the Modelling Regulations). Station details and data recovery for both stations are presented in **Table 7.1**. Although the Ermelo station is at distance from the study site, the local topography is not complex and thus the meteorological data is considered representative of regional weather conditions that would prevail at the proposed development sites.

Table 7.1 Meteorological station details and data recovery

STATION NAME	LATITUDE (°S)	LONGITUDE (°E)	ALTITUDE (M)	DATA RECOVERY			
				Temperature	Humidity	Rainfall	Wind field
Ermelo	-26.497000°	29.983000°	1752	97%	97%	98%	98%
Camden	-26.622600°	30.106000°	1646	97%	97%	97%	96%

TEMPERATURE AND RAINFALL

Ambient air temperature influences plume buoyancy as the higher the plume temperature is above the ambient air temperature, the higher the plume will rise. Further, the rate of change of atmospheric temperature with height influences vertical stability (i.e. formation of mixing or inversion layers). Rainfall is an effective removal mechanism of atmospheric pollutants and thus also relevant in the assessment of pollution potential.

Figure 7.1 and **Figure 7.2** presents average monthly temperature, rainfall and humidity as recorded at the Ermelo and Camden stations respectively. Both stations exhibit seasonal trends typical for the eastern half of South Africa. Higher rainfall occurs during the warmer summer months (December, January and February), with drier conditions during cooler winter months (June, July and August).

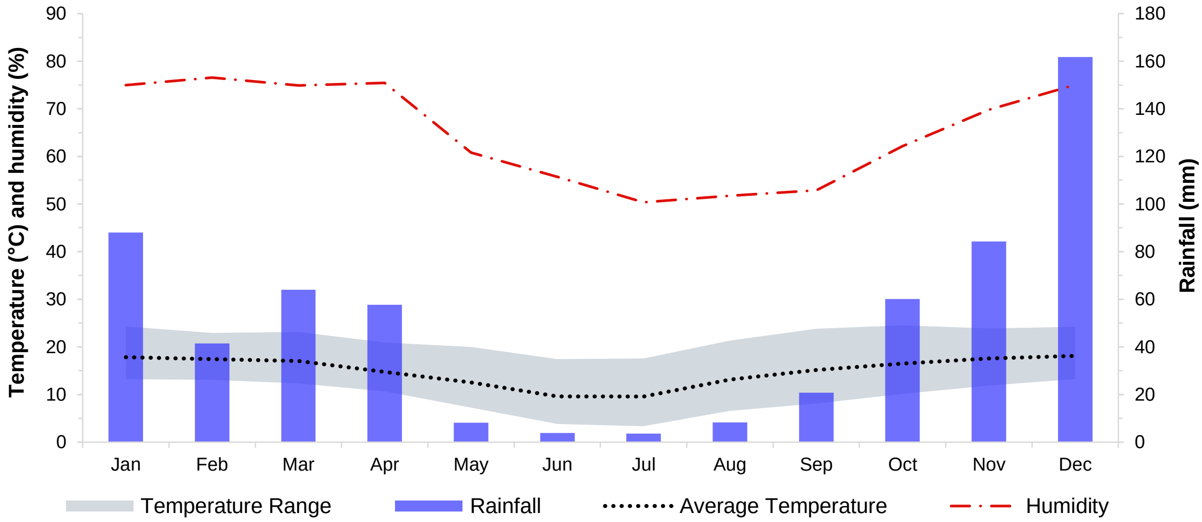


Figure 7.1 Meteorological summary for Ermelo (January 2018 - December 2020)

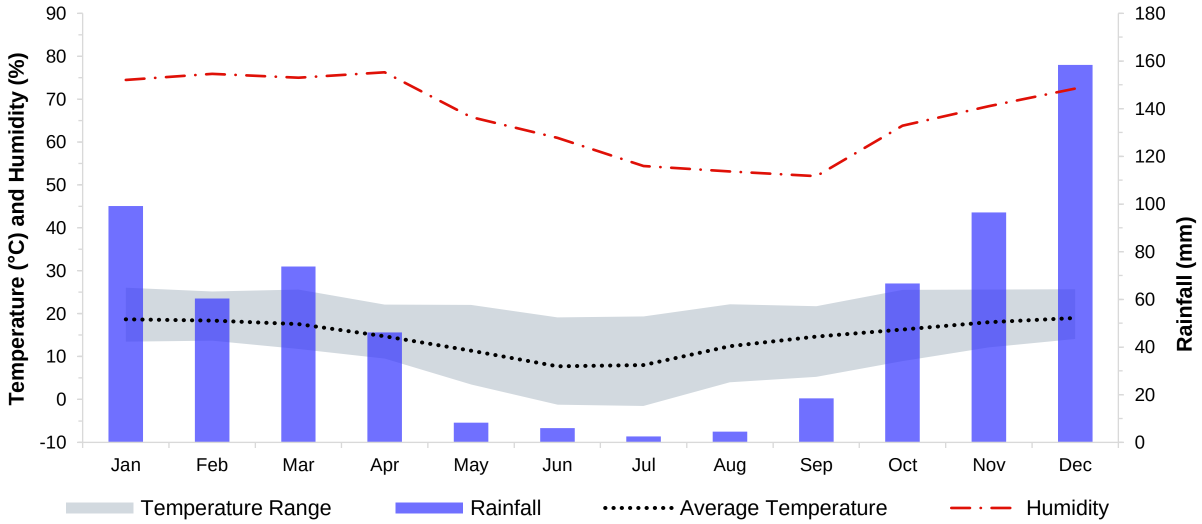


Figure 7.2: Meteorological summary for Camden (January 2018 - December 2020)

WIND

Wind rose summarize wind speed and directional frequency at a location. Calm conditions are defined as wind speeds less than 1.0 m/s (i.e. based on the typical sensitivity of the wind sensor installed at SAWS stations). Each directional branch on a wind rose represents wind originating from that direction. Each directional branch is divided into segments of colour, each representative of different wind speeds.

Typical wind fields are analysed for the full period (January 2018 – December 2020); diurnally for early morning (00h00–06h00), morning (06h00–12h00), afternoon (12h00–18h00) and evening (18h00–00h00); and seasonally for summer (December, January and February), autumn (March, April and May), winter (June, July and August) and Spring (September, October and November). Typical wind fields have been analysed using Lakes Environmental WRPlot Freeware (Version 7.0.0).

Wind roses for Ermelo are presented in **Figure 7.3**, and can be summarised as follows:

— Calm conditions (wind speeds <1.0 m/s) occurred 1.41% of the time;
— Gentle to strong breezes from the east prevailed in the region;
— Peak wind speeds occurred from the north-northwest (14.4 m/s) and highest average wind speeds occurred from the east-southeast (5.0 m/s);

- Easterly winds prevail throughout the day and night with northerly components noted during the early morning (00h00-06h00) and morning (06h00-12h00) hours as well as westerly components noted during the morning (06h00-12h00) and afternoon (12h00-18h00) hours;
- Diurnal peak (12.4 m/s) and highest average (4.8 m/s) wind speeds occurred during the afternoon;
- Winds from the east prevailed during the summer and autumn months;
- Winds from the west and north prevailed during winter;
- Winds from the east and north prevailed during spring; and
- Seasonal peak (12.9 m/s) wind speeds occur during winter and highest average (4.9 m/s) wind speeds occur during spring.

Wind roses for Camden are presented in **Figure 7.4**, and can be summarised as follows:

- Calm conditions (wind speeds <1 m/s) occurred 14.13% of the time;
- Gentle to strong breezes from the east prevailed in the region;
- Peak (13.8 m/s) and highest average (5.5 m/s) wind speeds occurred from the west;
- Easterly winds prevail throughout the day and night with north-westerly components noted during the early morning (00h00-06h00), morning (06h00-12h00) and night-time (18h00-00h00) hours, as well as westerly components noted during the afternoon (12h00-18h00);
- Diurnal peak (13.3 m/s) and highest average (5.0 m/s) wind speeds occurred during the afternoon;
- Winds from the east prevailed during the spring and autumn months;
- Winds from the northwest, west-northwest, west and east prevailed during winter;
- Winds from the east and northwest prevailed during spring; and
- Seasonal peak (13.3 m/s) wind speeds occur during winter and highest average (4.0 m/s) wind speeds occur during spring.

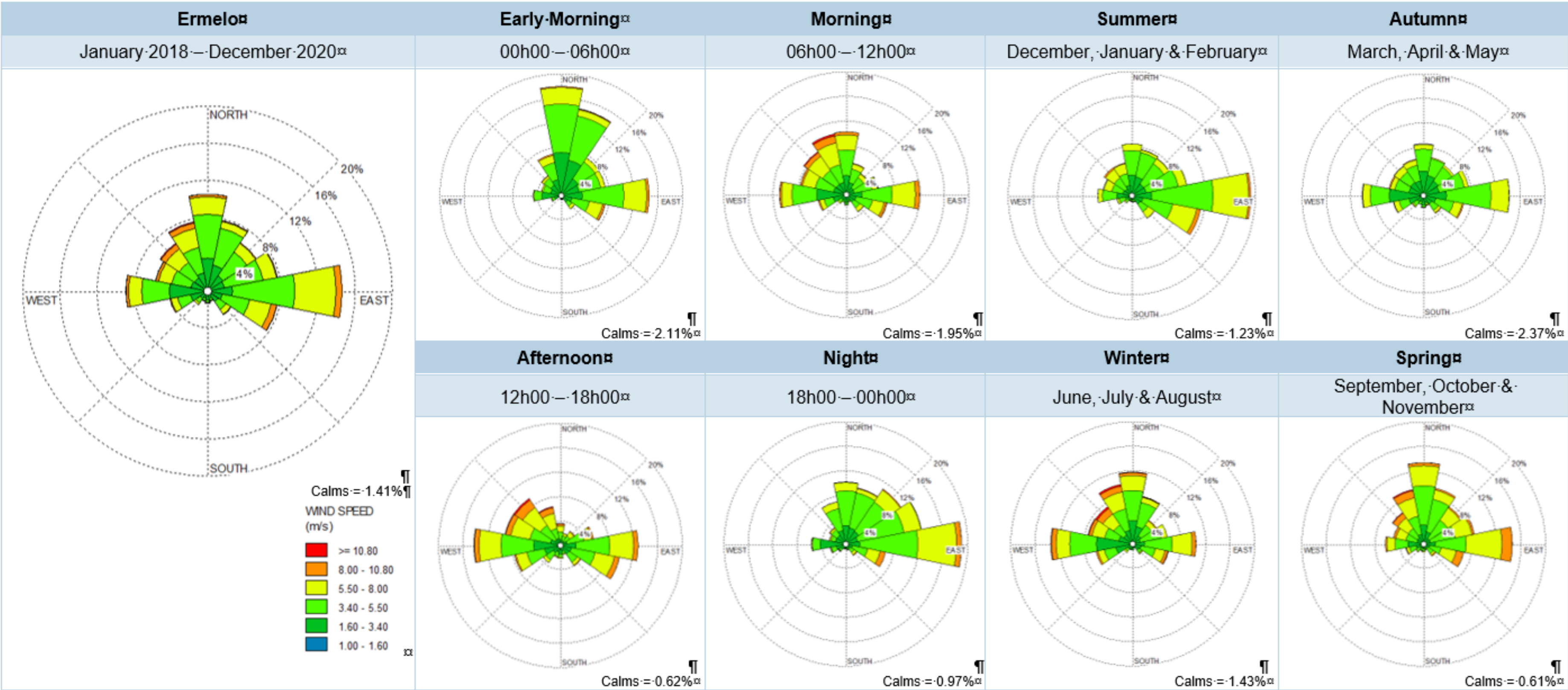


Figure 7.3: Local Wind Conditions at Ermelo

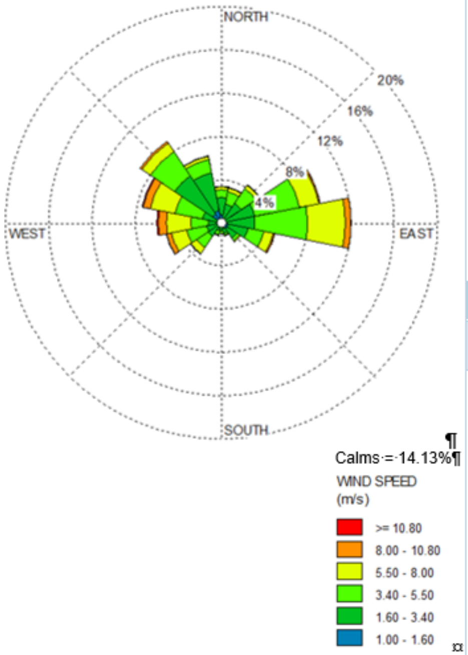
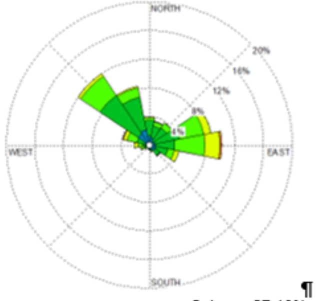
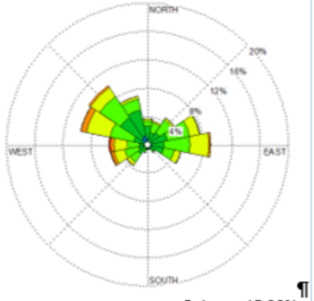
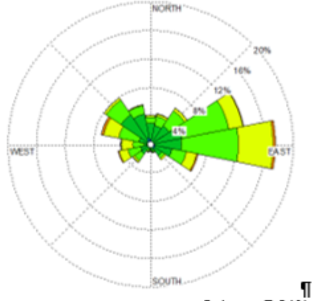
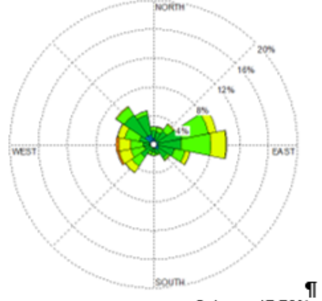
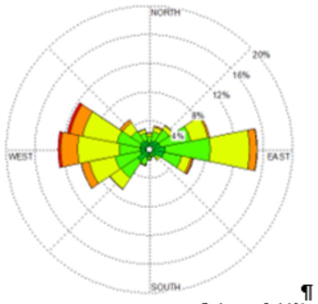
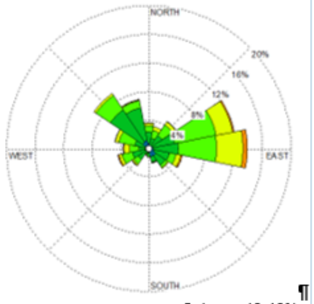
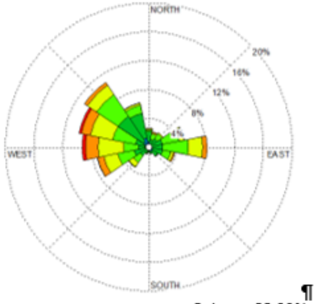
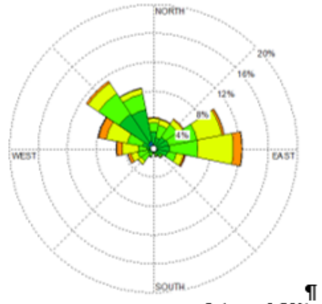
Camden	Early Morning	Morning	Summer	Autumn
January 2018 – December 2020	00h00 – 06h00	06h00 – 12h00	December, January & February	March, April & May
 Calms = 14.13%	 Calms = 27.10%	 Calms = 15.86%	 Calms = 7.61%	 Calms = 17.78%
	Afternoon	**Night**	**Winter**	**Spring**
	12h00 – 18h00	18h00 – 00h00	June, July & August	September, October & November
	 Calms = 0.11%	 Calms = 13.46%	 Calms = 22.39%	 Calms = 8.56%

Figure 7.4: Local Wind Conditions at Camden

7.1.2 TOPOGRAPHY

The following is extracted from the Visual Impact Assessment compiled by SiVest SA (Pty) Ltd and included as ***Appendix H-12.***

The proposed Camden I SEF development is located in an area largely characterised by a mix of undulating plains and greater relief in the form of higher lying plateaus intersected by river valleys. Slopes across the study area are relatively gentle to moderate, with steeper slopes being largely associated with the more incised river valleys. The main water course in the study area is the Vaal River in the south-eastern portion of the study area. Flat to gently undulating terrain prevails across much of the SEF project area.

The topography and slopes within and in the immediate vicinity of the Camden I SEF area are indicated in **Figure 7.5** and **Figure 7.6** respectively.

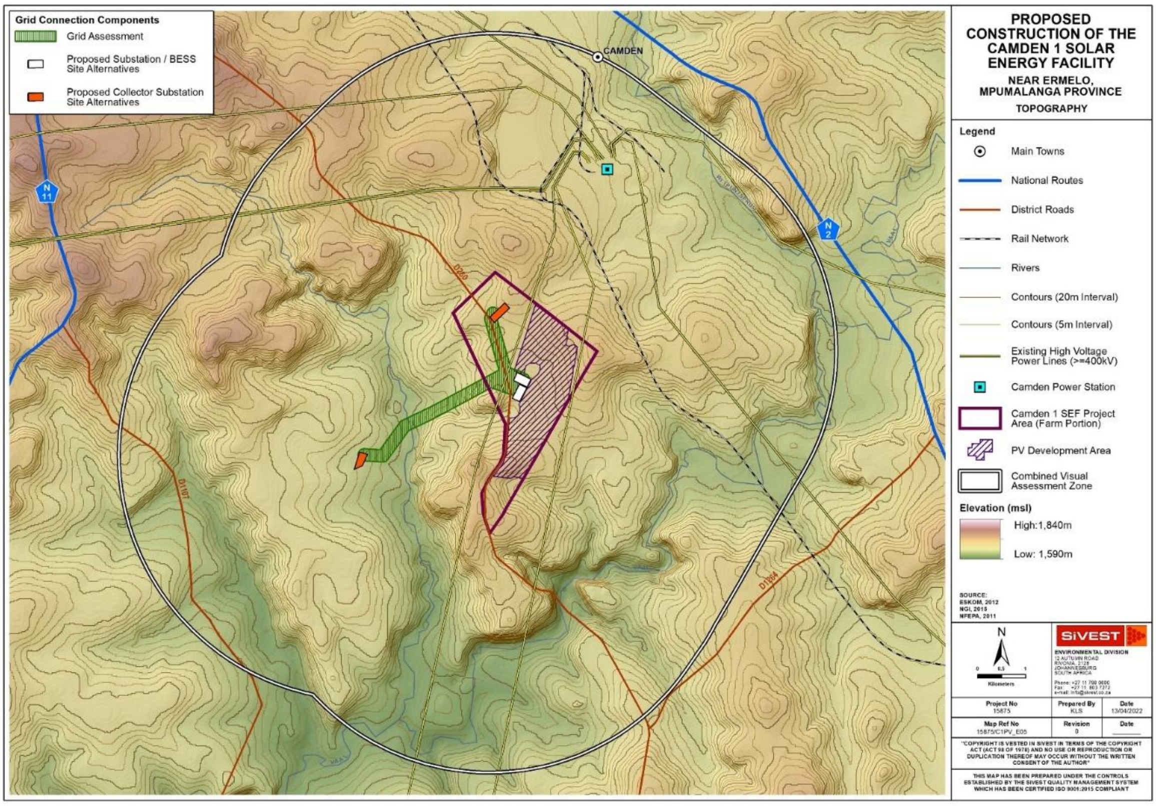


Figure 7.5: Topographical Map of Project Area (SiVest, 2022)

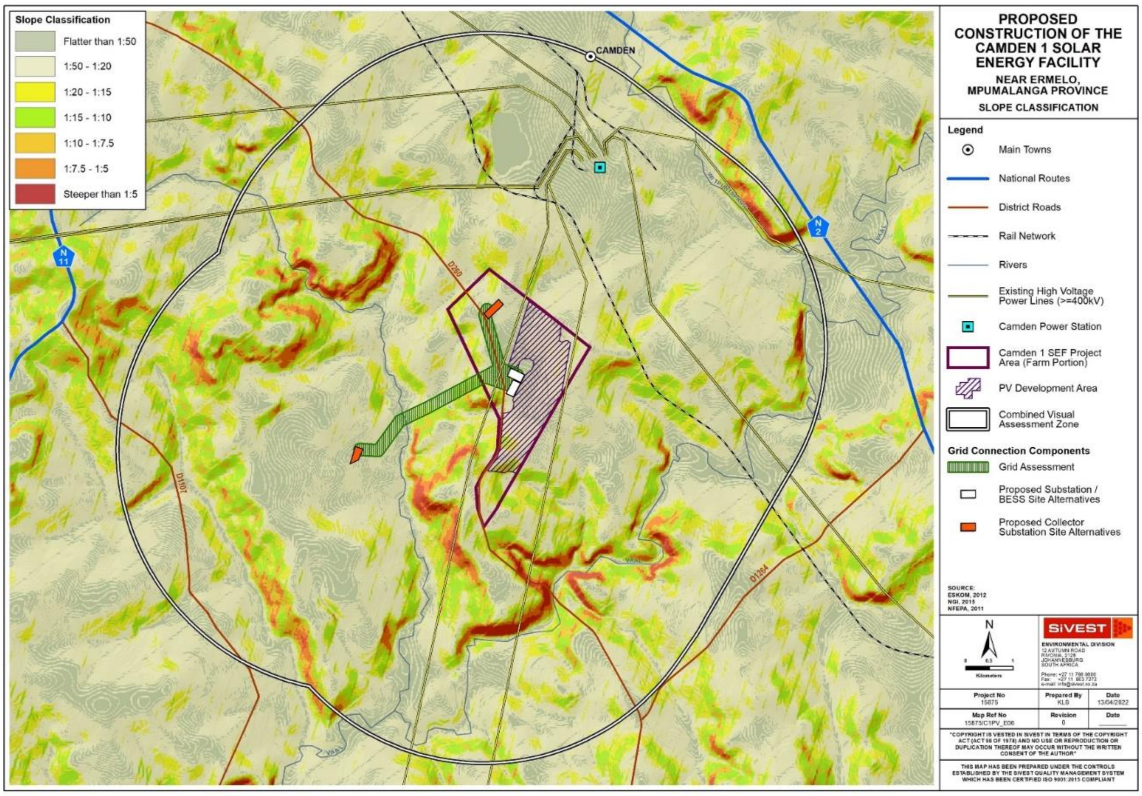


Figure 7.6: Slope classification of Project Area (SiVest, 2022)

7.1.3 GEOLOGY

*The following is extracted from the Palaeontological Impact Assessment compiled by Prof Marion Bamford and included as **Appendix H-11** and the Geotechnical Desktop Assessment compiled by SLR Consulting and included as **Appendix H-3.***

In accordance with the 1:250 000 Geological Maps 2628 East Rand and 2630 Mbabane, published by the Council of Geoscience, the study area is underlain by stratigraphic units of the Ecca Group, Karoo Supergroup which is extensively intruded by post-Karoo dolerite.

VRYHEID FORMATION, ECCA GROUP

The proposed development area is predominantly underlain by lithological units of the Ecca Group which is represented by sandstones, shales and coal seams of the Vryheid Formation, all deposited in a shallow marine environment. The Vryheid Formation has been extensively intruded by Jurassic aged dolerite, becoming relatively more prevalent further east of the proposed study area (**Figure 7.7**).

Sandstones comprise a larger portion of the Karoo sediments and are generally closely intercalated with mudrocks, resulting in alternating bands of arenaceous and argillaceous sediments. The Vryheid Formation sandstones may typically occur as arkosic to greywacke, ranging from a generally coarse grained, poorly sorted material to a fine grained, well sorted material, with an abrupt upward transition.

The Karoo Supergroup rocks cover a very large proportion of South Africa and extend from the northeast (east of Pretoria) to the southwest and across to almost the KwaZulu Natal south coast. It is bounded along the southern margin by the Cape Fold Belt and along the northern margin by the much older Transvaal Supergroup rocks. Representing some 120 million years (300 – 183Ma), the Karoo Supergroup rocks have preserved a diversity of fossil plants, insects, vertebrates and invertebrates.

During the Carboniferous Period South Africa was part of the huge continental landmass known as Gondwanaland and it was positioned over the South Pole. As a result, there were several ice sheets that formed and melted, and covered most of South Africa. Gradual melting of the ice as the continental mass moved northwards and the earth warmed, formed fine-grained sediments in the large inland sea. These are the oldest rocks in the system and are exposed around the outer part of the ancient Karoo Basin, and are known as the Dwyka Group (Johnson et al., 2006).

Overlying the Dwyka Group rocks are rocks of the Ecca Group that are Early Permian in age. There are eleven formations recognised in this group but they do not all extend throughout the Karoo Basin. In the Free State, Mpumalanga and KwaZulu Natal, from the base upwards are the Pietermaritzburg Formation, Vryheid Formation and the Volksrust Formation. All of these sediments have varying proportions of sandstones, mudstones, shales and siltstones and represent shallow to deep water settings, deltas, rivers, streams and overbank depositional environments.

Of significant economic importance is the presence of coal seams located stratigraphically between the sandstone and mudrock bedding partings, at the base of the Vryheid Formation. The lower coalseams attain thicknesses of approximately 18 m which progressively diminishes upwards through the formation, due to various depositional and post-depositional factors (Brink, 1983).

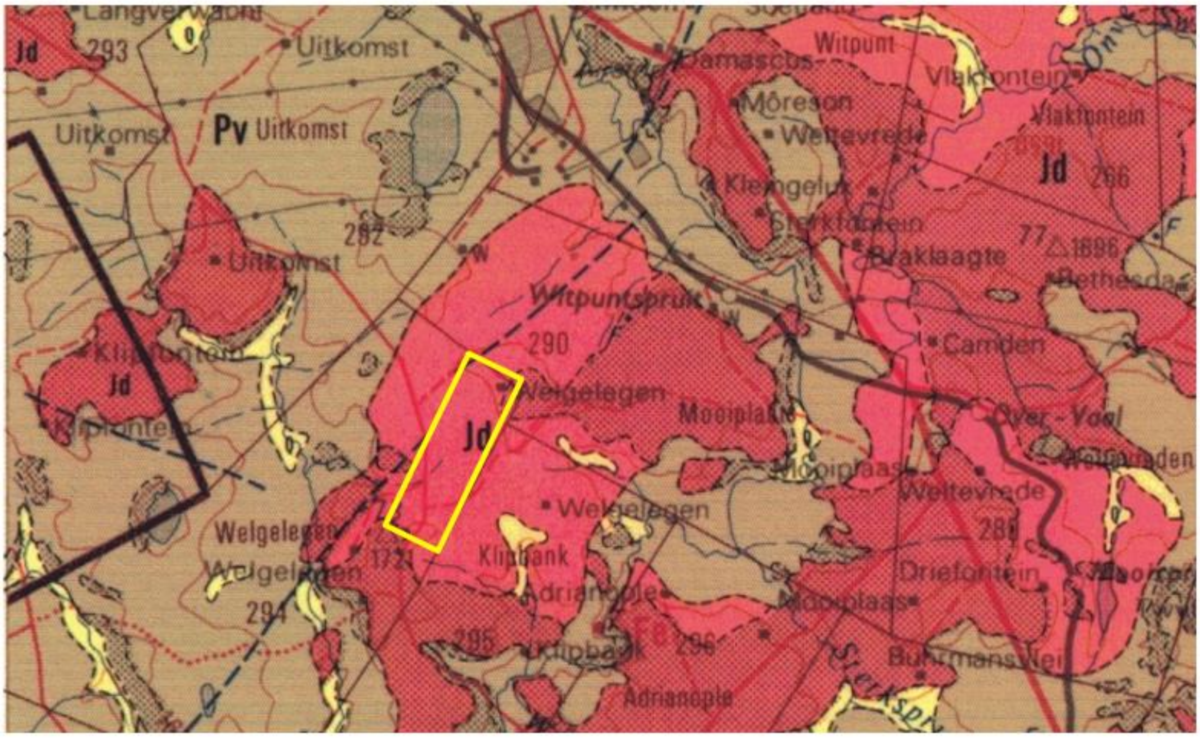


Figure 7.7: **Geological map of the area around the Camden Renewable Energy Cluster with the Camden I SEF area shown within the yellow polygon. Map enlarged from the Geological Survey 1: 250 000 map 2630 Mbabane.**

Table 7.2: **Explanation of symbols for the geological map and approximate ages (Johnson et al., 2006)**

SYMBOL	GROUP/FORMATION	LITHOLOGY	APPROXIMATE AGE
Q	Quaternary	Alluvium, sand, calcrete	Neogene, ca 2.5 Million years to present
Jd	Jurassic dykes	Dolerite dykes, intrusive	Jurassic, approx. 180 Million years
Pv	Vryheid Formation, Ecca Group, Karoo Super Group	Shales, siltstone, sandstone, coal seams	Early Permian

POST-KAROO DOLERITE

Overlying the Ecca Group are the rocks of the Beaufort Group that has been divided into the lower Adelaide Subgroup for the Upper Permian strata, and the Tarkastad Subgroup for the Early to Middle Triassic strata. As with the older Karoo sediments, the formations vary across the Karoo Basin.

Large exposures of Jurassic dolerite dykes occur throughout the area. These intruded through the Karoo sediments around 183 million years ago at about the same time as the Drakensberg basaltic eruption.

Along the rivers and streams much younger transported sediments have been deposited. They were sourced from older weathered strata upstream (Partridge et al., 2006).

Dolerite is an intrusive, hyperbyssal igneous rock of post-Karoo age that has intruded the sedimentary host rocks, mainly in the form of concordant sills and to a lesser extent as discordant dykes. It is a dark grey, crystalline, rock composed mainly of plagioclase feldspar and pyroxene, with accessory amounts of olivine, biotite, amphibole, apatite and iron ore minerals.

Whilst generally of medium grained texture, the dolerite adjacent to the sedimentary contacts is often of a finer texture due to rapid cooling of the magma. The intrusions have also frequently resulted in the formation of an alteration or "baked" zone in the sedimentary rocks adjacent to the contacts. The joints in the dolerite are in most cases filled or coated by secondary calcite and chlorite, deposited by the subsequent circulation of magmatic fluids (Brink, 1983).

RECENT DEPOSITS

Transported soils, referred to as recent deposits, are generally un-lithified sediments that have been derived from the slow disintegration of the parent bedrock material, which have been disbursed from their original locations and deposited by geomorphic processes. The transported soils anticipated to occur across the study area are:

- Colluvium: A term that includes all soils on hill slopes that have been displaced under the influence of gravity. In certain cases, the geotechnical characteristics of the colluvial soils may lead to an approximation of the parent bedrock material.
- Alluvium: Deposits that result from the transportation and deposition of sediments by rivers or similar water courses. These deposits are generally present along rivers and floodplains and may contain fine to coarse grain sizes which is dependent on the origin of the sediment as well as through the processes of eluviation and illuviation.
- Pedocretes: Superficial deposits that have formed either as weathering residues or by cementation of pre-existing soils by various authigenic minerals precipitated from the soil water or ground water. The pedocretes likely to be encountered across the study area are mainly ferricrete with sub-ordinate calcrete which may occur as nodular or hardpan.
- Pebble Marker: The base of the transported soil which is characterised by the presence of a gravel horizon, representing the most recent major geological unconformity in the soil profile. The pebble marker is generally a zone of high permeability due to the abundance of angular, sub-angular and rounded gravel fragments of mixed origin.

A detailed Geological Map of the underlying lithologies occurring across the study area is presented in **Figure 7.8**.

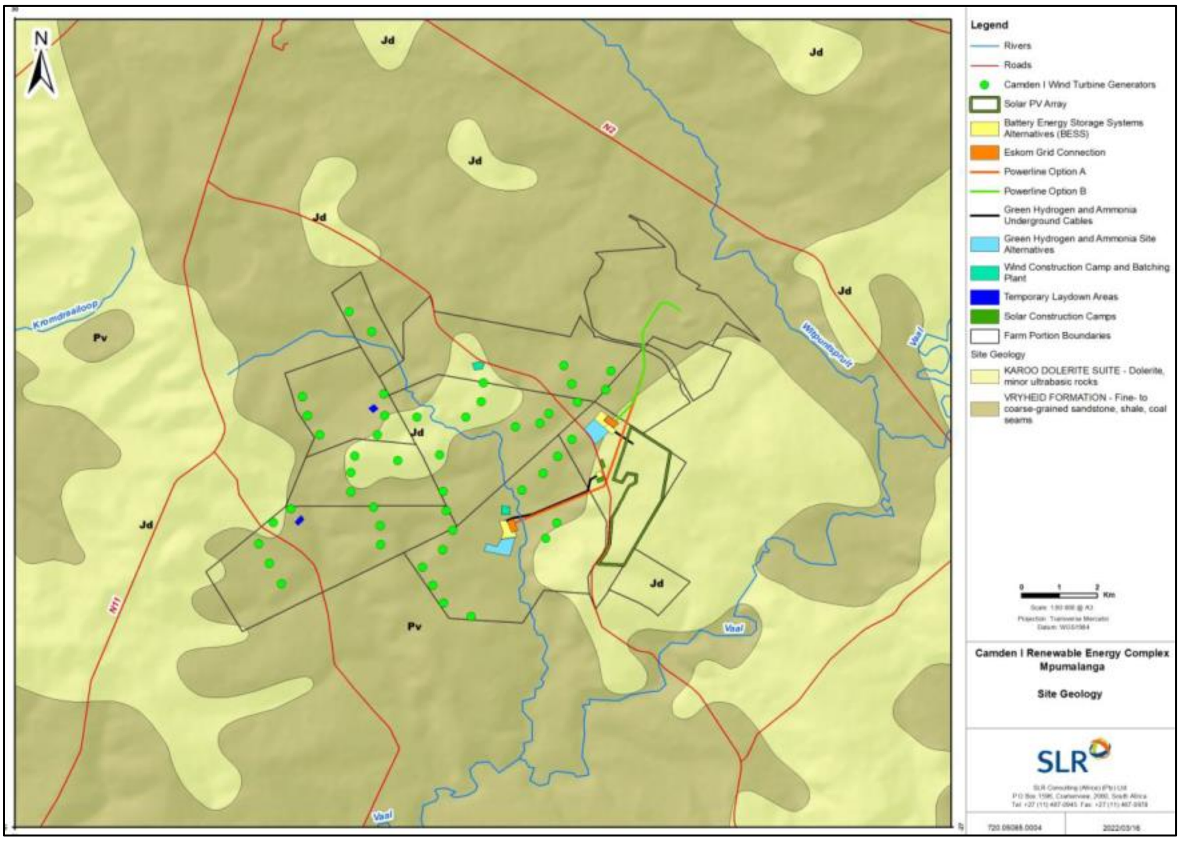


Figure 7.8: Geological map of the proposed development area (SLR, 2022)

7.1.4 SOILS AND AGRICULTURAL POTENTIAL

The following is extracted from the Agriculture Assessment compiled by Johann Lanz and included as ***Appendix H-1.***

The footprint falls across two land types, Ba51 and Ca3. Approximately half of both land types comprise deep, red and yellow, reasonably-drained, loamy soils of the Avalon, Hutton, Glencoe, and other soil forms that are good for crop production. The other half comprises other soils that have various limitations for crop production, which are predominantly the result of poor drainage or limited depth due to underlying clay or bedrock. These soils are of the Mispah and Glenrosa soil forms (shallow bedrock) and the Kroonstad, Estcourt Valsrivier, Longlands, and other soil forms (poor drainage and underlying clay).

The site is located in a grain and cattle farming agricultural region, but the soils vary in their suitability for crop production. Crops in the area include mainly maize and soya beans. Farmers generally utilise all suitable soil as cropland. Only soil that is not suitable for crop production is used for grazing of cattle and sheep. Limitations that render the soil unsuitable for crop production are poor drainage and depth limitations due to rock or dense clay in the subsoil. Coal-fired electricity generation and mining take place in the surrounding area.

LAND USE AND DEVELOPMENT ON AND SURROUNDING THE SITE

The site is located in a grain and cattle farming agricultural region, but the soils vary in their suitability for crop production. Crops in the area include mainly maize and soya beans. Farmers generally utilise all suitable soil as cropland. Only soil that is not suitable for crop production is used for grazing of cattle and sheep. Limitations that render the soil unsuitable for crop production are poor drainage and depth limitations due to rock or dense clay in the subsoil. Coal-fired electricity generation and mining take place in the surrounding area.

AGRICULTURAL POTENTIAL AND PRODUCTIVITY

Because of the favourable climate and suitable soils on the croplands, crop yields are fairly high with average maize yields of around 7 tons per hectare according to the farmers on site. The long-term grazing capacity of the area is fairly high at 4.5 hectares per large stock unit (DAFF, 2018).

7.1.5 SURFACE WATER

*The following is extracted from the Aquatic Impact Assessment compiled by EnviroSci (Pty) Ltd and included as **Appendix H-2**.*

HYDROLOGICAL CACHMENT

In terms of surface water, the study area is located within the western portion of C11B Quaternary Catchment (Vaal River) of the Highveld Ecoregion in the Vaal Water Management Area (WMA), with the Vaal River generally flowing northeast to southwest to within 1km of the south of the study area at its closest point. Most of the aquatic features and unknown tributary of the Vaal River within the study area are located within the riverine valleys and upper catchment areas of this quaternary catchment (**Figure 7.9**).

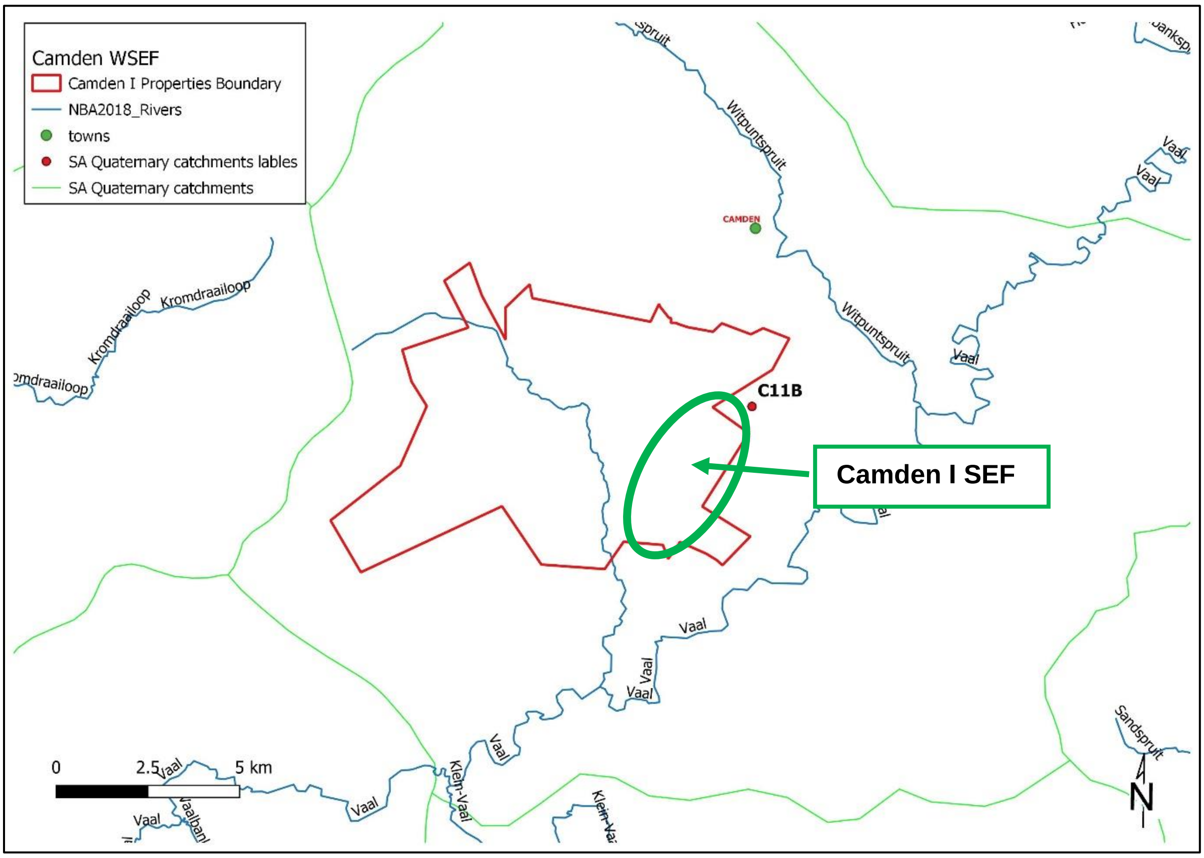


Figure 7.9: Mainstream rivers associated with the Project Area (EnviroSci, 2021)

7.1.6 GROUNDWATER

*The following is extracted from the Geotechnical Desktop Assessment compiled by SLR Consulting and included as **Appendix H-3.***

The Camden I Renewable Energy Complex is underlain by Karoo sedimentary rocks and dolerite intrusions and the hydrogeological characteristics of the study area are a function of the geological formations. The aquifers of the Karoo Supergroup display characteristics of intergranular and fractured rock. The borehole yielding potential of the aquifer is classified as D2, which implies an average borehole yield varying between 0.1 and 0.5 l/s.

According to Barnard (2000), there are typically six different modes of groundwater occurrence associated with these formations:

- Weathered and fractured sedimentary rocks not associated with dolerite intrusions;
- Indurated and jointed sedimentary rocks alongside dykes;
- Narrow weathered and fractured dolerite dykes;
- Basins of weathering in dolerite sills and highly jointed sedimentary rocks enclosed by dolerite;
- Weathered and fractured upper contact zones of dolerite sills; and
- Weathered and fractured lower contact zones of dolerite sills;

Numerous springs occur at lithological contacts such as where sandstone overlies an impervious shale horizon, along fault zones or along impermeable dolerite dykes. Groundwater seepage in lower lying areas contributes substantially to sustaining the dry season flow in the stream systems that drain these landscapes.

A detailed Hydrogeological Map illustrating the aquifer types and borehole yielding potential across the study area is presented in **Figure 7.10** below.

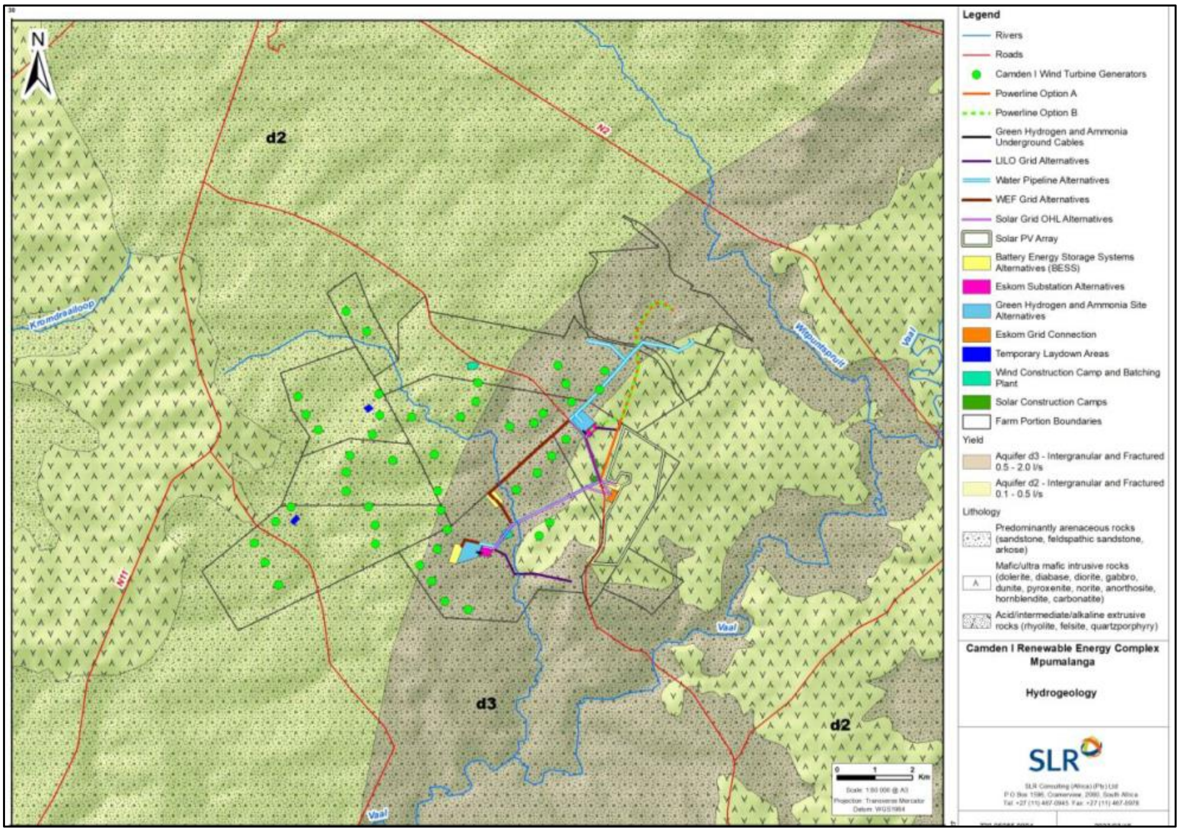


Figure 7.10: Hydrogeological Map of the Proposed Development Area (SLR, 2022)

Groundwater in the area is moderately vulnerable to contaminants when continuously discharged or leached (DWAF, 2013). The regional groundwater is of good quality with electrical conductivity typically <70mS/m (DWAF, 2012). With reference to GHT Consulting Scientists (GHT) Geohydrological Impact Assessment: Proposed Ash Dam Extension at Eskom Camden Power Station (2012) three aquifer types may be anticipated, as follows:

- Shallow: unconfined within the highly weathered Karoo sediments and/or alluvial deposits, and when underlain by less permeable material. Within the vicinity of the ash dam this reportedly ranges from approximately 0.2–1.3m below ground level (bgl)
- Intermediate: semi-confined within horizontal bedding interfaces between different lithologies or when connected through geological structures (joints, fractures, or dolerite dyke contacts)
- Deep: confined within basement lithologies

Groundwater flow directions are expected to somewhat mimic topography and regional drainage and largely be towards the south, in the direction of the Vaal River. This will, however, be complicated around the natural drainage lines where the topography will be expected to induce localised flows, particularly within the shallow aquifer, that will deviate from this general direction, with flow from elevated areas towards to lower lying drainage channels.

7.1.7 ENGINEERING GEOLOGY

The following is extracted from the Geotechnical Desktop Assessment compiled by SLR Consulting and included as ***Appendix H-3.***

Engineering geology refers to the engineering characteristics of the natural earth materials for founding of structures and identifies the suitability of in-situ soils for use as construction materials. The majority of the study area is dominated by the Vryheid Formation with occurrences of post-Karoo dolerite intrusions. Colluvial deposits can be anticipated along hillslopes with alluvial deposits anticipated near drainage features, especially adjacent to the rivers crossing the site.

The climatic regime plays a fundamental role in the development of a soil profile. Weinert (1964) demonstrated that mechanical disintegration is the predominant mode of rock weathering in areas where the climatic “N-value” is greater than 5, while chemical decomposition predominates where the N-value is less than 5. Weinert’s climatic N-value for the Camden area is approximately 1.8.

This implies that chemical decomposition is the dominant mode of weathering in the study area. Chemical decomposition is the chemical alteration of certain minerals, which result in the formation of clay minerals. The nature of the weathering is supported during previous investigations, with both dolerite and the sedimentary rocks weathering to residual soils with moderate to high clay contents.

VRYHEID FORMATION

The Vryheid Formation is predominantly arenaceous, coarse grained, and consists predominantly of sandstones, grits, arkoses, with subordinate mudrocks and coal seams. The sandstones of the Vryheid formation, while consisting predominantly of quartz, may contain significant quantities of rock fragments consisting of micaceous fragments (mica / clay minerals / chlorite) and felsite (fine grained quartz / feldspar mixture). The quartz-rich sandstones disintegrate to form sandy residual soils, whereas the feldspathic sandstones generally decompose to form clayey sands or sandy clays of low to medium plasticity (Brink, 1983). Based on previous investigations undertaken in near proximity to the study area, the sandstone bedrock was observed to weather to sandy and clayey residual soils.

The abovementioned rock types may be closely intercalated, resulting in highly variable geotechnical conditions, both vertically and horizontally. It is not unusual for a weak lens of mudrock to occur within a competent layer of sandstone, or for a band of rock to disappear horizontally over a short distance. The occurrence of weaker strata within or below competent rock strata may be problematic for the founding of heavy structures. The assumption that the founding conditions will improve with depth does not necessarily apply in the case of the Vryheid Formation.

In respect of sourcing construction materials for roads and laydown areas consideration could be given to natural gravely or crushed sandstone bedrock. Selective usage must be exercised to avoid using sandstone containing excessive pyrite and muscovite, which can cause distress when used as basecourse (Brink, 1983). In addition, where chemical stabilization is required the clay matrix of sandstones make them suitable for stabilization with lime (Brink, 1983). The occurrence, nature, material quality and quantity of sandstone and other potential construction materials will have to be assessed during the detailed geotechnical investigation. It is recommended that provision be made to procure aggregates for use in upper pavement layerworks construction and the manufacture of concrete from commercial sources.

On the contrary, mudrocks such as siltstone, mudstone and “mud-shales” are not considered suitable for use as construction materials, due to their swelling characteristics, excessive absorption of water and poor engineering performance. Slope stability issues can arise in areas where closely intercalated sandstones and mudrock co-exist. When mudrocks slake or disintegrate the exposed sandstone layers are undercut, which can result in rockfalls (Brink, 1983).

POST-KAROO DOLERITE

The types of materials that may form from the weathering of dolerite, as described by Brink (1983) are fractured dolerite, boulder dolerite, gravel dolerite, granular dolerite and residual dolerite soil. Fractured dolerite forms where the unweathered rock mass is closely jointed or fractured while boulder dolerite forms where the widely spaced fractures occur. The disintegration or decomposition of dolerite takes place from surface and preferentially along joints and fractures.

Weathering along vertical and horizontal joints and fractures leads to the formation of hard corestones with weathered zones surrounding the boulders. The preferential weathering along joints and fractures may result in variable geotechnical conditions, both laterally and vertically over short distances and a variable bedrock profile.

The dolerite observed on the site, based on previous geotechnical investigations undertaken, was found to be weathered to moderate depths and the rock was overlain by residual soils, typically with a moderate to high clay content.

7.1.8 MINING ACTIVITY AND SEISMICITY

The following is extracted from the Geotechnical Desktop Assessment compiled by SLR Consulting and included as ***Appendix H-3.***

A major component of the geotechnical desk study is to assess the affects that current coal mining operations have on the proposed development. As the Vryheid Formation comprises the most economically exploitable coal seams in South Africa, one cannot ignore the presence of undermined ground and the negative development constraints these can have in general.

The older coal mining operations utilised the board and pillar method of extraction, resulting in these areas being relatively more prone to surface subsidence. Due to the increased demand for coal, either for generation of electricity or for export purposes, more advanced mining methods were utilised, such as, pillar extraction, longwall mining or open cast and strip mining.

As the study area is underlain by relatively large concentrations of post-Karoo dolerite, it can be safe to deduce that coal mining operations will not be as significant as areas located to the north, thereby reducing the potential for undermined ground. This is predominantly due to the intrusions significantly decreasing the calorific potential of most coal layers resulting in the disruption of the lateral continuity of the coal seams in the area.

Based on a review of Google Earth satellite imagery and the Department of Mineral Resources and Energy's online self-service database, it was observed that only one coal mine is present, which is situated outside the eastern boundary of the site with the mine shaft proceeding in an easterly direction. **Table 7.3** summarises the details of the coal mining operation, which presumably focuses on the bituminous coal commodity. **Figure 7.11** illustrates the study area relative to the coal mine.

Table 7.3: List of Coal Mines in Near Proximity to Study Area

ITEM	NAME OF MINE	TYPE	FARM PORTION	OWNER
1	Mooiplaats Colliery	Underground	Mooiplaats 290 IT 1&9	Coal of Africa (Pty) Ltd

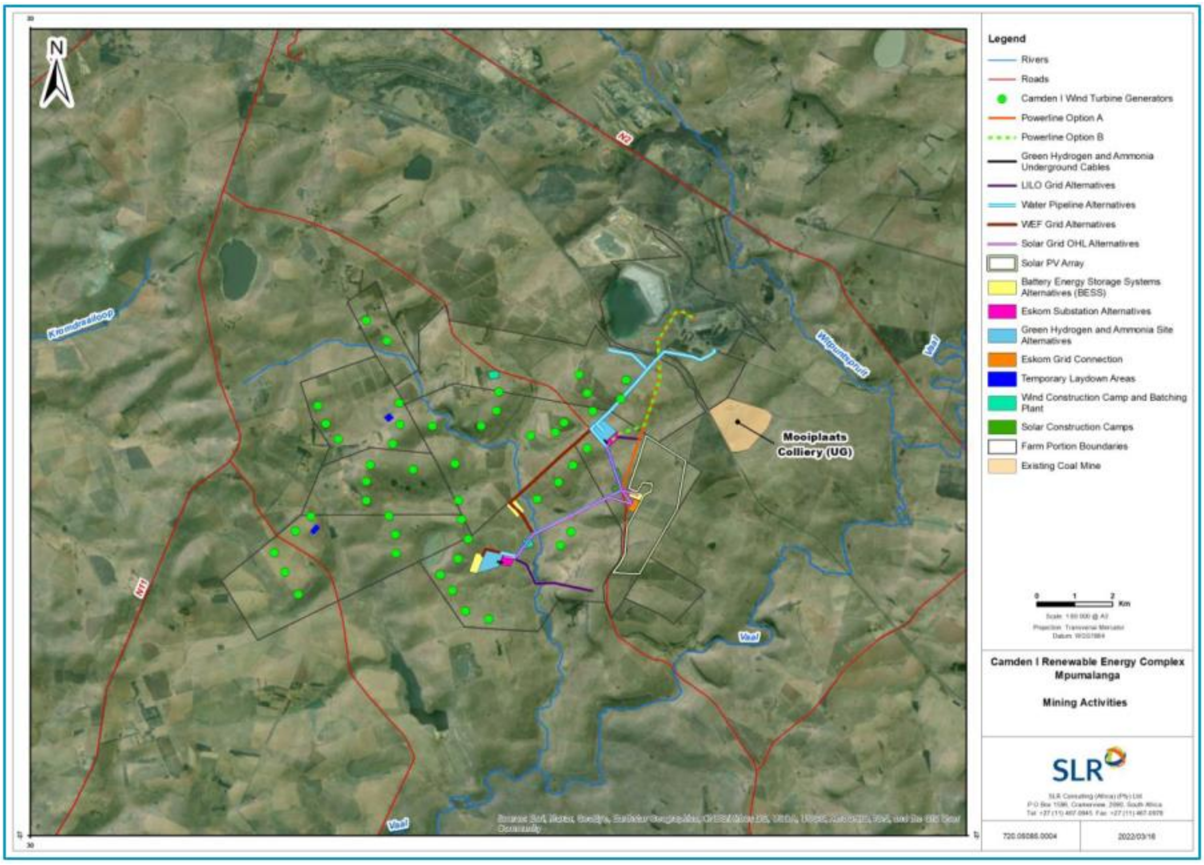


Figure 7.11: Coal Mine Locations Relative to Study Area

Although minimal coal mining operations were observed, the extent and direction of current mining operations cannot accurately be determined during the desk study phase. A detailed geotechnical investigation will be required to confirm their presence, which will comprise of rotary core drilling, geophysics, test pitting and in-situ testing.

In accordance with research undertaken by Andrzej Kijko, in particular, studies entitled, “Data Driven Probabilistic Seismic Hazard Assessment Procedure for Regions with Uncertain Seismogenic Zones” and “The South African National Seismograph Network”, it is observed that moderate to high expected peak ground accelerations (PGA) can be correlated with the presence of mining activities occurring in an area. The Seismic Hazard Map of South Africa (Kijko, 2008) included as **Figure 7.12**, indicates that the proposed study area comprises peak ground accelerations ranging between 0.12 g and 0.16 g, with a 10% probability of being exceeded in a 50 year period, which may potentially be due to the presence of mining activities in the area.

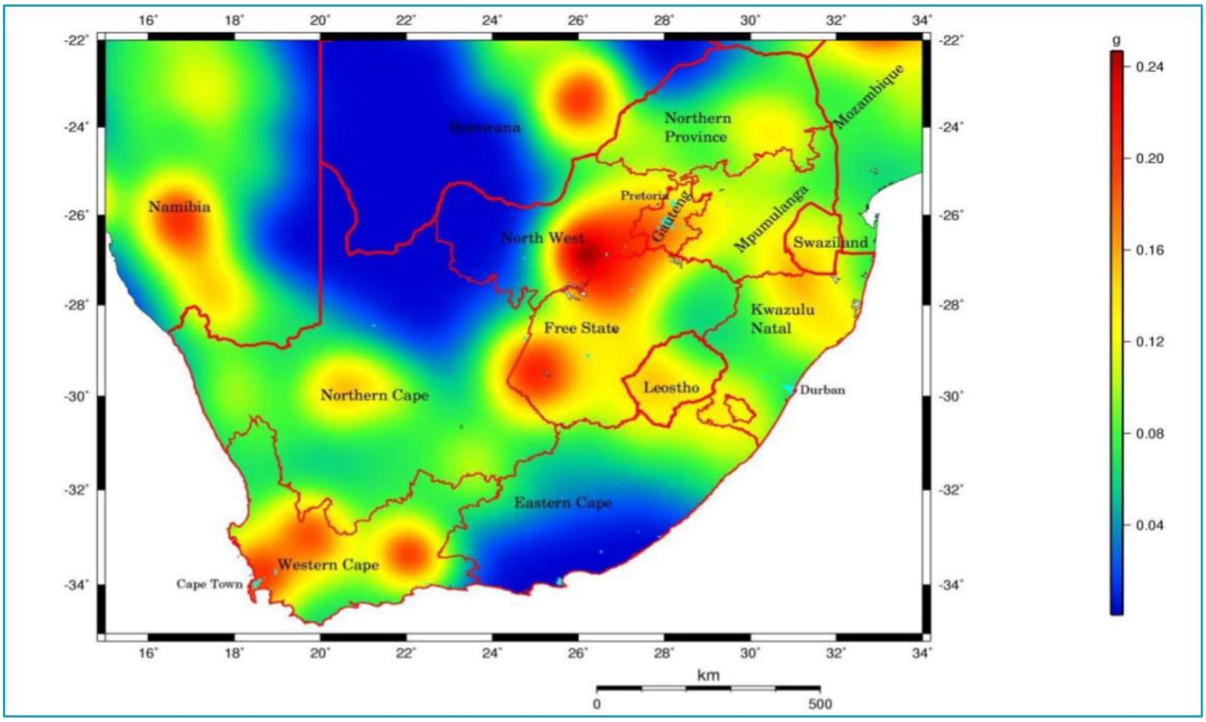


Figure 7.12: Seismic Hazard Map of South Africa – Peak Ground Acceleration (g) with a 10% probability of being exceeded in 50 years (Kijko, 2008)

Mining induced seismicity is the failure of the Earth's crust or rock mass due to changes in rock stress levels. Seismic events range in size from barely discernible ground motions to very large tremors. There are three types of mining induced seismicity:

- Failure at pre-existing geological zones of weakness such as faults, dykes and joints which results in medium to large events often far away from current workings.
- Failure of the intact rock mass in the form of shear fractures that results in larger events close to current workings.
- Localised bursting or failure of brittle rock types often referred to as strain bursting (Van der Walt, 2017).

In addition to the direct damage that may be caused by a seismic event, indirect effects such as the liquefaction of saturated soils and slope failures may also pose a hazard to structures.

7.1.9 GEOTECHNICAL APPRAISAL

*The following is extracted from the Geotechnical Desktop Assessment compiled by SLR Consulting and included as **Appendix H-3.***

Based on previous investigations carried out in near proximity to study area as well as Weinert's climatic N-Value, deeply weathered residual soils of a clayey and sandy nature may prevail across the proposed development area.

Competent, founding conditions can be anticipated at depths beyond 3 m from natural ground level and will need to be assessed and verified during the detailed geotechnical investigation. It must be noted that no details pertaining to the foundation design were provided during compilation of this report.

Photovoltaic structures generally impose light foundation loads on the subsurface materials, although wind loads exert uplift and lateral forces, which must be accounted for in the design.

Depending on the subsurface materials and founding conditions, the following foundation solution can be considered:

- Steel H piles – these are end bearing piles that are driven into the underlying competent rock. The pile is then socketed into the competent rock. Steel H piles can be driven through soil horizons and have previously been used on solar projects in South Africa. This solution is considered when competent bedrock is present at shallow depths and corresponds to the proposed invert level of the foundation.

— Pre-bored Piles – An alternate solution where bedrock is shallow or appears on surface. Pilot holes are percussion drilled in the bedrock to the founding level. Thereafter, piles are socketed into competent, bedrock conditions. The holes are then backfilled with grout or an inert granular material that meets the engineer's specification (G5).
— Driven Cast In-situ Piles – In areas where bedrock is relatively deeper than the invert level, driven cast in-situ piles can be considered. It typically utilises the friction of the pile against the soil to provide lateral and vertical support. This solution can be considered where the subsoils are firm/dense with gravel fragments or ferricrete.

For any of the abovementioned alternatives to be pragmatically viable, it is recommended that the ultimate pull-out loads, vertical and horizontal deflections be assessed by undertaking pull-out testing during a detailed geotechnical investigation. The pull-out tests must be supervised and verified by a competent geotechnical professional at the proposed embedment depths during testing.

It must be noted that a detailed geotechnical investigation will inform and finalise the recommendations of the most effective foundation solution for all structures and will play a pivotal role in determining the actual founding conditions prevailing across the proposed development area.

Of specific importance to the development of the REC is the excavation conditions prevailing across the site, which will generally impact the preparation and construction of foundations, trenches for buried services and access roads. Based on the geology of the area and the subsequent engineering geological implications mentioned in Sections 4 and 6, the following excavation conditions can be anticipated but will need to be confirmed during a detailed site investigation:

— Topsoil and Colluvium – generally soft excavation.
— Residual and pedocretes – soft to generally intermediate excavation. Can possibly occur as hard excavation if hardpan pedocretes are encountered.
— Weathered bedrock – generally intermediate to hard excavation.

The above excavation conditions have been referenced from SANS 1200 (1986), which is further summarised in **Table 7.4**.

Table 7.4: Summary of Excavation Conditions (SANS 1200, 1986)

CLASS OF EXCAVATION	DEFINITION
Soft	Material that can be efficiently excavated, without prior ripping by the following equipment: — Bulldozer with a mass of at least 22 tons and an engine developing approximately 145 kW at the flywheel. — A tractor-scraper unit with a mass of at least 28 tons and an engine developing approximately 245 kW at the flywheel, pushed by a bulldozer during loading (35 tons, 220 kW). Track-type front end loader with a mass of at least 22 tons and an engine developing approximately 140 kW at the flywheel.
Intermediate	Material that can be efficiently ripped by a bulldozer with a mass of at least 35 tons when fitted with a single tine ripper and an engine developing approximately 220 kW at the flywheel.
Hard	Material that cannot be efficiently ripped by a bulldozer equivalent to that described for Intermediate Excavation and requires blasting.
Boulder Class A	Material containing in excess of 40% by volume of boulders between 0.03 m^3 and 20 m^3 in size, in a matrix of softer material or smaller boulders.
Boulder Class B	Materials containing 40% or less by volume of boulders ranging from 0.03 m^3 to 20 m^3 in size, in a matrix of soft material or smaller boulders

7.2 BIOLOGICAL ENVIRONMENT

7.2.1 AQUATIC ECOLOGY

*The following is extracted from the Aquatic Impact Assessment compiled by EnviroSci (Pty) Ltd and included as **Appendix H-2.***

LOCAL AQUATIC FEATURES

The study area was dominated by a variety of aquatic features associated with catchments and rivers, and were characterised as follows as per their respective Hydrogeomorphic classes:

— Mainstem Rivers - Floodplain dominated systems with oxbow wetlands (**Figure 7.13**). A few reaches did contain very narrow riparian zones, consisting mostly of a single row of willow trees associated with the unknown tributary of the Vaal River;

— Valley Bottom Wetlands (Channelled and Unchannelled) (**Figure 7.14**);

— Endorheic pans (**Figure 7.15**);

— Seep wetlands (**Figure 7.16**); and

— One minor watercourse (**Figure 7.17**), that was previously part of a wetland systems, but now contains severe head cut and has eroded into a channel / watercourse.

It is noted that only the Seep wetlands and some artificial dams are specific to the Camden I SEF project area.

Figure 7.13: Wetlands associated with the unknown tributary that bisects the broader study area (West of the Camden I SEF Footprint)

Figure 7.14: Channelled Valley Bottom wetland (Northwest of the Camden I SEF footprint)

Figure 7.15: Endorheic Pan, one of three such large systems within the study area (north and west of the Camden I SEF footprint)

Figure 7.16: A medium sized seep wetland within the central portion of the site (immediately west and south of the Camden I SEF footprint)

Figure 7.17: A view of a minor water course, with a view of an earth wall farm dam upstream (west of the Camden I SEF footprint)

The DFFE identified the aquatic environment for the study area as having a Very High Sensitivity, based on the fact the following criteria are present within the site or the associated catchment, namely:

— Presence of Wetlands to the north and west of the footprint;
— Aquatic Ecological Support Areas (ESA);
— Freshwater Ecosystem Priority Area quinary catchments (NFEPA); and
— Eastern Highveld Grassland a listed Threatened Ecosystem under NEMA.

The presence of these Very High Sensitivity features, although to a finer mapping scale were confirmed during this assessment. The study area is however not located within an International Bird Area (IBA) or a Strategic Water Resource Area.

This ground-truthed delineations were then compared to current wetland inventories (van Deventer *et al*., 2020), 1: 50 000 top cadastral surveys mapping and the site. These inventories include wetland spatial data based on landcover 2007 data, previous assessments and wetland information retained by the Provincial authorities, combined into one database that formed part of the updated National Spatial Biodiversity Assessment, 2018.

A baseline map was then developed and refined using the August 2020 survey data, noting that due to the complex nature of the topography and geology, the features were digitised at a scale of 1:4000 **(Figure 7.18**).

Coupled to the aquatic delineations, information was collected on potential species that could occur within the wetlands and water courses, especially any areas that would contain open water for long periods and or conservation worthy species (Listed or Protected).

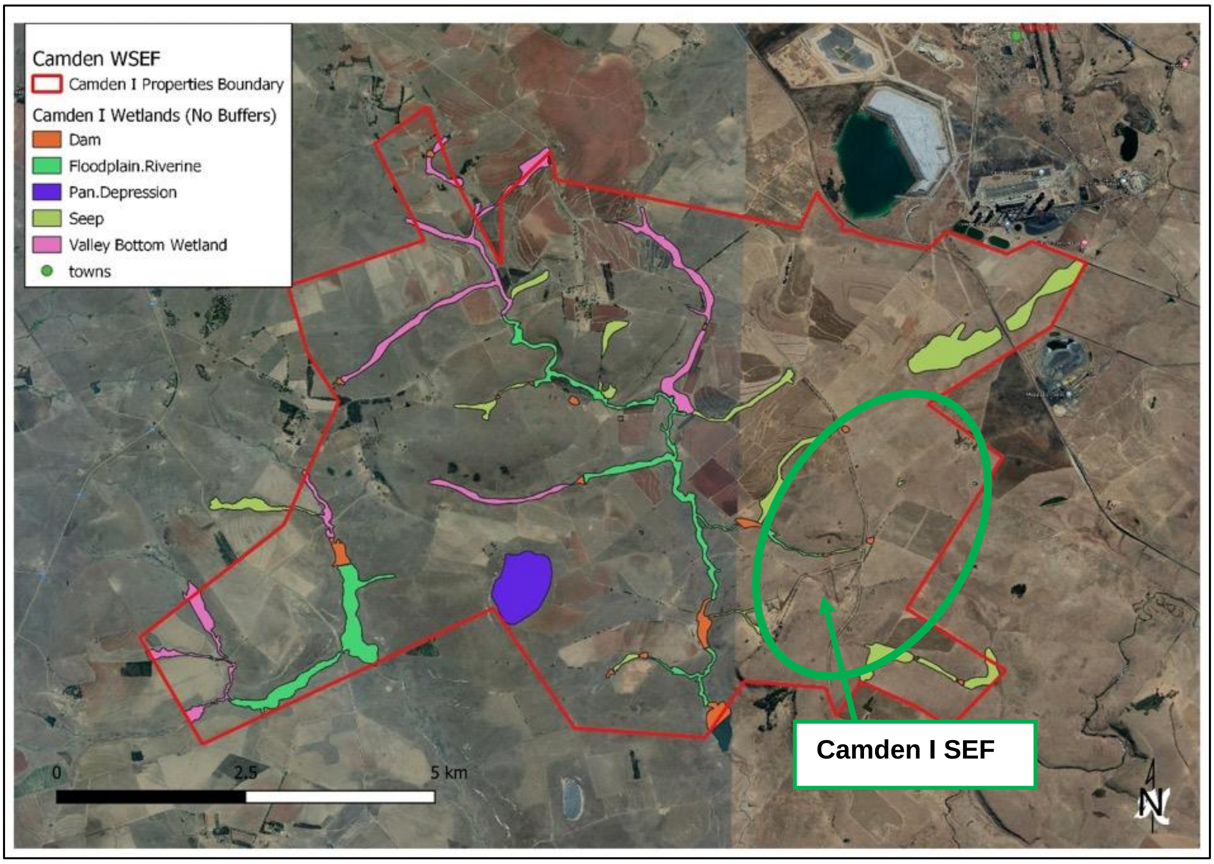


Figure 7.18: Delineated Wetlands within Project footprint based on ground-truthing information collected

PRESENT ECOLOGICAL STATE AND CONSERVATION IMPORTANCE

The Present Ecological State (PES) of a river, watercourse or wetland represents the extent to which it has changed from the reference or near pristine condition (Category A) towards a highly impacted system where there has been an extensive loss of natural habit and biota, as well as ecosystem functioning (Category E).

The PES scores have been revised for the country and based on the new models, aspects of functional importance as well as direct and indirect impacts have been included (DWS, 2014). The new PES system incorporates Ecological Importance (EI) and Ecological Sensitivity (ES) separately as opposed to Ecological Importance and Sensitivity (EIS) in the old model, although the new model is still heavily centred on rating rivers using broad fish, invertebrate, riparian vegetation, and water quality indicators. The Recommended Ecological Category (REC) is still contained within the new models, with the default REC being B, when little or no information is available to assess the system or when only one of the above-mentioned parameters are assessed or the overall PES is rated between a C or D.

All of the systems assessed by DWS (2014) on a Subquaternary level within the study area were rated as PES = C or Moderately Modified and PES = D or Largely Modified. While these were also rated as High in terms of Ecological Sensitivity and Ecological Importance respectively.

Based on the information collected during the field investigations, these ratings are verified and upheld for the riverine / wetland systems. The natural wetlands were however rated independently and achieved PES scores of C and D, while the EIS was rated as HIGH. The High EIS rating for both natural water courses and wetlands, is further substantiated by the fact that the affected catchments are included in both the National Freshwater Priority Atlas and the provincial Biodiversity Spatial Plan Critical Biodiversity Area spatial layers (**Figure 7.19** and **Figure 7.20**). These areas are also highlighted as important ecological support areas along the Vaal River.

Overall, these catchment areas and subsequent rivers / watercourses are largely in a natural state with localised impacts in some areas, which include the following:

- Erosion and sedimentation associated with road crossings;
- Impeded water flow due to several in channel farm dams; and
- Sedimentation and scour of channels due to undersized culverts within present day road crossings.

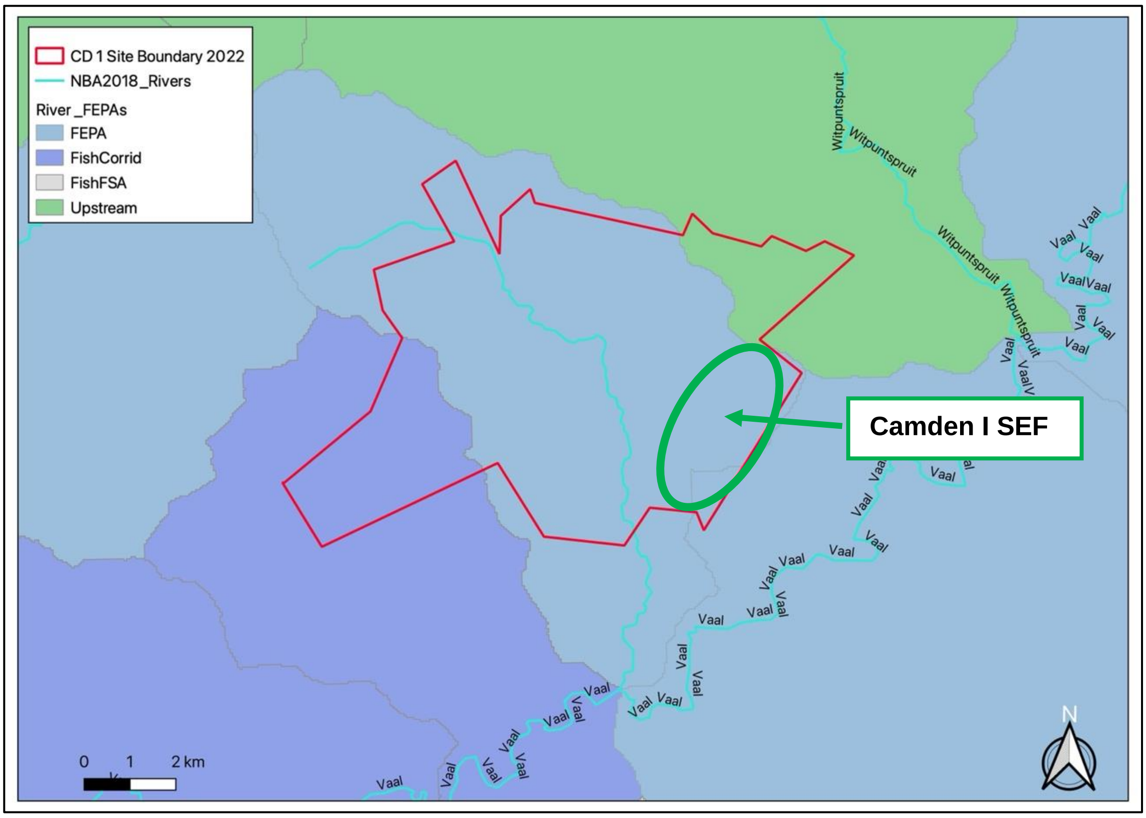


Figure 7.19: The Freshwater Ecosystem Priority Areas for the study area (Nel et al, 2011)

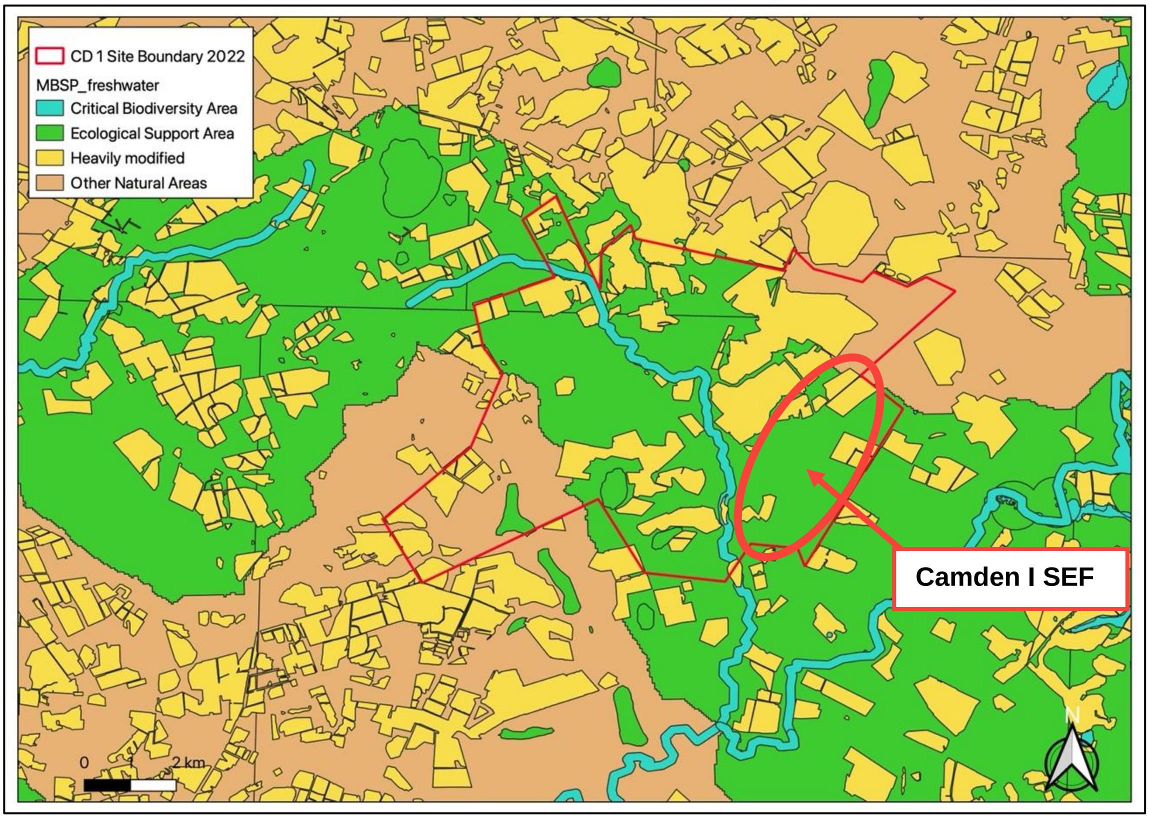


Figure 7.20: The freshwater Critical Biodiversity Areas as per the Mpumalanga Biodiversity Spatial Plan (Nel et al, 2011) issued 2014

7.2.2 REGIONAL VEGETATION

The following is extracted from the Terrestrial Biodiversity Assessment compiled by David Hoare Consulting (Pty) Ltd and included as ***Appendix H-4****.*

There is one regional vegetation type occurring in the study area, namely Eastern Highveld Grassland (**Figure 7.21**). Terrestrial vegetation patterns reflect this major vegetation type. The vegetation type description below is from Mucina & Rutherford (2006), extracted from the SANBI BGIS website (http://bgis.sanbi.org/vegmap).

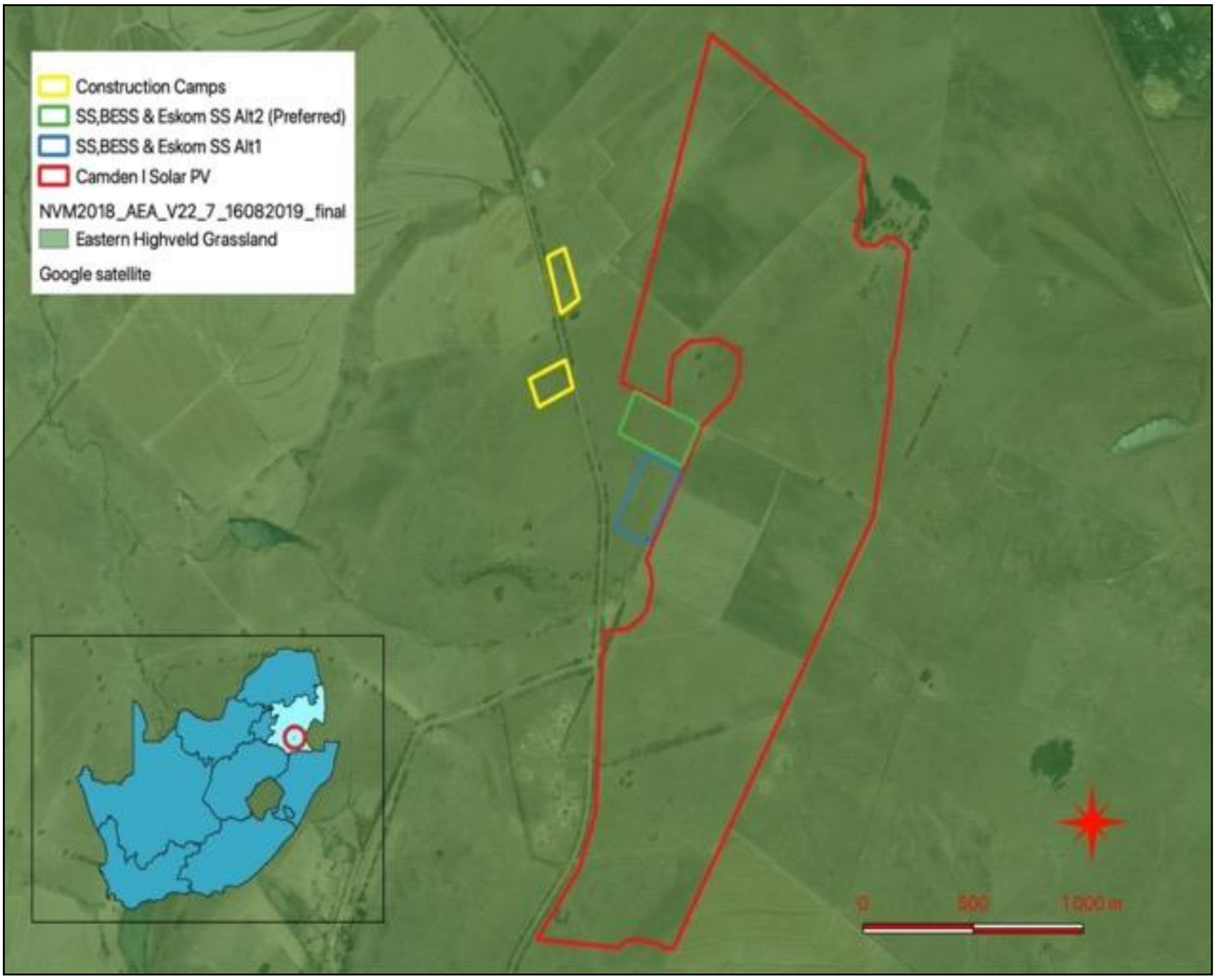


Figure 7.21: Regional Vegetation Types of the Study Area

EASTERN HIGHVELD GRASSLAND

DISTRIBUTION

Found in Mpumalanga and Gauteng Provinces, on the plains between Belfast in the east and the eastern side of Johannesburg in the west and extending southwards to Bethal, Ermelo and west of Piet Retief. The vegetation type occurs at an altitude of between 1 520–1 780 m.

VEGETATION & LANDSCAPE FEATURES

The vegetation occurs on slightly to moderately undulating plains, including some low hills and pan depressions. The vegetation is short dense grassland dominated by the usual highveld grass composition (*Aristida*, *Digitaria*, *Eragrostis*, *Themeda*, *Tristachya*, etc.) with small, scattered rocky outcrops with wiry, sour grasses and some woody species (*Acacia caffra*, *Celtis africana*, *Diospyros lycioides* subsp *lycioides*, *Parinari capensis*, *Protea caffra*, *P. welwitschii* and *Searsia magalismontanum*).

GEOLOGY & SOILS

Red to yellow sandy soils of the Ba and Bb land types found on shales and sandstones of the Madzaringwe Formation (Karoo Supergroup). Land types Bb (65%) and Ba (30%).

CLIMATE

Strongly seasonal summer rainfall, with very dry winters. MAP 650–900 mm (overall average: 726 mm), MAP relatively uniform across most of this unit, but increases significantly in the extreme southeast. The coefficient of variation in MAP is 25% across most of the unit but drops to 21% in the east and southeast. Incidence of frost from 13–42 days, but higher at higher elevations.

IMPORTANT TAXA

Low Shrubs	*Anthospermum rigidum* subsp. *pumilum*, *Stoebe plumosa*.
Herbs	*Berkheya setifera* (d), *Haplocarpha scaposa* (d), *Justicia anagalloides* (d), *Pelargonium luridum* (d), *Acalypha angustata*, *Chamaecrista mimosoides*, *Dicoma anomala*, *Euryops gilfillanii*, *E. transvaalensis* subsp. *setilobus*, *Helichrysum aureonitens*, *H. caespititium*, *H. callicomum*, *H. oreophilum*, *H. rugulosum*, *Ipomoea crassipes*, *Pentanisia prunelloides* subsp. *latifolia*, *Selago densiflora*, *Senecio coronatus*, *Vernonia oligocephala*, *Wahlenbergia undulata*.
Geophytic Herbs	*Gladiolus crassifolius*, *Haemanthus humilis* subsp. *hirsutus*, *Hypoxis rigidula* var. *pilosissima*, *Ledebouria ovatifolia*.
Succulent Herbs	*Aloe ecklonis*
Graminoids	*Aristida aequiglumis* (d), *A. congesta* (d), *A. junciformis* subsp. *galpinii* (d), *Brachiaria serrata* (d), *Cynodon dactylon* (d), *Digitaria monodactyla* (d), *D. tricholaenoides* (d), *Elionurus muticus* (d), *Eragrostis chloromelas* (d), *E. curvula* (d), *E. plana* (d), *E. racemosa* (d), *E. sclerantha* (d), *Heteropogon contortus* (d), *Loudetia simplex* (d), *Microchloa caffra* (d), *Monocymbium ceresiiforme* (d), *Setaria sphacelata* (d), *Sporobolus africanus* (d), *S. pectinatus* (d), *Themeda triandra* (d), *Trachypogon spicatus* (d), *Tristachya leucothrix* (d), *T. rehmannii* (d), *Alloteropsis semialata* subsp. *eckloniana*, *Andropogon appendiculatus*, *A. schirensis*, *Bewsia biflora*, *Ctenium concinnum*, *Diheteropogon amplectens*, *Eragrostis capensis*, *E. gummiflua*, *E. patentissima*, *Harpochloa falx*, *Panicum natalense*, *Rendlia altera*, *Schizachyrium sanguineum*, *Setaria nigrirostris*, *Urelytrum agropyroides*.

CONSERVATION STATUS OF THE REGIONAL VEGETATION TYPES

On the basis of a scientific approach used at national level by SANBI (Driver *et al*., 2005), vegetation types can be categorised according to their conservation status which is, in turn, assessed according to the degree of transformation relative to the expected extent of each vegetation type. The status of a habitat or vegetation type is based on how much of its original area still remains intact relative to various thresholds. The original extent of a vegetation type is as presented in the most recent national vegetation map (Mucina, Rutherford & Powrie 2005) and is the extent of the vegetation type in the absence of any historical human impact. On a national scale the thresholds are as depicted in **Figure 7.22**, as determined by best available scientific approaches (Driver *et al.*, 2005). The level at which an ecosystem becomes Critically Endangered differs from one ecosystem to another and varies from 16% to 36% (Driver *et al*., 2005).

According to scientific literature (Driver *et al*., 2005; Mucina *et al*., 2006), as shown in **Table 7.5**, Eastern Highvbeld Grassland is listed as Endangered.

Determining ecosystem status (Driver *et al*., 2005). *BT = biodiversity target (the minimum conservation requirement).

Habitat remaining (%)		
80–100	least threatened	LT
60–80	vulnerable	VU
*BT–60	endangered	EN
0–*BT	critically endangered	CR

Figure 7.22: Ecosystem Status (Driver et al. 2005)

Table 7.5: Conservation status of different vegetation types occurring in the study area

VEGETATION TYPE	TARGET (%)	CONSERVED (%)	TRANSFORMED (%)	CONSERVATION STATUS	
				DRIVER *ET AL*. 2005; MUCINA *ET AL*., 2006	NATIONAL ECOSYSTEM LIST (NEM:BA)
Eastern Highveld Grassland	24	0.3	44	Endangered	Vulnerable
Chrissiesmeer Panveld					Endangered

The National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004), lists national vegetation types, and other ecosystems defined in the Act, that are afforded protection on the basis of rates of transformation. The thresholds for listing in this legislation are higher than in the scientific literature, which means there are fewer ecosystems listed in the National Ecosystem List versus in the scientific literature. Eastern Highveld Grassland is listed as Vulnerable in the National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011).

There is an additional listed ecosystem defined under the National Ecosystem List, called Chrissiesmeer Panveld, which is listed as Endangered. This covers the entire site (**Figure 7.23**). It spatially co-incides partially with Eastern Highveld Grassland, but is defined on different criteria.

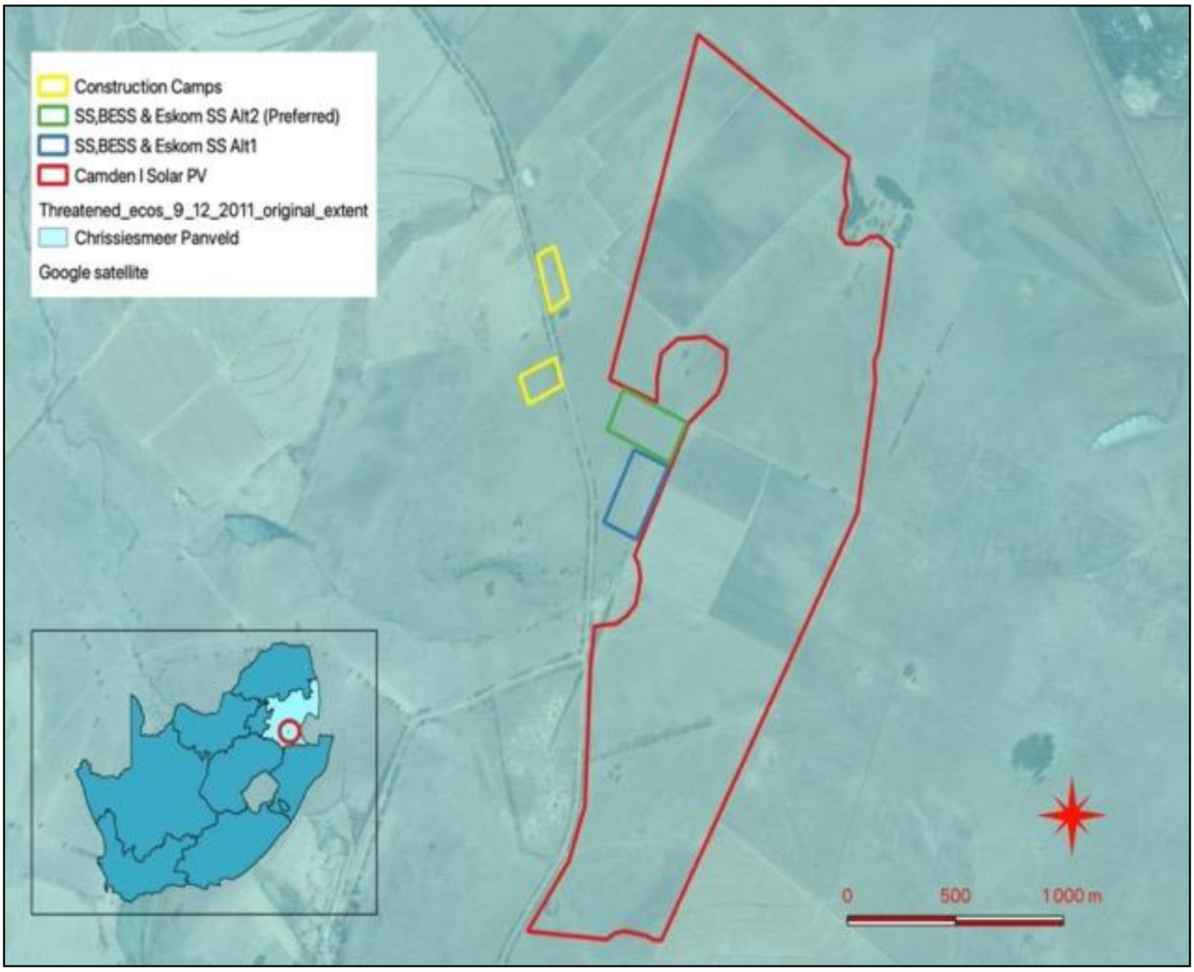


Figure 7.23: Distribution of listed ecosystems relative to the site

7.2.3 BIODIVERSITY CONSERVATION PLANS

*The following is extracted from the Terrestrial Biodiversity Assessment compiled by David Hoare Consulting (Pty) Ltd and included as **Appendix H-4**.*

The Mpumalanga Biodiversity Sector Plan (MBSP) (Mpumalanga Parks and Tourism Agency 2014) classifies the natural vegetation of the Province according to the following categories:

- Protected Areas (sub-divided into three categories);
- Critical Biodiversity Areas (sub-divided into “Irreplaceable” and “Optimal”);
- Other natural areas;
- Ecological Support Area (sub-divided into four categories); and
- Modified (sub-divided into Heavily or Moderately modified

Figure 7.24 shows features within the study area within three of these classes, as follows:

- Protected Areas: (National Parks and Nature Reserves): The entire site is shown as a protected area. This is, however, in the process of change (see discussion below).
- Critical Biodiversity Areas (CBA): Irreplaceable: Surrounding areas
- Critical Biodiversity Areas (CBA): Optimal: a small nearby patch.

According to the description for the MBSP Terrestrial Assessment categories, Critical Biodiversity Areas are areas that are required to meet biodiversity targets (for biodiversity pattern and ecological process features). The MBSP policy is that they should remain in a natural state. CBAs are areas of high biodiversity value which are usually at risk of being lost and usually identified as important in meeting biodiversity targets, except for Critically Endangered Ecosystems or Critical Linkages.

The part of the site shown as a Protected Area occupies the parts of the site on the Farm Welgelegen 322 IT (green area in **Figure 7.24**). This is the Langcarel Private Nature Reserve, proclaimed in 1967. This is not being managed as a nature reserve and a separate process is underway to have it (or part thereof) de-proclaimed as part of ongoing province-wide reserve verification efforts by the provincial authorities. No evidence was observed on site of any conservation activities during the field assessment.

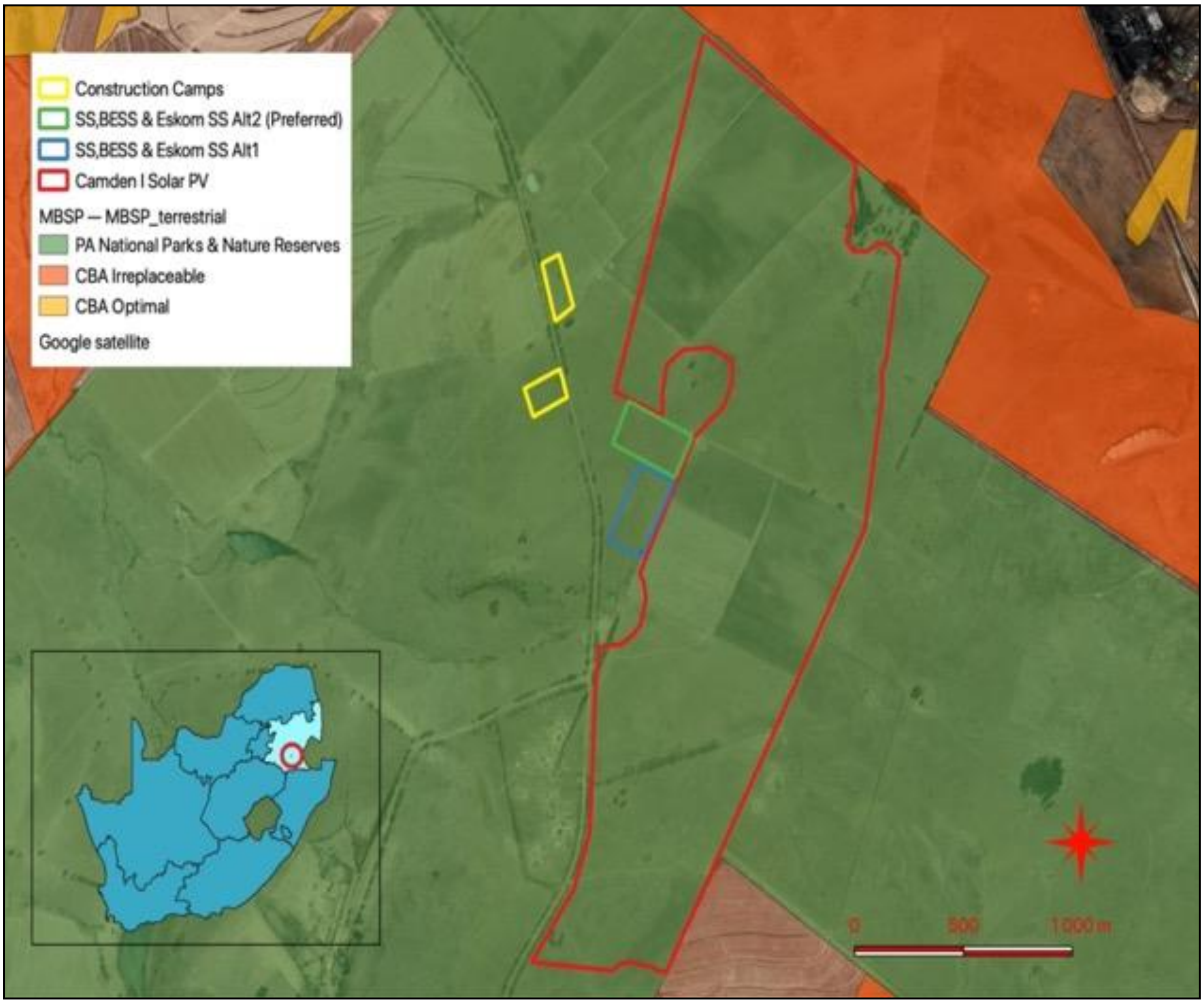


Figure 7.24: Mpumalanga CBA map for the study area

PROPOSED PROTECTED AREAS (NPAES FOCUS AREAS)

According to the National Protected Areas Expansion Strategy 2008 (NPAES2008), there are no areas within the study area that have been identified as priority areas for inclusion in future protected areas. The study area is therefore outside the NPAES focus area. A draft National Protected Areas Expansion Strategy was published for public comment in 2018, but is deliberately not available as a spatial dataset. It does, however, reference the Mpumalanga Protected Area Expansion Strategy, in which priority areas are identified in terms of High, Medium and Low priorities. A map within this document shows areas around Camden within the Low priority class that may include the site, but a spatial dataset to confirm this could not be sourced at the time of producing this report. On the basis of the Screening Tool output, which identifies "Protected Areas Expansion Strategy" (**Figure 7.25**) as a factor within the study area, it is assumed that natural areas within the study area fall within this category (Low Priority - Mpumalanga Protected Area Expansion Strategy).

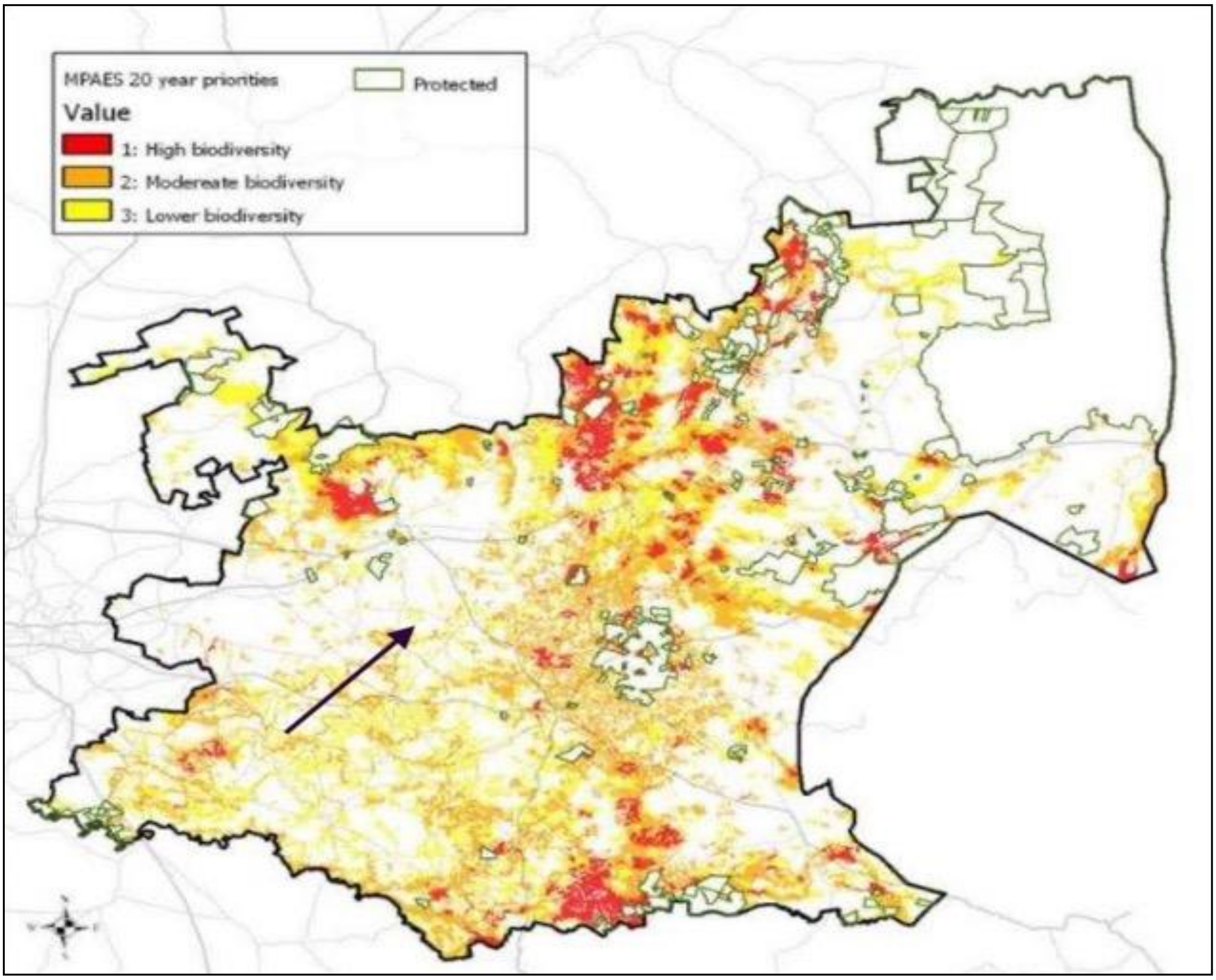


Figure 7.25: Mpumalanga Protected Area Expansion Strategy (Lotter 2015) (arrow points to approximate location of site)

7.2.4 PLANT SPECIES

The following is extracted from the Terrestrial Plant Species Assessment compiled by David Hoare Consulting (Pty) Ltd and included as ***Appendix H-5****.*

According to the DFFE online environmental screening tool, seven plant species have been flagged as of concern for the area the current project is in. A description of each species is provided in **Table 7.6**.

Table 7.6: Plant species of conservation concern

TAXONA	DESCRIPTION
Khadia carolinensis	Vulnerable. Occurs at Carolina and Belfast in Eastern Highveld Grassland, Lydenburg Montane Grassland, and Rand Highveld Grassland. It is found in well-drained, sandy loam soils among rocky outcrops, or at the edges of sandstone sheets, at around 1700 m elevation. It has been recently recorded just to the south of the site in grasslands close to the Vaal River. Based on the known distribution and habitat requirements, as well as known nearby populations, there is a HIGH chance of it occurring in the general area where the project is located.

TAXONA	DESCRIPTION
Sensitive species 1201	Occurs on dolerite outcrops in grasslands at about 2000m altitude, from Dullstroom in the north to Vryheid in the south. This geophyte is fairly restricted and threatened by alien invasive plants, and is therefore listed as Vulnerable on the national Red List. This species is conspicuous when flowering, with attractive pale white flowers in summer. The closest locality at which this species has been observed is Hartebeespruit due south of Camden. It therefore has a MODERATE chance of occurring on the site.
Aspidoglossum xanthosphaerum	Vulnerable. Occurs in Mpumalanga, around Groenvlei and Ermelo. Closest known record is from Breyten and just to the west of Ermelo. It is found in montane grassland, marshy sites, at around 1800 m elevation. Based on the known distribution and habitat requirements, as well as known nearby populations, there is a HIGH chance of it occurring in the general area where the project is located.
Sensitive species 41	A common and widespread geophyte that is very similar to Gladiolus crassifolius, also a widespread and common species with a similar distribution. The main distribution area is Witbank to Lydenburg, and southwards to Piet Retief and Wakkerstroom. It occurs in wetlands or marshes in high altitude grassland that remain wet throughout the year or dry out for only a short period. This species is listed on the South African Red List with a national assessment of Vulnerable, but is currently not recognized by the IUCN as it is regarded as a synonym of G. crassifolius. Whereas this species is confined more to wetland habitats, G. crassofolius has larger leaves, longer spikes and smaller flowers, and is found in drier, more stony habitats. It flowers from October to January and has a high probability of occurring in wetland areas on the study site. Without flowers, the plant can be recognized as a Gladiolus. The closest historical record is approximately 30km from the study site. This species has a MODERATE chance of occurring on the site.
Sensitive species 691	A widespread geophyte distributed in Free State, North West, Gauteng, and in Mpumalanga from Belfast and Ermelo to Wolmaransstad. It is found in wetlands in undulating grasslands. The species is currently listed as Vulnerable. It flowers from January to March but its peak flowering month is February. It could feasibly be found in wet areas on the site but is quite conspicuous in February when if flowers. The closest historical record is approximately 40km from the site. It has a MODERATE chance of occurring on the site.
Pachycarpus suaveolens	Vulnerable. Occurs in Gauteng and Mpumalanga to Eswatini, where it is found in Lydenburg Montane Grassland, Eastern Highveld Grassland, and Soweto Highveld Grassland in short or annually burnt grasslands, at elevations of 1400-2000 m. Based on the known distribution and habitat requirements, as well as known nearby populations, there is a HIGH chance of it occurring in the general area where the project is located.
Sensitive species 851	A small succulent perennial herb with white flowers, growing in marshy areas or shallow vleis. This species is listed as Vulnerable but the confidence in this assessment is low (according to the Red List). Its distribution is uncertain because of its taxonomic confusion with the very similar Crassula inanis, but it appears to be restricted to the area between Ermelo and Maseru. The closest known record to the site of the Project is in the Bethal area. It has a MODERATE chance of occurring on the site.

ADDITIONAL LISTED PLANT SPECIES FOR THE STUDY AREA

A database search identified a number of additional plant species of conservation concern that could also occur on site that are not flagged in the Screening Tool output. These are listed in

Table 7.7: Additional plant species of conservation concern

TAXONA	RED LIST STATUS	HABITAT AND DISTRIBUTION	FLOWERING TIME	PROBABILITY OF OCCURENCE
Alepidea cordifolia APIACEAE	Endangered (SA)	Widespread and extremely common across the eastern highveld of Mpumalanga, the eastern Free State, and north-western KwaZulu-Natal. It occurs along the north and north-eastern borders of Lesotho and is also found in Eswatini, on the Eastern Highlands of Zimbabwe and the Chimanimani Mountains of Mozambique. Forest margins, west and south facing mountain slopes and near drainage lines or islands within wetlands. Open grassland or on forest margins, often amongst rocks and/or along streams.	Summer, mostly February to March	MODERATE (within known overall distribution)
Alepidea longeciliata APIACEAE	Endangered	Between Breyten, Lothair, Middelburg and Stoffberg. Recorded from 2 neighbouring grids. Eastern Highveld Grassland. Grassland, Karoo Sandstone, above 1600 m. Possibly associated with edges of pans.	Summer	MODERATE (within known overall distribution)
Bowiea volubilis subsp. volubilis HYACINTHACEAE	Vulnerable (national)	Eastern Cape to Limpopo Province. Widespread elsewhere in southern and eastern Africa. Low and medium altitudes, usually along mountain ranges and in thickly vegetated river valleys, often under bush clumps and in boulder screes, sometimes found scrambling at the margins of karroid, succulent bush in the Eastern Cape. Occurs in bushy kloofs at the coast and inland in KwaZulu-Natal. In Gauteng, Mpumalanga and North West Province it is often found in open woodland or on steep rocky hills usually in well-shaded situations. Tolerates wet and dry conditions, growing predominantly in summer rainfall areas with an annual rainfall of 200-800 mm.		LOW (site within gap in distribution, habitat not suitable)
Brachystelma gerrardii APOCYNACEAE	Endangered	KwaZulu-Natal, Waterberg, Wolkberg and Eswatini. Open grassland, 400-1800 m. Site is within overall distribution range, but plant absent from Mpumalanga highveld.		LOW
Eucomis pallidiflora subsp. polevansii	Near Threatened	Pilgrim's Rest and Lydenburg to Eswatini to southern Mpumalanga. Wetlands in grassland, often in		HIGH (wetlands)

TAXONA	RED LIST STATUS	HABITAT AND DISTRIBUTION	FLOWERING TIME	PROBABILITY OF OCCURENCE
HYACINTHACEAE		standing water up to 300 mm deep. Recorded at Ermelo in similar habitat as that found on site.		
Gladiolus robertsoniae IRIDACEAE	Near Threatened	South-eastern Gauteng, northern Free State and south-western Mpumalanga. Moist highveld grasslands, found in wet, rocky sites, mostly dolerite outcrops, wedged in rock crevices.		HIGH
Habenaria barbertonii ORCHIDACEAE	Near Threatened	Gauteng and Mpumalanga. Rocky hillsides, in bushveld in association with acacias, 1000-1500 m.	February to March	MODERATE (habitat may not be suitable)
Kniphofia typhoides ASPHODELACEAE	Near Threatened	Gauteng, Limpopo, Mpumalanga, North West, Parys to Lydenburg to Paulpietersburg to Newcastle. Low lying wetlands and seasonally wet areas in climax Themeda triandra grasslands on heavy black clay soils, tends to disappear from degraded grasslands.		MODERATE (habitat may not be suitable)
Merwilla plumbea HYACINTHACEAE	Near Threatened	Widespread in eastern half of South Africa. Also in Eswatini and Lesotho. Montane mistbelt and Ngongoni grassland, rocky areas on steep, well drained slopes. 300-2500 m.		HIGH
Miraglossum davyi APOCYNACEAE	Vulnerable	Dullstroom, Middelburg and Standerton. Grassland (Lydenburg Montane Grassland, Soweto Highveld Grassland, Eastern Highveld Grassland).		HIGH
Riocreuxia aberrans APOCYNACEAE	Near Threatened	Dullstroom to Ermelo. Grassland. Wedged in cracks among rocks on exposed quartzite ridges.		LOW (habitat not suitable)

PROTECTED SPECIES RECORDED IN THE STUDY AREA

None of the tree species protected under the National Forests Act have been previously recorded in the area in which the site is located..

There are a number of species recorded on site that are protected under the Mpumalanga Nature Conservation Act No. 10 of 1998. It is a legal requirement to obtain a permit from the provincial authorities for the destruction of any of these species. A comprehensive walk-through survey of the final footprint is required to compile a complete list of these protected species.

7.2.5 TERRESTRIAL FAUNA SPECIES

The following is extracted from the Terrestrial Animal Species Assessment compiled by David Hoare Consulting (Pty) Ltd and included as ***Appendix H-6****.*

Species flagged for the site by the DFFE Screening Tool is indicated in **Table 7.8**.

Table 7.8: Species flagged by the DFFE Screening Tool

TAXONA	DESCRIPTION
Sensitive species 2	This is a large bird listed as Vulnerable. They are usually found in grasslands close to bodies of water or vleis. They prefer to nest near bodies of water that provide cover, but often feed in open savannas and grasslands. They can also be found in agricultural lands such as pastures, cropland, or fallow fields. They also often select habitats that include some trees, as they are able to roost in trees. A detailed avifaunal assessment has been undertaken for this project where additional information can be obtained regarding this species.
***Geronticus calvus* (Southern Bald Ibis)**	The Southern Bald Ibis, listed as Vulnerable, is restricted to Lesotho, north-east South Africa and west Eswatini. The core range lies in the north-eastern Free State, Mpumalanga and the KwaZulu-Natal Drakensberg. The site is therefore near to the centre of its relatively restricted global distribution. It prefers high rainfall (>700 mm p.a.), sour and alpine grasslands, characterised by an absence of trees and a short, dense grass sward. It also occurs in lightly wooded and relatively arid country. It forages preferentially on recently burned ground, also using unburnt natural grassland, cultivated pastures, reaped maize fields and ploughed areas (Birdlife International 2022). A detailed avifaunal assessment has been undertaken for this project where additional information can be obtained regarding this species.
***Tyto capensis* (African Grass Owl)**	The African Grass Owl is listed as Vulnerable. It is confined to the higher rainfall areas in the eastern half of South Africa, where it typically roosts and breeds in tall, rank grass or sedges associated with damp substrates, such as permanent and non-perennial wetlands and streams. The Vaal River is an important corridor for the species. A detailed avifaunal assessment has been undertaken for this project where additional information can be obtained regarding this species.
***Crocidura maquassiensis* (Maquassie Musk Shrew)**	The Maquassie Musk Shrew (Crocidura maquassiensis), listed as Vulnerable, is endemic to South Africa, Eswatini and Zimbabwe, where it is found in moist grassland habitats in Savannah and Grassland Biomes. It appears to tolerate a wide range of habitats, although threats to the species have been inferred as being related to loss or degradation of moist, productive areas, such as rank grassland and wetlands (Taylor et al. 2016). The species is patchily distributed within the north-eastern part of South Africa. The study area is within the known distribution of this species in the sense that there are records in quarter degree grids throughout the Highveld, although not from the current grid or any nearby grids. It is, however, flagged in the DFFE Online Screening Tool as potentially occurring on site. It is therefore considered possible that it could occur on site and individuals could therefore possibly be affected by construction activities.
***Ourebia ourebi ourebi* (Oribi)**	The Oribi (Ourebia ourebi), listed as Endangered in South Africa and Least Concern globally, has a geographical distribution that includes the study area. It is widely distributed in Africa, but the subspecies found in South Africa has a more limited distribution that includes South Africa and Mozambique. The species inhabits savanna woodlands, floodplains and other open grasslands from sea level to 2200 m asl (in Mpumalanga). They reach their highest density on floodplains and moist tropical grasslands. They prefer open grassland in good condition containing a mosaic of short grass for feeding and tall grass for feeding and shelter. It has not been recorded in the grid in which the site is located, which is one of a group of grids in south-western Mpumalanga where the species does not appear to occur. Nevertheless, the area is within the overall distribution range of the species. Based on

TAXONA	DESCRIPTION
	the gap in the distribution of the species, there is a low likelihood that it could occur on site within any suitable habitat, although it is flagged for the project in the Screening Tool.

OTHER LISTED SPECIES FOR THE STUDY AREA

All threatened (Critically Endangered, Endangered or Vulnerable) or near threatened vertebrate animals that could occur in the study area and have habitat preference that includes habitats available in the study area are discussed in **Table 7.9**.

Table 7.9: Threatened or near threatened vertebrate animals within the study area

SCIENTIFIC NAME	COMMON NAME	STATUS	LIKELIHOOD OF OCCURRENCE
Pelea capreolus	Grey Rhebok	Near Threatened	Moderate
Felis nigripes	Black-footed Cat	Vulnerable	High
Panthera pardus	Leopard	Vulnerable	Low
Dasymys robertsii	African Marsh Rat	Vulnerable	Low
Hydrictus maculicollis	Spotted-necked Otter	Vulnerable	Medium
Aonyx capensis	Cape Clawless Otter	Near Threatened	Medium
Poecilogale albinucha	African Striped Weasel	Near Threatened	Medium
Parahyaena brunnea	Brown hyaena	Near Threatened	Low
Atelerix frontalis	South African Hedgehog	Near Threatened	High
Crocidura mariquensis	Swamp Musk Shrew	Near Threatened	High
Amblysomus septentrionalis	Highveld Golden Mole	Near Threatened	Medium
Mystromys albicaudatus	White-tailed Rat	Vulnerable	Low
Otomys auratus	Vlei Rat	Near Threatened	High
Chamaesaura aenea	Coppery grass lizard	Near Threatened	Medium
Chamaesaura macrolepis	Large-scaled grass lizard	Near Threatened	Low
Tetradactylus breyeri	Breyer's Long-tailed Seps	Vulnerable	Low
Homoroselaps dorsalis	Striped Harlequin Snake	Near Threatened	Medium

SCIENTIFIC NAME	COMMON NAME	STATUS	LIKELIHOOD OF OCCURRENCE
Pyxicephalus adspersus	The Giant Bull Frog	Near Threatened	Medium

PROTECTED ANIMALS

There are a number of animal species protected according to the National Environmental Management: Biodiversity Act (Act No. 10 of 2004). According to this Act, "a person may not carry out a restricted activity involving a specimen of a listed threatened or protected species without a permit issued in terms of Chapter 7". Such activities include any that are "of a nature that may negatively impact on the survival of a listed threatened or protected species". This implies that any negative impacts on habitats in which populations of protected species occur or are dependent upon would be restricted according to this Act.

Those species protected according to the National Environmental Management: Biodiversity Act (Act No. 10 of 2004) that have a geographical distribution includes the following species:

- Black Wildebeest (does not occur on site),
- Oribi (unlikely to occur on site),
- White Rhinoceros (doesn't occur on site),
- Black-footed Cat,
- Serval,
- Leopard (probably does not occur on site),
- Cape Clawless Otter,
- Spotted-necked Otter,
- Cape Fox,
- Honey Badger,
- South African Hedgehog,
- Brown Hyena, and
- Giant Bullfrog.

There are additional species protected under the Mpumalanga Nature Conservation Act (Act No. 10 of 1998). These include the following that have a geographical distribution that includes the site:

- Giant Bullfrog,
- South African Hedgehog,
- Honey Badger,
- Aardwolf,
- Brown Hyaena,
- Mountain Reedbuck,
- Black Wildebeest,
- Klipspringer,
- Orbi,
- Steenbok,
- Eland,
- Cape Clawless Otter
- Spotted-necked Otter,
- All species of reptiles, except the water leguaan, rock leguaan and all species of snakes, of which the following have a geographical distribution that includes the site:
  - Marsh terrapin
  - Leopard tortoise

- Common dwarf gecko
- Spotted dwarf gecko
- Van Son’s gecko
- Delalande’s sandveld lizard
- Burchell’s sand lizard
- (Spotted sand lizard)
- Coppery grass lizard
- Cape grass lizard
- Large-scaled grass lizard
- Common girdled lizard
- Common crag lizard
- Yellow-throated plated lizard
- Breyer’s long-tailed seps
- Short-headed legless skink
- Thin-tailed legless skink
- Wahlberg’s snake-eyed skink
- Cape skink
- Red-sided skink
- Speckled rock skink
- Variable skink
- Montane dwarf burrowing skink
- Common flap-necked chameleon
- Eastern ground agama
- Southern rock agama

7.2.6 HABITATS

*The following is extracted from the Terrestrial Biodiversity Assessment compiled by David Hoare Consulting (Pty) Ltd and included as **Appendix H-4**.*

HABITATS ON SITE

A map of habitats within the study area is provided in Figure 8. The site is within an area of natural grassland but degraded (from heavily to light). The grassland contains variation due to changes in topography, slope inclination, surface rockiness and the influence of water-flow and water retention in the landscape. A broad classification of the habitat units on site, which also reflects relatively uniform plant species compositional units, is as follows:

Natural habitats:

1. Natural grassland (open grassland on undulating plains – the condition is not indicated in the habitat map although there is a gradient from heavily grazed poor condition to moderate condition);
2. Wetlands (permanent and seasonal wetlands in drainage valleys, including channels, where they occur);

The total amount of natural habitat on site potentially within the project footprint is 125 hectares. There is also approximately 190 ha of transformed or degraded habitat.

Transformed and degraded areas:

3. Old lands (secondary grasslands on previously cultivated areas);
4. Exotic trees (stands of exotic trees);
5. Degraded areas (disturbed areas with bare ground, weeds or waste ground).
6. Current cultivation (areas currently cultivated and fallow lands);
7. Transformed (areas such as roads and buildings where there is no vegetation).

NATURAL VERSUS SECONDARY GRASSLAND

Natural grassland	Areas of original vegetation in which the soil has not been mechanically disturbed, including areas that are in poor condition due to overgrazing, trampling, invasion by weeds or alien invasive species, inappropriate fire regimes, or any other factor that drives natural change in species composition or vegetation structure. The key factor is that the original plants continue to exist, often resprouting after defoliation from sub-surface stems or other storage organs.
Secondary grassland	Areas of vegetation where the original grassland vegetation has been lost through direct disturbance of the soil that results in physical removal of the original plants, the most common cause of which is ploughing, but could be other mechanical factors. The vegetation that then develops as a result of recolonization of the area through propagation.

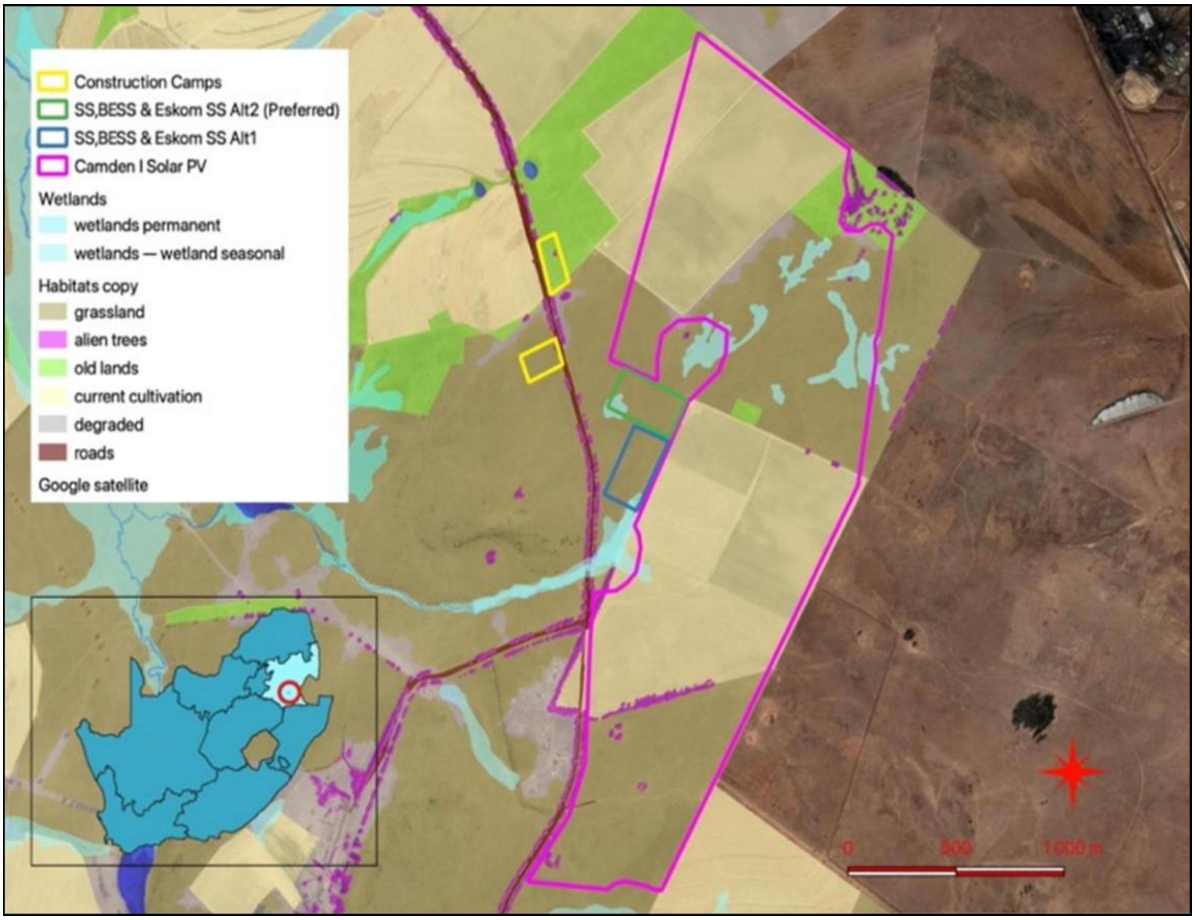


Figure 7.26: Main habitats of the study area

GRASSLAND

The general study area is characterised by an open grassland on the undulating hills and plains. It is generally a short to moderate height tussock grassland with closed canopy cover. The soil depth varies, as does the amount of surface rock cover, but tends to have shallow soil.

The general floristic character of this vegetation on site is fairly uniform across wide areas, often dominated by the same suite of species, including the grasses, *Alloteropsis semialata, Aristida diffusa, Aristida junciformis, Bewsia biflora, Brachiaria serrata, Diheteropogon amplectens, Elionurus muticus, Eragrostis capensis, Eragrostis chloromelas, Eragrostis plana, Eragrostis racemosa, Harpochloa falx, Heteropogon contortus, Microchloa caffra, Panicum natalense, Setaria sphacelata var. torta, Themeda triandra,* and *Tristachya leucothrix,* and the forbs, *Acalypha angustata, Anthospermum rigidum subsp. rigidum, Berkheya setifera, Chaetacanthus costatus, Commelina africana, Crabbea acaulis, Cucumis hirsutus, Cucumis zeyheri, Cyanotis* *speciosa, Gerbera viridifolia, Haplocarpha scaposa, Helichrysum rugulosum, Hemizygia pretoriae, Hermannia transvaalensis, Hibiscus aethiopicus, Hypoxis obtusa, Hypoxis rigidula, Indigofera comosa, Ipomoea ommaneyi, Justicia anagalloides, Kohautia amatymbica, Ledebouria ovatifolia, Monsonia attenuata, Nidorella hottentotta, Pentanisia angustifolia, Pollichia campestris, Scabiosa columbaria, Selago densiflora, Seriphium plumosum, Vernonia galpinii, Vernonia oligocephala,* and *Zornia milneana*. Overall diversity in this unit was high and included a full list of over 100 species. Local species richness was also high at 56 species per 400m2 sampling area. This rivals the local richness of some of the most species-rich grasslands anywhere in the country.

WETLANDS

Wetlands were mapped from Google Earth imagery dated 28/03/2019, a date which shows the wetness signal very well as darker green areas. This also corresponds well to black and white historical aerial photographs from 1955, where wetlands appear as darker areas.

There is one small wetland system on site that consists of patches of wetland linked by lower-lying areas through which water-flow probably occurs. These connected areas consist either of hygrophilous grassland, or temporary to seasonal wetlands, depending on local hydrological conditions.

Valley bottom wetlands in this general area around Ermelo, such as this one, are generally dominated by a variety of grasses, sedges and herbaceous plants, including the graminoids, *Kyllinga erecta, Leersia hexandra, Agrostis lachnantha, Andropogon appendiculatus, Helictotrichon turgidulum, Scirpoides burkei, Cyperus teneristolon, Cyperus macranthus, Typha capensis, Agrostis erianthe, Hemarthria altissima, Panicum schinzii, Cyperus rigidifolius and Arundinella nepalensis, the herbs, Centella asiatica, Senecio polyodon, Senecio erubescens, Haplocarpha scaposa, Pelargonium luridum, Commelina africana, Lobelia flaccida, Monopsis decipiens, and Helichrysum aureonitens*. The species composition depends entirely on the hydrological characteristics of the site, with a greater number of obligate wetland species occurring in more permanently damp areas, whereas dryer areas more closely resembling terrestrial grassland in species composition.

CURRENT CULTIVATION

These are areas that, according to recent satellite imagery, are currently being cultivated, or were recently cultivated (within the last five years). If not under crops, they would be a ploughed land, or a fallow land with either weeds or a cover crop. From an ecological or biodiversity perspective, these areas have no natural habitat and have no plant or vegetation biodiversity value. The soil profile has been completely disturbed, removing all original vegetation, including geophytic and resprouting plant species. In the Grassland Biome of South Africa, a large proportion of the indigenous biodiversity consists of herbaceous and low shrubby species that re-sprout seasonally, after fire, or after defoliation from grazing animals, and can persist under these conditions. In cultivated areas, it is possible through natural succession, or through active rehabilitation, to restore a perennial cover of grasses, but the original biodiversity is permanently lost. They also have little value for animal biodiversity, except for species that forage in cultivated areas.

OLD LANDS

These are areas that were previously ploughed for cultivation but have been left for an extended period without ploughing. Through natural succession processes, they generally develop a perennial cover of grasses, but these secondary grasslands are species poor and the original diversity of resprouting species is usually entirely absent. Non-grass species diversity usually consists of re-seeding and weedy species, and sometimes animal- and/or bird-dispersed woody species.

On aerial photographs and satellite images with adequate resolution, these areas are often recognisable by the presence of residual plough lines and other structural features often present in cultivated fields.

EXOTIC TREES

There are planted windrows on the roadsides in various parts of the site, as well as within homestead complex areas. These are mostly deliberately planted some decades ago and are not alien invasive species. There are, however, various places on site where alien invasive species have become established in previously disturbed areas. In both cases, the underlying natural grassland is lost.

DEGRADED AREAS

Any areas where the original vegetation is lost due to continuous degradation, such as trampling, severe overgrazing, or some other factor, it is mapped as degraded. These areas are unlikely to restore to natural grassland, even with removal of the drivers of the degradation.

TRANSFORMED AREAS

Areas where natural habitat no longer exists due to development of infrastructure, such as roads, buildings, and other hard surfaces. Current cultivation is also transformed, but has not been replaced by built infrastructure, therefore the soil surface can be colonized by plants, if cultivation is stopped.

HABITAT SENSITIVITY

To determine ecological sensitivity in the study area, site-specific, local and regional factors were taken into account. There are some habitats in the study area that have been described as sensitive in their own right, irrespective of the fact that they are listed ecosystems or included in a conservation zone e.g. CBA. For example, natural grassland in South Africa have been transformed to a high degree, and this is irreversible. Such habitats include stream beds and associated riparian zones and adjacent floodplains. A detailed assessment and delineation of these areas was undertaken by an aquatic specialist and they are only considered here in terms of being important habitat for flora and fauna.

At a regional level, the CBA map for Mpumalanga indicates various parts of the study area as being important for conservation. However, no parts of the site fall within CBAs (see Figure 6 on page 27).

A summary of sensitivities that occur on site and that may be vulnerable to damage from the proposed project are as follows:

- **Wetlands**: These are described here only in terms of being a unique botanical habitat and not in the sense of a formal wetland delineation, which is normally assessed in a separate specialist study. The wetlands must be delineated according to "DWAF, 2003: A Practical Guideline Procedure for the Identification and Delineation of Wetlands and Riparian Zones". Restrictions in terms of infrastructure within these areas should be according to the National Water Act (Act 36 of 1998).
- **Listed ecosystems**: Chrissiesmeer Panveld is listed as Endangered, and Eastern Highveld Grassland and Eastern Temperate Freshwater Wetlands are both listed as Vulnerable in the National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011).
- **Grasslands**: Grassland vegetation, in a general sense has been identified as threatened nationally as a habitat type. Indications are that loss of any grassland habitat is permanent in an ecological and biodiversity sense, and it is not possible to restore grassland to a natural state after they have been disturbed. They should therefore be treated as sensitive and all efforts made to minimize impacts on any area of grassland. If possible, the footprint of any proposed infrastructure should be kept to a minimum within any undisturbed, natural grasslands, especially those in a moderate to good condition.

This information was used in conjunction with methodology to calculate Site Ecological Importance, described below. A map of habitat sensitivity on site is provided in **Figure 7.27**.

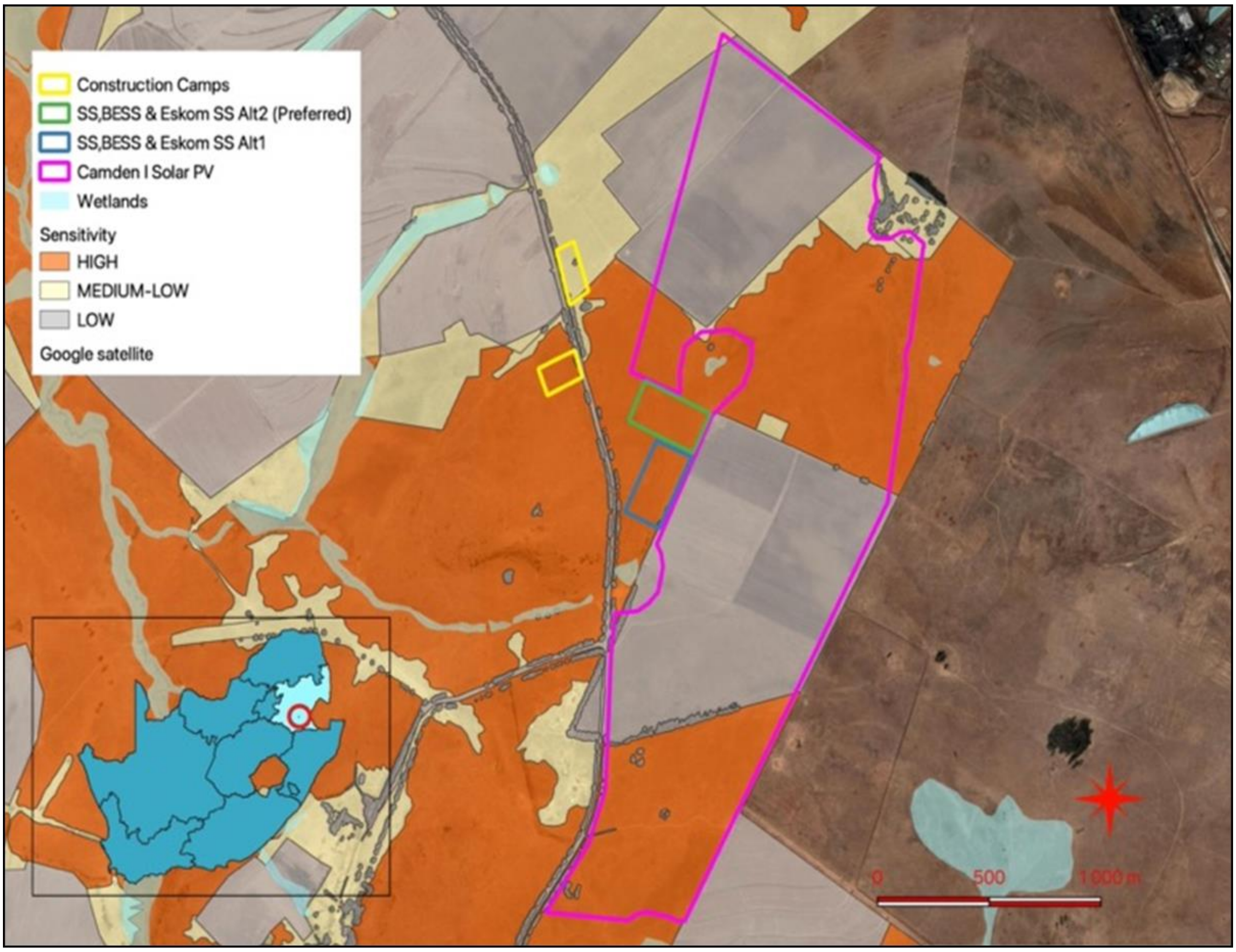


Figure 7.27: Habitat sensitivity of the study area, including consideration of CBAs

SITE ECOLOGICAL IMPORTANCE

The Species Environmental Assessment Guidelines (SANBI 2020) require that a Site Ecological Importance is calculated for each habitat on site and provides methodology for making this calculation.

1 Natural grassland (open grassland on undulating plains, including moderately to heavily grazed areas);
2 Wetlands (seasonal wetlands in drainage valleys);
3 Pans (seasonally inundated areas on the river floodplain);
4 Old lands (secondary grasslands on old lands);
5 Current cultivation (areas currently cultivated and fallow lands);
6 Exotic trees (stands of exotic trees);
7 Degraded areas (disturbed areas with weeds or waste ground);
8 Transformed areas (no vegetation, due to complete removal and replacement with hard surface

As per the Species Environmental Assessment Guidelines (SANBI 2020), Site Ecological Importance (SEI) is calculated as a function of the Biodiversity Importance (BI) of the receptor and its resilience to impacts (SEI = BI + RR). The Biodiversity Importance (BI) in turn is a function of Conservation Importance (CI) and Functional Integrity (FI), i.e. BI = CI + FI.

Table 7.10: Site ecological importance for habitats found on site

HABITAT	CONSERVATION IMPORTANCE	FUNCTIONAL INTEGRITY	RECEPTOR RESILIENCE	SITE ECOLOGICAL IMPORTANCE (BI)
	High	Medium	Very low	High

HABITAT	CONSERVATION IMPORTANCE	FUNCTIONAL INTEGRITY	RECEPTOR RESILIENCE	SITE ECOLOGICAL IMPORTANCE (BI)
Natural grassland	Small area (> 0.01% but < 0.1% of the total ecosystem type extent) of natural habitat of EN ecosystem type or large area (> 0.1%) of natural habitat of VU ecosystem type.	Large (> 20 ha but < 100 ha) intact area for any conservation status of ecosystem type or > 10 ha for EN ecosystem types. (Chrissiesmeer Panveld is listed as EN) BUT Mostly minor current negative ecological impacts with some major impacts (e.g. established population of alien and invasive flora) and a few signs of minor past disturbance. Moderate rehabilitation potential.	Habitat that is unable to recover from major impacts	(BI = Medium)
Wetlands	High	Medium	Low	High
	Any area of natural habitat of threatened ecosystem type with status of VU.	(> 5 ha but < 20 ha) semi-intact area for any conservation status of ecosystem type or > 20 ha for VU ecosystem types	Habitat that is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore less than 50% of the original species composition and functionality	(BI = Medium)
Old lands	Low	Very low	High	Very low
	No confirmed or highly likely populations of SCC or range-restricted species.	Several major current negative ecological impacts.	Habitat that can recover relatively quickly (5-10 years) to restore >75% to restore the original species composition and functionality	(BI = Very low)
Current cultivation	Very low	Very low	Very high	Very low
	No confirmed or highly likely populations of SCC or range-restricted species. No natural habitat remaining.	Several major current negative ecological impacts.	Habitat that can recover rapidly	(BI = Very low)
Exotic trees	Very low	Very low	Very high	Very low
	No confirmed or highly likely populations of SCC or range-restricted species. No natural habitat remaining.	Several major current negative ecological impacts.	Habitat that can recover rapidly	(BI = Very low)
Degraded	Very low	Very low	Very high	Very low
	No confirmed or highly likely populations of SCC or range-restricted	Several major current negative ecological impacts.	Habitat that can recover rapidly	(BI = Very low)

HABITAT	CONSERVATION IMPORTANCE	FUNCTIONAL INTEGRITY	RECEPTOR RESILIENCE	SITE ECOLOGICAL IMPORTANCE (BI)
	species. No natural habitat remaining.			
Transformed	Very low	Very low	Very high	Very low
	No confirmed or highly likely populations of SCC or range-restricted species. No natural habitat remaining.	Several major current negative ecological impacts.	Habitat that can recover rapidly	(BI = Very low)

The calculation of Site Ecological Importance matches the sensitivity classification given in the previous section of this report, but includes an explicit recognition of the ability of each ecosystem to tolerate and recover from disturbance. Guidelines for development activities within different importance levels are given in **Table 7.11** below.

Table 7.11: Guidelines for interpreting SEI in the context of the proposed development activities

SITE ECOLOGICAL IMPORTANCE	INTERPRETATION IN RELATION TO PROPOSED DEVELOPMENT ACTIVITIES
Very high	Avoidance mitigation – no destructive development activities should be considered. Offset mitigation not acceptable/ not possible (i.e. last remaining populations of species, last remaining good condition patches of ecosystems/ unique species assemblages). Destructive impacts for species/ecosystems where persistence target remains.
High	Avoidance mitigation wherever possible. Minimisation mitigation – changes to project infrastructure design to limit the amount of habitat impacted; limited development activities of low impact acceptable. Offset mitigation may be required for high impact activities.
Medium	Minimisation and restoration mitigation – development activities of medium impact acceptable followed by appropriate restoration activities.
Low	Minimisation and restoration mitigation – development activities of medium to high impact acceptable followed by appropriate restoration activities
Very low	Minimisation mitigation – development activities of medium to high impact acceptable and restoration activities may not be required.

7.2.7 AVIFAUNA

*The following is extracted from the Avifaunal Impact Assessment Report compiled by Chris Van Rooyen Consulting and included as **Appendix H-7.***

IMPORTANT BIRD AREAS

The project site is not located in an Important Bird Area (IBA), but it is located between three IBAs. The closest IBA to the project site is the Grasslands IBA SA020, which is located 6-7km to the east of the site. The Chrissies Pans IBA SA019 is located 16-17km to the north-east of the site, and the Amersfoort-Bethal-Carolina IBA SA018 is located about 7-8km to the west. Due to the close proximity of the site to the IBAs, it is possible that some highly mobile priority species which are also IBA trigger species, and which occur either permanently or sporadically in the IBAs, might be impacted by the project when they leave to forage or breed beyond the borders of the IBA. Species that were recorded in the broader area and fall within this category are the following:

- Secretarybird
- Pied Avocet
- Denham's Bustard

- Blue Crane
- Grey Crowned Crane
- Wattled Crane
- White-backed Duck
- Yellow-billed Duck
- Martial Eagle
- Lanner Falcon
- Greater Flamingo
- Lesser Flamingo
- Black-necked Grebe
- Little Grebe
- African Marsh Harrier
- Black Harrier
- Southern Bald Ibis
- African Grass Owl
- Southern Pochard
- Cape Shoveler
- White-winged Tern

BIRD HABITAT

Whilst much of the distribution and abundance of the bird species in the project site can be explained by the dominant biomes and vegetation types, it is also important to examine the modifications which have changed the natural landscape, and which may have an effect on the distribution of avifauna. These are sometimes evident at a much smaller spatial scale than the biome or vegetation types, and are determined by a host of factors such as topography, land use and man-made infrastructure.

The following bird habitat classes were identified in the project site:

GRASSLAND

The majority of the habitat in the project site comprises natural grassland. The grassland varies from dense stands of relatively high grass to areas of heavily grazed short grass. The priority species which could potentially use the natural grassland in the project site on a regular basis are the following:

- African Grass Owl
- African Harrier-Hawk
- Amur Falcon
- Black-chested Snake Eagle
- Black-headed Heron
- Black-winged Kite
- Blue Crane
- Blue Korhaan
- Cape Grassbird
- Cloud Cisticola
- Common Buzzard
- Grey-winged Francolin
- Jackal Buzzard
- Lanner Falcon
- Long-crested Eagle
- Marsh Owl
- Pied Starling

- Rock Kestrel
- Secretarybird
- South African Cliff Swallow
- Southern Bald Ibis
- Western Cattle Egret
- White Stork
- White-bellied Bustard

The priority species which could occasionally use the natural grassland in the project site are the following:

- Black Harrier
- Brown Snake Eagle
- Cape Vulture
- Denham's Bustard
- Eastern Long-billed Lark
- Grey Crowned Crane
- Martial Eagle
- Montagu's Harrier
- Peregrine Falcon
- Red-chested Flufftail
- Spotted Eagle-Owl
- Western Barn Owl
- Yellow-billed Kite

DRAINAGE LINES AND WETLANDS

There are several wetlands in the project area, most of which are associated with drainage lines. Wetlands are characterised by static or slow flowing water and are extensively covered by tall emergent wetland vegetation. The priority species which could potentially use the wetlands in the project site on a regular basis are the following:

- African Grass Owl
- African Snipe
- Black-headed Heron
- Blacksmith Lapwing
- Blue Crane
- Egyptian Goose
- Marsh Owl

The priority species which could occasionally use the wetlands in the project site are the following:

- African Black Duck
- African Marsh Harrier
- African Rail
- African Swamphen
- Glossy Ibis
- Grey Crowned Crane
- Hamerkop
- Ruff
- Wattled Crane

AGRICULTURAL LANDS

The project site contains a patchwork of agricultural fields, where maize, soya beans and pastures are cultivated. Some fields are lying fallow or are in the process of being re-vegetated by grass. The priority species which could potentially use the agricultural fields in the project site on a regular basis are the following:

- Common Buzzard
- Blue Crane
- Amur Falcon
- Lanner Falcon
- Egyptian Goose
- Spur-winged Goose
- Southern Bald Ibis
- Black-winged Kite

The priority species which could occasionally use the agricultural lands in the project site are the following:

- Grey Crowned Crane

ALIEN TREES

The project site contains few trees. Most trees are alien species, particularly Eucalyptus, Australian Acacia (Wattle), and Salix (Willow) species. Trees are often planted as wind breaks next to agricultural lands and around homesteads. Some of the drainage lines also have trees growing in them. The priority species which could potentially use the alien trees in the project site on a regular basis are the following:

- Secretarybird
- Common Buzzard
- Jackal Buzzard
- Black-chested Snake Eagle
- Long-crested Eagle
- Western Cattle Egret
- Amur Falcon
- Lanner Falcon
- Fiscal Flycatcher
- African Harrier-Hawk
- Black-headed Heron
- African Sacred Ibis
- Southern Bald Ibis
- Rock Kestrel
- Black-winged Kite
- Black Sparrowhawk
- Pied Starling
- White Stork
- Cape Weaver

The priority species which could occasionally use the alien trees in the project site are the following:

- Reed Cormorant
- White-breasted Cormorant
- Grey Crowned Crane
- African Darter
- African Fish Eagle
- Brown Snake Eagle

- Martial Eagle
- Spotted Eagle-Owl
- Peregrine Falcon
- Black-crowned Night Heron
- Grey Heron
- Giant Kingfisher
- Yellow-billed Kite
- Western Osprey
- Western Barn Owl
- African Spoonbill
- Karoo Thrush
- Cape Vulture
- Cape White-eye

DAMS

There are three small ground dams at the project site, located in drainage lines. The priority species which could potentially use the dams in the project site on a regular basis are the following:

- Egyptian Goose
- Spur-winged Goose
- African Sacred Ibis
- Blacksmith Lapwing
- Three-banded Plover
- South African Shelduck
- Cape Weaver

The priority species which could occasionally use the dams in the project site are the following:

- Hamerkop
- Pied Avocet
- Red-knobbed Coot
- Reed Cormorant
- White-breasted Cormorant
- Black Crake
- African Darter
- Fulvous Whistling Duck
- White-backed Duck
- White-faced Whistling Duck
- Yellow-billed Duck
- African Fish Eagle
- Martial Eagle
- Great Egret
- Intermediate Egret
- Little Egret
- Black-necked Grebe
- Little Grebe
- Common Greenshank
- Grey-headed Gull
- Black Heron

- Black-crowned Night Heron
- Goliath Heron
- Grey Heron
- Purple Heron
- Squacco Heron
- African Jacana
- Giant Kingfisher
- Malachite Kingfisher
- Pied Kingfisher
- Common Moorhen
- Lesser Moorhen
- Western Osprey
- Kittlitz's Plover
- Southern Pochard
- African Rail
- Common Sandpiper
- Wood Sandpiper
- Cape Shoveler
- African Spoonbill
- Black-winged Stilt
- Little Stint
- African Swamphen
- Blue-billed Teal
- Cape Teal
- Red-billed Teal
- Whiskered Tern

PANS

The project site contains two small pans. These pans are a potential drawcard for many species. Lesser and Greater Flamingos could use these pans for foraging and roosting. Large raptors and vultures could use the pans for bathing and drinking, and Blue Cranes could roost there on occasion. The priority species which could potentially use the pans in the project site on a regular basis are the following:

- Blue Crane
- Egyptian Goose
- Spur-winged Goose
- African Sacred Ibis
- Blacksmith Lapwing
- Three-banded Plover
- African Snipe

The priority species which could occasionally use the pans in the project site are the following:

- Red-knobbed Coot
- Black Crake
- White-faced Whistling Duck
- African Fish Eagle
- Martial Eagle
- Great Egret
- Intermediate Egret

- Little Egret
- Greater Flamingo
- Lesser Flamingo
- Little Grebe
- Common Greenshank
- Grey-headed Gull
- Black Heron
- African Jacana
- Kittlitz's Plover
- African Rail
- Common Sandpiper
- Wood Sandpiper
- African Spoonbill
- Black-winged Stilt
- Little Stint
- Blue-billed Teal
- Red-billed Teal
- Whiskered Tern

PRIORITY SPECIES

The South African Bird Atlas Project 2 (SABAP2) data indicates that a total of 234 bird species could potentially occur within the broader area. Appendix 1 of the Avifauna Report provides a comprehensive list of all the species. Of these, 107 species are classified as priority species (see definition of priority species in section 4) and 17 of these are South African Red List species. Of the priority species, 35 are likely to occur regularly in the development area.

Table 7.12 lists all the priority species that are likely to occur regularly and the possible impact on the respective species by the proposed solar farm. The following abbreviations and acronyms are used:

- NT = Near threatened
- VU = Vulnerable
- EN = Endangered

Table 7.12: Priority species potentially occurring at the development area (Red List species are shaded)

SPECIES	TAXONOMIC NAME	SABAP2 REPORTING RATE		CONSERVATION STATUS					HABITAT FEATURE							POTENTIAL IMPACT				
		Full protocol reporting rate	ad hoc protocol reporting rate	Global status	Regional status	IBA trigger species	RECORDED DURING SURVEYS	LIKELIHOOD OF REGULAR	Grassland	Drainage lines and	Agriculture	Dams	Pans	Alien trees	HV Lines	Collisions with solar panels	Displacement: Disturbance	Displacement: Habitat	Entanglement in fences	Powerline - Electrocution
African Black Duck	*Anas sparsa*	10.9	0.0	-	-		x	L		x						x				
African Darter	*Anhinga rufa*	16.4	2.2	-	-		x	L				x		x		x				
African Fish Eagle	*Haliaeetus vocifer*	12.1	0.9	-	-		x	L				x	x	x	x		x	x		x
African Grass Owl	*Tyto capensis*	2.4	0.0	-	VU	x	x	M	x	x						x	x	x	x	x
African Harrier-Hawk	*Polyboroides typus*	11.5	1.8	-	-		x	M	x					x						x
African Jacana	*Actophilornis africanus*	1.8	1.3	-	-			L				x	x			x				
African Marsh Harrier	*Circus ranivorus*	0.6	0.0	-	EN	x		L		x							x	x		x
African Rail	*Rallus caerulescens*	5.5	0.0	-	-		x	L		x		x	x			x				
African Sacred Ibis	*Threskiornis aethiopicus*	47.9	6.2	-	-		x	M				x	x	x	x	x				x
African Snipe	*Gallinago nigripennis*	20.0	0.9	-	-		x	M		x			x			x				
African Spoonbill	*Platalea alba*	16.4	2.2	-	-		x	L				x	x	x		x				
African Swamphen	*Porphyrio madagascariensis*	6.1	2.2	-	-		x	L		x		x				x				
Amur Falcon	*Falco amurensis*	29.1	6.6	-	-		x	H	x		x			x	x	x		x		
Black Crake	*Zapornia flavirostra*	9.1	0.0	-	-		x	L				x	x			x				
Black Harrier	*Circus maurus*	0.0	0.9	EN	EN	x		L	x									x		x

Black Heron	*Egretta ardesiaca*	0.6	0.0	-	-			L				x	x			x				
Black Sparrowhawk	*Accipiter melanoleucus*	12.1	0.9	-	-		x	M						x		x				x
Black-chested Snake Eagle	*Circaetus pectoralis*	3.0	0.4	-	-		x	M	x					x	x			x		x
Black-crowned Night Heron	*Nycticorax nycticorax*	0.6	0.0	-	-			L				x		x		x				
Black-headed Heron	*Ardea melanocephala*	52.1	4.0	-	-		x	H	x	x				x	x	x		x		x
Black-necked Grebe	*Podiceps nigricollis*	0.6	0.4	-	-	x		L				x				x				
Blacksmith Lapwing	*Vanellus armatus*	67.9	7.0	-	-		x	H		x		x	x			x				
Black-winged Kite	*Elanus caeruleus*	60.6	12.8	-	-		x	H	x		x			x	x			x		
Black-winged Stilt	*Himantopus himantopus*	9.1	0.0	-	-		x	L				x	x			x				
Blue Crane	*Grus paradisea*	11.5	0.4	VU	NT	x	x	H	x	x	x		x				x	x	x	
Blue Korhaan	*Eupodotis caerulescens*	6.1	0.0	NT	LC		x	M	x							x	x	x	x	
Blue-billed Teal	*Spatula hottentota*	1.2	0.0	-	-			L				x	x			x				
Brown Snake Eagle	*Circaetus cinereus*	1.8	0.0	-	-			L	x					x	x		x	x		x
Buff-streaked Chat	*Campicoloides bifasciatus*	5.5	0.4	-	-			L								x	x			
Cape Grassbird	*Sphenoeacus afer*	24.8	0.9	-	-		x	H	x							x	x	x		
Cape Shoveler	*Spatula smithii*	18.8	0.0	-	-	x	x	L				x				x				
Cape Teal	*Anas capensis*	3.0	0.0	-	-		x	L				x				x				
Cape Vulture	*Gyps coprotheres*	0.00	0.00	EN	EN		x	L	x					x	x		x			x
Cape Weaver	*Ploceus capensis*	33.9	2.2	-	-		x	H				x		x		x				
Cape White-eye	*Zosterops virens*	35.2	1.3	-	-		x	L						x		x	x	x		
Chorister Robin-Chat	*Cossypha dichroa*	1.2	0.0	-	-			L								x		x		
Cloud Cisticola	*Cisticola textrix*	7.9	0.9	-	-		x	M	x							x	x	x		
Common Buzzard	*Buteo buteo*	27.9	9.3	-	-		x	H	x		x			x	x			x		x
Common Greenshank	*Tringa nebularia*	5.5	0.0	-	-		x	L				x	x			x				
Common Moorhen	*Gallinula chloropus*	32.7	1.8	-	-		x	L				x				x				

Common Sandpiper	*Actitis hypoleucos*	1.2	0.0	-	-			L				x	x			x				
Denham's Bustard	*Neotis denhami*	1.8	0.0	NT	VU	x		L	x								x	x	x	
Drakensberg Prinia	*Prinia hypoxantha*	18.8	0.0	-	-		x	M								x	x			
Eastern Long-billed Lark	*Certhilauda semitorquata*	4.8	0.0	-	-		x	L	x							x	x			
Egyptian Goose	*Alopochen aegyptiaca*	78.2	6.2	-	-		x	H		x	x	x	x		x	x				x
Fiscal Flycatcher	*Melaenornis silens*	17.0	0.9	-	-		x	M						x		x				
Fulvous Whistling Duck	*Dendrocygna bicolor*	0.0	0.4	-	-			L				x				x				
Giant Kingfisher	*Megaceryle maxima*	4.8	0.0	-	-			L				x		x						
Glossy Ibis	*Plegadis falcinellus*	4.2	1.8	-	-			L		x						x				
Goliath Heron	*Ardea goliath*	2.4	0.0	-	-			L				x				x				
Great Egret	*Ardea alba*	7.9	1.3	-	-			L				x	x			x				
Greater Flamingo	*Phoenicopterus roseus*	3.6	4.4	-	NT	x	x	L					x			x				
Grey Crowned Crane	*Balearica regulorum*	5.5	0.0	EN	EN	x	x	L	x	x	x			x	x		x	x	x	x
Grey Heron	*Ardea cinerea*	24.8	3.5	-	-		x	L				x		x	x	x				
Grey-headed Gull	*Chroicocephalus cirrocephalus*	3.6	0.4	-	-			L				x	x							
Grey-winged Francolin	*Scleroptila afra*	27.3	2.2	-	-		x	H	x							x	x	x	x	
Hamerkop	*Scopus umbretta*	11.5	0.0	-	-		x	L		x		x	x			x				x
Intermediate Egret	*Ardea intermedia*	13.9	1.8	-	-		x	L				x	x			x				
Jackal Buzzard	*Buteo rufofuscus*	19.4	2.2	-	-		x	H	x					x	x			x		x
Karoo Thrush	*Turdus smithi*	5.5	0.0	-	-			L						x		x	x	x		
Kittlitz's Plover	*Charadrius pecuarius*	7.3	0.4	-	-		x	L				x	x			x				
Lanner Falcon	*Falco biarmicus*	7.3	0.0	-	VU	x	x	M	x		x			x	x	x		x		x
Lesser Flamingo	*Phoeniconaias minor*	3.6	1.3	NT	NT	x	x	L					x			x				
Lesser Moorhen	*Paragallinula angulata*	0.6	0.4	-	-		x	L				x				x				
Little Egret	*Egretta garzetta*	4.2	1.3	-	-			L				x	x			x				

Little Grebe	*Tachybaptus ruficollis*	38.8	3.1	-	-	x	x	L				x	x			x				
Little Stint	*Calidris minuta*	1.8	0.0	-	-			L				x	x			x				
Long-crested Eagle	*Lophaetus occipitalis*	6.7	9.3	-	-		x	M	x					x	x			x		x
Malachite Kingfisher	*Corythornis cristatus*	7.3	0.0	-	-		x	L				x								
Marsh Owl	*Asio capensis*	5.5	0.4	-	-		x	H	x	x						x	x	x	x	x
Martial Eagle	*Polemaetus bellicosus*	2.4	0.0	EN	EN	x	x	L	x			x	x	x	x		x	x		x
Montagu's Harrier	*Circus pygargus*	1.2	0.0	-	-			L	x									x		x
Peregrine Falcon	*Falco peregrinus*	1.2	0.0	-	-		x	L	x					x	x			x		x
Pied Avocet	*Recurvirostra avosetta*	4.8	0.0	-	-	x	x	L				x	x			x				
Pied Kingfisher	*Ceryle rudis*	12.7	0.4	-	-		x	L				x								
Pied Starling	*Lamprotornis bicolor*	55.2	11.5	-	-		x	H	x					x		x	x	x		
Purple Heron	*Ardea purpurea*	4.2	0.0	-	-			L				x				x				
Red-billed Teal	*Anas erythrorhyncha*	17.0	1.3	-	-		x	L				x	x			x				
Red-chested Flufftail	*Sarothrura rufa*	0.6	0.0	-	-		x	L	x							x	x			
Red-knobbed Coot	*Fulica cristata*	58.2	4.8	-	-		x	L				x	x			x				
Reed Cormorant	*Microcarbo africanus*	63.6	4.8	-	-		x	L				x		x		x				
Rock Kestrel	*Falco rupicolus*	5.5	0.9	-	-		x	M	x					x	x			x		
Ruff	*Calidris pugnax*	1.8	0.4	-	-			L		x						x				
Secretarybird	*Sagittarius serpentarius*	13.3	0.0	EN	VU	x	x	H	x					x			x	x	x	
Sentinel Rock Thrush	*Monticola explorator*	2.4	0.0	NT	LC		x	L								x				
South African Cliff Swallow	*Petrochelidon spilodera*	38.2	3.5	-	-		x	H	x							x		x		
South African Shelduck	*Tadorna cana*	30.3	3.5	-	-		x	M				x				x				
Southern Bald Ibis	*Geronticus calvus*	23.0	3.1	VU	VU	x	x	H	x		x			x	x	x		x		x
Southern Pochard	*Netta erythrophthalma*	9.1	0.0	-	-	x	x	L				x				x				
Spotted Eagle-Owl	*Bubo africanus*	9.1	0.9	-	-		x	L	x					x	x	x	x		x	x

Spur-winged Goose	*Plectropterus gambensis*	44.2	1.8	-	-		x	M			x	x	x		x	x				x
Squacco Heron	*Ardeola ralloides*	1.2	0.0	-	-			L				x				x				
Three-banded Plover	*Charadrius tricollaris*	35.2	0.9	-	-		x	M				x	x			x				
Wattled Crane	*Grus carunculata*	0.6	0.0	VU	CR	x		L		x						x	x	x	x	
Western Barn Owl	*Tyto alba*	3.0	0.4	-	-			L	x					x						x
Western Cattle Egret	*Bubulcus ibis*	44.8	12.3	-	-		x	H	x					x		x	x	x		
Western Osprey	*Pandion haliaetus*	0.6	0.0	-	-			L				x		x	x					x
Whiskered Tern	*Chlidonias hybrida*	12.1	5.3	-	-			L				x	x							
White Stork	*Ciconia ciconia*	7.3	1.3	-	-		x	M	x					x	x			x		
White-backed Duck	*Thalassornis leuconotus*	6.7	0.0	-	-	x	x	L				x				x				
White-bellied Bustard	*Eupodotis senegalensis*	7.9	0.0	-	VU		x	M	x							x	x	x	x	
White-breasted Cormorant	*Phalacrocorax lucidus*	11.5	0.9	-	-		x	L				x		x		x				
White-faced Whistling Duck	*Dendrocygna viduata*	0.6	0.0	-	-			L				x	x			x				
White-winged Tern	*Chlidonias leucopterus*	3.6	0.9	-	-	x	x	L												
Wood Sandpiper	*Tringa glareola*	6.1	0.0	-	-			L				x	x			x				
Yellow-billed Duck	*Anas undulata*	61.8	4.4	-	-	x	x	L				x				x				
Yellow-billed Kite	*Milvus aegyptius*	2.4	0.0	-	-		x	L	x					x	x					x

AVIFAUNA SENSITIVITY

The following specific environmental sensitivities have been identified from an avifaunal perspective:

- **100m all infrastructure exclusion zone around drainage lines, associated wetlands and pans excluding essential road and grid crossings..** Wetlands are important breeding, roosting and foraging habitat for a variety of Red List priority species, most notably for African Grass Owl (SA status Vulnerable), Grey Crowned Crane (SA status Endangered) and African Marsh Harrier (SA status Endangered).
- **High sensitivity grassland - Limited infrastructure zone**. Development in the remaining high sensitivity grassland must be limited as far as possible. Where possible, infrastructure must be located near margins, with shortest routes taken from the existing roads. The grassland is vital breeding, roosting and foraging habitat for a variety of Red List priority species. These include Blue Crane (SA status near-threatened), Blue Korhaan (Global status near -threatened), White-bellied Bustard (SA Status Vulnerable), Denham's Bustard (SA Status Vulnerable).

The avifaunal sensitivities identified for the Camden I SEF are shown in **Figure 7.28**.

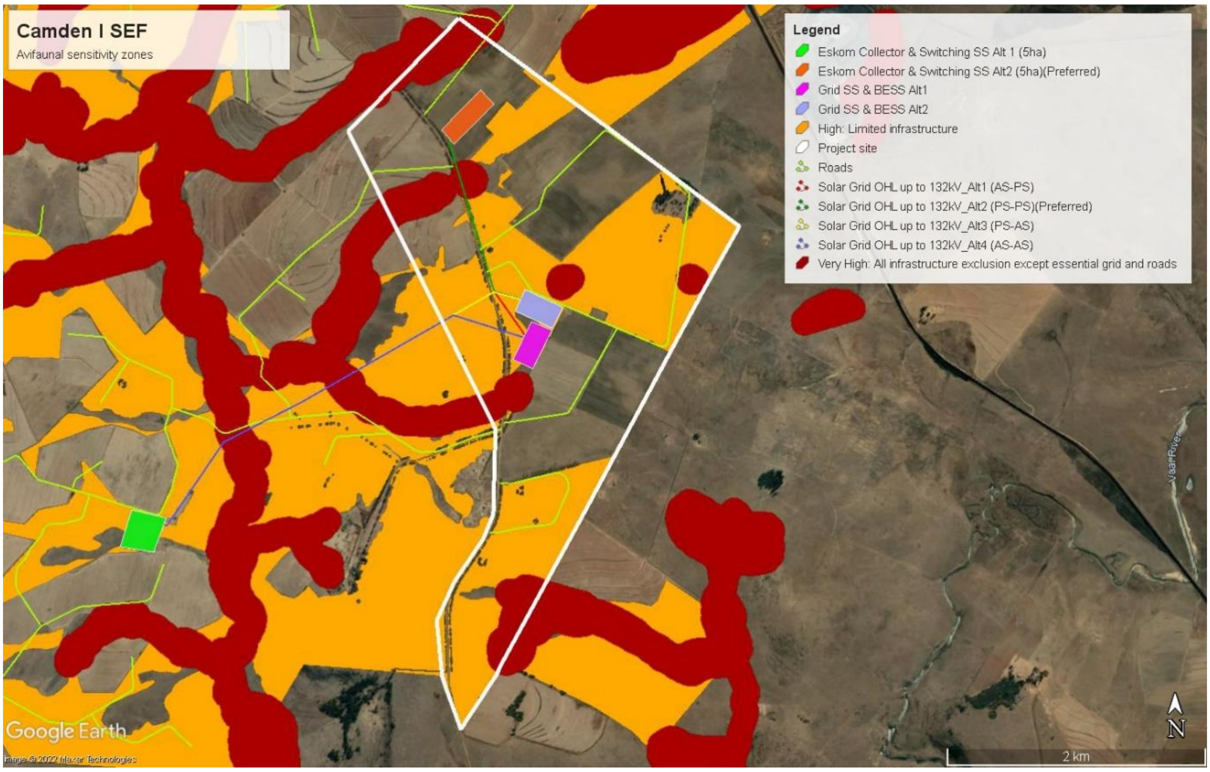


Figure 7.28: Proposed avifaunal sensitivities at the Camden I SEF (Chris van Rooyen Consulting, 2021).

PRE-CONSTRUCTION MONITORING

Table 7.13, **Figure 7.29** and **Figure 7.30** below present the results of the pre-construction monitoring conducted at the Camden I PV project area. Monitoring was conducted by means of drive and walk transect counts as per the requirements of the latest avifaunal guideline at the time of writing. Monitoring was implemented in the following time slots:

- Survey 1: 10 – 11, 20 – 26 February 2021
- Survey 2: 20 – 21 March,12 and 14 April, 5 and 12 May 2021

The results of the transect counts are tabled in **Table 7.13** below:

Table 7.13: Transect count results

PV SITE	NUMBER OF RECORDS
Species Composition	
All Species	74
Solar Priority Species (30%)	22
Non-Priority Species	52
Total Count	
Drive transects	1103
Walk transects	217
Total	1320

An Index of Kilometric Abundance (IKA = birds/km) was calculated for each solar priority species recorded during transects counts (see Figures 5 and 6 below).

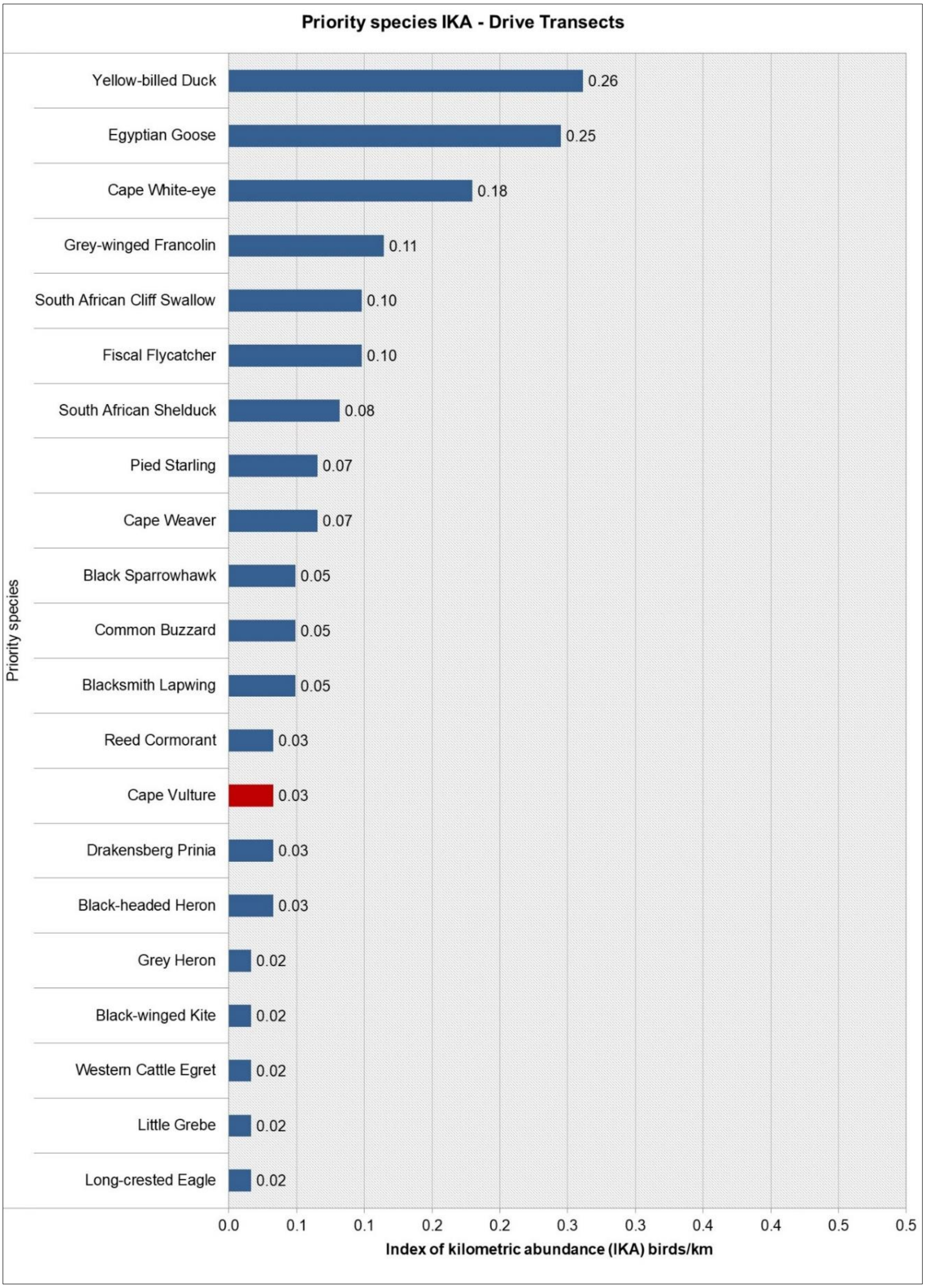


Figure 7.29: Index of kilometric abundance of solar priority species recorded at the project site. Species of conservation concern (SCC) are indicated in red

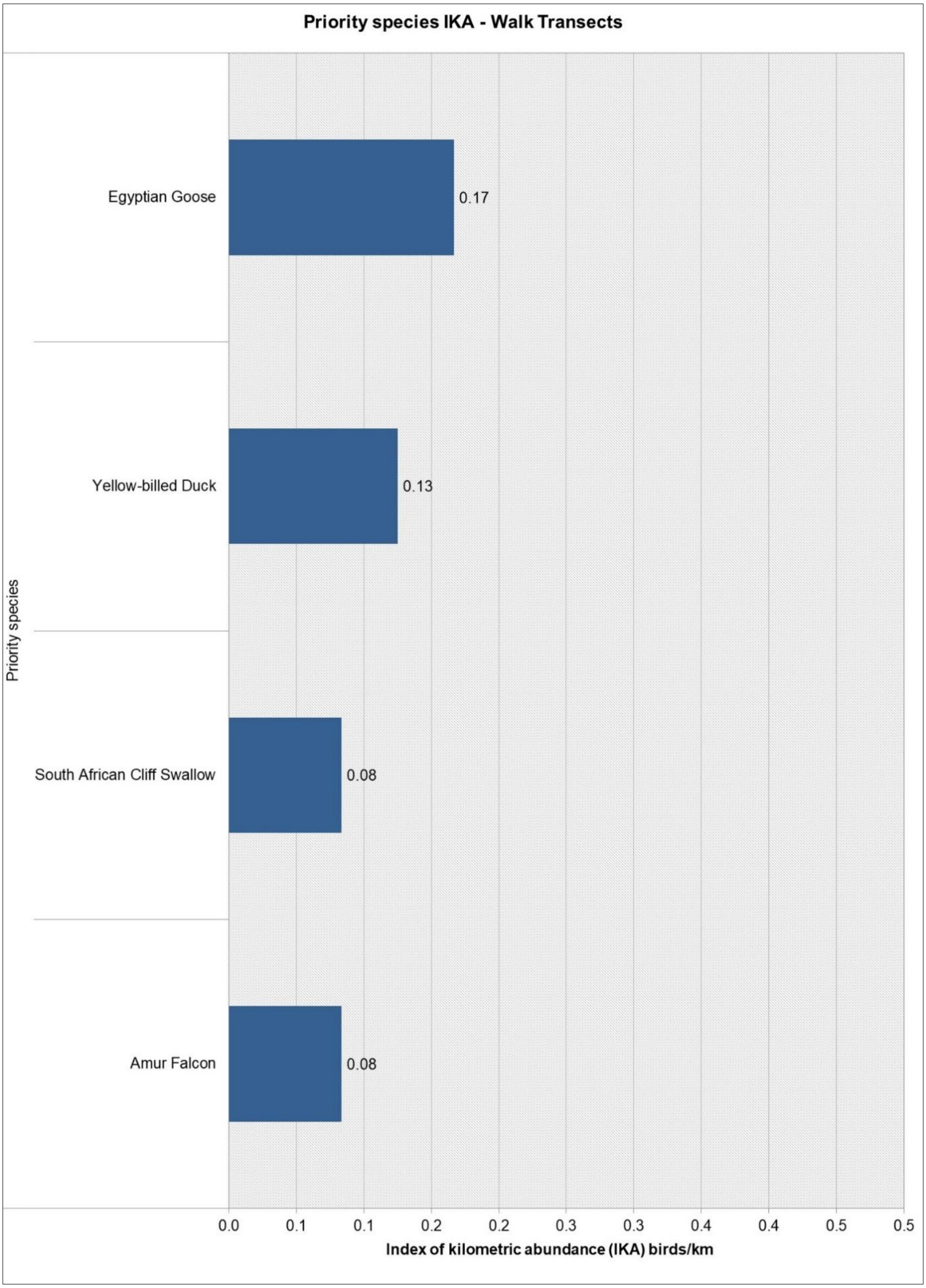


Figure 7.30: Index of kilometric abundance of solar priority species recorded at the SEF through walk transect surveys

Figure 7.31 below shows the spatial distribution of the solar priority species recorded during transect counts.

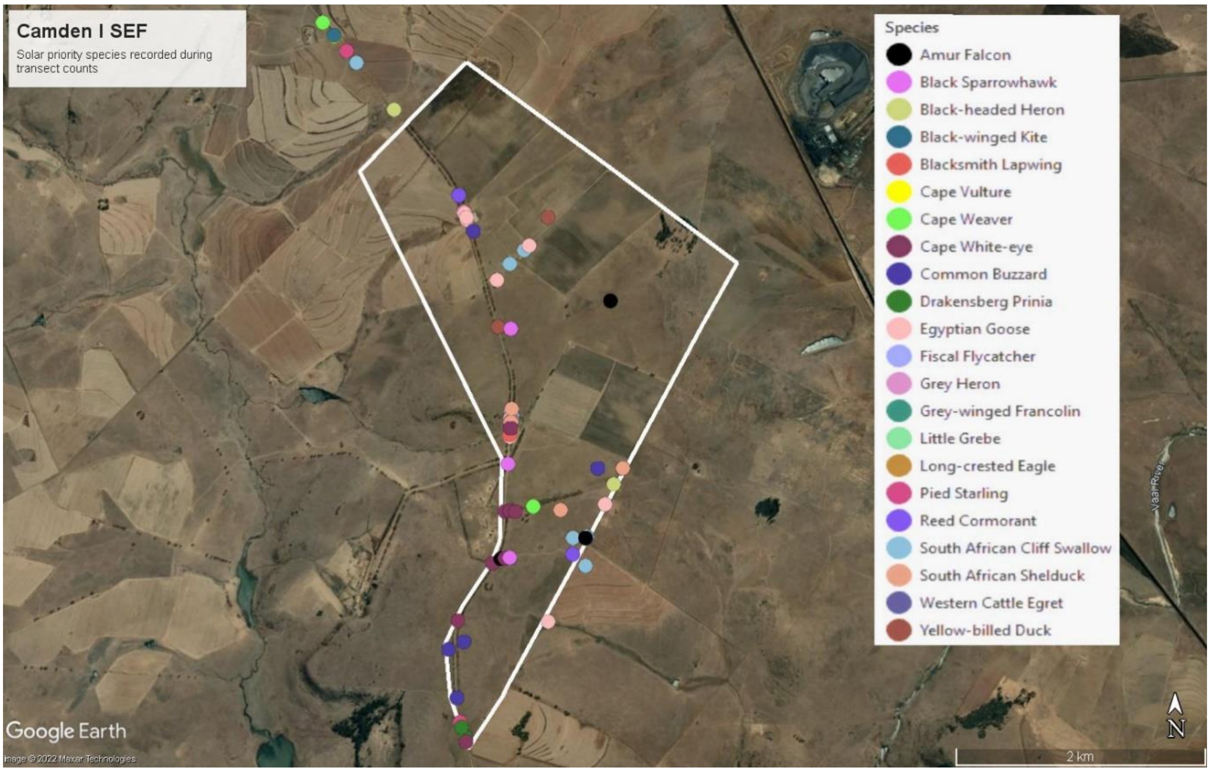


Figure 7.31: The location of solar priority species recorded at the proposed SEF through transect counts

7.2.8 BATS

The following is extracted from the Bats 12 Month Pre-Construction Monitoring Report compiled by Animalia and included as ***Appendix H-8.***

Bats form part of the Order Chiroptera and are the second largest group of mammals after rodents. They are the only mammals to have developed true powered flight and have undergone various skeletal changes to accommodate this. Most South African bats are insectivorous and are capable of consuming vast quantities of insects on a nightly basis (Taylor 2000, Tuttle and Hensley 2001) however, they have also been found to feed on amphibians, fruit, nectar and other invertebrates. As a result, insectivorous bats are the predominant predators of nocturnal flying insects in South Africa and contribute greatly to the suppression of these numbers. Their prey also includes agricultural pests such as moths and vectors for diseases such as mosquitoes (Rautenbach 1982, Taylor 2000).

Currently there is no evidence of Solar Facilities posing a direct threat of fatality impact on bats during operation. However, roosting and foraging habitats may be destroyed during the construction phase. This is primarily due the fact that such facilities require areas of land to be cleared, and in some cases, earthworks are required for levelling purposes. This can result in habitat that is suitable for micro roosts, such as rocky outcrops, clumps of trees and certain vegetation being destroyed, which can also be fatal to bats residing in such roosts. Natural vegetation can support higher insect food quantities and diversity than cleared land, therefore foraging habitat can also be displaced, especially by solar facilities.

The pre-construction monitoring took place between August 2020 and October 2021. **Table 7.14** below indicates the species of bat which have been confirmed to occur on site, those unconfirmed species which may potentially occur on site, as well as those occurring in the broader area of the site based on literature review. For each species, the risk of impact by wind energy infrastructure was assigned by MacEwan et al. (2020) based on their distributions, altitudes at which they fly, and foraging ecology. The predicted risk of impact incurred by PV and GHA is inferred by literature-based foraging ecology for each species.

The bat species most likely to be impacted on by the proposed PV facilities are *Laephotis* (formally *Neoromicia*) *capensis*. This species is of special importance based on their likelihood of being impacted by the proposed PV facilities, due to their habit of roosting readily in building roofs and stands of tall trees. These more abundant species are of a large value to the local ecosystems as they provide a greater contribution to most ecological services than the rarer species, due to their higher numbers.

Table 7.14 Bat species confirmed on site, previously recorded or potentially occurring

SPECIES	COMMON NAME	OCCURRENE IN AREA	CONSERVATION STATUS (SANBI & EWT, 2016)	POSSIBLE ROOSTING HABITAT ON SITE	POSSIBLE FORAGING HABITAT UTILISED ON SITE	RISK OF IMPACT
Tadarida aegyptiaca	Egyptian free-tailed bat	Confirmed on site	Least Concern (2016 Regional Listing)	Hollows in trees, and behind the bark of dead trees. The species has also taken to roosting in roofs of buildings.	It forages over a wide range of habitats; its preferences of foraging habitat seem independent of vegetation. It seems to forage in all types of habitats.	Medium to Low
Mops midas	Midas free-tailed bat	Confirmed in 100km radius	Least Concern (2016 Regional Listing)	Hollows in trees, and behind the bark of dead trees. The species has also taken to roosting in roofs of buildings.	It forages over a wide range of habitats; its preferences of foraging habitat seem independent of vegetation. It seems to forage in all types of habitats.	Medium to Low
Mops (Chaerephon) pumilus	Little free-tailed bat	Confirmed in 100km radius	Least Concern (2016 Regional Listing)	Hollows in trees, and behind the bark of dead trees. The species has also taken to roosting in roofs of buildings.	It forages over a wide range of habitats; its preferences of foraging habitat seem independent of vegetation. It seems to forage in all types of habitats.	Medium to Low

SPECIES	COMMON NAME	OCCURRENE IN AREA	CONSERVATION STATUS (SANBI & EWT, 2016)	POSSIBLE ROOSTING HABITAT ON SITE	POSSIBLE FORAGING HABITAT UTILISED ON SITE	RISK OF IMPACT
Laephotis (Neoromicia) capensis	Cape serotine	Confirmed on site	Least Concern (2016 Regional Listing)	Roosts in the roofs of houses and buildings, and also under the bark of trees.	It appears to tolerate a wide range of environmental conditions from arid semi-desert areas to montane grasslands, forests, and savannahs. Predominantly a medium height clutter edge forager on site.	High
Laephotis zuluensis	Zulu serotine	Confirmed in 100km radius	Least Concern (2016 Regional Listing)	Roosts under the bark of trees, and possibly roofs of buildings.	Predominantly a medium height clutter edge forager on site.	Medium to Low
Laephotis nanus	Banana bat	Confirmed in 100km radius	Least Concern (2016 Regional Listing)	Roosts under the bark of trees, and in the folded leaves of banana trees in the larger area.	Predominantly a medium height clutter edge forager on site.	Medium to Low
Pipistrellus hesperidus	Dusky pipistrelle	Confirmed in 100km radius	Least Concern (2016 Regional Listing)	Roosts under the bark of trees, and possibly roofs of buildings.	Prefers vegetation edges and clutter with open water sources.	High
Miniopterus natalensis	Natal long-fingered bat	Confirmed on site	Least Concern (2016 Regional Listing)	Caves and mine tunnels present in the larger area, may also take residence in suitable hollows such as culverts under roads.	Clutter-edge forager. May forage in more open terrain during suitable weather.	Medium

SPECIES	COMMON NAME	OCCURRENE IN AREA	CONSERVATION STATUS (SANBI & EWT, 2016)	POSSIBLE ROOSTING HABITAT ON SITE	POSSIBLE FORAGING HABITAT UTILISED ON SITE	RISK OF IMPACT
Miniopterus fraterculus	Lesser long-fingered bat	Confirmed in 100km radius	Least Concern (2016 Regional Listing)	Caves and mine tunnels present in the larger area.	Clutter-edge forager. May forage in more open terrain during suitable weather.	Medium
Eptesicus hottentotus	Long-tailed serotine	Confirmed in 100km radius	Least Concern (2016 Regional Listing)	It is a crevice dweller roosting in rock crevices in the larger area, as well as other crevices in buildings.	It generally seems to prefer woodland habitats, and forages on the clutter edge. But may still forage over open terrain occasionally.	Medium to Low
Myotis tricolor	Temmink's myotis	Confirmed in 100km radius	Least Concern (2016 Regional Listing)	Caves and mine tunnels present in the larger area, may also take residence in suitable hollows such as culverts under roads.	Clutter-edge forager. May forage in more open terrain during suitable weather.	Medium
Rhinolophus blasii	Blasius's horseshoe bat	Confirmed in 100km radius	Near Threatened (2016 Regional Listing)	Caves and mine tunnels present in the larger area.	Vegetation clutter forager, clumps of trees on site.	Medium
Rhinolophus clivosus	Geoffroy's horseshoe bat	Confirmed in 100km radius	Least Concern (2016 Regional Listing)	Caves and mine tunnels present in the larger area.	Vegetation clutter forager, clumps of trees on site.	Medium
Rhinolophus swinnyi	Swinny's horseshoe bat	Confirmed in 100km radius	Vulnerable (2016 Regional Listing)	Caves and mine tunnels present in the larger area.	Vegetation clutter forager, clumps of trees on site.	Medium

SPECIES	COMMON NAME	OCCURRENE IN AREA	CONSERVATION STATUS (SANBI & EWT, 2016)	POSSIBLE ROOSTING HABITAT ON SITE	POSSIBLE FORAGING HABITAT UTILISED ON SITE	RISK OF IMPACT
Rhinolophus simulator	Bushveld horseshoe bat	Confirmed in 100km radius	Least Concern (2016 Regional Listing)	Caves and mine tunnels present in the larger area.	Vegetation clutter forager, clumps of trees on site.	Medium
Scotophilus dinganii	Yellow-bellied house bat	Confirmed in 100km radius	Least Concern (2016 Regional Listing)	Roofs of buildings and other suitable hollows.	Clutter-edge forager. May forage in more open terrain during suitable weather.	High
Cloeotis percivali	Percival's short-eared trident bat	Confirmed in 100km radius	Endangered (2016 Regional Listing)	Caves and mine tunnels present in the larger area.	Vegetation clutter forager, clumps of trees on site.	High
Epomophorus wahlbergi	Wahlberg's epauletted fruit bat	Confirmed in 100km radius	Least Concern (2016 Regional Listing)	Roosts in dense foliage of large, leafy trees in the larger area, and may travel several kilometres each night to reach fruiting trees.	Feeds on fruit, nectar, pollen and flowers. If and where available on or near site.	Low
Eidolon helvum	African straw-coloured fruit bat	Possible as migrant	Least Concern (2016 Regional Listing) (Globally Near threatened)	Non-breeding migrant with sparse scattered records.	Feeds on fruit, nectar, pollen and flowers, if and where available on site.	Low

*Occurrence of species records based on ACR 2020 and Monadjem *et al*. 2020

CONSERVATION AND PROTECTED AREAS, KNOWN SENSITIVITIES AND CAVES/ROOSTS WITHIN 100KM OF THE SITE

There is only a single conservation area within 100km of Camden I REC, namely the RAMSAR-recognised Seekoeivlei Nature Reserve of approximately 4 300 ha on the outer extent of the 100km boundary (**Figure 7.32).** This has no bearing on the current site and will not be discussed further.

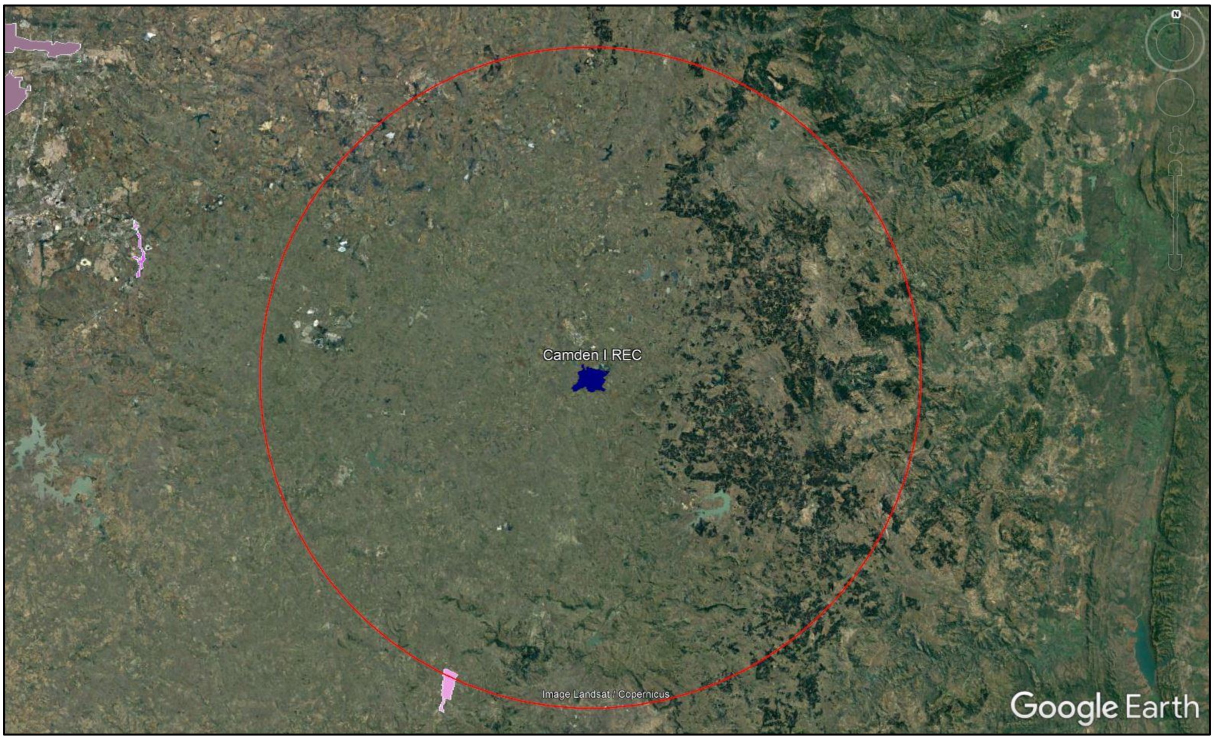


Figure 7.32: Protected areas within a radius of approximately 100km (red line) around the Camden I REC site (DEA, 2021) (Animalia, 2022)

Figure 7.33 shows the dolomitic geology of the greater area, with an approximate 100km site boundary radius shown in red. At its nearest, this extends to approximately 65km north-east of the REC. Dolomite is known to be prone to good cave formation, and many bat colonies are supported in such caves in the country, particularly in the province of Gauteng. Museum records of bats collected from two caves and two mines within approximately 100km of the site exist. Specimens of *Miniopterus. natalensis* and *Rhinolophus clivosus* were collected from River Cave (96km north of site); *R. simulator*, *Myotus tricolor* and *Cloeotis percivali* from a mine tunnel on Waterval Farm (91km north), R. simulator, R. blasii, R. clivosus and Miniopterus fraterculus from Kalkoenkrans Cave (64km north-east) and *Miniopterus. natalensis* from Barites mine (108km northeast). The habitat preferences and sensitivity of these species have been discussed in **Table 7.14**.

The Strategic Environmental Assessment (SEA) assigns 5km buffers to large bat roosts for PV energy, therefore any of the existing or possible cave/roost locations may be assigned a buffer up to 5km if they are found to be supporting large enough bat colonies. All of the above locations are further than 5km from the proposed site. The cave/roost buffers assigned by the SEA may be subject to change based on field-verified observations and roost buffers recommended by the South African Good Practice Guidelines for Surveying Bats (pre-construction) at Wind Energy Facility Developments (MacEwan et al. 2020).

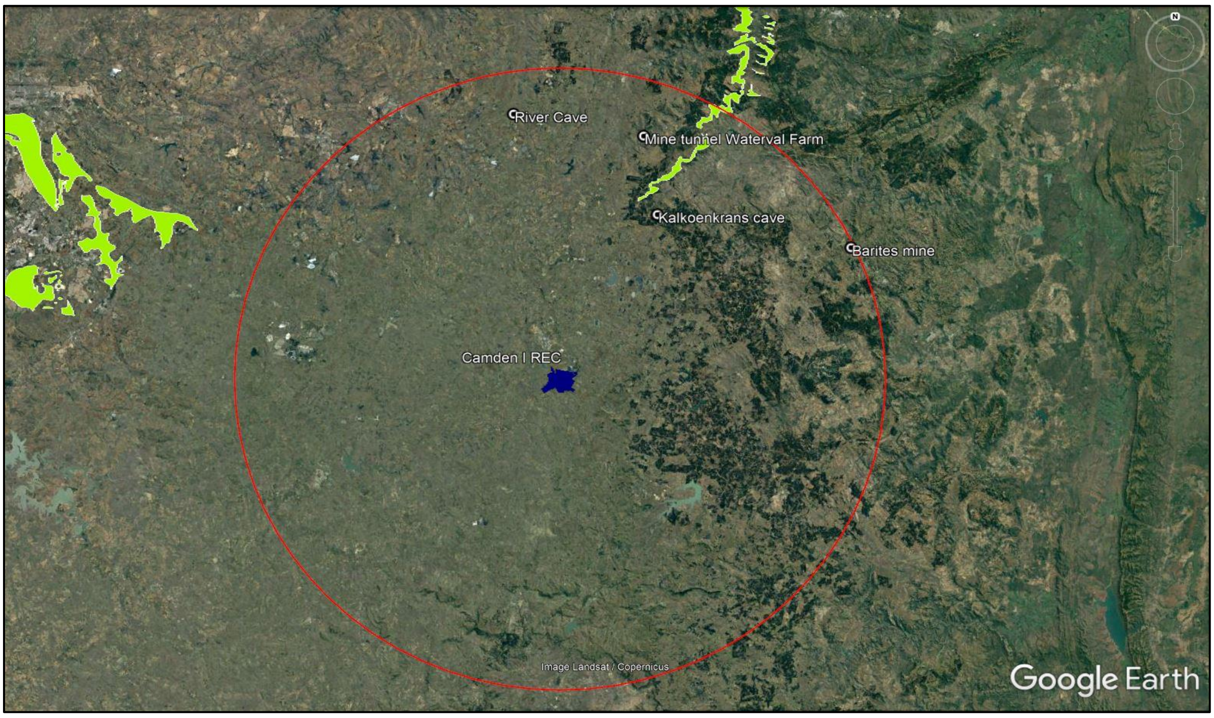


Figure 7.33: Approximate 100km radius (red circle) surrounding Camden I REC (navy shape). Dolomite geology represented in lime green (SEA data), and four known bat roosts depicted with white circles ((Animalia, 2022)

7.3 SOCIAL ENVIRONMENT

7.3.1 LAND USE

*The following is extracted from the Visual Impact Assessment compiled by SiVest SA (Pty) Ltd and included as **Appendix H-12**.*

According to the South African National Land Cover dataset (Geoterraimage 2020), much of the visual assessment area is classified as "Grassland" interspersed with significant areas of "Cultivation". Small tracts of forested land and numerous water bodies are scattered throughout the study area (**Figure 7.34**).

Commercial agriculture is the dominant activity in the study area, with the main focus being maize cultivation and livestock grazing. Although there are several farm portions in the study area, the density of rural settlement is relatively low, and farmsteads are scattered across the study area. Built form in much of the study area comprises farmsteads, ancillary farm buildings and workers' dwellings, gravel access roads, telephone lines, fences and windmills.

High levels of human influence are however visible in the northern sector of the study area caused by the presence of Camden Power Station and the adjacent Camden residential area and associated high voltage power lines. Mooiplaats Colliery, located north-east of the Camden 1 SEF project area also forms a distinctive anthropogenic feature in the otherwise pastoral landscape.

Other evidence of significant human influence includes road, rail, telecommunications and high voltage electricity infrastructure.

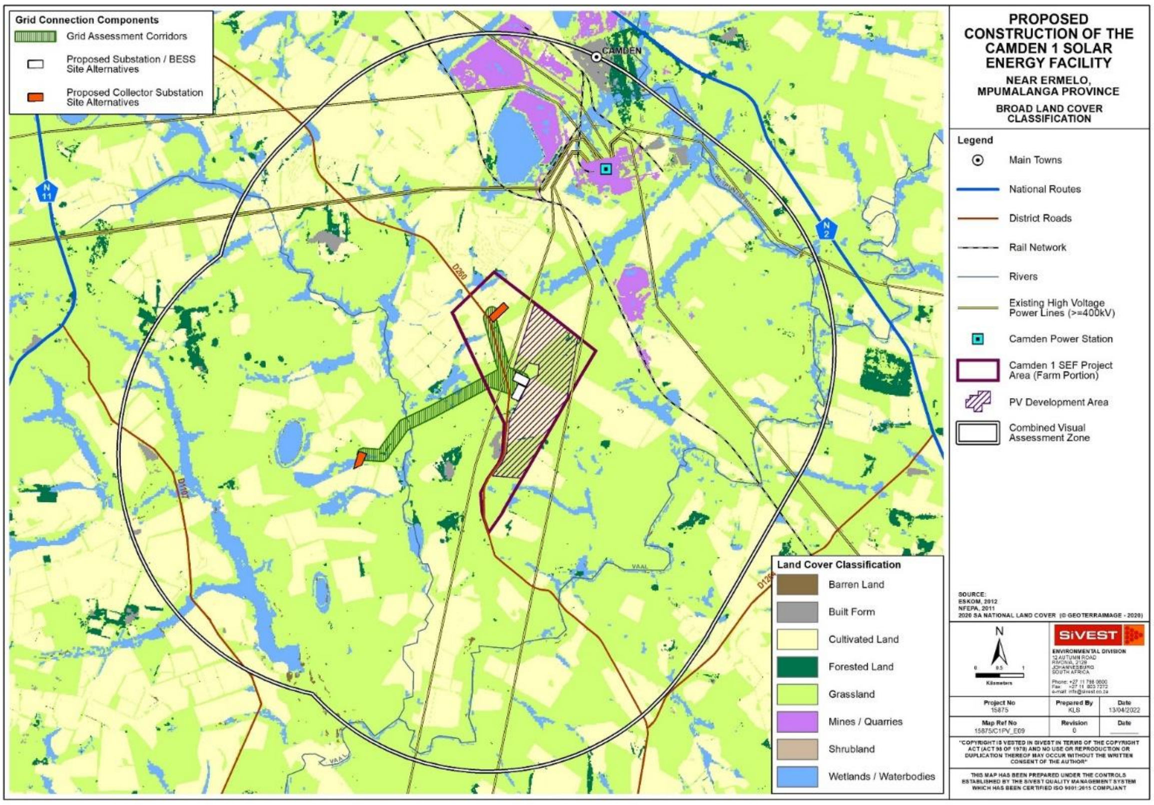


Figure 7.34: Broad land cover classification (SiVest 2022)

7.3.2 TRAFFIC

*The following is extracted from the Traffic Impact Assessment compiled by WSP Group Africa and included as **AppendixH-9**.*

ROAD NETWORK DESCRIPTION

The Camden I SEF facility will be located south-west Camden and National Road N2, and to the west of National Road N11. The N2 is the primary road link between Ermelo and Richards Bay and south to Durban. In the vicinity of the site, the N2 is a single carriageway with 1 lane per direction and gravel shoulders. The N11 is the primary road link between Ladysmith and Newcastle in Kwa-Zulu-Natal, through Ermelo to Middelburg and beyond. In the vicinity of the site, the N11 is a single carriageway with 1 lane per direction and gravel shoulders.

The site is traversed by two district roads:

- The D260 is a district collector from the N11 and follows a roughly southerly alignment beyond its intersection with the D1264. It is a single carriageway 2-way unsurfaced road (1 lane per direction), with no shoulders. It has a priority Stop controlled T-junction on the N11;
- The D1107 is a district collector between the N11 and Road D1329/D261. It is a single carriageway 2-way unsurfaced road (1 lane per direction), with no shoulders. It has a priority Stop controlled T-junction on the N11;
- The D1264 is a district collector between the D260 and the N2, located to the south of the site. It is a single carriageway 2-way unsurfaced road (1 lane per direction), with no shoulders. It has a priority Stop controlled T-junction on the N2, and a grade separated crossing (road over rail), over the main railway line between Mpumalanga and Richards Bay.

SITE ACCESS

It is recommended that access to the Camden I SEF facility for the construction and operation phase be obtained via either the D260 or D1107 off the N11 or the D1264 off the N2 (Refer to **Figure 7.35**). These routes have accesses to the Class 1 National road network. The use of these roads will also not require an application for temporary or permanent access of the National roads.

If an alternate access off the National roads is required for the construction and/or operational phases, the access location/s will require assessment in terms of sight distance, topography, access geometry and overall safety and suitability. This assessment will require a formal access application and approval from SANRAL.

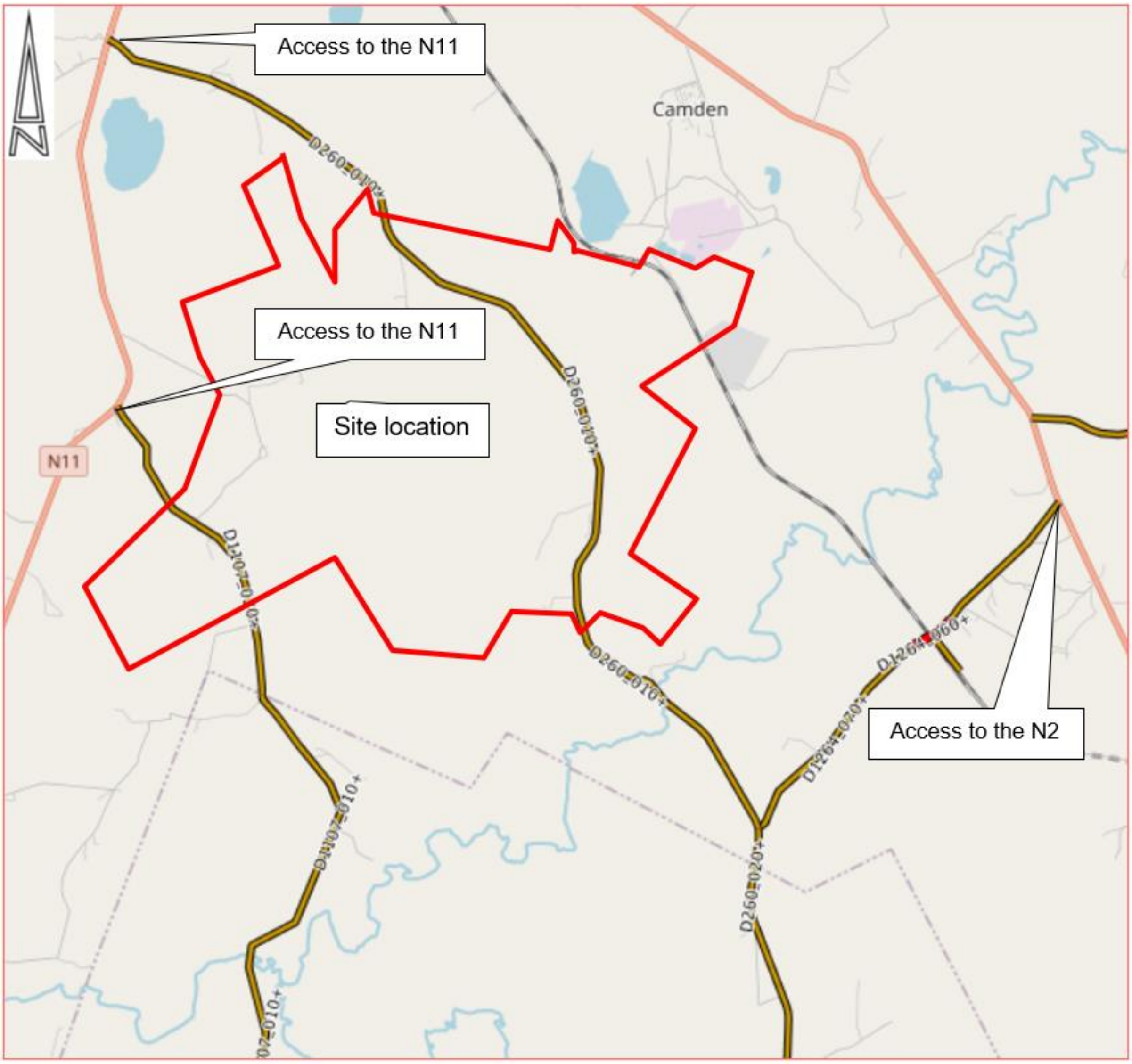


Figure 7.35: Proposed site access

INTERNAL SITE ACCESS ROADS

The internal access roads are shown in **Figure 7.36**.These roads will take direct access off the D1107 and D260 at T-junctions and 4-way crossings. Due to the low construction and operation traffic volumes, these intersections are expected to operate far below capacity. No additional analysis is therefore required.

The expected traffic increase on the district roads during the construction phase may result in deterioration of the roads, as they are not designed for abnormal loads. The cost of maintaining and repairing these gravel roads during the construction phase should be borne by the developer.

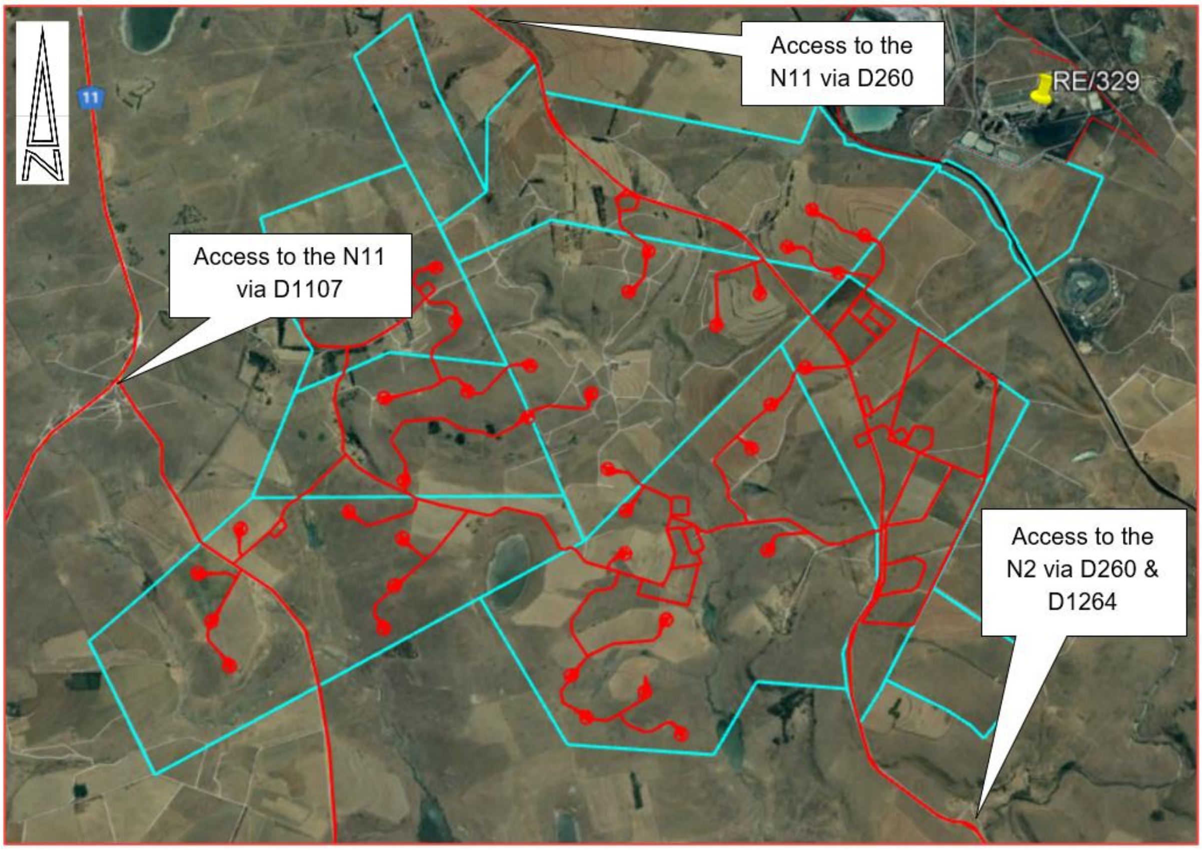


Figure 7.36: Proposed internal access roads

PARKING ASSESSMENT

The proposed on-site parking provision will be limited to the following:

- Construction phase – temporary parking for construction staff and construction deliveries.
- Operational phase – parking for operational & maintenance staff vehicles.

All parking will be accommodated on-site.

PUBLIC & NON-MOTORISED TRANSPORT ASSESSMENT

In terms of the National Land Transport Transition Act (NLTTA) 22 of 2000, section 29, it is a requirement that an assessment of public and non-motorised transport be included in a transport impact assessment.

Due to the remote location of the site on private farms, public access will not be allowed or required during the construction or operational phases of the project. There is therefore no need for public transport services or non-motorised transport infrastructure, except for the transport of construction staff.

7.3.3 HERITAGE AND CULTURAL RESOURCES

The following is extracted from the Heritage Impact Assessment compiled by Beyond Heritage and included as ***Appendix H-10****.*

The archaeological record for the greater study area consists of the Stone Age and Iron Age

STONE AGE

The Stone Age of southern Africa starts when hominins (ancestral to modern-day humans) first started to produce crude tools made with stone. The Earlier Stone Age (2 million - 200 000 years ago) is associated with hominins such as Homo habilis and Homo erectus (Dusseldorp et al. 2013). Mpumalanga currently does not have an extensive ESA archaeological record, at Maleoskop on the farm Rietkloof, only a few ESA artefacts have been found and stone tools consisted of choppers (Oldowan), hand axes, and cleavers (Acheulean) (Esterhuysen & Smith 2007) and some surface scatters have been recorded near Piet Retief (Nel & Karodia 2013).

Middle Stone Age artefacts represents archaic and modern humans that occupied the landscape between 300 000 to 40 000 before present. Later Stone Age occupational sequences reflect San and Khoisan communities from 40 000 years ago until recently (Dusseldorp et al. 2013). Although the MSA and LSA has not been extensively studied in Mpumalanga, evidence for these periods has been excavated from Bushman Rock Shelter in the Ohrigstad District (Esterhuysen & Smith 2007; Lombard et al. 2012) and it is known that San communities lived near Lake Chrissie as recently as the 1950s (e.g., Schlebusch et al. 2016). MSA and LSA surface scatters have also been investigated in the vicinity of Piet Retief, and De Wittekrans nearby Camden is a Later Stone Age archaeological rock art site complex (Nel & Karodia 2013).

IRON AGE

The archaeology of farming communities of southern Africa encompasses three phases. The Early Iron Age (200-900 CE) represents the arrival of Bantu-speaking farmers in southern Africa. Living in sedentary settlements often located next to rivers, these farmers cultivated sorghum, beans, cowpeas, and kept livestock. The Middle Iron Age (900-1300 CE) is mostly confined to the Limpopo Valley in southern Africa with Mapungubwe Hill probably representing the earliest 'state' in this region (Huffman 2007).

The Late Iron Age (1300-1840s CE) marks the arrival and spread of ancestral Eastern Bantu-speaking Nguni and Sotho-Tswana communities into southern Africa. The location of Late Iron Age settlements is usually on or near hilltops for defensive purposes. The Late Iron Age as an archaeological period ended by 1840 CE, when the Mfecane caused major socio-political disruptions in southern Africa (Huffman 2007).

Dates from Early Iron Age sites indicated that by the beginning of the 5th century CE Bantu-speaking farmers had settled in the Mpumalanga lowveld. Subsequently, farmers continued to move into and between the lowveld and highveld of Mpumalanga. Iron Age sites such as Welgelegen Shelter, Robertsdrift and Tafelkop situated 50-100 km west of Camden dates from the 12th to the 18th century (Derricourt & Evers 1973; Esterhuysen & Smith 2007).

During the mid-17th century Europeans started to settle in modern-day Cape Town. During and after the conflict caused by the Mfecane (1820-1840), during the reign of king kaSenzangakhona Zulu, known as Shaka, Dutch-speaking farmers started to migrate to the interior regions of South Africa. A period that is marked by various skirmishes and battles between the local inhabitants, Dutch settlers and the British (Giliomee & Mbenga 2007).

HISTORICAL CONTEXT OF CAMDEN

Camden power station was commissioned in 1967 (Gaigher 2011; Matenga 2020). However, the nearby town of Ermelo has a rich history. The earliest record for settlers in Ermelo is from 1860, when the area was under the jurisdiction of Zulu-speaking Nhlapo communities (Nhlapo 1945). The construction of the town of Ermelo was initiated by the Dutch Reform Church, which purchased the eastern part of the farm Nooitgedacht on 26 May 1879. The town was officially proclaimed on 12 February 1880 by William Owen Lanyon, the Administrator of the Transvaal (Greyling 2017).

BATTLEFIELDS AND WAR HISTORY

Due to the proximity of Ermelo to the Nederlandsche Zuid-Afrikaansche Spoorweg-Maatskappij railway line linking Pretoria with Lourenço Marques (Maputo), the area was subject to various skirmishes during the Anglo-Boer War of 1899-1902. At the time there were about 100 families residing in the town and many women and children were sent to British concentration camps. In 1901, British troops burnt the town down due to their scorched earth policy, and Ermelo was rebuilt in 1903 (Moody 1977; Pretorius 2000; Van Schalkwyk 2012; Greyling 2017).

GRAVES AND BURIAL SITES

No graves are indicated by the Genealogical Society of the South Africa for the study area. The Klipbank cemetery with 21 graves is indicated 4,6 km to the south of the Project.

HERITAGE RESOURCES

Heritage finds are limited to a burial site and the demolished remains of structures in the greater area (**Figure 7.37**). The sites are briefly described in **Table 7.15** and general site conditions are indicated in **Figure 7.38** – **Figure 7.47**.

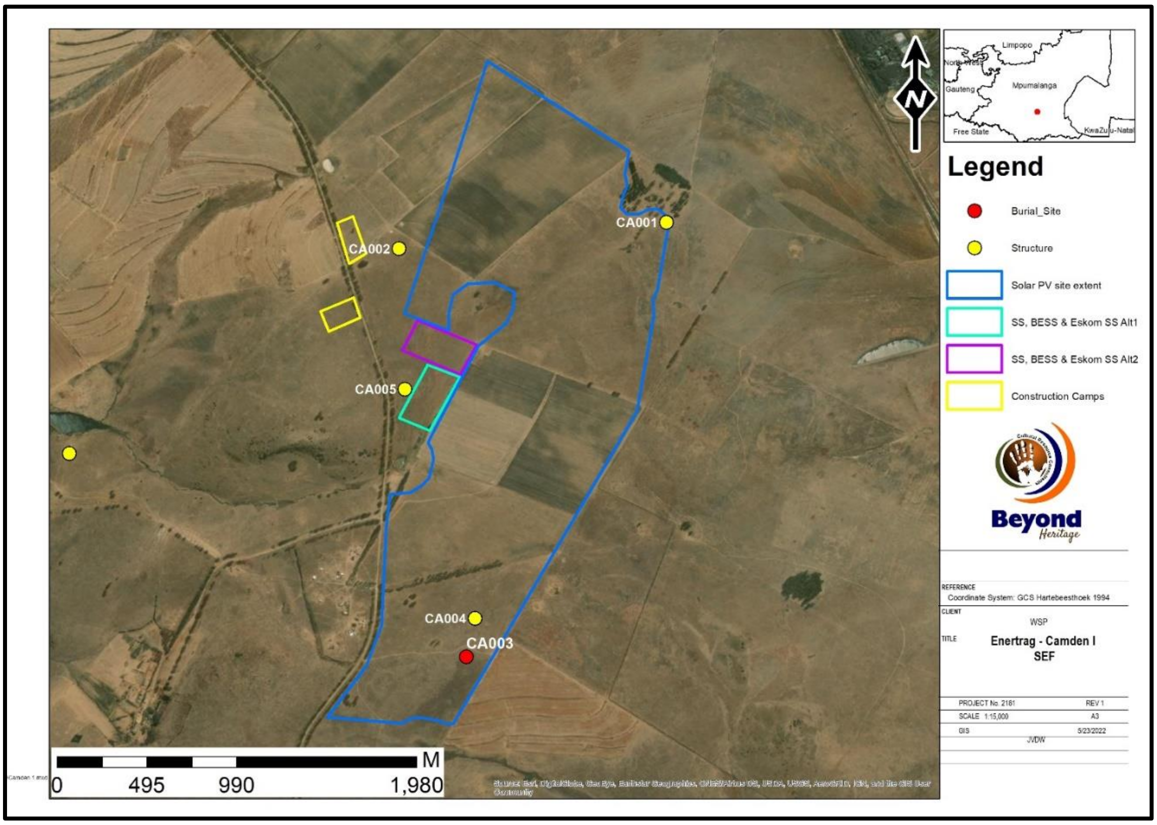


Figure 7.37: Observation points in relation the project area

Table 7.15: Recorded observations in the study area

LABEL	LONGITUDE	LATITUDE	DESCRIPTION	SIGNIFANCE
CA001	30° 05' 05.6868" E	26° 39' 13.6648" S	Large, degraded farmstead containing multiple structures over an area of 150 x 150 m. The site is situated on the north-eastern edge of the proposed solar project area. The site includes a large, degraded farmhouse with multiple associated structures.	Generally Protected B (GP. B) - Medium significance
CA002	30° 04' 17.9363" E	26° 39' 18.3757" S	The feature is situated right next to the existing powerline and includes the ephemeral traces of the possible foundation of a stone packed wall over 5 x 5 m. .	Generally Protected C (GP.C) - Low significance

LABEL	LONGITUDE	LATITUDE	DESCRIPTION	SIGNIFANCE
CA003	30° 04' 29.9592" E	26° 40' 31.2407" S	Small cemetery situated on the southern portion of the proposed solar project area. The cemetery contains mainly stone packed graves that are partially enclosed by a low stone wall. Few graves have headstones with inscriptions (including Shop Paul Hlatshwayo 1927 and Gabisile Gladys Mhlanga 1965 – 2020) Some graves have been given small metal grave markers. The site is overgrown and might contain graves that are not visible at the surface	GP A High Social significance
CA004	30° 04' 31.4867" E	26° 40' 24.3699" S	Small degraded square stone packed feature. Possibly the remnants of a small structure or enclosure. The feature is overgrown with the walling built with larger stones on the outside and smaller stones used as infill. The site is situated close to the small cemetery at CA003.	GP C Low Significance
CA005	30° 04' 19.0009" E	26° 39' 43.4465" S	Remnants of an ephemeral stone feature. The site is severely degraded.	GP C Low Significance

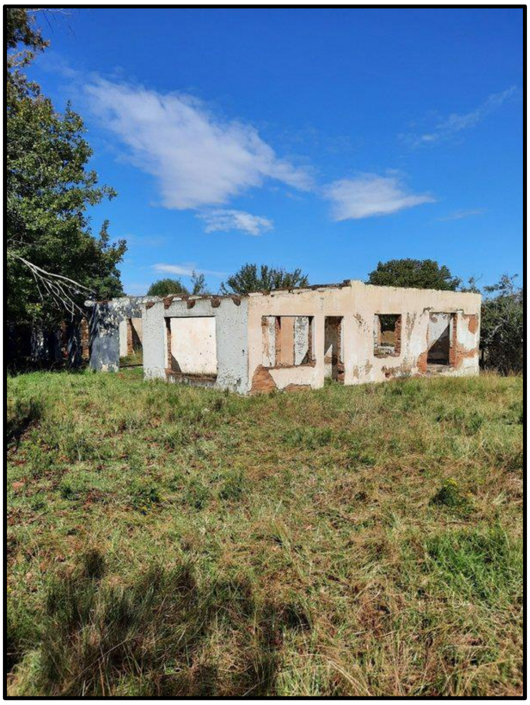


Figure 7.38. Remains of the main farmstead at CA001

Figure 7.39. additional buildings at CA001

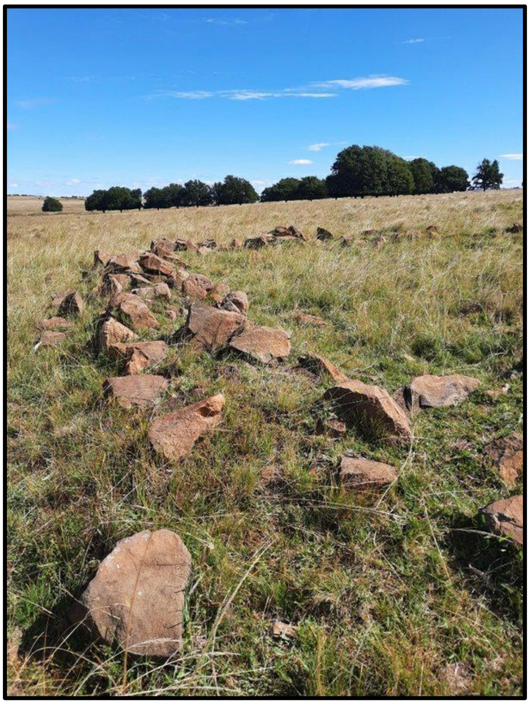


Figure 7.40. Ephemeral stone packed wall at CA002

Figure 7.41. Location of CA002 in relation to the powerline

Figure 7.42. General view of the cemetery at CA003

Figure 7.43. Grave and boundary fence at CA003

Figure 7.44. Ephemeral stone packed at CA004

Figure 7.45. General view of CA004

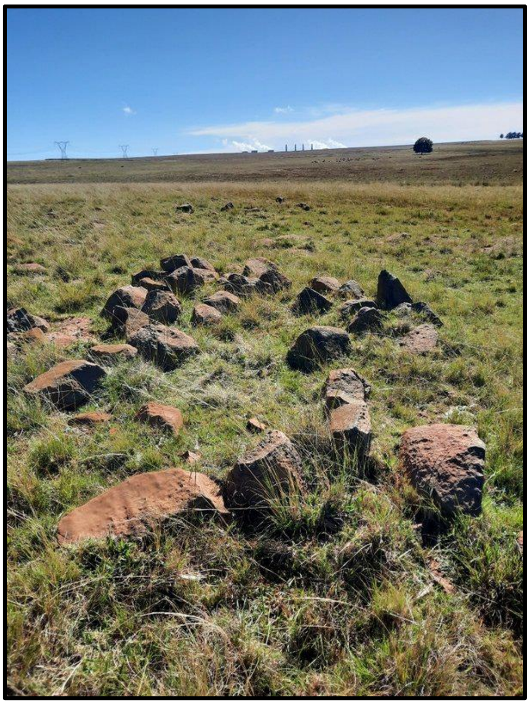


Figure 7.46. Possible ephemeral stone packed foundation at CA005

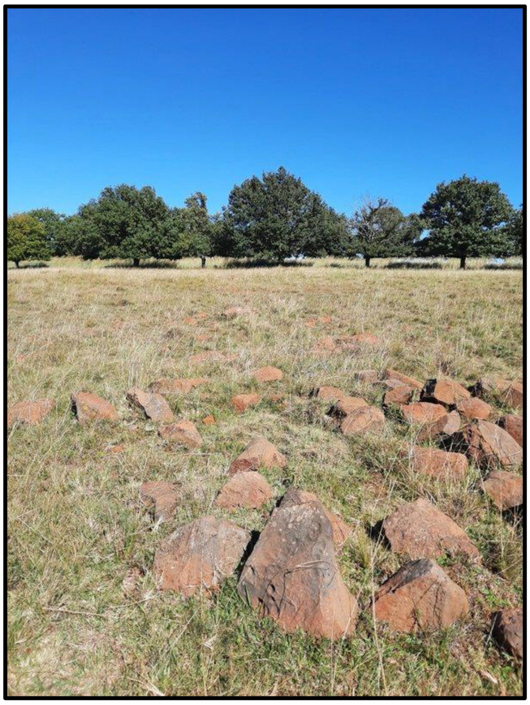


Figure 7.47. General view of site CA005

CULTURAL LANDSCAPE

The study area is in a rural setting and characterised by cultivation and agricultural activities with a historical layering consisting of burial sites and the remnants of stone packed structures/ settlements. A more recent industrial element is introduced by the Camden Power Station that was commissioned in 1967.

7.3.4 PALEONTOLOGICAL RESOURCES

The following is extracted from the Palaeontological Impact Assessment compiled by Prof Marion Bamford and included as ***Appendix H-11.***

The palaeontological sensitivity of the area under consideration is presented in Figure 5. The site for the SEF development is in the non-fossiliferous Jurassic dolerite (grey) but some of the grid connections (separate report) are on the Vryheid Formation (red; very highly sensitive). Dolerite is an intrusive igneous rock and do does not preserve fossils, in fact, dykes can destroy any fossils that were in the rocks through which they have intruded.

The Vryheid Formation is potentially very rich in fossils of the Glossopteris flora. This flora includes Glossopteris leaves, seeds, roots, stems and reproductive structures, as well as other plants such as lycopods, sphenophytes, ferns, cordaitaleans and early gymnosperms (Plumstead, 1969; Anderson an Anderson, 1985; Bamford, 2004). Coal seams were formed from peats comprising these plants that were altered by heat and pressure to make coal. The coal itself, however, does not preserve any recognisable plant structure, but the shales associated with the seams can preserve recognisable impressions of the ancient plants (Plumstead, 1969).

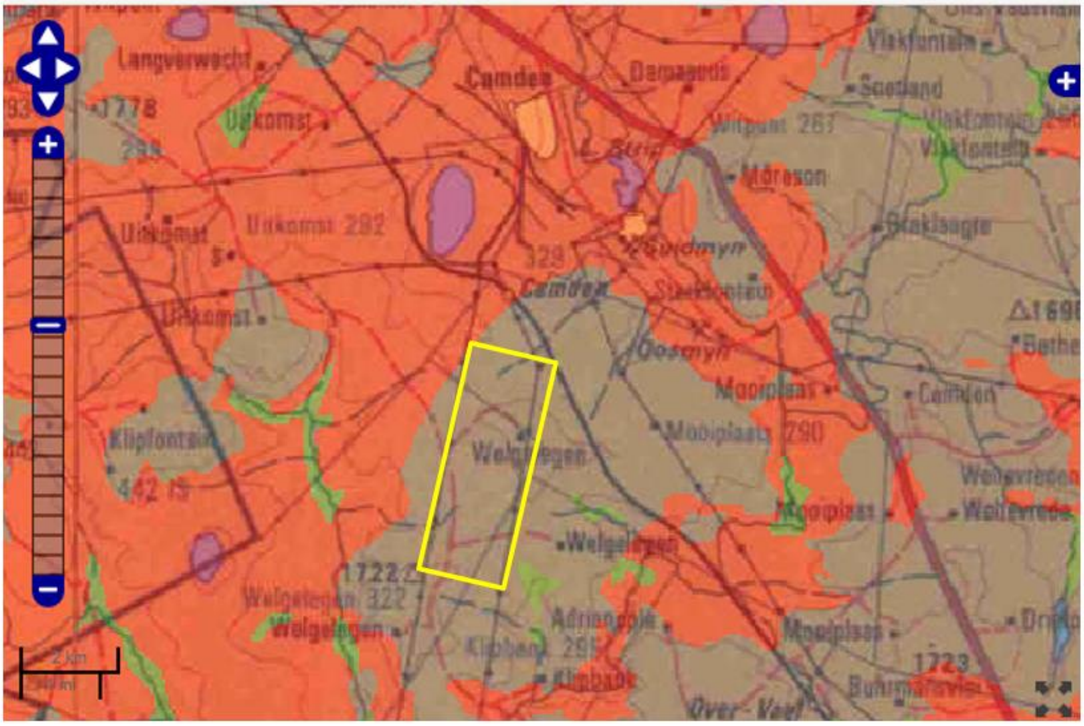


Figure 7.48: SAHRIS palaeosensitivity map for the site for the proposed Camden I SEF within the yellow polygon

Background colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

The project area was walked down in April 2022 and photographs taken of representative features of the land (**Figure 7.49**). Fossils do not survive in soils, only in rocky outcrops, however, the area has been cultivated for decades and the lands cleared for crops. No rocky or shale outcrops and no fossils were seen. Although the main SEF area is on non-fossiliferous rocks, the area was walked through to be consistent with the rest of the project.

Figure 7.49: Photographs from the site visit for the Camden I Solar Energy Facility on Farm Welgelegen 322

7.3.5 VISUAL CHARACTER AND SENSITIVITY

*The following is extracted from the Visual Impact Assessment compiled by SiVest SA (Pty) Ltd and included as **Appendix H-12**.*

VISUAL CHARACTER AND CULTURAL VALUE

The physical and land use-related characteristics of the study area as described above contribute to its overall visual character. Visual character largely depends on the level of change or transformation from a natural baseline in which there is little evidence of human transformation of the landscape. Varying degrees of human transformation of a landscape would engender differing visual characteristics to that landscape, with a highly modified urban or industrial landscape being at the opposite end of the scale to a largely natural, undisturbed landscape. Visual character is also influenced by the presence of built infrastructure including buildings, roads and other objects such as telephone or electrical infrastructure. The visual character of an area largely determines the sense of place relevant to the area. This is the unique quality or character of a place, whether natural, rural or urban which results in a uniqueness, distinctiveness or strong identity.

The predominant land use in the area (maize cultivation) has significantly transformed the natural landscape across much of the study area. In addition, the landscape becomes progressively more transformed towards the north-eastern boundary of the study area where Camden Power Station and mining activities have resulted in a high degree of visual degradation. The more industrial character of the landscape is an important factor in this context, as the introduction of the proposed SEF and associated grid connection infrastructure would result in less visual contrast where other anthropogenic elements are already present, especially where the scale of those elements is similar to that of the proposed development.

The scenic quality of the landscape is also an important factor that contributes to the visual character or inherent sense of place. Visual appeal is often associated with unique natural features or distinct variations in form. As such, the pastoral landscape and rolling hills in parts of the study area are important features that could increase the visual appeal and visual interest in the area.

Cultural landscapes are becoming increasingly important concepts in terms of the preservation and management of rural and urban settings across the world. The concept of ‘cultural landscape’ is a way of looking at a place that focuses on the relationship between human activity and the biophysical environment (Breedlove, 2002). In this instance, the rural / pastoral landscape represents how the environment has shaped the predominant land use and economic activity practiced in the area, as well as the patterns of human habitation and interaction. The presence of small towns, such as Ermelo, engulfed by an otherwise rural / pastoral environment, form an integral part of the wider landscape.

In light of this, it is important to assess whether the introduction of a solar PV facility and associated grid connection infrastructure into the study area would be a degrading factor in the context of the prevailing character of the cultural landscape. Broadly speaking, visual impacts on the cultural landscape in the area around the proposed development would be reduced by the fact that the visual character in much of the area has been significantly transformed and degraded mining and infrastructural development.

VISUAL SENSITIVITY

Visual sensitivity can be defined as the inherent sensitivity of an area to potential visual impacts associated with a proposed development. It is based on the physical characteristics of the area (i.e. topography, landform and land cover), the spatial distribution of potential receptors, and the likely value judgements of these receptors towards a new development (Oberholzer: 2005). A viewer’s perception is usually based on the perceived aesthetic appeal of an area and on the presence of economic activities (such as recreational or nature-based tourism) which may be based on this aesthetic appeal.

In order to assess the visual sensitivity of the area, SiVEST has developed a matrix based on the characteristics of the receiving environment which, according to the Guidelines for Involving Visual and Aesthetic Specialists in the EIA Processes, indicate that visibility and aesthetics are likely to be ‘key issues’ (Oberholzer: 2005).

Based on the criteria in the matrix (**Table 7.16**), the visual sensitivity of the area is broken up into a number of categories, as described below:

— **High** - The introduction of a new development such as a SEF or a power line would be likely to be perceived negatively by receptors in this area; it would be considered to be a visual intrusion and may elicit opposition from these receptors.

— **Moderate** – Receptors are present, but due to the nature of the existing visual character of the area and likely value judgements of receptors, there would be limited negative perception towards the new development as a source of visual impact.

— **Low** - The introduction of a new development would not be perceived to be negative, there would be little opposition or negative perception towards it.

The table below outlines the factors used to rate the visual sensitivity of the study area. The ratings are specific to the visual context of the receiving environment within the study area.

Table 7.16: Environmental factors used to define visual sensitivity of the study area

		RATING									
FACTORS	**DESCRIPTION**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Pristine / natural / scenic character of the environment	Study area is largely natural with areas of scenic value and some pastoral elements.										
Presence of sensitive visual receptors	Relatively few sensitive receptors have been identified in the study area.										
Aesthetic sense of place / visual character	Visual character is a typical rural / pastoral landscape.										
Irreplaceability / uniqueness / scarcity value	Although there are areas of scenic value within the study area, these are not rated as highly unique.										
Cultural or symbolic meaning	Much of the area is a typical rural / pastoral landscape										
Protected / conservation areas in the study area	No protected or conservation areas were identified in the study area.										
Sites of special interest present in the study area	No sites of special interest were identified in the study area.										
Economic dependency on scenic quality	Relatively few tourism/leisure based facilities in the area										
International / regional / local status of the environment	Study area is a typical rural/pastoral landscape										

FACTORS	DESCRIPTION	RATING 1	2	3	4	5	6	7	8	9	10
**Scenic quality under threat / at risk of change	Introduction of a SEF and associated infrastructure will alter the visual character and sense of place. In addition, the development of other renewable energy facilities in the broader area as planned will introduce an increasingly industrial character, giving rise to significant cumulative impacts										

**Any rating above '5' for this specific aspect will trigger the need to undertake an assessment of cumulative visual impacts.

LOW					MODERATE				HIGH
10	20	30	40	50	60	70	80	90	100

Based on the above factors, the total score for the study area is 39, which according to the scale above, would result in the area being rated as having a low visual sensitivity. It should be stressed however that the concept of visual sensitivity has been utilised indicatively to provide a broad-scale indication of whether the landscape is likely to be sensitive to visual impacts, and is based on the physical characteristics of the study area, economic activities and land use that predominates. An important factor contributing to the visual sensitivity of an area is the presence, or absence of visual receptors that may value the aesthetic quality of the landscape and depend on it to produce revenue and create jobs and this has been factored into the sensitivity rating above.

The rating has also taken into account the Langcarel Private Nature Reserve identified in the South African Protected Areas Database (incremental release Quarter 2 2021). Field investigation found no outward indication of the presence of a nature reserve in this area and much of the land within the demarcated reserve is utilised for commercial cultivation, while the land parcels involved are all managed for agricultural purposes (commercial farming). The reserve boundaries include the farm property that forms the Camden I SEF project area and it is known that the land owners support the proposed development. Accordingly, visual sensitivities normally associated with nature reserves will be reduced in this instance.

During the initial stages of the EIA, a site sensitivity assessment was undertaken to inform the site layout for the SEF and the power line route alignments. The aim of this exercise was to indicate any areas of the application site or grid assessment corridors which should be precluded from the development footprint. From a visual perspective, sensitive areas would be areas where the establishment of establishment of PV panels, power lines, substations or other associated infrastructure would result in the greatest probability of visual impacts on sensitive or potentially sensitive visual receptors.

SEF SITE SENSITIVITY

Using GIS-based visibility analysis, it was possible to determine which sectors of the SEF application site would be visible to the highest numbers of receptors in the study area. However, this analysis found that no areas on the site are significantly more visible than the remainder of the site. In addition, due to the relatively low number of receptors in the area, and the fact that some of these receptors lie outside the viewshed for the PV arrays, very few areas on the site were found to be visible to more than two (2) receptors. As such, in terms of visibility, no areas on the site were found to be particularly sensitive.

In determining visual sensitivity, consideration must be given to the direct visual impact of the PV arrays on any farmsteads or receptors located in, or within 500m of, the project area. Only one farmstead is located within 500m of the Camden I SEF project area and as such a 500m zone of potential visual sensitivity has been delineated around this receptor. However, this farmstead is located within the Camden I WEF project area and it is known that the relevant owners / occupants support the overall Camden Renewable Energy Complex project. As such, they are not expected to perceive the proposed development in a negative light and this would reduce the level of sensitivity potentially associated with the proposed SEF.

In addition, consideration must be given to the possible adverse effects of glint and glare on passing motorists. Accordingly, a 300m zone of potential visual sensitivity has been identified on either side of the D260 district road which traverses the SEF project area. It should be noted however that possible visual impacts on road users would be significantly reduced in this instance by the presence of trees planted alongside stretches of the D260 district road providing some measure of visual screening. The full extent of these impacts can however only be determined by way of a Glint and Glare Impact Assessment.

In light of the above, the zones of potential visual sensitivity are not considered "no go" areas, but rather should be viewed as zones where development should, where possible, be limited and / mitigated. It should be stressed that these zones apply to PV array development only and not the remainder of the infrastructure detailed in this report.

The visual impacts resulting from the associated on-site infrastructure are considered to have far less significance when viewed in the context of the SEF as a whole and as such the associated on-site infrastructure has been excluded from the sensitivity analysis.

The areas identified as potentially visually sensitive to SEF development are shown in **Figure 7.50** below.

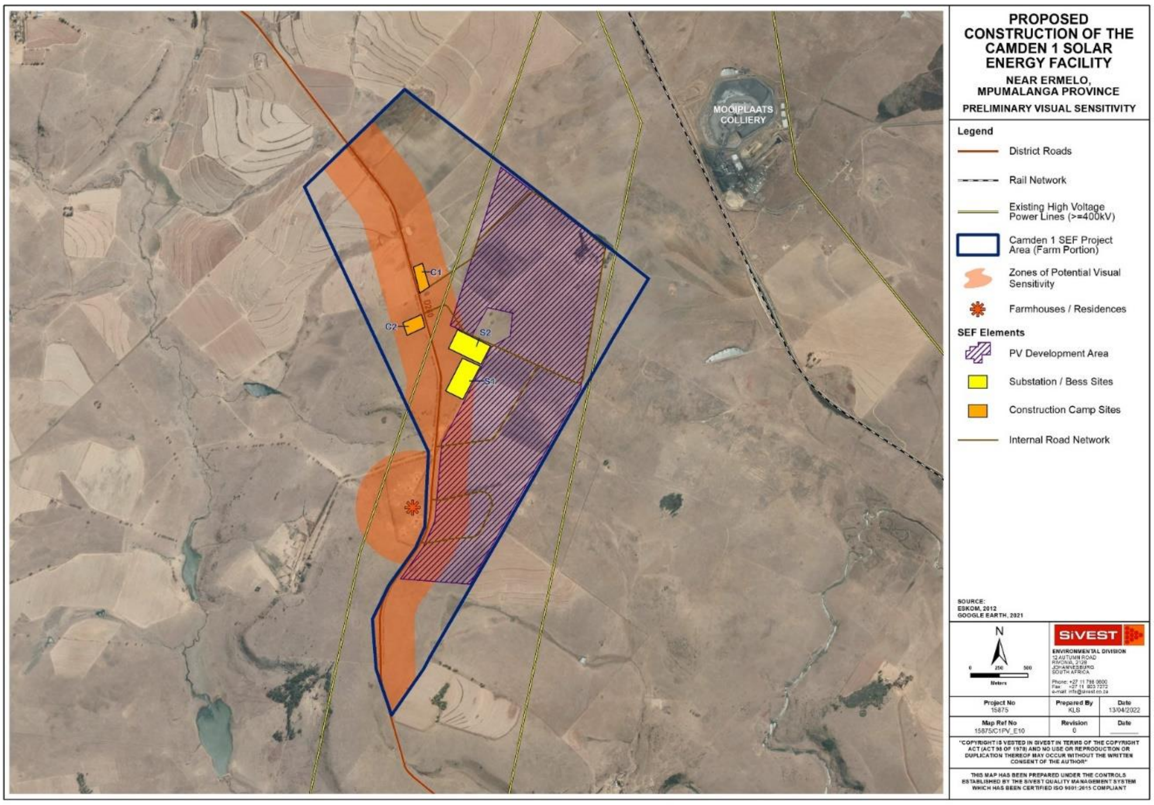


Figure 7.50: Visual sensitivity on the Camden 1 SEF Site (SiVest 2022)

VISUAL ABSORPTION CAPACITY

Visual absorption capacity is the ability of the landscape to absorb a new development without any significant change in the visual character and quality of the landscape. The level of absorption capacity is largely based on the physical characteristics of the landscape (topography and vegetation cover) and the level of transformation present in the landscape.

Although the undulating topography in the study area and the areas of cultivation and grassland would reduce the visual absorption capacity, this would be offset to some degree by the presence of Camden Power Station, mining and infrastructural development in the vicinity of the proposed Camden I SEF. In addition, the presence of a tall invasive alien trees lining both sides of the district road nearest the proposed Solar PV facility provides a measure of visual shielding and therefore increases absorption capacity in the immediate vicinity of the Camden I SEF and associated grid connection infrastructure. Visual absorption capacity in the study area is therefore rated as moderate.

SENSITIVE VISUAL RECEPTORS

A sensitive visual receptor location is defined as a location where receptors would potentially be impacted by a proposed development. Adverse impacts often arise where a new development is seen as an intrusion which alters the visual character of the area and affects the 'sense of place'. The degree of visual impact experienced will however vary from one receptor to another, as it is largely based on the viewer's perception.

A distinction must be made between a receptor location and a sensitive receptor location. A receptor location is a site from where the proposed development may be visible, but the receptor may not necessarily be adversely affected by any visual intrusion associated with the development. Less sensitive receptor locations include locations of commercial activities and certain movement corridors, such as roads that are not tourism routes. More sensitive receptor locations typically include sites that are likely to be adversely affected by the visual intrusion of the proposed development. They include tourism facilities, scenic sites and residential dwellings in natural settings.

The identification of sensitive receptors is typically based on a number of factors which include:

- The visual character of the area, especially taking into account visually scenic areas and areas of visual sensitivity;
- The presence of leisure-based (especially nature-based) tourism in an area;
- The presence of sites or routes that are valued for their scenic quality and sense of place;
- The presence of homesteads / farmsteads in a largely natural setting where the development may influence the typical character of their views; and
- Feedback from interested and affected parties, as raised during the public participation process conducted as part of the EIA and BA studies.

As the visibility of the development would diminish exponentially over distance, receptor locations which are closer to the SEF or power line would experience greater adverse visual impacts than those located further away.

Preliminary desktop assessment of the study area identified nineteen (19) potentially sensitive visual receptor locations within the combined study area for the Camden I SEF, most of which appear to be existing farmsteads. Although the findings of the desktop assessment were largely confirmed during the field investigation, it was not possible to confirm the presence of receptors at all the identified locations due to access restrictions. Notwithstanding this limitation, all the identified receptor locations were assessed as part of the VIA as they are still regarded as being potentially sensitive to the visual impacts associated with the proposed development.

Only one of the identified receptor locations was found to be sensitive (SR3), this being a residence whose occupants have previously expressed some concern about elements of the proposed Camden Renewable Energy Complex. This receptor was however found to be outside the viewshed for the Camden 1 SEF project.

The remaining receptor locations are all farmsteads that are regarded as potentially sensitive visual receptors as the proposed development will likely alter natural or semi-natural vistas experienced from these locations. Where such receptors are located within the adjoining project area for the Camden I WEF, it has been assumed that the relevant land owners are involved in the overall Camden Renewable Energy Complex project. As such, these land owners are not expected to perceive the proposed development in a negative light and this would reduce the level of visual impact

It was noted that the residential area of Camden is partially located within the Camden I SEF study area. While the residences in this area could be considered to be receptors, they are not expected to be sensitive due to their location within built-up, heavily transformed areas.

In many cases, roads along which people travel, are regarded as sensitive receptors. The primary thoroughfare in the study area is the D260 district road which traverses the study area in a north-south direction. This road, in conjunction with the minor roads in the area, is primarily used as a local access road and does not form part of any scenic tourist routes. As such, the road is not specifically valued or utilised for its scenic or tourism potential and is therefore not regarded as visually sensitive.

As previously stated, the South African Protected Areas Database identifies the Langcarel Private Nature Reserve within the Camden I SEF study area. The area is however entirely managed for commercial agriculture with no conservation activities present, and therefore any visual appeal has been reduced. Accordingly, the reserve is not considered to be a sensitive receptor. Furthermore, the reserve includes the farm property that forms the Camden I SEF project area and it is known that the land owners support the proposed SEF development. The identified potentially sensitive visual receptor locations for the proposed SEF are indicated in **Figure 7.51**.

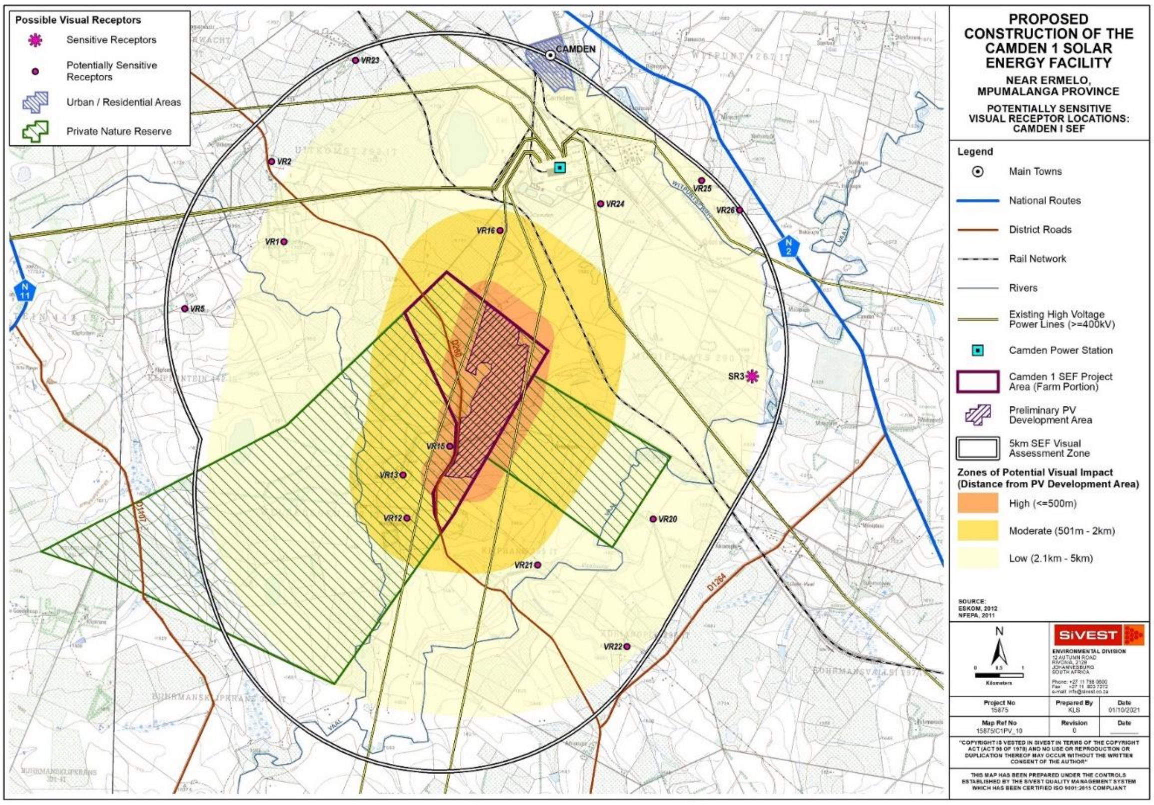


Figure 7.51: Sensitive receptor locations within 5km of the Camden I SEF site (SiVest, 2022)

Table 7.17 below presents a summary of the overall visual impact of the proposed Camden I SEF on each of the potentially sensitive visual receptor locations identified within 5kms of the boundary of the Camden I SEF project area.

Table 7.17: Receptor impact rating for the proposed Camden I SEF

<table>
<tr><th></th><th colspan="2">DISTANCE TO PV ARRAY</th><th>SCREENING</th><th>CONTRAST</th><th>OVERALL IMPACT RATING</th></tr>
<tr><th>RECEPTOR LOCATION</th><th>KM</th><th>RATING</th><th>RATING</th><th>RATING</th><th>RATING</th></tr>
<tr><td>SR3 - Homestead on Ptn 2 of Mooiplaats No 290 *</td><td colspan="5">NIL</td></tr>
<tr><td>VR1 - Farmstead *</td><td colspan="5">NIL</td></tr>
<tr><td>VR2 - Farmstead #</td><td colspan="5">NIL</td></tr>
<tr><td>VR5 - Farmstead #</td><td colspan="5">NIL</td></tr>
</table>

RECEPTOR LOCATION	DISTANCE TO PV ARRAY KM	RATING		SCREENING RATING		CONTRAST RATING		OVERALL IMPACT RATING RATING	
*VR12 - Farmstead **	NIL								
*VR13 - Farmstead **	NIL								
VR15 - Farmstead	0.2	High	3	High	3	Mod	2	HIGH	8
*VR16 - Farmstead **	NIL								
VR20 - Farmstead	3.7	Low	1	Low	1	High	3	MODERATE	5
*VR21 - Farmstead **	NIL								
VR22 - Farmstead	4.8	Low	1	Mod	2	High	3	MODERATE	6
VR23 - Farmstead #	NIL								
VR24 - Farmstead	3.1	Low	1	Mod	2	Low	1	LOW	4
VR25 - Farmstead	4.8	Low	1	Mod	2	Mod	2	MODERATE	5
VR26 - Farmstead #	NIL								

The table above shows that six of the identified receptors are outside the viewshed for the PV arrays, including the only sensitive receptor (SR3) in the study area. In addition, four receptors are more than 5km from the proposed PV arrays and as such are not expected to experience any visual impacts as a result of the proposed development.

One of the remaining receptors (VR15) would experience high levels of visual impact, largely as a result of proximity to the proposed PV arrays. As this receptor is located within the Camden I WEF project area, it has been assumed that the relevant land owners are involved in the overall Camden Renewable Energy Complex project. In addition, this receptor receives a high degree of screening due to the district road being lined on either side by tall alien invasive trees and thereby shielding the receptor from the proposed solar PV site As such, they are not expected to perceive the proposed development in a negative light and this would reduce the level of visual impact.

Four of the remaining receptor locations are expected to experience moderate levels of impact as a result of the SEF development, while one receptor will only experience low levels of visual impact.

NIGHT TIME

The visual impact of lighting on the nightscape is largely dependent on the existing lighting present in the surrounding area at night. The night scene in areas where there are numerous light sources will be visually degraded by the existing light pollution and therefore additional light sources are unlikely to have a significant impact on the nightscape. In contrast, introducing new light sources into a relatively dark night sky will impact on the visual quality of the area at night. It is thus important to identify a night-time visual baseline before exploring the potential visual impact of the proposed wind farm at night.

Camden Power Station and the adjacent Camden residential area, as well as Mooiplaats Colliery to the north of the Camden I SEF project area are the main sources of light within the study area. These elements are expected to have a significant impact on the night scene in the northern sector of the study area.

Other light sources in the broader area would largely emanate from the farmsteads dotted across the study area, and also from vehicles travelling along the district roads.

Overall, the visual character of the night environment within the study area is considered to be moderately 'polluted' and will therefore not be regarded as pristine. While the operational and security lighting required for the proposed SEF project is likely to intrude on the nightscape and create some glare, the impact of the additional lighting is expected to be reduced by the significant amount of light already present within the surrounding area at night. However, farmsteads located in areas characterised by lower levels of disturbance / transformation would be moderately sensitive to the impact of additional lighting.

7.3.6 SOCIO-ECONOMIC

The following is extracted from the Socio-Economic Assessment compiled by Tony Barbour and included as ***Appendix H-13****.*

ADMINISTRATIVE CONTEXT

The study area is located ~ 10 km to the south-east of the town of Ermelo, which is the administrative centre of the Msukaligwa Local Municipality. Ermelo is also known as the garden city of Mpumalanga and the gateway to the province. The only other settlement in the area is the rural settlement of Sheepmore located ~ 20 km to the east of the site.

Three national highways, namely the N2, N11 and the N17 intersect at Ermelo. The N2 freeway connects Ermelo with Richards Bay on the KwaZulu Natal coastline. The N11 South connects the town to Newcastle to the south and then onto the Ladysmith before linking up with the N3 to Durban. The N11 north connects to Middelburg and the N4 freeway west to Pretoria. The N17 West connects the town to the southern suburbs of Johannesburg and N17 East to eSwatini.

Ermelo is also a major railway junction between Mpumalanga and KwaZulu-Natal. The rail junction connects to Machadodorp which is on the Pretoria and Maputo railway line. The town also lies on the railway line that connects the Mpumalanga coalfields with the export Port of Richards Bay on the Indian Ocean.

The study area is flanked by the N2 to the north and north-east of the site, and the N11 to the west and south west of the site. The Richards Bay railway line traverse the site to the south of the Camden Power station site (**Figure 7.52**). The Eskom Camden Coal Power station is located immediately to the north and north east of the site. Construction of the 1600 MW power station commenced in November/December 1962 and the first turbo-generator was commissioned in April 1967. The last of the eight units was commissioned in 1969. The Camden Power station became the starting point of the national power grid, consisting of a series of 400 kV lines which today interconnect the entire country. The power station has six 111.86m high cooling towers and four 154m high chimney (smoke stacks) that serve 8 boilers.

Between 1990 and 2006 the station was mothballed, but South Africa's energy crisis in the early 21st century prompted Eskom to recommission the station, starting with unit 6 in July 2005 and completing with unit 1 in July 2008.

The development of the Camden Power station also involved the construction of 356 permanent houses to the north of the power station to accommodate administration, operating and maintenance personnel. Community facilities including a community hall, sports facilities, included four tennis courts, a bowling green, swimming bath, shooting range, rugby, hockey, soccer, and cricket fields and jukskei, and the associated clubhouses and changerooms were also established. Several parks, situated throughout the residential property, provided playgrounds for some 500 children at Camden. Schooling was provided in Ermelo for these children, with a regular bus service operating between Camden and Ermelo[9].

The other land uses in the study area include coal mining and commercial agriculture. Commercial agriculture in the area between the N2 and N11 to the south and west of the Camden Power Station includes livestock and grain

[9] https://www.eskom.co.za/sites/heritage/Pages/Camden.aspx

farming. There are a number of farmsteads associated with the farming operations in the area, some of which are no longer inhabited. The number of occupied farmsteads will be confirmed during the site visit undertaken during the assessment phase. A guest farm, the Drinkwater Guest Farm, is located adjacent to and east of the N11, ~ 14 km south west of the Camden Power Station.

The social environment can therefore be described is a working agricultural / industrial (power related) environment. With the exception of the Drinkwater Guest Farm there do not appear to be any other tourist related activities located in the study area. Therefore, from a social perspective there appear to be a limited number of sensitive social receptors.

Figure 7.52: Camden Power Station

ADMINISTRATIVE CONTEXT

The study area is located within the Msukaligwa Local Municipality within the Mpumalanga Province. The MM is one of the seven Local Municipalities that make up the Gert Sibande District Municipality (**Figure 7.53**). The town of Ermelo is the administrative seat of the Msukaligwa Local Municipality.

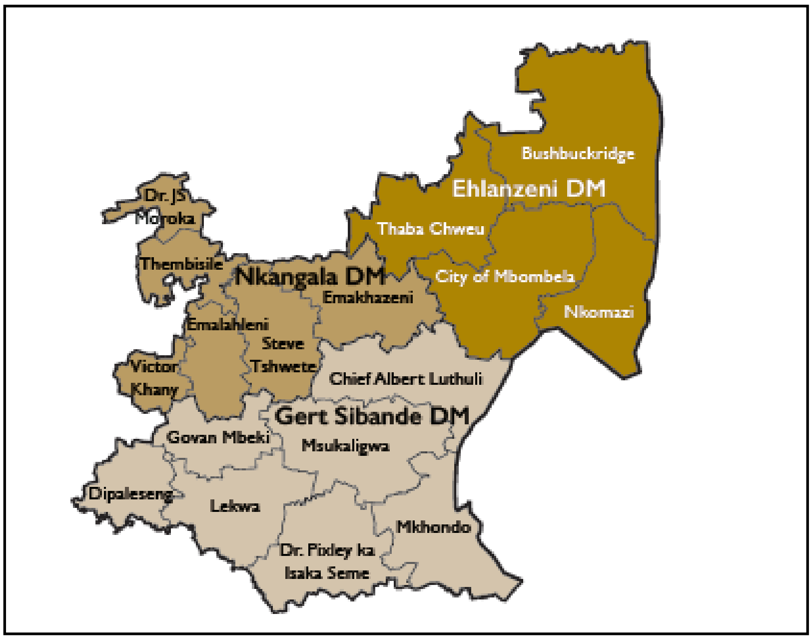


Figure 7.53: Location of Msukaligwa Municipality within the Gert Sibande District Municipality and Mpumalanga Province

DEMOGRAPHIC OVERVIEW

POPULATION

The population of the Msukaligwa Local Municipality in 2016 was 164 608 (Community Household Survey 2016). Of this total, 35.4% were under the age of 18, 60.4% were between 18 and 64, and the remaining 4.1% were 65 and older. The MM therefore had a high percentage of the population that fall within the economically active group of 18-65. The figures are higher than the figures for the GSDM and Mpumalanga (57.7% and 56.6% respectively). This is likely to be due to the employment opportunities associated with the mining and manufacturing activities in the Msukaligwa Local Municipality.

The dependency ratio is the ratio of non-economically active dependents (usually people younger than 15 or older than 64) to the working age population group (15-64). The higher the dependency ratio the larger the percentage of the population dependent on the economically active age group. This in turn translates to reduced revenue for local authorities to meet the growing demand for services. The traditional approach is based people younger than 15 or older than 64. The information provided provides information for the age group under 18. The total number of people falling within this age group will therefore be higher than the 0-15 age group. However, most people between the age of 15 and 17 are not economically active (i.e., they are likely to be at school).

Using information on people under the age of 18 is therefore likely to represent a more accurate reflection of the dependency ratio. Based on these figures, the dependency ratios for the Msukaligwa Local Municipality, the GSDM and Mpumalanga in 2016 were 65.4%, 73.5% and 77% respectively. The high dependency ratios reflect the limited employment and economic opportunities in the area and the province as a whole. As indicated above, a high dependency ratio also places pressure on local authorities in terms of service delivery.

In terms of race groups, Black Africans made up 91.6% of the population on the MM, followed by Whites, 6.9% and Asian or Indians, 0.9%, and Coloureds, 0.6%. This figures for the GSDM are similar. The main first language spoken in the Msukaligwa Local Municipality was isizulu, 79.1%, followed by Siswati, 7.3% and Afrikaans, 6.2%.

HOUSEHOLDS AND HOUSE TYPES

The total number of households in the Msukaligwa Local Municipality in 2016 was 51 090, which constituted approximately 20% of the total number of households in the GSDM. Of these 66.2% were formal houses, 9.1% flats in backyards, 6.6% traditional dwellings, and 9.4% shacks or informal dwellings. The figures for the GSDM were 67.2%, 4.6%, 6.7% and 13.4% respectively. The majority of dwellings in the Msukaligwa Local Municipality are therefore formal structures. A relatively large percentage of the properties in the MM (43.3%), while 5.9% were owned and in the process of being paid off. 22.1% of the households rented their properties, while 10.6% occupied their properties rent free. The rent-free figure is likely to be associated with farm workers. The relatively high number of properties that are owned and or in the process of being paid off reflects a relatively stable and established community.

In terms of household heads, approximately 38.9% of the households in the Msukaligwa Local Municipality and 39.1% of the households in the GSDM were headed by women. These figures similar to the provincial figure of 39.71%. The high percentage of households headed by women reflects the likelihood that the men have left the area in search of employment opportunities in Gauteng. Women headed households tend to be more vulnerable.

HOUSEHOLD INCOME

Based on the data from the 2011 Census, 12.6% of the population of the Msukaligwa Local Municipality had no formal income, 4.1% earned less than R 4 800, 7.1% earned between R 5 000 and R 10 000 per annum, 17.7% between R 10 000 and R 20 000 per annum and 20.9% between R 20 000 and 40 000 per annum (2016). The poverty gap indicator produced by the World Bank Development Research Group measures poverty using information from household per capita income/consumption. This indicator illustrates the average shortfall of the total population from the poverty line. This measurement is used to reflect the intensity of poverty, which is based on living on less than R3 200 per month for an average sized household (~ 40 000 per annum). Based on this measure, in the region of 62.4% of the households in the Msukaligwa Local Municipality and 65.2% in the GSDM live close to or below the poverty line.

The low-income levels reflect the rural nature of the local economy and the limited formal employment opportunities outside in the urban areas. This is also reflected in the high unemployment rates. The low-income levels are a major concern given that an increasing number of individuals and households are likely to be dependent on social grants. The low-income levels also result in reduced spending in the local economy and less tax and rates revenue for the Msukaligwa Local Municipality. This in turn impacts on the ability of the Msukaligwa Local Municipality to maintain and provide services.

Household income levels are likely to have been impacted by the COVID-19 pandemic. The number of households in the Msukaligwa Local Municipality and GSDM that live close to or below the poverty line is likely to have increased over the last 18 months. This, coupled with the high dependency ratio, is a major cause of concern for the area.

EMPLOYMENT

The official unemployment rate in the Msukaligwa Local Municipality in 2016 was 15.6%, while 42.6% were employed, and 36.4% were regarded as not economically active. However, the COVID-19 pandemic is likely to have resulted in an increase in unemployment rates in both the ULM and Ward 3. Recent figures released by Stats South Africa also indicate that South Africa's unemployment rate is in the region of 36%, the highest formal unemployment rate in the world.

EDUCATION

In terms of education levels, the percentage of the population over 20 years of age in the Msukaligwa Local Municipality and GSDM with no schooling was 10.6% (2016), compared to 10.8% and 11.3% for the GSDM and Mpumalanga Cape Province. The percentage of the population over the age of 20 with matric was 34.12%, compared to 34.3% and 36.1% for the GSDM and Mpumalanga. The education levels for the Msukaligwa Local Municipality are therefore similar to the DM and Provincial figures.

MUNICIPAL SERVICES

ELECTRICITY

Based on 2016 survey, 87% of households in the Msukaligwa Local Municipality had access to electricity, compared to 90% for the GSDM and 93% for Mpumalanga.

ACCESS TO WATER

Based on the 2016 survey information, 81.7% of households in the Msukaligwa Local Municipality were supplied by a service provider, while 5.8% relied on their own service or natural sources (4%). The reliance on own services or natural sources reflects the rural nature of large parts the Msukaligwa Local Municipality.

SANITATION

72.3% of the households in the Msukaligwa Local Municipality had access to flush toilets (2016), while 18.8% relied on pit toilets and 3.2% had no access to formal sanitation. The high percentage of households that rely on pit toilets is linked to the relatively high percentage (9.4%) of households that live in shacks.

REFUSE COLLECTION

Only 59.4% of the households in the Msukaligwa Local Municipality had access to regular refuse removal service, while 16.5% disposed of their waste at their own dump and 7.1% had not access to facilities. The low percentage of households that have access to regular refuse removal services is linked to the relatively high percentage (9.4%) of households that live in shacks. The relatively higher percentage that dispose of their waste at their own dump reflects the rural nature of the area and the difficulty of providing municipal services to areas located at a distance from the main towns in the area.

HEALTH, EDUCATION AND COMMUNITY FACILITIES

HEALTH SERVICES

The Msukaligwa Local Municipality IDP indicates that there is 1 government and 1 private hospital in the Msukaligwa Local Municipality, 10 primary health care clinics, and 4 mobile clinics (**Table 7.18**).

Table 7.18: Health services in Msukaligwa Local Municipality

FACILITIES	NUMBER
Private Hospitals	1
Primary Health Care Clinics	10
Mobile Clinics	4
Government hospitals	1
Infectious Hospital (TB)	1
Dentists	4
Gynaecologist	1
Social Workers	12
Private Doctors	20

EDUCATIONAL FACILITIES

The Msukaligwa Local Municipality IDP indicates that there are 71 primary schools, 6 high schools, 12 combined schools and 11 secondary schools in the Msukaligwa Local Municipality . There is 1 FET College, but no tertiary facility (**Table 7.19**). The IDP notes that given the growth in the area there is a need for at least a tertiary institution within the GSDM. Development within Ermelo has also created a need for more primary and high schools.

Table 7.19: Educational Facilities in Msukaligwa Local Municipality

FACILITY	NUMBER
No. of Primary Schools	71
No. of High School	6
No. of Combined Schools	12
No. of Secondary Schools	11
No. of Tertiary Education Facilities	0
No. of FET Colleges	1
No. of Training Centres/Adult Education	9

No. of Private Schools	3
Day Care Centres	40

COMMUNITY FACILITIES

Table 7.20 lists the community facilities in the Msukaligwa Local Municipality. As indicated in the table, Ermelo as the administrative centre is relatively well catered for in terms of community facilities, including police stations, sports facilities, libraries, community halls and pension pay out points. However, Sheepmore, which is the closest rural settlement to the development area does not have a library and the sports facility is an informal soccer field.

Table 7.20: Community facilities

AREA / TOWN	POLICE STATION	PUBLIC SPORT FACILITIES	PUBLIC LIBRARIES	COMMUNITY HALLS	MPCC/TSC	POST OFFICE	PENSION PAY POINTS	COMMENTS
Breyton / KwaZanele	1	4	2	2	1	1	1	There is one informal soccer field at Breyton
Ermelo, Wesselton, Cassim Park and Thusiville	2	9	4	5	-	1	2	There are five informal soccer fields at Wesselton. The Thusiville library is completed but not yet operating
Chrissiesmeer / Kwachibikhulu	1	1	1	1	-	1	1	There is one informal soccer field as Chrissiesmeer
Davel / Kwadela	1	2	1	1	-	1	1	There is one informal soccer field at KwaDela. There is a complaint that the existing library at Davel is far from the majority of users who reside at KwaDela
Lothair / Silindile	1	1	1	1	1	1	1	The TSC is almost completed and postal services run by agency at Lothair
Sheepmoor	1	1	-	1	-	1	1	There is one informal soccer field at Sheepmoor. No library at Sheepmoor
Warburton / Nganga	-	1	-	-	-	1	-	Postal services run at agency at Warburton. The sport facility is an informal soccer field. No library at Warburton

ECONOMIC OVERVIEW

The economic growth rate for Msukaligwa Local Municipality was at 3.0% per annum on average over the period 1996 to 2017 and forecasted average annual GDP growth for 2017-2022 relatively low at 1.3%. The contribution of Msukaligwa Local Municipality to the Mpumalanga economy was around 4.3%, making it the fifth largest local economy in the province. It is the second largest economy in the District, contributing around 15.5%.21

The key economic sectors in the Msukaligwa Local Municipality in 2017 in terms of contribution to GDP were mining (20.3%), community services (18.5%), trade (including industries such as tourism) (18.2%) and finance (14.2%) (**Table 7.21**). Despite the importance of agriculture, it only contributed 6% to GDP in 2017. The IDP notes that the Msukaligwa Local Municipality has a comparative advantage in economic sectors such as agriculture, transport, and mining.

Table 7.21: Contribution of sectors to Msukaligwa Local Municipality GDP

ECONOMIC SECTOR	2014	2017	CHANGE
Agriculture	5,3%	6,0%	0,7%
Community Services	18,4%	18,5%	0,1%
Construction	2,7%	2,7%	0,0%
Finance	13,3%	14,2%	0,9%

ECONOMIC SECTOR	2014	2017	CHANGE
Manufacturing	5,1%	5,1%	0,0%
Mining	20,8%	20,3%	-0,5%
Trade	18,5%	18,2%	-0,3%
Transport	11,3%	11,3%	0,0%
Utilities	4,5%	3,8%	-0,7%

Finance and Agriculture achieved the highest, although slight, growth in contribution from 2014 to 2017. The contribution of utilities, mining and trade declined slightly. In terms of employment, the trade sector (20.6%) was the most important sector in terms of employment, followed by community services (15.3%), mining (12.8%), finance (11.6%) and manufacturing (10.1%) (**Table 7.22**).

Table 7.22: Contribution to employment of sectors in Msukaligwa Local Municipality

EMPLOYMENT SECTOR	2014	2017	CHANGE
Agriculture	6%	6,3%	0,3%
Community Services	14,5%	15,3%	0,8%
Construction	7,9%	8,5%	0,6%
Finance	11,2%	11,6%	0,4%
Manufacturing	9,9%	10,1%	0,2%
Mining	14,7%	12,8%	-1,9%
Trade	21,1%	20,6%	-0,5%
Transport	4,5%	4,7%	0,2%
Utilities	2,5%	2,4%	-0,1%

In terms of unemployment, the Msukaligwa Local Municipality unemployment rate was the 6th lowest among all the municipal areas of Mpumalanga. The unemployment rate deteriorated slightly from 23.1% in 2014 to 24.1% in 2017. Unemployment rates are higher for females at 29.8% and for males at 24.1%. However, youth unemployment at 34.5% is a key concern.

The IDP notes that in terms of future economic development, coal mining can be expected to remain an important sector for the short to medium term. However, the role of this sector is expected to decline in the medium to long term due to limited coal resources, and a move away from a coal-based economy locally and globally due the impact on climate. The current transport and logistics sector is also likely to be impacted on by a decline in coal mining.

7.4 SAFETY, HEALTH AND ENVIRONMENTAL RISK

*The following is extracted from the High Level Safety Health and Environmental Risk Assessment compiled by ISHECON and included as **Appendix H-14**.*

A high-level Safety Health and Environmental Risk Assessment was conducted by ISHECON for the proposed Solid-State Lithium (SSL) or Vanadium Redox Flow (VRF) BESS systems at the proposed Camden I SEF.

7.4.1 VANADIUM REDOX FLOW BATTERY HAZARDS

HAZARD – TOXICITY AND CORROSIVITY

The electrolyte in the VRF system is corrosive. It is composed of a sulphuric acid-based solution similar to common automotive lead acid batteries. Unlike traditional lead-acid batteries, VRBs do not include lead.

Therefore, VRBs do not have the toxicity issues of lead that conventional car batteries have. The only potential source of human toxicity in a VRB is Vanadium.

Vanadium in various physio-chemical states can have a relatively high aquatic and human toxicity. Acute oral exposure to high doses can lead to hemorrhaging, while chronic exposure leads to adverse effects on the digestive system, kidneys and blood (diarrhea, cramps etc.).

Inhalation hazards lead to irritation of the respiratory tract, bronchospasm, pulmonary congestion. There is little evidence that vanadium compounds are reproductive toxics or teratogens. There is also no evidence that it is carcinogenic (Source USA EPA Risk Assessment Information Systems, Toxicity Profiles, Vanadium 1998).

In the electrolyte the concentration levels of Vanadium are so low that when it is mixed into liquid form in the final product and put into operation, the VRB is deemed non-toxic. In addition, VRBs have a lower concentration of sulfuric acid than traditional lead-acid batteries. Vanadium poses a hazard when it is in powder form, i.e. when making up the electrolyte solution. The Camden facilities will purchase electrolyte already made up and there will be no solid vanadium powder on site.

Toxicity or corrosion risks may be present from off-gassing produced by over-heating aqueous or vaporized electrolytes. In addition, flow batteries in fire scenarios may generate toxic gas from the combustion of hydrocarbons, plastics, or acidic electrolytes. Refer to sections on fire below for mitigation measures.

HAZARD – ELECTRICAL SHOCK/ARC

Electrical shock presents a risk to workers and emergency responders, if the energy storage system cannot be “turned off”. This is referred to as “stranded energy” and presents unique hazards. Arc flash or blast is possible for systems operating above 100 V. Li-ion systems operate from 48 - 1000 V, depending on the battery design.

In the area of shock hazard, a flow battery produces voltage only when electrolytes are in a cell stack. For most designs, if the motors are turned off and fluids drained from the cell stack, then the cell stacks have no measurable voltage at the terminals. This happens not only when the battery is forcible turned off but also in the standby mode as vanadium batteries do not include any metal plates to hold the chemical reactions / charges / voltages and can be fully drained when not in use.

If not fully drained, vanadium flow batteries are also unique in terms of short circuiting in that the internal dynamics of the battery are such that the energy discharge is limited to the fluid in the battery at any given time and the is typically less than 1% of the total stored energy. Therefore, together with the relatively low energy density of the vanadium electrolyte, the immediate release of energy, which occurs as a result of electrical shorting, is somewhat limited. The high heat capacity of the aqueous electrolyte is also beneficial in limiting the temperature rise.

Vanadium flow batteries have been tested under dead-short conditions resulting in normal operation with no danger to either equipment or personnel.

HAZARD – FIRE / DEFLAGRATION

Over 50% of the electrolyte solution is made up of water, which gives the electrolyte a non-flammable property. In the event of short circuiting, intense heat or high pressure, it is unlikely for the battery to catch fire. There is no "thermal runaway" risk when compared to other battery technologies.

Whilst some heat may be discharged from the battery, it will not be at a level that is deemed unsafe. Like all other RFBs, VRFs also have a battery management system. A battery management system ensures optimum and safe conditions for battery operation. Often a heat management system is integrated to avoid too high or too low temperatures.

HAZARD - HYDROGEN GENERATION

As with all other aqueous batteries, aqueous energy storage media from redox flow batteries are also subject to water limitations. In case of too high voltages or more precisely too high or too low half-cell potentials, the water is decomposed into its components, hydrogen and oxygen. The generation of hydrogen in particular is often present as a very small but undesirable side reaction and causes a charge carrier imbalance between positive and negative half-cells, which leads to a slow loss of capacity. It also presents a fire / explosion hazard.

With VRF, due to the flowability of the energy storage medium, the reaction products that would normally remain in the half-cell can be transported out of the cell and stored in separate tanks thus allowing the capability for a higher capacity than that attainable with conventional batteries. In addition, any deviations from safe operating parameter will trigger the shutdown of the system pumps ceasing to charge the electrolyte and thereby reducing the changes of accidental H2 generation. In addition, the thermal mass of the electrolyte tanks can provide an additional barrier to overcharging conditions by allowing ambient temperature during the discharge times to cool the VRF for the next charge cycle.

HAZARD – WASTE ELECTROLYTE

Unfortunately, pentavalent vanadium ions have a tendency to react with each other, which leads to the formation of larger molecules which precipitate as solids and can thus damage the system. The reaction depends on the temperature and the concentration of VO2+ (state of charge) but is also a function of the proton concentration. Temperature and concentrations therefore need to be controlled within specified ranges.

Should the concentration of undesirable components increase in the electrolyte, a part may need to be purged and replaced with fresh electrolyte.

HAZARD - ELECTROLYTE LEAKS

Leaks must be expected in any hazardous-fluid handling equipment. Secondary containment is typically designed into the system and standard corrosive PPE is required for handling liquid. Reliable leak detection, annunciation, and containment is paramount.

As with any chemicals plant a suitable design with detection, alarm and trip instrumentation that has been subject to thorough Hazop study should be in place, e.g. detection of dry running of pumps, detection of dead heading of pumps, prevention of reverse flow, detection of drop in tank levels etc.

7.4.2 SOLID STATE LITHIUM BATTERY CHEMICAL HAZARDS

HAZARD - THERMAL DECOMPOSITION

Upon heating of the contents of a battery due to shorting, contaminants, external heat or exposure to water and reaction heat, the lithium salts in batteries begin to break down exothermically to release either oxygen (oxidants) that enhances combustion, possibly leading to explosion, or fumes such as hydrogen fluoride or chlorine that are toxic.

These exothermic break down reactions are self-sustaining above a certain temperature (typically 70 deg C) and can lead to thermal run away. In this process the battery gets hotter and hotter, the decomposition reactions happen faster and faster and excessive hot fumes are generated in the battery. Eventually the pressure in the battery builds up to the point where those gases need to vented, usually via the weakest point in the system. These vented fumes can be flammable due to vaporization of the electrolyte and can ignite as a flash fire or fire ball (if large amounts) leading to the fire spreading to any surrounding combustible materials, e.g. plastic insulation on cables, the electrolyte, the electrodes and possibly even the plastic parts of the battery casing etc. If the vented flammable vapours do not ignite immediately, they can accumulate within the surrounding structures. If this flammable mixture is ignited later, e.g. due to a spark, this can lead to a violent explosion of the module, cabinet, room, container etc. In addition to being flammable the vented gases will contain toxic components. These could include:

- The products of combustion such as carbon dioxide/monoxide, hydrogen cyanide
- VOCs like benzene and ethylene,
- Decomposition products such as hydrogen fluoride, hydrogen chloride, phosphorous pentafluoride, phosphoryl fluoride and oxides of aluminium, cobalt, copper etc.

The temperature in the batteries and of these vented gases can be extremely high, e.g. > 600 deg C.

In the situation where oxygen is released internally as part of the decomposition (e.g. lithium perchlorate) the oxygen is available to react with the combustible electrolyte and if all this happens extremely fast in a self-sustaining manner within the confines of the device, an explosion of the device can result.

HAZARD - PROPAGATION

A BESS is composed of individual batteries which are combined into different size packs such as modules, racks. The very high temperature generated by one battery cell in thermal run away could lead to overheating of adjacent cells. This cell in turn then starts thermal decomposition and so the process propagates through the entire system. In order to prevent propagation, there are separation requirements between cells, modules etc. Separation could be with physical space or insulating materials etc.

HAZARD - ELECTROLYTE LEAKS

Although extremely unlikely due to the structure of the batteries, should electrolyte liquid leak out of the batteries, it can be potentially flammable as well as corrosive etc. If ignited as fire, or explosion, the smoke would contain toxic components. If unignited it can still be extremely harmful especially if its decomposition products include hydrofluoric acid.

7.4.3 OTHER CHEMICALS OR HAZARDS

The BESS is composed not only of the batteries. There are electrical connections, switches, power converters, cooling systems etc.

COOLING SYSTEMS

Due to the need to keep the batteries within a specified temperature range most of the containerized modular system have built-in air-conditioning systems while the VRF building systems may have cooling water systems. Some have only fans for air cooling with filters to remove dust prior to cooling. Others, particularly those in hot environments requiring more cooling, may have refrigerant-based systems. These would have a refrigerant circuit usually containing non-flammable non-toxic refrigerant such as R134a (simple asphyxiant) etc as well as a low hazard circulating medium such as an ethylene glycol-based coolant. At high temperatures above 250 deg C R134 may decompose and may generate hydrogen fluoride and other toxic gases. Ethylene glycol is really only harmful if swallowed. In the environment it breaks down quickly and at low concentrations that would typically occur from occasional small spills, it has no toxicity.

FIRE SUPPRESSION SYSTEMS

Although these are only effective for some fire scenarios, some of the solid-state containerized systems come fitted with "Clean agent" fire suppressant systems. These are pressurized containers of powder/gases that are released into the container to snuff a fire and do not leave a residue on the equipment.

Some containers have water sprinkler systems installed to quench thermal run-away reactions.

VRF batteries do not present a high fire risk. However, on any chemical plant there is always the risk of fires with electrical equipment and other materials used on site. Fire systems would typically consist of local strategically placed extinguishers as well as a fire water hose/hydrant system.

In general fire fighters may respond with water cannons/hydrants, foam systems etc. Such responses may generate large amount of contaminated and hazardous water runoff. A system to contain as much of this as possible should be in place.

GENERAL ELECTRICAL AND ELECTRONIC EQUIPMENT

Whatever the configuration of the battery containers/ buildings there will be electrical and electronic equipment in the battery compartment, the battery building as well as outside. In some installations the main electrical equipment such as the power conversion system is in a separate compartment separated by a fire wall. In others it can be in a separate container.

Wherever there is electrical equipment there is a possibility of shorting and overheating and fire.

8 IMPACT ASSESSMENT

The EIA phase of the S&EIR process has determined potential impacts associated with the proposed Camden I SEF. The anticipated environmental and social impacts have been identified and assessed by the various specialists according to the phases of the project's development. The assessment methodology is indicated in **Section 4.2**.

For the purpose of this project, these phases have been generically defined below:

- Construction Phase:
  - The construction phase includes the preparatory works/activities typically associated with the creation of surface infrastructure, access and electrical power. The activities most relevant to this phase include:
  - Topsoil stripping;
  - Cut and fill activities associated with site preparation (if required); and
  - Construction of the surface infrastructure including invertors, site substation and internal powerlines.
- Operational Phase:
  - The operational phase includes the daily activities associated with the Solar PV Facility.
- Decommissioning Phase:
  - The decommissioning phase includes the activities associated with the removal/dismantling of machinery/equipment/infrastructure no longer necessary to the operation.

The impact assessment findings outlined in this section represent a summary of the detailed specialist findings/assessments contained in the relevant specialist reports (**Appendix H**).

The impacts below have been assessed according to environmental categories.

8.1 ACTIVITIES MATRIX

The impacts below have been assessed according to environmental categories. **Table 8.1** provides an indication of how these environments are linked to the various NEMA listed activities outlined in **Section 2.1**.

Table 8.1: ***Activities Matrix (C – Construction; O – Operation; D – Decommissioning)***

ACTIVITY DESCRIPTION	CLIMATE	AIR QUALITY	TOPOGRAPHY	GEOLOGY	SOIL AND AGRICULTURE POTENTIAL	SURFACE WATER	GROUNDWATER	REGIONAL VEGETATION	BIODIVERSITY	FAUNA	AVIFAUNA	SOCIAL	HERITAGE AND PALEONTOLOGY	VISUAL
GNR 983- Listing Notice 1														
Activity 11(i)	C, D	N/A	C, D	C	C, D	C, D	C, D	C, D	C, D	C, D	C, O, D	C, D	C, D	C, D
Activity 12(ii)(a)(c)	C, D	N/A	C, D	C	C, D	C,O, D	C, D	C, D	C, D	C,O, D	C, D	C,O, D	C, D	C, O, D
Activity 14	C, D	N/A	C, D	C	C, D	C, D	C, D	C, D	C, D	C, D	C, D	C, D	C, D	C, D
Activity 19	C, D	N/A	C, D	C	C, D	C,O, D	C, D	C, D	C, D	C,O, D	C, D	C,O, D	C, D	C, O, D
Activity 24(ii)	C, D	N/A	C, D	C	C, D	C,O, D	C, D	C, D	C, D	C,O, D	C, D	C,O, D	C, D	C, O, D
Activity 28(ii)	C, D	N/A	C, O,D	C, O,D	C, O,D	C, O,D	C, O,D	C, O,D	C, O,D	C, O,D	C, O,D	C, O,D	C,D	C, O,D
Activity 30	C,D	N/A	C,D	C,D	C,O,D	C,O,D	C,D	C,O,D	C,O,D	C,O,D	C,O,D	C,O,D	C,D	C,O,D
Activity 48(i)(a)(c)	N/A	N/A	N/A	N/A	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D
Activity 56(i)(ii)	N/A	N/A	N/A	N/A	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D

ACTIVITY DESCRIPTION	CLIMATE	AIR QUALITY	TOPOGRAPHY	GEOLOGY	SOIL AND AGRICULTURE POTENTIAL	SURFACE WATER	GROUNDWATER	REGIONAL VEGETATION	BIODIVERSITY	FAUNA	AVIFAUNA	SOCIAL	HERITAGE AND PALEONTOLOGY	VISUAL
GNR 984- Listing Notice 2														
Activity 1	N/A	N/A	N/A	N/A	O	O	O	O	O	O	O	O	N/A	N/A
Activity 15	N/A	N/A	N/A	C	C,D	C,O,D	C,O,D	C,D	C,O,D	C,O,D	C,O,D	C,O,D	C,D	C,O,D
GNR 985- Listing Notice 3														
Activity 4(f)(i)(bb)(cc)(ee)	N/A	N/A	C,O,D	C,D	C,D	C,O,D	C,O,D	C,O,D	C,O,D	C,O,D	C,O,D	C,O,D	C,D	C,O,D
Activity 12(f)(i)(ii)	N/A	N/A	C	N/A	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D
Activity 14(ii)(a)(c)(f)(i)(bb)(dd)(ff)(hh)	N/A	N/A	N/A	N/A	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D
Activity 15 (d)(ii)	N/A	N/A	C,O	C	C,D	C,O,D	C,O,D	C,O,D	C,D	C,O,D	C,O,D	C,O,D	C,D	C,O,D
Activity 18(f)(i)(bb)(cc)(ee)(gg)	N/A	N/A	N/A	N/A	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D
Activity 23(ii)(a)(c)(f)(i) (bb)(cc)(ee)(gg)	N/A	N/A	N/A	N/A	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D

8.2 AIR QUALITY

8.2.1 CONSTRUCTION PHASE

DUST AND PARTICULATE MATTER

The National Dust Control Regulations (GNR 827) prescribe general measures for the control of dust in both residential and non-residential areas and will be applicable during construction of the SEF. **Table 8.2** provides the acceptable dust fall rates as prescribed by GNR 827.

Table 8.2: Acceptable dust fall rates (GNR 827)

RESTRICTION AREAS	DUST FALL RATE (D) (mg/m^2/day – 30 DAYS AVERAGE)	PERMITTED FREQUENCY OF EXCEEDING DUST FALL RATE
Residential area	D < 600	Two within a year, not sequential months
Non-residential area	600 < D < 1200	Two within a year, not sequential months

During the construction phase, dust and vehicular emissions (carbon monoxide (CO), hydrocarbons, particulate matter (PM) and nitrogen oxides (NO_x) will be released as a result of vegetation clearing activities, transportation of equipment and materials to site, and the installation thereof, all of which involves the movement of large plant and trucks along unpaved roads and exposing of soils. The emissions will, however, have short-term impacts on the immediate surrounding areas that can be easily mitigated and thus the authorisation of such emissions will not be required. All construction phase air quality impacts will be minimised with the implementation of dust control measures contained within the EMPr (**Appendix I**).

The impact of the construction phase on the generation of dust and particulate matter (PM) is shown in **Table 8.3**.

Table 8.3: Construction Impact on Generation of Dust and PM

Potential Impact GENERATION OF DUST AND PM	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	1	2	1	2	5	35	Moderate	(-)	High
With Mitigation	1	1	1	2	5	25	Low	(-)	High
Mitigation and Management Measures	— Dust-reducing mitigation measures must be put in place and must be strictly adhered to, for all roads and soil/material stockpiles especially. This includes wetting of exposed soft soil surfaces and not conducting activities during high wind periods which will increase the likelihood of dust being generated; — Limit the duration of the construction phase to as short a timeframe as possible; — Where possible, minimise the area under construction; — Make use of wet suppression techniques to minimise dust entrainment along unpaved roads and during periods of high wind speeds; — All stockpiles (if any) must be restricted to designated areas and may not exceed a height of two (2) metres; — Ensure that all vehicles, machines and equipment are adequately maintained to minimise emissions; — It is recommended that the clearing of vegetation from the site should be selective, be kept to the minimum feasible area, and be undertaken just before construction so as to minimise erosion and dust potential;								

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance	Character	Confidence
GENERATION OF DUST AND PM								
	— All materials transported to, or from, site must be transported in such a manner that they do not fly or fall off the vehicle. This may necessitate covering or wetting friable materials; — Enforcing of speed limits. Reducing the dust generated by the listed activities above, putting up signs to enforce speed limit in access roads; — No burning of waste, such as plastic bags, cement bags and litter is permitted; — All issues/complaints must be recorded in the complaints register; and — Once construction is complete, initiate rehabilitation (e.g. re-vegetation) procedures to reduce wind speed across exposed surfaces.							

8.2.2 OPERATIONAL PHASE

There are no anticipated air quality impacts during the operational phase as maintenance activities will occur as and when required and will be extremely short term.

8.2.3 DECOMMISSIONING PHASE

There are no anticipated air quality impacts during the decommissioning phase.

8.3 NOISE EMISSIONS

8.3.1 CONSTRUCTION PHASE

Elevated noise levels are likely to be generated by the construction activities (machinery and vehicles) and the workforce. It is important to note that noise impacts (nuisance factor) may vary in the different areas as a result of the surrounding land uses and will be temporary in nature. Due to the temporary and limited nature of the Project activities, coupled with the fact that there are a limited number of noise receptors around the Project area, the impact is regarded as low. The construction impact on noise is indicated in **Table 8.4**.

Table 8.4: Construction Impact on Noise

Potential Impact:	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
NOISE									
Without Mitigation	2	1	3	1	4	**28**	**Low**	(-)	High
With Mitigation	2	1	1	1	3	**15**	**Low**	(-)	High
Mitigation and Management Measures	— The equipment must be in maintained in good working order, within service dates, and inspected before use; — Align working times with the substation related operational times; and — Install noise reducing fittings on machinery (if required).								

8.3.2 OPERATIONAL PHASE

There are no anticipated noise impacts during the operational phase as maintenance activities will occur as and when required and will be extremely short-term.

8.3.3 DECOMMISSIONING PHASE

There are no anticipated noise impacts during the decommissioning phase.

8.4 AGRICULTURAL POTENTIAL

8.4.1 ALL PHASES

The purpose of the agricultural component in the Environmental Authorisation process is to ensure that South Africa balances the need for development against the need to ensure the conservation of the natural agricultural resources, including land, required for agricultural production and national food security.

When the agricultural impact of a development involves the permanent or long-term non-agricultural use of potential agricultural land, as it does in this case, the focus and defining question of the agricultural impact assessment is to determine the importance, from an agricultural production point of view, of that land not being utilised for the development and kept solely for agriculture.

It is important to note that renewable energy facilities have both positive and negative effects on the production potential of land (see below) and so it is the net sum of these positive and negative effects that determines the extent of the change in future production potential.

It should be noted that, in assessing agricultural impact, the exact nature and layout of the different infrastructure within a solar energy facility has absolutely no bearing on the significance of agricultural impacts. All that is of relevance is simply the total footprint of the facility that excludes agricultural land use or impacts agricultural land, referred to as the agricultural footprint.

There is ultimately only ever a single agricultural impact of a development and that is a change to the future agricultural production potential of the land. This impact occurs by way of different mechanisms some of which lead to a decrease in production potential and some of which lead to an increase. It is the net sum of positive and negative effects that determines the overall agricultural impact.

AGRICULTURAL PRODUCTION POTENTIAL

There is ultimately only ever a single agricultural impact of a development and that is a change to the future agricultural production potential of the land. This impact occurs by way of different mechanisms some of which lead to a decrease in production potential and some of which lead to an increase. It is the net sum of positive and negative effects that determines the overall agricultural impact.

Two direct mechanisms have been identified that lead to decreased agricultural potential by:

1. **Occupation of land** - Agricultural land directly occupied by the development infrastructure will become restricted for agricultural use, with consequent potential loss of agricultural productivity for the duration of the project lifetime.
2. **Soil erosion and degradation** – Erosion can occur as a result of the alteration of the land surface run-off characteristics, predominantly through the establishment of hard surface areas including roads, and through the disturbance of existing contour bank systems that control erosion. Soil erosion is completely preventable. The storm water management that will be an inherent part of the engineering on site and standard, best practice erosion control measures recommended and included in the EMPr, are likely to be effective in preventing soil erosion. Loss of topsoil can result from poor topsoil management during construction related excavations.

It is important to assess the agricultural impact within the context of the whole Camden renewable energy project. It does not make sense to consider the agricultural impacts of the different components of the project in isolation from each other. The impact on agriculture potential across all phases is indicated in **Table 8.5**.

Table 8.5: Impact on Agricultural Production Potential

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
DECREASE IN AGRICULTURAL PRODUCTION POTENTIAL									
Without Mitigation	3	1	3	4	3	**33**	**Moderate**	(-)	High
With Mitigation	3	1	3	4	3	**33**	**Moderate**	(-)	High
Mitigation and Management Measures	— Consider agro-voltaic principles when designing the solar facility								

Two indirect mechanisms have been identified that lead to increased agricultural potential through:

1. Increased financial security for farming operations - Reliable income will be generated by the farming enterprise through the lease of the land to the energy facility. This is likely to increase its cash flow and financial security and could improve farming operations and productivity through increased investment into farming.
2. Improved security against stock theft and other crime due to the presence of security infrastructure and security personnel at the energy facility.

The extent to which any of these mechanisms is likely to actually affect levels of agricultural production is small and the overall impact of a change in agricultural production potential is therefore small.

Mitigation measures against soil degradation are standard best-practice for construction sites and renewable energy facilities but will not change the significance rating as assessed above. Mitigation measures include:

— A system of storm water management, which will prevent erosion, will be an inherent part of the engineering on site. Any occurrences of erosion must be attended to immediately and the integrity of the erosion control system at that point must be amended to prevent further erosion from occurring there.

— Any excavations done during the construction phase, in areas that will be re-vegetated at the end of the construction phase, must separate the upper 30 cm of topsoil from the rest of the excavation spoils and store it in a separate stockpile. When the excavation is back-filled, the topsoil must be back-filled last, so that it is at the surface. Topsoil should only be stripped in areas that are excavated. Across the majority of the site, it will be much more effective for rehabilitation, to retain the topsoil in place. If levelling requires significant cutting, topsoil should be temporarily stockpiled and then re-spread after cutting, so that there is a covering of topsoil over the entire surface before the panels are mounted. It will be advantageous to have topsoil and vegetation cover below the panels during the operational phase to control dust and erosion.

The loss of cropland could possibly be mitigated by designing the solar facility along agro-voltaic principles, which increases the height of the solar panels to allow cropping to be practised below them. However, this technology is very new to South Africa and has not really been tested here. Its viability for the particular site conditions is not known and would be dependent on a number of engineering and agricultural factors. Where feasible and desirable, this option may be implemented by the proponent to further reduce agricultural impact.

8.4.2 ALLOWABLE DEVELOPMENT LIMITS

The agricultural protocol achieves its purpose, in relation to renewable energy developments on agricultural land, by imposing allowable development limits on different agricultural sensitivity categories of land. The allowable development footprint is the area of a particular sensitivity category of land that can be directly occupied by the agricultural footprint of a renewable energy development. The purpose of the development limits is to conserve valuable agricultural land for agricultural production by steering renewable energy development away from higher potential agricultural land and onto lower potential land. There are six different allowable development footprints, defined according to a combination of land capability and cropping status, as specified in **Table 8.6**, below.

Table 8.6: Allowable development limits as specified in the agricultural protocol

ALLOWABLE FOOTPRINT CATEGORY	AGRICULTURAL SENSITIVITY ON SCREENING TOOL	ALLOWABLE FOOTPRINT (ha / MW)	DEFINITION OF CATEGORY
1	Very high	0.00	Land capability of 11-15; or irrigated land; or dryland horticulture or viticulture
2	High	0.20	Land capability of 8-10 on existing field crops
3	High	0.25	Land capability of 6-7 on existing field crops
4	High	0.30	Land capability of 1-5 on existing field crops
5	High	0.35	Land capability of 9-10 outside of existing field crops
	Medium		Land capability of 8 outside of existing field crops
6	Medium	2.5	Land capability of 6-7 outside of existing field crops
	Low		Land capability of 1-5 outside of existing field crops

Solar energy is effectively prevented by the limits, from being developed on any land other than land of category 6 in **Table 8.6** above.

The agricultural protocol requires confirmation of whether the development footprint is in line with the allowable development limits or not, and requires motivation to support any deviation from the limits. The proposed development site for the Camden 1 SEF includes cropland of category 2, which means that the facility will not therefore be within the allowable development limits. However, there are good reasons for exceeding the allowable development limits for the Camden 1 SEF. These are detailed below.

The overall Camden renewable energy project which, in addition to the SEF, includes two wind energy facilities and a hydrogen / ammonia plant, is desirable in the area for the positive economic impacts that it will introduce in addition to the long term project benefits discussed in Section 8.4.3 below.. This greater project is integrated with agricultural production in a way that provides benefits to agriculture and leads to very little loss of future agricultural production potential. It offers increased financial security for the on-site farming operations through reliable, additional rental income generation without loss of production income. This is an important source of improving economic viability for agricultural operations in an increasingly challenging agricultural economic environment. Other benefits to the on-site farming operations include security benefits against stock theft and other crime and an improved road network. Furthermore the project will indirectly decrease the need for coal power and thereby contribute to reducing the large agricultural impact that open cast coal mining has on highly productive agricultural land in the area.

The net overall agricultural impact of the greater project is likely to be positive and to benefit agriculture in the area through the positive impacts discussed above. However, the financial viability of the greater project is dependent on having a solar component due to the energy feed requirements of the hydrogen / ammonia plant.

Options for the location of the solar component are constrained by a number of competing factors that include engineering and other environmental constraints. The proposed site has been chosen to balance the competing constraints. The majority of the 290 hectare site (61%) has been located off cropland, but 114 hectares of cropland need to be included in the site.

In summary, the greater Camden renewable energy project offers benefits to agriculture that can only be realised if the project includes a solar component which must necessarily impinge partially on cropland. The trade-off for agriculture of losing 114 hectares of cropland is likely to be more than compensated by the agricultural benefits of the project and a deviation from the allowable development limits to include this cropland in the Camden 1 SEF is considered justified.

8.4.3 LONG TERM PROJECT BENEFITS VERSUS AGRICULTURAL BENEFITS

The development will generate a significant (at the scale of an individual farm),reliable and predictable additional income for the directly affected farming enterprise, without significantly compromising the existing farming income or requiring expense and effort on behalf of the landowner (i.e. passive income). In this manner it also promotes multiple land uses on the existing property. It will also generate additional income and employment in the local economy. In addition, it will contribute to the country's need for energy generation, particularly renewable energy that has lower environmental and agricultural impact on a national scale than existing, coal powered energy generation. The renewable energy complex also aims to beneficially utilise existing infrastructure by connecting into the Camden Power Station, infrastructure otherwise intended for decommissioning. In supplying generated energy to the hydrogen and ammonia plant associated with the Camden Renewable Energy Developments, the project is indirectly stimulating the green hydrogen economy and in particular hydrogen-specific skills and market participation in green hydrogen and ammonia fuel products, both of which have large-scale potential in international and local markets. This in turn therefore supports the indirect diversification of the local economy and assists in maintaining existing ammonia supply chains, and promoting future hydrogen supply chains

8.5 GEOTECHNICAL

From a preliminary geological and geotechnical assessment, no fatal flaws have been identified that will pose a significant constraint to the construction of the Camden I Renewable Energy Facility.

As the geotechnical study is only a desktop study, no detailed impact assessment matrix was undertaken.

IMPACT OF THE PROJECT ON THE GEOLOGICAL ENVIRONMENT

Areas with steep slope inclinations are not favoured for the proposed developments due to the earthworks requirements and the potential need for advanced foundations. The topography of the site is relatively gentle and significant earthworks are not anticipated (although some minor earthworks are anticipated where local undulations occur). The soils and topography render the site moderately susceptible to soil erosion (**Section 8.4**).

The Karoo Supergroup is known for its fossil bearing units which will have to be more accurately assessed by a palaeontologist (**Section 8.14**). The removal of rock which contains these fossils will result in the destruction of these fossils.

Based on the preliminary geotechnical assessment, the site is considered suitable for the proposed development provided that the recommendations presented in the desktop geotechnical report are adhered to, which needs to be verified by more detailed geotechnical investigations during the detailed design stage.

8.5.1 CONSTRUCTION PHASE

PRESENCE OF UNDERMINED AREAS

Based on a preliminary assessment, the impact of the development from a geotechnical perspective will be restricted to the possible presence of undermined areas. The presence of undermined areas will have a negative effect on foundations, resulting in subsidence of the ground and potential collapse of both lightly and heavily loaded structures. The likelihood of undermined areas within the proposed development area is low, as the site is predominantly underlain by dolerite. To confirm this assumption, the retrieval of mining plans must be arranged prior to the detailed geotechnical investigation and design. As this information is generally confidential, application by the relevant environmental assessment practitioner / developer will be necessary prior to commencement of construction. The construction impact on the presence of undermined areas is indicated in **Table 8.10**.

Table 8.7: Construction Impact on the presence of undermined areas

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
PRESENCE OF UNDERMINED AREAS									
Without Mitigation	5	2	5	1	1	**13**	**Very Low**	(-)	Mod
With Mitigation									
Mitigation and Management Measures	— Mining plans must be retrieved prior to the detail geotechnical investigation and design.								

DISPLACEMENT AND EXPOSURE OF SUBSOILS

The levelling of areas to create building platforms will also result in the displacement and exposure of soil, boulders and bedrock referred to as "subsoils". These impacts will have a negative visual impact on the environment, which in some cases can be remediated. The risk of soil erosion is also increased during construction activities, by the removal of vegetation and by possible disturbance to the natural drainage environment, subsequently leading to the prevention of infiltration of rainwater and increased surface run-off. The construction phase impact on the displacement and exposure of subsoils is indicated in **Table 8.8**.

Table 8.8: Construction Impact on the displacement and exposure of subsoils

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
DISPLACEMENT AND EXPOSURE OF SUBSOILS									
Without Mitigation	3	2	3	2	3	**30**	**Low**	(-)	Mod
With Mitigation	2	1	3	1	2	**14**	**Very Low**	(-)	Mod
Mitigation and Management Measures	— Implement mitigation measures proposed by the visual specialist. — Implement mitigation measures proposed by the agriculture specialist for soil erosion.								

8.5.2 OPERATIONAL PHASE

CONCENTRATED SURFACE FLOW

Areas of concentrated surface flow can be anticipated at the energy facilities, resulting in gradual erosion of unconsolidated soil during the operational life of the facilities. This can result in the creation of preferential drainage features, unless remediated through proper engineering design (i.e., stormwater drainage). The operational impact of concentrated surface flow is indicated in **Table 8.9**.

Table 8.9: Operational Impact on concentrated surface flow

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
CONCENTRATED SURFACE FLOW									
Without Mitigation	3	3	3	3	3	**36**	**Moderate**	(-)	Mod
With Mitigation	2	1	1	3	2	**14**	**Very Low**	(-)	Mod
Mitigation and Management Measures	— Implement stormwater control measures								

8.6 AQUATIC ECOLOGY

With regard the proposed SEF, BESS substation options including alternatives, the overall layout has avoided the delineated systems inclusive of the calculated buffers and the recommended buffers (**Figure 8.1**).

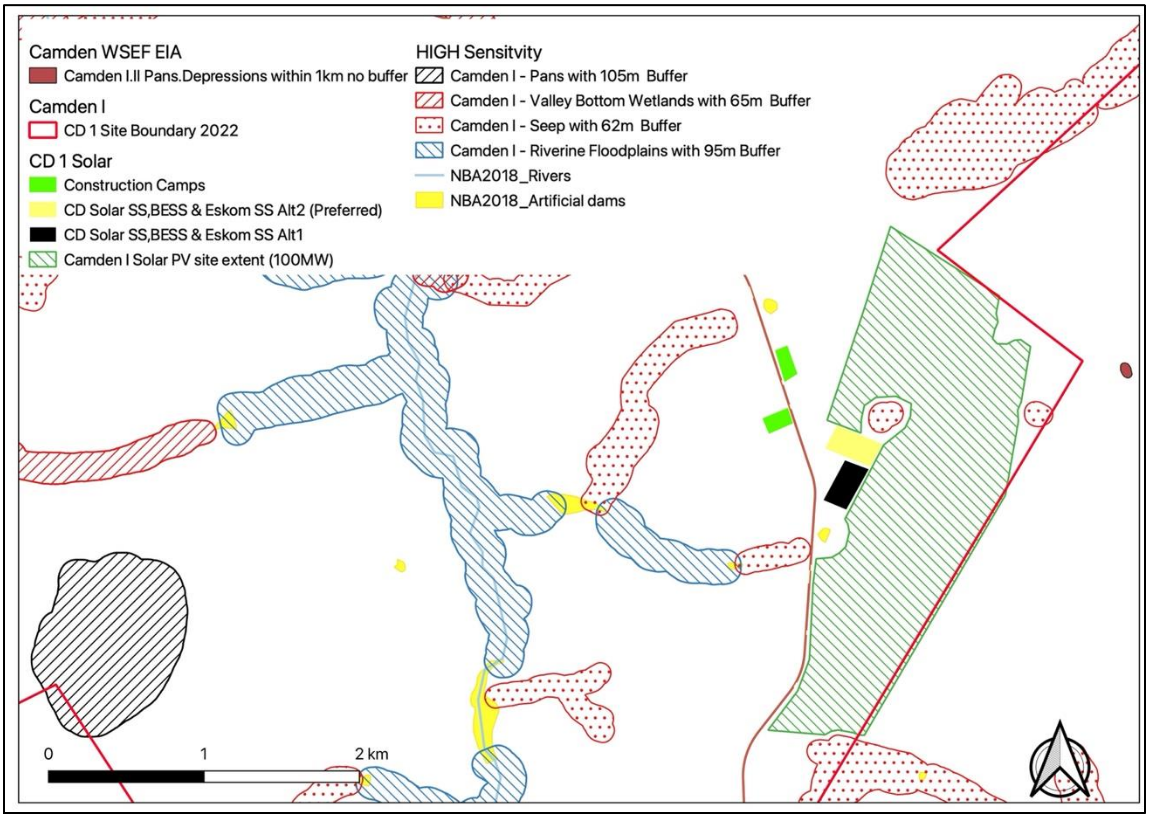


Figure 8.1: Camden I SEF, BESS and associated substation including alternatives in relation to buffered aquatic systems delineated in this assessment

8.6.1 CONSTRUCTION PHASE

LOSS OF VERY HIGH SENSITIVITY SYSTEMS

Loss of Very High Sensitivity systems, namely the wetlands through physical disturbance, the proposed layout has avoided these systems. The construction impact on the loss of very high sensitivity systems is indicated in **Table 8.10**.

Table 8.10: Construction Impact on loss of very high sensitivity systems

Potential Impact LOSS OF VERY HIGH SENSITIVITY SYSTEMS	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	2	2	2	2	2	16	Low	(-)	High
With Mitigation	2	2	2	2	2	16	Low	(-)	High
Mitigation and Management Measures	— All alien plant re-growth must be monitored and should these alien plants reoccur these plants should be re-eradicated. The scale of the development does however not warrant the use of a Landscape Architect and / or Landscape Contractor. — It is further recommended that a comprehensive rehabilitation / monitoring plan be implemented from the project onset i.e. during the detailed design phase prior to construction, to ensure a net benefit to the environment within all areas that will remain undisturbed. — Vegetation clearing should occur in a phased manner in accordance with the construction programme to minimise erosion and/or run-off. Large tracts of bare soil will either cause dust pollution or quickly erode and then cause sedimentation in the									

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
LOSS OF VERY HIGH SENSITIVITY SYSTEMS									
	lower portions of the catchment. Suitable dust and erosion control mitigation measures should be included in the EMP to mitigate these impacts.								

DAMAGE OR LOSS OF RIPARIAN AND RIVERINE SYSTEMS

The physical removal of riparian zones within watercourses, will not occur as these areas will be voided based on the assumption that the PV facility will be accessed via the existing road. The construction impact on damage or loss of riparian and riverine systems is indicated in **Table 8.11**.

Table 8.11: Construction Impact on damage or loss of riparian and riverine systems

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
DAMAGE OR LOSS OF RIPARIAN AND RIVERINE SYSTEMS									
Without Mitigation	2	2	2	2	2	16	Low	(-)	High
With Mitigation	2	2	2	2	2	16	Low	(-)	High
Mitigation and Management Measures	— All alien plant re-growth must be monitored and should these alien plants reoccur these plants should be re-eradicated. The scale of the development does however not warrant the use of a Landscape Architect and / or Landscape Contractor. — It is further recommended that a comprehensive rehabilitation / monitoring plan be implemented from the project onset i.e. during the detailed design phase prior to construction, to ensure a net benefit to the environment within all areas that will remain undisturbed. — Vegetation clearing should occur in a phased manner in accordance with the construction programme to minimise erosion and/or run-off. Large tracts of bare soil will either cause dust pollution or quickly erode and then cause sedimentation in the lower portions of the catchment. Suitable dust and erosion control mitigation measures should be included in the EMP to mitigate these impacts.								

WATER QUALITY

During both construction and, to a limited degree, the operational activities, chemical pollutants (hydrocarbons from equipment and vehicles, cleaning fluids, cement powder, wet cement, shutter-oil, etc.) associated with site-clearing machinery and construction activities, as well as maintenance activities, could be washed downslope via the watercourses. The construction impact on water quality is indicated in **Table 8.12**.

Table 8.12: Construction Impact on water quality

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
WATER QUALITY									
Without Mitigation	4	4	5	4	2	34	Moderate	(-)	High
With Mitigation	2	2	2	2	2	16	Low	(-)	High
Mitigation and Management Measures	— No runoff may be discharged or directed into the Pans, as these are not tolerant of excessive / regular volumes of water and would then change in nature and attributes, i.e. stormwater detention pond.								

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
WATER QUALITY									
	— Strict use and management of all hazardous materials used on site. — Strict management of potential sources of pollution (e.g. litter, hydrocarbons from vehicles & machinery, cement during construction, etc.) within demarcated / bunded areas — Containment of all contaminated water by means of careful run-off management on site. — Appropriate ablution facilities should be provided for construction workers during construction and on-site staff during the operation of the facility. These must be situated outside of any delineated watercourses and pans/depressions or the buffers shown. — Strict control of the behaviour of construction workers. — Appropriate waste management. — Working protocols incorporating pollution control measures (including approved method statements by the contractor) should be clearly set out in the Construction Environmental Management Plan (EMPr) for the project and strictly enforced.								

HABITAT CHANGE AND FRAGMENTATION RELATED TO HYDROLOGICAL REGIMES

Increase in hard surface areas, and roads that require stormwater management will increase the concentration of surface water flows that could result in localised changes to flows (volume) that would result in form and function changes within the aquatic systems, which are currently ephemeral, i.e. aquatic vegetation species composition changes, which then results in habitat change / loss. The construction impact on habitat change and fragmentation related to hydrological regimes is indicated in **Table 8.13**.

Table 8.13: Construction Impact on habitat change and fragmentation related to hydrological regimes

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HABITAT CHANGE AND FRAGMENTATION RELATED TO HYDROLOGICAL REGIMES									
Without Mitigation	4	4	5	4	2	**34**	**Moderate**	(-)	High
With Mitigation	2	2	2	2	2	**16**	**Low**	(-)	High
Mitigation and Management Measures	— Vegetation clearing should occur in a phased manner in accordance with the construction programme to minimise erosion and/or run-off. Large tracts of bare soil will either cause dust pollution or quickly erode and then cause sedimentation in the lower portions of the catchment. Suitable dust and erosion control mitigation measures should be included in the EMP to mitigate these impacts. — A stormwater management plan must be developed in the preconstruction phase, detailing the stormwater structures and management interventions that must be installed to manage the increase of surface water flows directly into any natural systems. The stormwater control systems must be inspected on an annual basis to ensure these are functional. Effective stormwater management must include effective stabilisation (gabions and Reno mattresses) of exposed soil and the re-vegetation of any disturbed riverbanks. — No runoff may be discharged or directed into the Pans, as these are not tolerant of excessive / regular volumes of water and								

Potential Impact HABITAT CHANGE AND FRAGMENTATION RELATED TO HYDROLOGICAL REGIMES	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
	would then change in nature and attributes, i.e. stormwater detention pond. — Install properly sized culverts with erosion protection measures at the present road / track crossings where already installed by local landowners / public works entities.								

8.6.2 OPERATIONAL PHASE

INCREASE IN SURFACE WATER RUNOFF

An increase in hard surface areas, and or roads that require stormwater management increases runoff from a site through the concentration of surface water flows. These higher volume flows, with increased velocity can result in downstream erosion and sedimentation if not managed. The operational impact on increase in surface water runoff is indicated in **Table 8.16**.

Table 8.14: Operational Impact on surface water runoff

Potential Impact INCREASE IN SURFACE WATER RUNOFF	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	2	4	5	4	2	**30**	**Low**	(-)	High
With Mitigation	1	2	2	2	2	**14**	**Very Low**	(-)	High
Mitigation and Management Measures	— A stormwater management plan must be developed in the preconstruction phase, detailing the stormwater structures and management interventions that must be installed to manage the increase of surface water flows directly into any natural systems. The stormwater control systems must be inspected on an annual basis to ensure these are functional. Effective stormwater management must include effective stabilisation (gabions and Reno mattresses) of exposed soil and the re-vegetation of any disturbed riverbanks. — No runoff may be discharged or directed into the Pans, as these are not tolerant of excessive / regular volumes of water and would then change in nature and attributes, i.e. stormwater detention pond. — Install properly sized culverts with erosion protection measures at the present road / track crossings where already installed by local landowners / public works entities.								

8.6.3 DECOMMISSIONING PHASE

There are no anticipated aquatic ecology impacts during the decommissioning phase.

8.7 TERRESTRIAL BIODIVERSITY

8.7.1 CONSTRUCTION PHASE

LOSS OF INDIGENOUS NATURAL VEGETATION DUE TO CLEARING

The regional vegetation type in the broad study area is Eastern Highveld Grassland, classified in the scientific literature as Endangered (Mucina et al., 2008) and listed as Vulnerable in the National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011). Any areas of natural habitat (specifically natural grassland, as described above) within this regional vegetation type are therefore considered to have high conservation value.

Vegetation on site is within the Grassland Biome. Mesic grasslands in South Africa have a life-form composition that includes a high number of resprouting sub-terranean species that constitute more than 50% of the species richness at any single location and a higher proportion, if counted across a wider area. Secondary grassland that develops in previously cleared areas (for example, cultivated lands) usually develop a perennial grass cover, but the resprouting component of the flora almost never recovers. This means that any clearing of grassland vegetation, even if temporary, results in permanent loss of the local species composition. Clearing of natural grassland is therefore a permanent impact.

Habitat loss refers to physical disturbance of habitats through clearing, grading and other permanent to semi-permanent loss or degradation. Loss of habitat on site could lead to loss of biodiversity as well as habitat important for the survival of populations of various species.

The construction impact on clearing of natural habitat for construction is indicated in **Table 8.15**.

Table 8.15: Construction Impact on clearing of natural habitat for construction

Potential Impact LOSS OF INDIGENOUS NATURAL VEGETATION	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	2	1	3	5	5	**55**	**Moderate**	(-)	High
With Mitigation	1	1	3	5	5	**50**	**Moderate**	(-)	High
Mitigation and Management Measures	— Restrict impact to development footprint only and limit disturbance in surrounding areas. — Prior to commencement of construction, compile a Rehabilitation Plan including monitoring specifications, to be included into the EMPr during final approval. — Prior to commencement of construction, compile an Alien Plant Management Plan, to be included into the EMPr during final approval. — The solar arrays require an area of approximately 280 ha within the almost 300 ha area assessed here. Impacts on natural habitats can be somewhat avoided by placing the panels within currently or previously cultivated areas.								

ESTABLISHMENT AND SPREAD OF DECLARED WEEDS AND ALIEN INVADER PLANTS

Major factors contributing to invasion by alien invader plants includes inter alia high disturbance (such as clearing for construction activities) and negative grazing practices. Exotic species are often more prominent near infrastructural disturbances than further away. Consequences of this may include:

1. Loss of indigenous vegetation;
2. Change in vegetation structure leading to change in various habitat characteristics;
3. Change in plant species composition;

4. Change in soil chemical properties;
5. Loss of sensitive habitats;
6. Loss or disturbance to individuals of rare, endangered, endemic and/or protected species;
7. Fragmentation of sensitive habitats;
8. Change in flammability of vegetation, depending on alien species;
9. Hydrological impacts due to increased transpiration and runoff; and
10. Impairment of wetland function.

Low existing populations of alien plants were see on site, but areas of farm infrastructure were not investigated in detail during the field survey. There is a high possibility that alien plants could be introduced to areas within the footprint of the proposed activities from surrounding areas in the absence of control measures. The potential consequences may be of moderate seriousness for affected natural habitats. Control measures could prevent the impact from occurring. These control measures are relatively standard and well-known. Known alien invasive species recorded in the general geographical area that includes the site are as follows (in order of frequency observed):

- *Campuloclinium macrocephalum*
- *Acacia mearnsii*
- *Verbena bonariensis*
- *Solanum mauritianum*
- *Datura stramonium*
- *Cirsium vulgare*
- *Rumex acetosella*
- *Acacia dealbata*
- *Solanum sisymbriifolium*
- *Cortaderia selloana*
- *Arundo donax*
- *Sesbania punicea*
- *Ipomoea purpurea*
- *Melia azedarach*
- *Nicotiana glauca*
- *Eucalyptus camaldulensis*
- *Solanum elaeagnifolium*
- *Phytolacca octandra*
- *Robinia pseudoacacia*
- *Ailanthus altissima*
- *Xanthium spinosum*
- *Myriophyllum aquaticum*
- *Araujia sericifera*
- *Nasturtium officinale*
- *Verbena rigida*
- *Acacia melanoxylon*
- *Xanthium strumarium*
- *Azolla filiculoides*
- *Pinus taeda*
- *Alisma plantago-aquatica*
- *Rubus niveus*
- *Agave americana*
- *Acacia podalyriifolia*
- *Carduus nutans*

— *Ligustrum lucidum*
— *Ageratum houstonianum*
— *Spathodea campanulata*
— *Verbena brasiliensis*
— *Salvia tiliifolia*
— *Solanum pseudocapsicum*
— *Argemone ochroleuca*
— *Pinus patula*
— *Paspalum quadrifarium*
— *Austrocylindropuntia subulata*
— *Rumex usambarensis*

The construction impact on Establishment and spread of declared weeds and alien invader plants is indicated in **Table 8.16**.

Table 8.16: Construction Impact on establishment and spread of declared weeds and alien invader plants

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
ESTABLISHMENT AND SPREAD OF DECLARED WEEDS AND ALIEN INVADER PLANTS									
Without Mitigation	2	2	3	1	3	**24**	**Low**	(-)	High
With Mitigation	1	1	3	1	2	**12**	**Very Low**	(-)	High
Mitigation and Management Measures	— Prior to commencement of construction, compile and implement an alien management plan, which highlights control priorities and areas and provides a programme for long-term control, including monitoring specifications. — Undertake monitoring to detect alien invasions early so that they can be controlled, as per the specifications of the alien management plan. — Implement control measures as per the specifications of the alien management plan.								

8.7.2 OPERATIONAL PHASE

CONTINUED DISTURBANCE TO NATURAL HABITATS

During the operational phase of the project, there will be continuous activity on site, including normal operational activities, maintenance and monitoring. There may also be minor additional construction. Rehabilitation of various sites, such as the construction camps, will also take place. These activities all have the potential to cause additional direct and/or indirect damage to natural habitat and vegetation. These activities include sporadic unforseen disturbance to natural habitats e.g. accidental fires, driving off-road, dumping etc. during general operational activities and maintenance.

The operational impact on continued disturbance to natural habitats is indicated in **Table 8.17**.

Table 8.17: Operational Impact on continued disturbance to natural habitats

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
CONTINUED DISTURBANCE TO NATURAL HABITATS									
Without Mitigation	2	2	3	5	3	**36**	**Moderate**	(-)	High

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
CONTINUED DISTURBANCE TO NATURAL HABITATS									
With Mitigation	1	1	3	5	2	**20**	**Low**	(-)	High
Mitigation and Management Measures	— Restrict impact to development footprint only and limit disturbance in surrounding areas. — Prior to commencement of construction, compile a Rehabilitation Plan including monitoring specifications, to be included into the EMPr during final approval. — Prior to commencement of construction, compile an Alien Plant Management Plan, to be included into the EMPr during final approval. — The solar arrays require an area of approximately 280 ha within the almost 300 ha area assessed here. Impacts on natural habitats can be somewhat avoided by placing the panels within currently or previously cultivated areas.								

CONTINUED ESTABLISHMENT AND SPREAD OF ALIEN INVASIVE PLANT SPECIES

The presence of disturbed surfaces on site creates ecological edges and corridors along which alien species can travel and become established. The operational impact on continued establishment and spread of alien invasive plant species due to the presence of migration corridors and disturbance vectors is indicated in **Table 8.18**.

Table 8.18: Operational Impact on continued establishment and spread of alien invasive plant species

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
CONTINUED ESTABLISHMENT AND SPREAD OF ALIEN INVASIVE PLANT SPECIES									
Without Mitigation	3	2	3	4	3	**36**	**Moderate**	(-)	High
With Mitigation	1	1	3	2	2	**14**	**Very Low**	(-)	High
Mitigation and Management Measures	— Prior to commencement of construction, compile and implement an alien management plan, which highlights control priorities and areas and provides a programme for long-term control. — Undertake monitoring to detect alien invasions early so that they can be controlled as per the specifications of the alien management plan. — Implement control measures as per the specifications of the alien management plan.								

RUNOFF AND EROSION

Increased erosion (water and wind) and water run-off will be caused by the clearing of indigenous vegetation, creation of new hard surfaces and compaction of soil.

The operational impact of runoff and erosion due to the presence of hard surfaces is indicated in **Table 8.19**.

Table 8.19: Operational Impact on runoff and erosion

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
RUNOFF AND EROSION									
Without Mitigation	3	1	3	5	3	**36**	**Moderate**	(-)	High
With Mitigation	2	1	3	5	2	**22**	**Low**	(-)	High

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
RUNOFF AND EROSION									
Mitigation and Management Measures	— Prior to commencement of construction, compile and implement a stormwater management plan including monitoring specifications. — Monitor surfaces for erosion, repair and/or upgrade, where necessary.								

8.7.3 DECOMMISSIONING PHASE

It is expected that the project will operate for a minimum of twenty to twenty-five years (a typical planned life-span for a project of this nature). Decommissioning will probably require a series of steps resulting in the removal of equipment from the site and rehabilitation of footprint areas. It is possible that the site could be returned to a rural nature, but it is unlikely that natural vegetation would become established at disturbed locations on site for a very long time thereafter. The reality is that it is not possible to determine at this stage whether rehabilitation measures will be implemented or not or what the future plans for the site would be nor is it possible at this stage to determine what surrounding land pressures would be. These uncertainties make it difficult to undertake any assessment to determine possible impacts of decommissioning. It is recommended that a closure and rehabilitation plan be compiled near to the decommissioning stage but in advance of when decommissioning is planned, and that this would be required to be implemented prior to closure of the project. The closure and rehabilitation plan must be in compliance with the regulatory requirements at the time of decommissioning. Possible impacts are described below.

LOSS AND DISTURBANCE OF NATURAL VEGETATION

During the decommissioning phase of the project, there will be a flurry of activity on site over a period of time, similar to during the construction phase, including dismantling and removal of equipment and rehabilitation. There may also be minor additional construction. Rehabilitation of various sites will also take place. These activities all have the potential to cause additional direct and/or indirect damage to natural habitat and vegetation.

The decommissioning impact on the loss and disturbance of natural vegetation is indicated in **Table 8.20**.

Table 8.20: Decommissioning Impact on loss and disturbance of natural vegetation

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
LOSS AND DISTURBANCE OF NATURAL VEGETATION									
Without Mitigation	1	1	3	5	2	20	Low	(-)	High
With Mitigation	1	1	3	5	2	20	Low	(-)	High
Mitigation and Management Measures	— Prior to decommissioning commencing, compile a Rehabilitation Plan in compliance with the regulatory requirements at the time of decommissioning.								

CONTINUED ESTABLISHMENT AND SPREAD OF ALIEN INVASIVE PLANT SPECIES

The presence of disturbed surfaces on site creates ecological edges and corridors along which alien species can travel and become established. The decommissioning impact on the establishment and spread of declared weeds and alien invader plants is indicated in **Table 8.21**.

Table 8.21: Decommissioning Impact on establishment and spread of declared weeds and alien invader plants

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
ESTABLISHMENT AND SPREAD OF DECLARED WEEDS AND ALIEN INVADER PLANTS									
Without Mitigation	2	2	3	4	4	**44**	**Moderate**	(-)	High
With Mitigation	1	1	3	4	3	**27**	**Low**	(-)	High
Mitigation and Management Measures	— Rehabilitate disturbed areas in accordance with the specifications of a Rehabilitation Plan.								

8.8 TERRESTRIAL PLANT SPECIES

8.8.1 CONSTRUCTION PHASE

LOSS OF INDIVIDUALS OF SPECIES OF CONSERVATION CONCERN DUE TO CLEARING FOR CONSTRUCTION

For all infrastructure components located within natural habitat there is the possibility that individuals or populations of plant species of conservation concern may be lost due to construction impacts. Based on known information, and data collected on site, the probability of encountering species of conservation concern at any particular location is dependent on local habitat conditions. Both substation alternatives and the southern construction camp are located within natural habitat. The assessed area for the solar PV panels is almost 300 ha in size, of which 280 ha is proposed to be developed. There is therefore minor potential to locate the PV panels to avoid natural habitat.

The clearing of natural habitat for construction may result in the loss of species of conservation concern. The construction impact on loss of species of conservation concern is indicated in **Table 8.22**.

Table 8.22: Construction Impact on loss of species of conservation concern

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
LOSS OF SPECIES OF CONSERVATION CONCERN									
Without Mitigation	2	2	5	5	3	**42**	**Moderate**	(-)	High
With Mitigation	2	2	5	5	1	**14**	**Very Low**	(-)	High
Mitigation and Management Measures	— Prior to construction commencing, undertake a detailed walk-through survey of footprint areas that are within habitats where SCC are likely to occur. — Where significant populations of SCC are found, collect the data for any flora permits or micro-siting of infrastructure that may be required. — Prior to construction commencing, compile a Plant Rescue Plan, including monitoring specifications (timeframe, frequency etc). — Undertake monitoring (as per the Plant Rescue Plan specifications) to evaluate whether further measures would be required to manage impacts.								

8.8.2 OPERATIONAL PHASE

There are no anticipated impacts to the terrestrial plant species during the operational phase.

8.8.3 DECOMMISSIONING PHASE

There are no anticipated impacts to the terrestrial plant species during the decommissioning phase.

8.9 TERRESTRIAL ANIMAL SPECIES

8.9.1 CONSTRUCTION PHASE

LOSS OF FAUNAL HABITAT

Construction activities will require clearing of natural habitat, to be replaced by the infrastructure. This will result in permanent local loss of habitat. The construction impact on the loss of faunal habitat is indicated in **Table 8.23**.

Table 8.23: Construction Impact on loss of faunal habitat

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
LOSS OF FAUNAL HABITAT									
Without Mitigation	2	1	3	5	4	**44**	**Moderate**	(-)	High
With Mitigation	1	1	3	5	3	**30**	**Low**	(-)	High
Mitigation and Management Measures	— No driving of vehicles off-road outside of construction areas. — Apply mitigation measures recommended in the Terrestrial Biodiversity Assessment to minimise loss of natural vegetation.								

DIRECT MORTALITY OF FAUNA

Construction activities will require use of heavy machinery and vehicles, as well as placement of various obstructions that may be hazardous resulting in the direct mortality of fauna. The construction impact on mortality of fauna is indicated in **Table 8.24**.

Table 8.24: Construction Impact on direct mortality of fauna

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
DIRECT MORTALITY OF FAUNA									
Without Mitigation	2	1	1	2	3	**18**	**Low**	(-)	High
With Mitigation	1	1	1	2	2	**10**	**Very Low**	(-)	High
Mitigation and Management Measures	— It is a legal requirement to obtain permits for specimens or protected species that will be lost due to construction of the project. — Conduct a pre-construction walk-through of natural habitat within the development footprint prior to construction activities commencing in order to move any individual animals, such as tortoises, where required. — Personnel on site should undergo environmental induction training, including the need to abide by speed limits, to minimise risk of collisions with wild animals on roads in rural areas. — Proper waste management must be implemented, ensuring no toxic or dangerous substances are accessible to wildlife. This should also apply to stockpiles of new and used materials to ensure that they do not become a hazard. — No collecting, hunting or poaching of any animal species.									

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
DIRECT MORTALITY OF FAUNA									
	— Personnel to be educated about protection status of species, including distinguishing features, to be able to identify protected species. — Appropriate lighting should be installed to minimize impacts on nocturnal animals, as per visual specialist assessment.								

8.9.2 OPERATIONAL PHASE

DIRECT MORTALITY OF FAUNA

Direct mortality of fauna may occur through traffic, illegal collecting, poaching and collisions and/or entanglement with infrastructure. The operational impact on mortality of fauna is indicated in **Table 8.25**.

Table 8.25: Operational Impact on direct mortality of fauna

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
DIRECT MORTALITY OF FAUNA									
Without Mitigation	2	1	1	4	3	**24**	**Low**	(-)	High
With Mitigation	1	1	1	4	2	**14**	**Very Low**	(-)	High
Mitigation and Management Measures	— It is a legal requirement to obtain permits for specimens or protected species that will be lost due to construction of the project. — Personnel on site should undergo environmental induction training, including the need to abide by speed limits, the increased risk of collisions with wild animals on roads in rural areas. — Proper waste management must be implemented, ensuring no toxic or dangerous substances are accessible to wildlife. This should also apply to stockpiles of new and used materials to ensure that they do not become a hazard. — No collecting, hunting or poaching of any animal species. — Personnel to be educated about protection status of species, including distinguishing features, to be able to identify protected species. — Appropriate lighting should be installed to minimize impacts on nocturnal animals, as per visual specialist assessment.								

8.9.3 DECOMMISSIONING PHASE

Decommissioning phase impacts are identical in nature and rating to that of the construction phase impacts.

LOSS OF FAUNAL HABITAT

Decommissioning activities will require clearing of natural habitat, to remove the existing infrastructure. This will result in permanent local loss of habitat. The decommissioning impact on the loss of faunal habitat is indicated in **Table 8.26**.

Table 8.26: Decommissioning Impact on loss of faunal habitat

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
LOSS OF FAUNAL HABITAT									
Without Mitigation	2	1	3	5	4	**44**	**Moderate**	(-)	High
With Mitigation	1	1	3	5	3	**30**	**Low**	(-)	High
Mitigation and Management Measures	— No driving of vehicles off-road outside of construction areas. — Apply mitigation measures recommended in the Terrestrial Biodiversity Assessment to minimise loss of natural vegetation.								

DIRECT MORTALITY OF FAUNA

Decommissioning activities will require use of heavy machinery and vehicles, as well as placement of various obstructions that may be hazardous resulting in the direct mortality of fauna. The decommissioning impact on mortality of fauna is indicated in **Table 8.27**.

Table 8.27: Decommissioning Impact on direct mortality of fauna

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
DIRECT MORTALITY OF FAUNA									
Without Mitigation	2	1	1	2	3	**18**	**Low**	(-)	High
With Mitigation	1	1	1	2	2	**10**	**Very Low**	(-)	High
Mitigation and Management Measures	— It is a legal requirement to obtain permits for specimens or protected species that will be lost due to construction of the project. — Conduct a pre-construction walk-through of natural habitat within the development footprint prior to construction activities commencing in order to move any individual animals, such as tortoises, where required. — Personnel on site should undergo environmental induction training, including the need to abide by speed limits, to minimise risk of collisions with wild animals on roads in rural areas. — Proper waste management must be implemented, ensuring no toxic or dangerous substances are accessible to wildlife. This should also apply to stockpiles of new and used materials to ensure that they do not become a hazard. — No collecting, hunting or poaching of any animal species. — Personnel to be educated about protection status of species, including distinguishing features, to be able to identify protected species. — Appropriate lighting should be installed to minimize impacts on nocturnal animals, as per visual specialist assessment.								

8.10 AVIFAUNA

8.10.1 CONSTRUCTION PHASE

DISPLACEMENT OF PRIORITY SPECIES DUE TO DISTURBANCE FOR SEF CONSTRUCTION

As far as disturbance is concerned, it is likely that all the avifauna, including all the priority species, will be temporarily displaced in the footprint area, either completely or more likely partially (reduced densities) during the construction phase, due to the disturbance associated with the construction activities e.g. increased vehicle traffic, and short-term construction-related noise (from equipment) and visual disturbance. At the PV facility, the priority species which would be most severely affected by disturbance would be ground dwelling species which are the following: White-bellied Bustard, Cloud Cisticola, Blue Crane, Western Cattle Egret, Grey-winged Francolin, Cape Grassbird, Blue Korhaan, African Grass Owl, Marsh Owl, Drakensberg Prinia, and Pied Starling. Secretarybirds breeding or roosting at or near to the project site might also be affected.

The impact of displacement of priority species due to disturbance linked to construction activities in the construction phase is indicated in **Table 8.28**.

Table 8.28: Construction Impact on displacement of priority species due to disturbance

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
DISPLACEMENT OF PRIORITY SPECIES DUE TO DISTURBANCE									
Without Mitigation	4	2	4	2	5	**60**	**High**	(-)	High
With Mitigation	3	2	3	2	4	**40**	**Moderate**	(-)	High
Mitigation and Management Measures	— Maintain 100m solar panel buffer zones around drainage lines, wetlands and pans (as per Avifauna specialist report (**Appendix** H-7). — Limit construction of infrastructure in high sensitivity grassland as much as possible.								

DISPLACEMENT OF PRIORITY SPECIES DUE TO HABITAT TRANSFORMATION FOR SEF CONSTRUCTION

Ground-disturbing activities affect a variety of processes, including soil density, water infiltration rate, vulnerability to erosion, secondary plant succession, invasion by exotic plant species, and stability of cryptobiotic soil crusts. These processes have the ability – individually and together – to alter habitat quality, often to the detriment of wildlife, including avifauna. Any disturbance and alteration to the landscape, including the construction and decommissioning of utility-scale solar energy facilities, has the potential to increase soil erosion. Erosion can physically and physiologically affect plant species and can thus adversely influence primary production and food availability for wildlife (Lovich & Ennen 2011). Solar energy facilities require substantial site preparation (including the removal of vegetation) that alters topography and, thus, drainage patterns to divert the surface flow associated with rainfall away from facility infrastructure. Channelling runoff away from plant communities can have dramatic negative effects on water availability and habitat quality. Areas deprived of runoff from sheet flow support less biomass of perennial and annual plants relative to adjacent areas with uninterrupted water-flow patterns. As far as displacement, either completely or partially (reduced densities) due to habitat loss is concerned, it is highly likely that the same pattern of reduced avifaunal densities will manifest itself at the proposed PV facility. In addition, ground dwelling species and some raptors are also likely to be impacted by the habitat transformation, as it will result in reduced prey availability and accessibility. Priority species that could be negatively affected by displacement due to habitat loss are the following: Common Buzzard, Jackal Buzzard, Cloud Cisticola, Blue Crane, Black-chested Snake Eagle, Long-crested Eagle, Western Cattle Egret, Amur Falcon, Lanner Falcon, Grey-winged Francolin, Cape Grassbird, Black-headed Heron, Southern Bald Ibis, Rock Kestrel, Black-winged Kite, Blue Korhaan, African Grass Owl, Marsh Owl, Pied Starling, White Stork, and South African Cliff Swallow.

The impact of displacement of priority species due to habitat transformation linked to construction activities in the construction phase is indicated in **Table 8.29**.

Table 8.29: Construction Impact on displacement of priority species due to habitat transformation

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
DISPLACEMENT OF PRIORITY SPECIES DUE TO HABITAT TRANSFORMATION									
Without Mitigation	3	2	4	4	4	**52**	**High**	(-)	High
With Mitigation	3	2	3	3	4	**36**	**Moderate**	(-)	High
Mitigation and Management Measures	— Maintain 100m solar panel buffer zones around drainage lines, wetlands and pans as per Avifauna specialist report (**Appendix** H-7. — Limit construction of infrastructure in high sensitivity grassland as much as possible.								

DISPLACEMENT DUE TO DISTURBANCE FOR BESS CONSTRUCTION

Construction activities in close proximity to breeding locations could be a source of disturbance and could lead to temporary breeding failure or even permanent abandonment of nests. A potential mitigation measure is the timeous identification of nests and the timing of the construction activities to avoid disturbance during a critical phase of the breeding cycle, although in practice that can admittedly be challenging to implement. The priority species which are potentially most vulnerable to the impact of displacement due to disturbance linked to the BESS are terrestrial species and owls. Priority species that could be most affected are the following: African Grass Owl, Black-bellied Bustard, Black-winged Lapwing, Blue Crane, Blue Korhaan, Buff-streaked Chat, Denham's Bustard, Grey Crowned Crane, Grey-winged Francolin, Marsh Owl, Northern Black Korhaan, Secretarybird and White-bellied Bustard.

The impact of displacement of priority species due to disturbance linked to construction activities in the construction phase is indicated in **Table 8.30**.

Table 8.30: Construction Impact on displacement of priority species due to disturbance

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
DISPLACEMENT OF PRIORITY SPECIES DUE TO DISTURBANCE									
Without Mitigation	2	1	1	2	3	**18**	**Low**	(-)	High
With Mitigation	2	1	1	2	2	**12**	**Very Low**	(-)	High
Mitigation and Management Measures	— A site-specific CEMPr must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. All contractors are to adhere to the CEMPr and should apply good environmental practice during construction. The CEMPr must specifically include the following: — No off-road driving; — Maximum use of existing roads, where possible; — Measures to control noise and dust according to latest best practice; — Restricted access to the rest of the property;								

DISPLACEMENT OF PRIORITY SPECIES DUE TO HABITAT TRANSFORMATION FOR BESS CONSTRUCTION

These construction activities will impact on birds breeding, foraging and roosting in or in close proximity of the proposed facility through transformation of habitat, which could result in temporary or permanent displacement. Unfortunately, very little mitigation can be applied to reduce the significance of this impact as the total permanent transformation of the natural habitat within the construction footprint of the facility is unavoidable. The loss of habitat for priority species due to direct habitat transformation associated with the construction of the 5 ha proposed facility is likely to be relatively insignificant due to the relatively small size of the footprint (only 0.07% of the total project area, and 2.5% of the buildable area).

The impact of displacement of priority species due to disturbance linked to construction activities in the construction phase is indicated in **Table 8.31**.

Table 8.31: Construction Impact on displacement of priority species due to habitat transformation

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
DISPLACEMENT OF PRIORITY SPECIES DUE TO HABITAT TRANSFORMATION									
Without Mitigation	2	1	5	4	2	**24**	**Low**	(-)	High
With Mitigation	2	1	5	4	2	**24**	**Low**	(-)	High
Mitigation and Management Measures	— Monitor rehabilitation via site audits and site inspections to ensure compliance. — Record and report any non-compliance								

8.10.2 OPERATIONAL PHASE

COLLISION MORTALITY OF PRIORITY SPECIES CAUSED BY SOLAR PANELS

The proposed SEF could potentially pose a collision risk to several priority species which could occur regularly at the site. However, the results of the available literature lack compelling evidence of collisions as a cause of large-scale mortality among birds at PV facilities. The lack of systematic and standardised data collection is a major problem in the assessment of the causes and extent of avian mortality at all types of solar facilities, regardless of the technology employed. Until statistically tested results emerge from existing compliance programmes and more dedicated scientific research, conclusions will inevitably be largely preliminary and based on professional opinion. Based on the lack of evidence to the contrary, it is not foreseen that collisions with the solar panels at the PV facility will be a significant impact. The priority species which would most likely be potentially affected by this impact are mostly small to medium-sized, ground-dwelling birds which forage between the solar panels, and possibly raptors which prey on them, or forage for insects between the PV panels, e.g. Amur Falcons (i.e. if they are not completely displaced due to the habitat transformation). Due to the absence of large permanent waterbodies at or close to the development area, it is unlikely that waterbirds will be attracted in large numbers to the solar arrays due to the “lake effect”. Priority species which occur regularly and could potentially be impacted due to collisions with the solar panels are the following: Western Cattle Egret, Amur Falcon, Lanner Falcon, Fiscal Flycatcher, Grey-winged Francolin, Egyptian Goose, Spur-winged Goose, Cape Grassbird, Black-headed Heron, Southern Bald Ibis, African Sacred Ibis, Blue Korhaan, Blacksmith Lapwing, African Grass Owl, Marsh Owl, Three-banded Plover, Drakensberg Prinia, South African Shelduck, African Snipe, Black Sparrowhawk, Pied Starling, South African Cliff Swallow and Cape Weaver.

The impact of collision mortality of priority species caused by the solar panels in the operational phase is indicated in **Table 8.32**.

Table 8.32: Operational Impact of collision mortality of priority species caused by the solar panels

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
COLLISSION MORTALITY OF PRIORITY SPECIES CAUSED BY SOLAR PANELS									
Without Mitigation	2	1	1	4	2	16	Low	(-)	High
With Mitigation	2	1	1	4	2	16	Low	(-)	High
Mitigation and Management Measures	— No mitigation measures required								

MORTALITY DUE TO ENTRAPMENT IN PERIMETER FENCES

The impact of mortality due to entrapment large-bodied birds in the double perimeter fence during the operational phase is indicated in **Table 8.33**.

Table 8.33: Operational Impact of mortality due to entrapment large-bodied birds in the double perimeter fence

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
MORTALITY DUE TO ENTRAPMENT IN PERIMETER FENCES									
Without Mitigation	3	2	1	4	3	30	Low	(-)	High
With Mitigation	3	2	1	4	1	10	Very Low	(-)	High
Mitigation and Management Measures	— No mitigation measures required								

COLLISSION MORTALITY OF PRIORITY SPECIES CAUSED BY OVERHEAD LINES

The impact of collision mortality of priority species caused by the overhead lines during the operational phase indicated in **Table 8.34**.

Table 8.34: Operational Impact of collision mortality of priority species caused by the overhead lines

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
COLLISSION MORTALITY OF PRIORITY SPECIES CAUSED BY OVERHEAD LINES									
Without Mitigation	4	3	4	4	3	45	Moderate	(-)	High
With Mitigation	3	3	3	4	2	26	Low	(-)	High
Mitigation and Management Measures	— Bury cables as far as possible. — In instances where the medium voltage cables cannot be buried due to technical constraints, a bird-friendly pole design must be used for the overhead lines. The avifaunal specialist must approve the pole design.								

MORTALITY OF PRIORITY SPECIES CAUSED BY ELECTROCUTION FROM OVERHEAD LINES

The impact of mortality of priority species caused by electrocution from overhead lines during the operational phase is indicated in **Table 8.35**.

Table 8.35: Operational Impact of mortality of priority species caused by electrocution from overhead lines

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
MORTALITY OF PRIORITY SPECIES CAUSED BY ELECTROCUTION FROM OVERHEAD LINES									
Without Mitigation	4	3	4	4	4	**60**	**Moderate**	(-)	High
With Mitigation	1	3	2	4	2	**20**	**Low**	(-)	High
Mitigation and Management Measures	— Inspections of the substation yard to look for carcasses of electrocuted birds.								

8.10.3 DECOMMISSIONING PHASE

DISPLACEMENT OF PRIORITY SPECIES DUE TO DISTURBANCE ASSOCIATED WITH DISMANTLING OF THE SOLAR PANELS

The displacement of priority species due to disturbance linked to dismantling activities in the decommissioning phase is likely to be similar in nature and extent to the construction phase of the proposed SEF.

The impact of displacement of priority species due to disturbance linked to decommissioning activities is indicated in **Table 8.36**.

Table 8.36: Decommissioning Impact on displacement of priority species due to disturbance linked to dismantling activities

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
DISPLACEMENT OF PRIORITY SPECIES DUE TO DISTURBANCE ASSOCIATED WITH THE DISMANTLING OF THE SOLAR PANELS									
Without Mitigation	4	2	3	2	4	**44**	**Moderate**	(-)	High
With Mitigation	3	2	2	2	3	**27**	**Low**	(-)	High
Mitigation and Management Measures	— A site-specific EMPr must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. All contractors are to adhere to the EMPr and must apply good environmental practice during construction. The EMPr must specifically include the following: — No off-road driving. — Maximum use of existing roads. — Measures to control noise and dust according to latest best practice. — Restricted access to the rest of the property. — Strict application of all recommendations in the botanical specialist report pertaining to the limitation of the footprint.								

DISPLACEMENT OF PRIORITY SPECIES DUE TO DISTURBANCE LINKED TO DISMANTLING ACTIVITIES

The displacement of priority species due to disturbance linked to dismantling activities in the decommissioning phase is likely to be similar in nature and extent to the construction phase of the proposed BESS.

The impact of displacement of priority species due to disturbance linked to decommissioning activities is indicated in **Table 8.37**.

Table 8.37: Decommissioning Impact on displacement of priority species due to disturbance linked to dismantling activities

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
DISPLACEMENT OF PRIORITY SPECIES DUE TO DISTURBANCE ASSOCIATED WITH THE DISMANTLING ACTIVITIES									
Without Mitigation	2	1	1	2	3	18	Low	(-)	High
With Mitigation	2	1	1	2	2	12	Very Low	(-)	High
Mitigation and Management Measures	— A site-specific EMPr must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. All contractors are to adhere to the EMPr and must apply good environmental practice during construction. The EMPr must specifically include the following: — No off-road driving. — Maximum use of existing roads. — Measures to control noise and dust according to latest best practice. — Restricted access to the rest of the property. — Strict application of all recommendations in the botanical specialist report pertaining to the limitation of the footprint.								

8.11 BATS

8.11.1 CONSTRUCTION PHASE

LOSS OF FORAGING HABITAT

Construction activities, temporary and long term, such as construction yards and PV panel arrays, will clear vegetation supporting bat insect prey. The construction impact on the loss of foraging habitat for bats is indicated in **Table 8.38**.

Table 8.38: Construction Impact on foraging habitat for bats

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
LOSS OF FORAGING HABITAT BY CLEARING OF VEGETATION									
Without Mitigation	3	1	2	4	4	40	Moderate	(-)	High
With Mitigation	3	1	1	4	3	27	Low	(-)	High
Mitigation and Management Measures	— Adhere to the bat sensitivity map during all phases of the facility's operation, thus avoiding all bat sensitive areas. This also applies to temporary activities such as storage yards and construction offices. Vegetation should be allowed to recover where it was cleared after the construction and decommissioning of the facility. — All lights on substation and/or Operations and Management (O&M) buildings, should be down-hooded and connected to motion sensors (where safe to do so), to minimise light pollution.								

ROOST DESTRUCTION

Construction activities may possibly disturb or destroy bat roosts in tall tree which will force bats to find alternative roosts. The construction impact on the bats roost destruction is indicated in **Table 8.39**.

Table 8.39: Construction Impact on bats roost destruction

Potential Impact BAT ROOST DESTRUCTION	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	3	1	3	4	3	**33**	**Moderate**	(-)	High
With Mitigation	3	1	3	4	1	**11**	**Very Low**	(-)	High
Mitigation and Management Measures	— Adhere to the bat sensitivity map during all phases of the facility's operation, thus avoiding all bat sensitive areas. This also applies to temporary activities such as storage yards and construction offices.								

8.11.2 OPERATIONAL PHASE

INCREASE IN BAT MORTALITIES

Floodlights and other lights at buildings will attract bats preying on insects and therefore significantly increase the likelihood of these bats being impacted on by the nearby wind turbines. Habitat creation in the roofs of nearby buildings can cause a similar increased risk factor. The operational impact on the increase in bat mortality is indicated in **Table 8.40**.

Table 8.40: Operational Impact on increase in bat mortalities

Potential Impact INCREASE IN BAT MORTALITY	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	4	1	4	4	4	**52**	**Moderate**	(-)	High
With Mitigation	4	1	4	4	2	**26**	**Low**	(-)	High
Mitigation and Management Measures	— All lights on substation and/or Operations and Management (O&M) buildings, should be down-hooded and connected to motion sensors (where safe to do so), to minimise light pollution. — For buildings, avoid tin roofs and roof structures that offer entrance holes into the roof cavity.								

8.12 TRAFFIC

The Operational and Decommissioning phases were not assessed, as the trip generation during these phases will be negligible, with a negligible impact.

8.12.1 CONSTRUCTION PHASE

NOISE, DUST AND EXHAUST POLLUTION DUE TO VEHICLE TRIPS ON-SITE

The impact of additional traffic during construction is expected to be minimal and short term. The construction impact on traffic is indicated in **Table 8.41**.

Table 8.41: Construction Impact due to vehicle trips on-site

Potential Impact NOISE, DUST AND EXHAUST POLLUTION DUE TO VEHICLE TRIPS ON-SITE	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	2	1	1	1	5	25	**Low**	(-)	High
With Mitigation	1	1	1	1	2	8	**Very Low**	(-)	High
Mitigation and Management Measures	— All unsurfaced roads must be regularly sprayed with water to prevent dust generation — All vehicles that travel on-site must be roadworthy to ensure noise and emissions levels comply to national vehicle standards, thereby minimising noise/exhaust pollution — All vehicles that travel on-site must not be overloaded, and abnormal vehicles must comply to relevant legislation for overweight loads, to ensure lowest possible road surface damage.								

NOISE, DUST AND EXHAUST POLLUTION DUE TO ADDITIONAL TRIPS ON THE NATIONAL AND DISTRICT ROADS

The impact of additional traffic during construction is expected to be minimal and short term. The construction impact on traffic is indicated in **Table 8.42**.

Table 8.42: Construction Impact due to additional trips on the National and District Roads

Potential Impact: NOISE, DUST AND EXHAUST POLLUTION DUE TO VEHICLE TRIPS ON NATIONAL AND DISTRICT ROADS	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	2	2	1	1	5	**30**	**Low**	(-)	High
With Mitigation	1	2	1	1	2	**10**	**Very Low**	(-)	High
Mitigation and Management Measures	— All unsurfaced roads must be regularly sprayed with water to prevent dust generation — All vehicles that travel to site must be roadworthy to ensure noise and emissions levels comply to national vehicle standards, thereby minimising noise/exhaust pollution — All vehicles that travel to site must not be overloaded, and abnormal vehicles must comply to relevant legislation for overweight loads, to ensure lowest possible road surface damage.								

8.12.2 OPERATIONAL PHASE

No impacts are expected during the operation phase.

8.12.3 DECOMMISSIONING PHASE

The impacts expected during the decommissioning phase are the same as the construction phase impacts.

8.13 HERITAGE

Based on the current layout, CA001, CA003 and CA004 will be directly impacted on by the proposed Camden 1 SEF. The significance of the recorded ruins at CA001 is medium and CA004 is of low significance. The cemetery at CA003 is of high social significance. The ruins at CA001 are assumed to be older than 60 years based on historical maps (the feature is indicated on the 1968 map (Figure 8.12) and will need to be recorded prior to application for a destruction permit. The cemetery at CA003 should be avoided with a 30 m buffer zone and fenced with an access gate for family members. After mitigation the impacts on the recorded features and graves will be very low and low. Impacts to heritage resources without mitigation within the project footprint will be permanent and negative and occur during the construction activities.

Any additional effects to subsurface heritage resources can be successfully mitigated by implementing a Chance Find Procedure. All known sites should be avoided and additional recommendations in this report should be implemented during all phases of the project. With the implementation of the recommended mitigation measures impacts of the project on heritage resources is acceptable.

8.13.1 CONSTRUCTION PHASE

It is assumed that the construction phase involves the removal of topsoil and vegetation as well as the establishment of infrastructure. These activities can have a negative and irreversible impact on heritage features if any occur. Impacts include destruction or partial destruction of non-renewable heritage resources.

DESTRUCTION OR DAMAGE TO RECORDED RUINS

The construction impact on destruction or damage to recorded ruins is indicated in **Table 8.43.**

Table 8.43: Construction Impact on destruction or damage to recorded ruins

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
DESTRUCTION OR DAMAGE TO RECORDED RUINS									
Without Mitigation	3	1	5	5	2	28	Low	(-)	High
With Mitigation	3	1	5	5	1	14	Very Low	(-)	High
Mitigation and Management Measures	— Implementation of a Chance Find Procedure for the Project — The study area should be monitored by the ECO during construction. — CA001 should be recorded before a destruction permit can be applied for. — Recorded heritage features (CA002, CA004, CA005) should be monitored by the ECO during construction.								

DESTRUCTION OR DAMAGE TO RECORDED GRAVES

The construction impact on destruction or damage to recorded graves is indicated in **Table 8.44**.

Table 8.44: Construction Impact on destruction or damage to recorded graves

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
DESTRUCTION OR DAMAGE TO RECORDED GRAVES									
Without Mitigation	4	2	5	5	4	64	High	(-)	High
With Mitigation	4	2	5	5	1	16	Low	(-)	High
Mitigation and Management Measures	— Implementation of a Chance Find Procedure for the Project — The study area should be monitored by the ECO during construction.								

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
DESTRUCTION OR DAMAGE TO RECORDED GRAVES									
	— The recorded cemetery (CA003) must be avoided with a 30 m buffer zone. The site must be fenced and access for family members must be ensured, alternatively the graves can be relocated adhering to all legal requirements.								

8.13.2 OPERATIONAL PHASE

No impacts are expected during the operation phase.

8.13.3 DECOMMISSIONING PHASE

No impacts are expected during the decommissioning phase.

8.14 PALAEONTOLOGY

8.14.1 CONSTRUCTION PHASE

If fossils occur in the footprint of any section of the project, the footprint of the Solar PV Facility, the substation and ancillary infrastructure, as well as the grid connection infrastructure related thereto can be removed, and the project can continue. If no fossils are found then no mitigation is required.

The site for the Camden I SEF is on non-fossiliferous dolerite but some of the grid connections are not. The Fossil Chance Find Protocol is not relevant for the Solar PV Footprint because it will be on dolerite.

Once fossils have been removed there will be not further impact on the palaeontological heritage. Therefore the impact is only applicable to the construction phase.

If fossils are recovered, removed and placed in a recognised institution such as a museum or university palaeontology collection this will be a positive impact because the fossils will be available for research. Otherwise they would have remained unknown to science.

IMPACT TO FOSSILS THAT MAY OCCUR

The construction impact on fossils that may occur is indicated in **Table 8.45**.

Table 8.45: Construction Impact on fossils that may occur

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
IMPACT TO FOSSILS THAT MAY OCCUR									
Without Mitigation	1	1	3	1	6	6	Very Low	(-)	High
With Mitigation	1	1	3	1	6	6	Very Low	(+)	High
Mitigation and Management Measures	— Implement Fossil Chance Find Protocol if fossils are found during construction								

8.14.2 OPERATIONAL PHASE

No impacts are expected during the operation phase.

8.14.3 DECOMMISSIONING PHASE

No impacts are expected during the decommissioning phase.

8.15 VISUAL

8.15.1 CONSTRUCTION PHASE

VISUAL IMPACTS

The following activities will have a visual impact during construction:

- Large construction vehicles, equipment and construction material stockpiles will alter the natural character of the study area and expose visual receptors to impacts associated with construction.
- Construction activities may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings.
- Temporary stockpiling of soil during construction may alter the flat landscape. Wind blowing over these disturbed areas could result in dust which would have a visual impact.
- Dust emissions and dust plumes from increased traffic on the gravel roads serving the construction site may evoke negative sentiments from surrounding viewers.
- Surface disturbance during construction would expose bare soil resulting in visual scarring of the landscape and increasing the level of visual contrast with the surrounding environment.
- Potential visual pollution resulting from littering on the construction site.

The visual impact during the construction phase is expected to be minimal and short term and is indicated in **Table 8.46.**

Table 8.46: Construction Impact on visual

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
VISUAL									
Without Mitigation	3	2	3	4	3	**40**	**Moderate**	(-)	Med
With Mitigation	2	2	3	2	2	**18**	**Low**	(-)	Med

Mitigation and Management Measures	— Carefully plan to minimise the construction period and avoid construction delays.
	— Where possible, restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting.
	— Minimise vegetation clearing and rehabilitate cleared areas as soon as possible.
	— Maintain a neat construction site by removing rubble, litter and waste materials regularly.
	— Position storage / stockpile areas in unobtrusive positions in the landscape, where possible.
	— Make use of existing gravel access roads where possible.
	— Limit the number of vehicles and trucks travelling to and from the construction site, where possible.
	— Ensure that dust suppression techniques are implemented:
	  — On all access roads;
	  — In all areas where vegetation clearing has taken place;								

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
VISUAL									
	— On all soil stockpiles.								

8.15.2 OPERATIONAL PHASE

VISUAL IMPACT

During the operational phase the following activities may have an impact on visual:

— The PV arrays may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings;

— The proposed solar PV facility will alter the visual character of the surrounding area and expose potentially sensitive visual receptor locations to visual impacts;

— Glint and glare from PV arrays may impact nearby receptors;

— Dust emissions and dust plumes from maintenance vehicles accessing the site via gravel roads may evoke negative sentiments from surrounding viewers;

— The night time visual environment will be altered as a result of operational and security lighting at the proposed PV facility.

The operational impact on visual is indicated in **Table 8.47**.

Table 8.47: Operational Impact on visual

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
VISUAL									
Without Mitigation	3	3	3	4	4	**52**	**Moderate**	(-)	Med
With Mitigation	3	3	3	4	4	**52**	**Moderate**	(-)	Med
Mitigation and Management Measures	— Restrict vegetation clearance on the site to that which is required for the correct operation of the facility. — As far as possible, limit the number of maintenance vehicles which are allowed to access the site. — Ensure that dust suppression techniques are implemented on all gravel access roads. — As far as possible, limit the amount of security and operational lighting present on site. — Light fittings for security at night should reflect the light toward the ground and prevent light spill (as far as possible). — Lighting fixtures should make use of minimum lumen or wattage (whilst adhering to relevant safety standards). — Mounting heights of lighting fixtures should be limited, or alternatively, foot-light or bollard level lights should be used (whilst adhering to relevant safety standards). — If economically and technically feasible, make use of motion detectors on security lighting.								

8.15.3 DECOMMISSIONING PHASE

VISUAL IMPACTS

During the decommissioning phase the following activities may have an impact on visual:

— Vehicles and equipment required for decommissioning will alter the natural character of the study area and expose visual receptors to visual impacts.

— Decommissioning activities may be perceived as an unwelcome visual intrusion.

— Dust emissions and dust plumes from increased traffic on the gravel roads serving the decommissioning site may evoke negative sentiments from surrounding viewers.

— Surface disturbance during construction would expose bare soil resulting in visual scarring of the landscape and increasing the level of visual contrast with the surrounding environment.

— Temporary stockpiling of soil during decommissioning may alter the flat landscape. Wind blowing over these disturbed areas could result in dust which would have a visual impact

The decommissioning impact on visual is indicated in **Table 8.48**.

Table 8.48: Decommissioning Impact on visual

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
VISUAL									
Without Mitigation	3	2	3	4	3	40	Moderate	(-)	Med
With Mitigation	2	2	3	2	2	18	Low	(-)	Med
Mitigation and Management Measures	— All infrastructure that is not required for post-decommissioning use should be removed. — Carefully plan to minimize the decommissioning period and avoid delays. — Maintain a neat decommissioning site by removing rubble and waste materials regularly. — Position storage / stockpile areas in unobtrusive positions in the landscape, where possible. — Ensure that dust suppression procedures are maintained on all gravel access roads throughout the decommissioning phase. — All cleared areas should be rehabilitated as soon as possible. — Rehabilitated areas should be monitored post-decommissioning and remedial actions implemented as required, in compliance with the regulatory requirements at the time of decommissioning.									

8.16 SOCIO-ECONOMIC

The development of renewable energy is strongly supported at a national, provincial, and local level. The development of and investment in renewable energy is supported by the National Development Plan (NDP), New Growth Path Framework and National Infrastructure Plan, which all refer to and support renewable energy. The development of renewable energy is also supported by the MMSDF. In this regard the SDF acknowledges the importance of the mining sector and notes that it will need to be accommodated over the short to medium term. However, of relevance to the proposed development the SDF refers to green industries and indicates that the existing site of the Camden Power Station and surrounds should be made available for new industrial development in the long term, to manage the long-term impact of the Power Station being decommissioned.

8.16.1 CONSTRUCTION PHASE

CREATION OF EMPLOYMENT AND BUSINESS OPPORTUNITIES

The construction phase will extend over a period of approximately 18 months and create in the region of 100-150 employment opportunities that will benefit members from the local communities in the area, specifically Ermelo. These opportunities will include opportunities for low, semi and highly workers. Most of the employment opportunities will accrue to Historically Disadvantaged (HD) members of the community. A percentage of the wage bill will be spent in the local economy which will also create opportunities for local businesses in the local towns in the area, specifically Ermelo. Given relatively high local unemployment levels and limited job opportunities in the area, this will represent a significant, if localised, social benefit.

The construction impact on the creation of employment and business opportunities is indicated in **Table 8.49**.

Table 8.49: Construction Impact on employment and business opportunities

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
CREATION OF EMPLOYMENT AND BUSINESS OPPORTUNITIES									
Without Mitigation	3	2		2	3	**21**	**Low**	(+)	High
With Mitigation	3	3		2	4	**32**	**Moderate**	(+)	High
Mitigation and Management Measures	— Employment: — Preparation and implementation of a Stakeholder Engagement Plan (SEP) prior to and during the construction phase. — Where reasonable and practical, the proponent should appoint local contractors and implement a 'locals first' policy, especially for semi and low-skilled job categories. However, due to the low skills levels in the area, the majority of skilled posts are likely to be filled by people from outside the area. — Where feasible, efforts should be made to employ local contactors that are compliant with Broad Based Black Economic Empowerment (BBBEE) criteria. — Before the construction phase commences the proponent should meet with representatives from the Msukaligwa Municipality to establish the existence of a skills database for the area. If such as database exists, it should be made available to the contractors appointed for the construction phase. — The local authorities, community representatives, and organisations on the interested and affected party database should be informed of the final decision regarding the project and the potential job opportunities for locals and the employment procedures that the proponent intends following for the construction phase of the project. — Where feasible, training and skills development programmes for locals should be initiated prior to the initiation of the construction phase. — The recruitment selection process should seek to promote gender equality and the employment of women wherever possible. — Business: — The proponent should liaise with the MM with regards the establishment of a database of local companies, specifically BBBEE companies, which qualify as potential service providers (e.g., construction companies, catering companies, waste collection companies, security companies etc.) prior to the commencement of the tender process for construction service providers. These companies should be notified of the tender process and invited to bid for project-related work.								

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
CREATION OF EMPLOYMENT AND BUSINESS OPPORTUNITIES									
	— Note that while preference to local employees and companies is recommended, it is recognised that a competitive tender process may not guarantee the employment of local labour for the construction phase.								

CONSTRUCTION WORKERS ON LOCAL COMMUNITIES

The presence of construction workers poses a potential risk to family structures and social networks. While the presence of construction workers does not in itself constitute a social impact, the manner in which construction workers conduct themselves can impact on local communities. The most significant negative impact is associated with the disruption of existing family structures and social networks. This risk is linked to potentially risky behaviour, mainly of male construction workers, including:

— An increase in alcohol and drug use.

— An increase in crime levels.

— The loss of girlfriends and/or wives to construction workers.

— An increase in teenage and unwanted pregnancies.

— An increase in prostitution.

— An increase in sexually transmitted diseases (STDs), including HIV.

The construction impact of construction workers on local communities is indicated in **Table 8.50**.

Table 8.50: Construction Impact of construction workers on local communities

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
CONSTRUCTION WORKERS ON LOCAL COMMUNITIES									
Without Mitigation	3	2		2	3	**30**	**Low**	(-)	High
With Mitigation	2	1		2	3	**24**	**Low**	(-)	High
Mitigation and Management Measures	— Preparation and implementation of a Stakeholder Engagement Plan (SEP) prior to and during the construction phase. — Preparation and implementation of a Community Health, Safety and Security Plan (CHSSP) prior to and during the construction phase. — The SEP and CHSSP should include a Grievance Mechanism that enables stakeholders to report resolve incidents. — Where possible, the proponent should make it a requirement for contractors to implement a 'locals first' policy for construction jobs, specifically for semi and low-skilled job categories. — The proponent and contractor should develop a Code of Conduct (CoC) for construction workers. The code should identify which types of behaviour and activities are not acceptable. Construction workers in breach of the code should be subject to appropriate disciplinary action and/or dismissed. All dismissals must comply with the South African labour legislation. The CoC should be signed by the proponent and the contractors before the contractors move onto site. The CoC should form part of the CHSSP. — The proponent and the contractor should implement an HIV/AIDS, COVID-19 and Tuberculosis (TB) awareness programme for all construction workers at the outset of the construction phase. The programmes should form part of the CHSSP.								

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
CONSTRUCTION WORKERS ON LOCAL COMMUNITIES									
	— No construction workers, with the exception of security personnel, should be permitted to stay over-night on the site.								

INFLUX OF JOB SEEKERS

Large construction projects tend to attract people to the area in the hope that they will secure a job, even if it is a temporary job. These job seekers can in turn become "economically stranded" in the area or decide to stay on irrespective of finding a job or not. While the proposed project on its own does not constitute a large construction project, the establishment of a number of renewable energy projects in the area may attract job seekers to the area. As in the case of construction workers employed on the project, the actual presence of job seekers in the area does not in itself constitute a social impact. However, the way in which they conduct themselves can impact on the local community. The main areas of concern associated with the influx of job seekers include:

— Impacts on existing social networks and community structures.
— Competition for housing, specifically low-cost housing.
— Competition for scarce jobs.
— Increase in incidences of crime.

The findings of the SIA indicate that the potential for economically motivated in-migration and subsequent labour stranding is likely to be negligible. The risks associated with the influx of job seekers are therefore likely to be low.

The construction impact of the influx of job seekers is indicated in **Table 8.51**.

Table 8.51: Construction Impact on influx of job seekers

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
INFLUX OF JOB SEEKERS									
Without Mitigation	2	2	3	2	3	**27**	**Low**	(-)	High
With Mitigation	2	1	3	2	3	**24**	**Low**	(-)	High
Mitigation and Management Measures	— Preparation and implementation of a Stakeholder Engagement Plan (SEP) prior to and during the construction phase. — Preparation and implementation of a Community Health, Safety and Security Plan (CHSSP) prior to and during the construction phase. — The proponent should implement a "locals first" policy, specifically with regard to unskilled and low skilled opportunities. — The proponent should implement a policy that no employment will be available at the gate.								

RISK TO SAFETY, LIVESTOCK AND FARM INFRASTRUCTURE

The presence on and movement of construction workers on and off the site poses a potential safety threat to local famers and farm workers in the vicinity of the site. In addition, farm infrastructure, such as fences and gates, may be damaged and stock losses may also result from gates being left open and/or fences being damaged, or stock theft linked either directly or indirectly to the presence of farm workers on the site. The potential risks (safety, livestock, and farm infrastructure) can be effectively mitigated by careful planning and managing the movement of construction on and off the site workers during the construction phase.

The construction impact of risk to safety, livestock and farm infrastructure is indicated in **Table 8.52**.

Table 8.52: Construction Impact of risk to safety, livestock and farm infrastructure

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
RISK TO SAFETY, LIVESTOCK, AND FARM INFRASTRUCTURE									
Without Mitigation	3	2	3	2	3	**30**	**Low**	(-)	High
With Mitigation	2	1	3	2	3	**24**	**Low**	(-)	High
Mitigation and Management Measures	— Preparation and implementation of a Stakeholder Engagement Plan (SEP) prior to and during the construction phase. — Preparation and implementation of a Community Health, Safety and Security Plan (CHSSP) prior to and during the construction phase. — The proponent should enter into an agreement with the local farmers in the area whereby damages to farm property etc. during the construction phase will be compensated for. — All farm gates must be closed after passing through. — Contractors appointed by the proponent should provide daily transport for low and semi-skilled workers to and from the site. — The proponent should establish a CoC for workers (see above). — The proponent should hold contractors liable for compensating farmers and communities in full for any stock losses and/or damage to farm infrastructure that can be linked to construction workers. This should be contained in the Code of Conduct to be signed between the proponent, the contractors, and neighbouring landowners. The agreement should also cover loses and costs associated with fires caused by construction workers or construction related activities (see below). — The proponent should implement a Grievance Mechanism that provides local farmers with an effective and efficient mechanism to address issues related to report issues related to damage to farm infrastructure, stock theft and poaching etc. — The Environmental Management Plan (EMP) must outline procedures for managing and storing waste on site, specifically plastic waste that poses a threat to livestock if ingested. — Contractors appointed by the proponent must ensure that all workers are informed at the outset of the construction phase of the conditions contained in the Code of Conduct, specifically consequences of stock theft and trespassing on adjacent farms. — Contractors appointed by the proponent must ensure that construction workers who are found guilty of stealing livestock and/or damaging farm infrastructure are dismissed and charged. This should be contained in the CoC. All dismissals must be in accordance with South African labour legislation. — It is recommended that no construction workers, with the exception of security personnel, should be permitted to stay over-night on the site.									

NOISE, DUST AND SAFETY IMPACTS

The construction activities on site and movement of heavy construction vehicles during the construction phase has the potential to create noise and dust impacts, damage local roads and create safety impacts for other road users. Based on the findings of the SIA the potential dust and noise impacts associated with the construction phase are likely to be limited. The traffic related impacts associated with the transport of materials to the site can also be effectively managed if the required mitigation measures are implemented.

In terms of impacts to local roads, construction traffic for all projects would need to be co-ordinated with farming activities in order to avoid harvesting periods when unimpeded access to silos at Ermelo and Overvaal is required. The De Emigratie Road and Overvaal Road are of key importance. The critical period is from May to August.

The relevant roads also serve as primary access to and link between a number of study area farms, i.e., are used on a daily basis.

The construction impact of noise, dust and safety indicated in **Table 8.53**.

Table 8.53: Construction Impact of nuisances

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
NOISE, DUST AND SAFETY IMPACTS									
Without Mitigation	2	2	1	2	3	**21**	**Low**	(-)	High
With Mitigation	2	1	1	2	2	**12**	**Very Low**	(-)	High
Mitigation and Management Measures	— Preparation and implementation of a Stakeholder Engagement Plan (SEP) prior to and during the construction phase. — Preparation and implementation of a Community Health, Safety and Security Plan (CHSSP) prior to and during the construction phase. — Timing of construction activities should be planned to avoid / minimise impact on access to the silos at Ermelo and Overvaal, specifically access along the De Emigratie Road and Overvaal Road. The critical period is from May to August. — Ongoing communication with land owners and road users during construction period. This should be outlined in the SEP. — The proponent should implement a Grievance Mechanism that provides local farmers and other road users with an effective and efficient mechanism to address issues related to construction related impacts, including damage to local gravel farm roads. — Implementation of a road maintenance programme throughout the construction phase to ensure that the affected roads maintained in a good condition and repaired once the construction phase is completed. — Repair of all affected road portions at the end of construction period where required. — Dust suppression measures must be implemented on un-surfaced roads, such as wetting on a regular basis and ensuring that vehicles used to transport building materials are fitted with tarpaulins or covers. — All vehicles must be roadworthy, and drivers must be qualified and made aware of the potential road safety issues and need for strict speed limits.									

POTENTIAL LOSS OF LIVESTOCK AND GRAZING AND DAMAGE TO FARM INFRASTRUCTURE ASSOCIATED WITH INCREASED INCIDENCE OF GRASS FIRES

The presence of construction workers and construction-related activities on the site poses an increased risk of grass fires that could, in turn pose, a threat to livestock, crops, wildlife and farm infrastructure. The local landowners indicated that the area is very susceptible to grass fires during the winter months (May-October) and that the veld can take up to 3 years to recover to full productivity.

The construction impact of grass fires to livestock, crops, wild life and farm infrastructure is indicated in **Table 8.54**.

Table 8.54: Construction Impact of grass fires to livestock, crops, wild life and farm infrastructure

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
POTENTIAL LOSS OF LIVESTOCK AND GRAZING AND DAMAGE TO FARM INFRASTRUCTURE ASSOCIATED WITH INCREASED INCIDENCE OF GRASS FIRES									
Without Mitigation	3	2	3	2	3	**30**	**Low**	(-)	High
With Mitigation	2	1	3	2	2	**16**	**Low**	(-)	High
Mitigation and Management Measures	— Preparation and implementation of a Stakeholder Engagement Plan (SEP) prior to and during the construction phase. — Preparation and implementation of a Community Health, Safety and Security Plan (CHSSP) prior to and during the construction phase. — The proponent should enter into an agreement with the local farmers in the area whereby damages to farm property etc., during the construction phase will be compensated for. The agreement should be signed before the construction phase commences. — Contractor should ensure that open fires on the site for cooking or heating are not allowed except in designated areas. — Smoking on site should be confined to designated areas. — Contractor should ensure that construction related activities that pose a potential fire risk, such as welding, are properly managed and are confined to areas where the risk of fires has been reduced. Measures to reduce the risk of fires include avoiding working in high wind conditions when the risk of fires is greater. In this regard special care should be taken during the high risk dry, windy summer months. — Contractor should provide adequate fire-fighting equipment on-site, including a fire fighting vehicle. — Contractor should provide fire-fighting training to selected construction staff. — No construction staff, with the exception of security staff, to be accommodated on site overnight. — As per the conditions of the Code of Conduct, in the advent of a fire being caused by construction workers and or construction activities, the appointed contractors must compensate farmers for any damage caused to their farms. The contractor should also compensate the fire-fighting costs borne by farmers and local authorities.									

LOSS OF FARMLAND

The activities associated with the construction phase and establishment of the proposed project and associated infrastructure will result in the disturbance and loss of land available for crops and grazing. The loss of high-quality agricultural land should where possible be minimised by careful planning in the final layout of the proposed SEF and associated components. The impact on farmland associated with the construction phase can also be mitigated by minimising the footprint of the construction related activities and ensuring that disturbed areas are fully rehabilitated on completion of the construction phase. Recommended mitigation measures are outlined below.

As indicated above, the PV site (including substation and BESS) would occupy approximately 280 ha of Welgelegen 322/1 (approximately 692 ha). The site would therefore occupy approximately 40% (280 of 692 ha) of Welgelegen 322/1 and includes cropping areas. However, currently only ~150 ha of the proposed footprint area of 280 ha is cultivated. The affected land owners indicated that they were not concerned about the loss of the area to farming. In this regard the loss of income from farming would be off-set by PV rental income. Local farmers also indicated that the input costs, specifically fertilizer costs, impacting on the viability of crop farming.

Local landowners also indicated that the timing / phasing on construction activities should where possible be planned to avoid and or minimise disruption to planning and harvesting operations. Harvests are typically marketed in advance and farmers are committed to deliver contracted yields. This requires advance planning to determine how much land needs to be cultivated during the season. Consideration should also be given to planning the construction activities so as to ensure arable areas remain productive for as long as possible, i.e., are not withdrawn from production months in advance. Ideally, construction should start after harvesting and be planned to reduce disruptions to the following planting season.

The construction impact on the loss of farmland is indicated in **Table 8.55**.

Table 8.55: Construction Impact on loss of farmland

Potential Impact LOSS OF FARMLAND	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	3	2	3	2	4	**40**	**Moderate**	(-)	High
With Mitigation	2	1	3	2	3	**24**	**Low**	(-)	High
Mitigation and Management Measures	— The loss of high-quality agricultural land should be avoided and or minimised by careful planning of the final layout of the proposed SEF facilities where possible. — Affected landowners should be notified about the timing of construction related activities in advance. — The footprint associated with the construction related activities (access roads, construction platforms, workshop etc.) should be minimised. — An Environmental Control Officer (ECO) should be appointed to monitor the establishment phase of the construction phase. — All areas disturbed by construction related activities, such as access roads on the site, construction platforms, workshop area etc., should be rehabilitated at the end of the construction phase. — The implementation of a rehabilitation programme should be included in the terms of reference for the contractor/s appointed. The specifications for the rehabilitation programme should be drawn up by the Environmental Consultants appointed to manage the EIA. — The implementation of the Rehabilitation Programme should be monitored by the ECO.								

8.16.2 OPERATIONAL PHASE

IMPROVE ENERGY SECURITY AND SUPPORT RENEWABLE SECTOR

The primary goal of the proposed project is to improve energy security in South Africa by generating additional energy. The proposed SEF also reduces the carbon footprint associated with energy generation. The project should therefore be viewed within the context of the South Africa’s current reliance on coal powered energy to meet the majority of its energy needs, and secondly, within the context of the success of the REIPPPP.

The operational impact on the development of infrastructure to improve energy security and support the renewable sector is indicated in **Table 8.56**.

Table 8.56: Impact of development of infrastructure to improve energy security during the operational phase

Potential Impact IMPROVE ENERGY SECURITY AND SUPPORT RENEWABLE SECTOR	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	4	4		4	4	48	Moderate	(+)	High
With Mitigation	4	4		4	5	60	Moderate	(+)	High
Mitigation and Management Measures	— Maximize the number of employment opportunities for local community members. — Implement training and skills development programs for members from the local community. — Maximise opportunities for local content and procurement.								

CREATION OF EMPLOYMENT AND BUSINESS OPPORTUNITIES

The proposed development will create in the region of 20 full time employment opportunities during the operational phase. Based on similar projects the annual operating budget will be in the region of R 24 million (2022 Rand values), including wages.

The operational impact on the creation of employment and business opportunities is indicated in **Table 8.57**.

Table 8.57: Operational Impact on employment and business opportunities

Potential Impact CREATION OF EMPLOYMENT AND BUSINESS OPPORTUNITIES	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	2	1		4	2	14	Very Low	(+)	High
With Mitigation	1	2		4	4	36	Moderate	(+)	High
Mitigation and Management Measures	— Employment: — Preparation and implementation of a Stakeholder Engagement Plan (SEP) prior to and during the construction phase. — Where reasonable and practical, the proponent should appoint local contractors and implement a 'locals first' policy, especially for semi and low-skilled job categories. However, due to the low skills levels in the area, the majority of skilled posts are likely to be filled by people from outside the area. — Where feasible, efforts should be made to employ local contactors that are compliant with Broad Based Black Economic Empowerment (BBBEE) criteria. — Before the construction phase commences the proponent should meet with representatives from the MM to establish the existence of a skills database for the area. If such as database exists, it should be made available to the contractors appointed for the construction phase. — The local authorities, community representatives, and organisations on the interested and affected party database should be informed of the final decision regarding the project and the potential job opportunities for locals and the employment procedures that the proponent intends following for the construction phase of the project. — Where feasible, training and skills development programmes for locals should be initiated prior to the initiation of the construction phase.								

Potential Impact CREATION OF EMPLOYMENT AND BUSINESS OPPORTUNITIES	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
	— The recruitment selection process should seek to promote gender equality and the employment of women wherever possible. — Business: — The proponent should liaise with the MM with regards the establishment of a database of local companies, specifically BBBEE companies, which qualify as potential service providers (e.g., construction companies, catering companies, waste collection companies, security companies etc.) prior to the commencement of the tender process for construction service providers. These companies should be notified of the tender process and invited to bid for project-related work. — Note that while preference to local employees and companies is recommended, it is recognised that a competitive tender process may not guarantee the employment of local labour for the construction phase. — Investigate providing training and skills development to enable locally based service providers to provide the required services for the operational phase.								

GENERATE INCOME FOR AFFECTED LAND OWNERS

The proponent will be required to either purchase the land or enter into a rental agreement with the affected landowners for the use of the land for the establishment of the proposed SEF. Based on the findings of the SIA the area is prone to droughts and farming operations can be challenging. Any additional source of income therefore represents a significant benefit for the affected landowner(s). The additional income would assist to reduce the risks to their livelihoods posed by droughts and fluctuating market prices for sheep and farming inputs, such as fuel, feed etc. The additional income would improve economic security of farming operations, which in turn would improve job security of farm workers and benefit the local economy.

The impact of additional income for affected land owners during the operational phase is indicated in **Table 8.58**.

Table 8.58: Operational Impact of the generation of additional income for affected land owners

Potential Impact GENERATION OF ADDITIONAL INCOME FOR AFFECTED LAND OWNERS	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	2	1		4	3	**21**	**Low**	(+)	High
With Mitigation	3	2		4	5	**45**	**Moderate**	(+)	High
Mitigation and Management Measures	— Implement agreements with affected landowners. — The loss of high-quality agricultural land should be avoided and or minimised by careful planning in the final layout of the proposed SEF facilities, where possible.								

BENEFITS ASSOCIATED WITH SOCIO-ECONOMIC DEVELOPMENT CONTRIBUTIONS

The REIPPPP has been designed not only to procure energy but has also been structured to contribute to the broader national development objectives of job creation, social upliftment and broadening of economic ownership. Socio-economic development (SED) contributions are an important focus of the REIPPPP and are aimed at ensuring that local communities benefit directly from the investments attracted into the area. These contributions are linked to Community Trusts and accrue over the project operation life and, in so doing, create an opportunity to generate a steady revenue stream over an extended period. This revenue can be used to fund development initiatives in the area and support the local community. The long-term duration of the revenue stream also allows local municipalities and communities to undertake long term planning for the area. The revenue from the proposed SEF can be used to support a number of social and economic initiatives in the area, including:

— Creation of jobs;
— Education;
— Support for and provision of basic services;
— School feeding schemes;
— Training and skills development and
— Support for SMME's.

The benefits associated with socio-economic development contributions during the operational phase is indicated in **Table 8.59**.

Table 8.59: Benefits associated with socio-economic development contributions during the operational phase

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
BENEFITS ASSOCIATED WITH SOCIO-ECONOMIC DEVELOPMENT CONTRIBUTIONS									
Without Mitigation	3	2		4	4	**36**	**Moderate**	(+)	High
With Mitigation	4	3		4	5	**55**	**Moderate**	(+)	High
Mitigation and Management Measures	— The proponents should liaise with the LM and KHLM to identify projects that can be supported by SED contributions. — Clear criteria for identifying and funding community projects and initiatives in the area should be identified. The criteria should be aimed at maximising the benefits for the community as a whole and not individuals within the community. — Strict financial management controls, including annual audits, should be instituted to manage the SED contributions.								

VISUAL IMPACT AND IMPACT ON SENSE OF PLACE

The proposed SEF will impact on the areas existing rural sense of place. However, the impact on the areas sense of place should be viewed within the context of the impact of the Camden Power Station and associated transmission lines on areas sense of place. The areas sense of place has also been impacted by large-scale coal mining operations. The potential visual impact on the areas sense place is therefore likely to be limited. In addition, none of the affected landowners interviewed raised concerns about potential visual impacts associated with the proposed project. Most of the local farmsteads in the area are also screened by the rolling topography or trees.

The visual impact associated with the proposed facility and associated infrastructure and the potential impact on the areas rural sense of place during the operational phase is indicated in **Table 8.60**.

Table 8.60: Visual impact and the potential impact on the areas rural sense of place during the operational phase

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
VISUAL IMPACT AND IMPACT ON SENSE OF PLACE									
Without Mitigation	2	2	3	4	2	**26**	**Low**	(-)	High
With Mitigation	2	2	3	4	2	**26**	**Low**	(-)	High
Mitigation and Management Measures	— The recommendations contained in the VIA should also be implemented. —								

PROPERTY VALUE

The potential loss of productive land and the associated potential impact on property values can also be minimised by careful planning and siting of the PV panels. However, the proposed Camden I PV SEF will result take up ~40% of Welgelegen 322/1, including cropped land.

The operational impact on property values is indicated in **Table 8.61**.

Table 8.61: Operational impact on property values

Potential Impact PROPERTY VALUES	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	2	2		4	2	**16**	**Low**	(-)	High
With Mitigation	2	1		4	2	**14**	**Very Low**	(-)	High
Mitigation and Management Measures	— The recommendations contained in the VIA should be implemented.								

TOURISM

Based on the findings of the SIA the proposed SEF will not impact on the tourism in the area. Only one tourist accommodation facility is located within 5 km of the site, namely the Camden Guest House located adjacent to Camden Power station 3 km to the north of the site. The nearest other facility is located to the north and north-east of the site, namely the Indawo Game Lodge (7 km). Indawo is located in closer proximity to Camden power station, the N2 and mining areas than the site. A few venue-type facilities are located on the southern outskirts of Ermelo, these essentially catering for local functions such as weddings. The nearest is Oogappel, located near the intersection of the N11 and De Emigratie road 11 km north-west of the site.

The impact on tourism in the region during the operational phase is indicated in **Table 8.62**.

Table 8.62: Impact on tourism in the region during the operational phase

Potential Impact IMPACT ON TOURISM IN THE REGION DURING THE OPERATIONAL PHASE	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	1	2		4	2	**14**	**Very Low**	(-)	High
With Mitigation	1	2		4	2	**14**	**Very Low**	(-)	High
Mitigation and Management Measures	— No mitigation measures required								

8.16.3 DECOMMISSIONING PHASE

There are no anticipated social impacts during the decommissioning phase.

8.17 WASTE MANAGEMENT

8.17.1 CONSTRUCTION PHASE

Construction-related waste is not anticipated to trigger the need for a Waste Management Licence (WML) in terms of NEMWA (Refer to Section 2). Waste management at the Project site will be undertaken in line with the EMPr to consider the correct disposal of general and hazardous waste generated on the Project. **Table 8.63** describes the different waste streams that the proposed Project will likely generate, as well as the various potential management options. Due to the nature of the Project, waste will mainly be generated during the construction phase. During operation, Eskom staff are only on the site for limited amount of time as and when maintenance is required.

The construction impact on improper waste management and littering is indicated in **Table 8.64**.

Table 8.63: Waste Management Options

WASTE	TYPE OF WASTE	MANAGEMENT OPTIONS
Hydrocarbons (Contaminated soil)	Hazardous	Fuel and oil spillages can be a source of contamination of water sources and the soil. Management options include: — Ensure hazardous waste is stored separately from general waste; — Using spill kits to clean any spillages; — Ensure storage facilities are maintained and meet industry regulations; — Transportation and storage of fuel must be regulated and correctly managed according to the EMPr; — Waste generated along servitude to be taken to the contractor laydown area at the end of each day; — Co-ordinate waste removal with the removal of waste from the contractor laydown area; and — All hazardous waste is to be disposed of at a registered hazardous landfill (safe disposal certificates must be obtained).
Contaminated Personal Protective Equipment (PPE) / Used oil containers	Hazardous	PPE can be contaminated during handling of hydrocarbons. Management options include: — Store contaminated PPE / used oil containers in hazardous waste skips or similarly demarcated/bunded area — Waste generated to be taken to the contractor laydown area at the end of each day; — Co-ordinate waste removal with the removal of waste from the contractor laydown area; and — Ensure contaminated PPE is disposed of at a registered hazardous landfill (safe disposal certificates must be obtained).
General waste	General	General waste (inorganic matter) can be disposed of as per normal and form part of the municipal waste management system. Management options include: — Ensure waste is stored securely in refuse bins; — Recycling of waste to be undertaken, where possible; — Waste generated to be taken to the contractor laydown area at the end of each day; and — Co-ordinate waste removal with the general removal of waste from the contractor laydown area.
Food waste	General	Food waste is generated as site personnel take their meals on the construction site. Management options include: — Store any waste and packaging into a labelled food waste bin; — Waste generated be taken to the contractor laydown area at the end of each day; — Co-ordinate waste removal with the removal of waste from the contractor laydown area; and — Co-ordinate waste removal with the general removal of waste from the contractor laydown area.

Table 8.64: Construction Impact on Improper Waste Management

Potential Impact: IMPROPER WASTE MANAGEMENT AND LITTERING	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	3	1	3	1	4	**32**	**Moderate**	(-)	High
With Mitigation	2	1	1	1	3	**15**	**Very Low**	(-)	High

Mitigation and Management Measures	— Waste management must be a priority and all waste must be collected and stored adequately. It is recommended that all waste be stored at the construction camp / laydown area and removed from site on a weekly basis to prevent rodents and pests entering the site; — A minimum of one toilet must be provided per 10 persons; — The Contractor should supply sealable and properly marked domestic waste collection bins and all solid waste collected shall be disposed of at a licensed disposal facility; — Hazardous waste must be stored separately in covered containers and appropriately disposed of at a licensed disposal facility; — Recycling should take place, where possible; — Where a registered disposal facility is not available close to the Project area, the Contractor shall provide a method statement with regards to waste management. Under no circumstances may domestic waste be burned on site; and — Storage of domestic waste shall be in covered waste skips.

8.17.2 OPERATIONAL PHASE

No operational phase impacts are expected as a maintenance team will only be on site as and when required (intermittently) and for an extremely limited time. As such, the impacts are considered negligible.

8.17.3 DECOMMISSIONING PHASE

The impacts are anticipated to be similar to the assessed for the construction phase.

8.18 SAFETY, HEALTH AND ENVIRONMENTAL RISK

A high-level Safety Health and Environmental Risk Assessment for the proposed SSL or VRF BESS was undertaken for the construction, operational and decommissioning phases.

8.18.1 CONSTRUCTION PHASE

SSL BESS

HUMAN HEALTH - CHRONIC EXPOSURE TO TOXIC CHEMICAL OR BIOLOGICAL AGENTS

Construction materials such as cement, paints, solvents, welding fumes, truck fumes etc. can cause chronic exposure to toxic chemical or biological agents to employees and contractors. The construction impact on human health - chronic exposure to toxic chemical or biological agents is indicated in **Table 8.65**.

Table 8.65: Construction Impact on human health - chronic exposure to toxic chemical or biological agents for SSL BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN HEALTH - CHRONIC EXPOSURE TO TOXIC CHEMICAL OR BIOLOGICAL AGENTS									
Without Mitigation	3	1	3	4	4	**44**	**Moderate**	(-)	High
With Mitigation	1	1	3	4	2	**18**	**Low**	(-)	High
Mitigation and Management Measures	— The construction phase will be managed according to all the requirements of the Occupational Health and Safety Act 85 of 1993 specifically the Construction Regulations.								

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN HEALTH - CHRONIC EXPOSURE TO TOXIC CHEMICAL OR BIOLOGICAL AGENTS									
	— SHEQ policy in place. — A detailed construction risk assessment prior to work. — SHE procedure in place. — PPE to be specified. — SHE appointees in place. — Contractor's safety files in place and up to date. — All necessary health controls/ practices to be in place, e.g. ventilation of welding and painting areas. — SHE monitoring and reporting programs in place. — Emergency response plan to be in place prior to beginning construction and to include aspects such as appointment of emergency controller, provision of first aid, first responder contact numbers.								

HUMAN HEALTH - EXPOSURE TO NOISE

Drilling, piling, generators and air compressors can cause exposure to noise resulting in adverse impact on hearing of workers and possible nuisance factor in near-by areas. The construction impact on human health - exposure to noise is indicated in **Table 8.66**.

Table 8.66: Construction Impact on human health - exposure to noise for SSL BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN HEALTH - EXPOSURE TO NOISE									
Without Mitigation	3	1	5	5	4	56	Moderate	(-)	High
With Mitigation	2	1	5	5	2	26	Low	(-)	High
Mitigation and Management Measures	— Health risk assessment to determine if equipment noise exceeds 85dB at workstation and 61dB at boundary of the site. — Employees to be provided with hearing protection if working near equipment that exceeds the noise limits.								

HUMAN HEALTH - EXPOSURE TO TEMPERATURE EXTREMES AND/OR HUMIDITY

Exposure to extreme temperatures and/or humidity such as heat during the day and cold weather in winter can result in heat stroke or hypothermia. The construction impact on human health - exposure to temperature extremes and/or humidity is indicated in **Table 8.67**.

Table 8.67: Construction Impact on human health - exposure to temperature extremes and/or humidity for SSL BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN HEALTH - EXPOSURE TO TEMPERATURE EXTREMES AND/OR HUMIDITY									
Without Mitigation	3	2	3	1	2	18	Low	(-)	High
With Mitigation	2	2	3	1	1	8	Very Low	(-)	High
Mitigation and Management Measures	— Construction site facilities to comply with Occupational Health and Safety Act 85 of 1993 specifically the thermal, humidity, lighting and ventilation requirements of the Environmental Regulations for Workplaces. — Adequate potable water for employees to be provided during all phases of the project. Bore hole, bowser and tank or small water								

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN HEALTH - EXPOSURE TO TEMPERATURE EXTREMES AND/OR HUMIDITY									
	treatment plant may be required to provide potable water for the BESS installation staff during all phases of the project.								

HUMAN HEALTH - EXPOSURE TO PSYCHOLOGICAL STRESS

Large projects bring many contractor workers into a small, isolated community. This may result in lack of sufficient accommodation, entertainment etc. which in turn may increase in alcohol abuse, violence. The construction impact on human health - exposure to psychological stress is indicated in **Table 8.68**.

Table 8.68: Construction Impact on human health - exposure to psychological stress for SSL BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN HEALTH - EXPOSURE TO PSYCHOLOGICAL STRESS									
Without Mitigation	2	3	3	2	2	**20**	**Low**	(-)	High
With Mitigation	2	3	3	2	2	**20**	**Low**	(-)	High
Mitigation and Management Measures	— Implement mitigation measures as per the Socio-Economic Assessment recommendations								

HUMAN HEALTH - EXPOSURE TO ERGONOMIC STRESS

Lifting heavy equipment and at awkward angles during construction can result in back and other injuries. The construction impact on human health - exposure to ergonomic stress is indicated in **Table 8.69**.

Table 8.69: Construction Impact on human health - exposure to ergonomic stress for SSL BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN HEALTH - EXPOSURE TO ERGONOMIC STRESS									
Without Mitigation	4	1	3	2	3	**30**	**Low**	(-)	High
With Mitigation	4	1	3	2	2	**20**	**Low**	(-)	High
Mitigation and Management Measures	— Training in lifting techniques. — Ensure that despite the isolated location all the necessary equipment is available (and well maintained) during construction. Otherwise employees may revert to unsafe practices. — Isolated location, maintenance of construction equipment to ensure safe operation is critical. Ensure this is in place prior to project beginning. — First aid provision on site.								

HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO FIRE RADIATION

Involvement in an external fire such as fire involving fuels used in construction vehicles or vehicles themselves (e.g. tyre fire); fire due to uncontrolled welding or other hot-work may result in injuries due to radiation especially amongst first responders and bystanders. Fatalities are unlikely from the heat radiation as not highly flammable nor massive fire. The construction impact on human and equipment safety - exposure to fire radiation is indicated in **Table 8.70**.

Table 8.70: Construction Impact on human and equipment safety - exposure to fire radiation for SSL BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO FIRE RADIATION									
Without Mitigation	4	2	3	5	4	**56**	**Moderate**	(-)	High
With Mitigation	4	2	3	5	2	**28**	**Low**	(-)	High
Mitigation and Management Measures	— Fuels stored on site in dedicated, demarcated and bunded areas. — Suitable fire-fighting equipment on site near source of fuel, e.g. diesel tank, generators, mess, workshops etc — Emergency plan to be in place prior to commencement of construction. — Fuel spill containment procedures and equipment to be in place. — Hot-work permit and management system to be in place.								

Solid state battery containers damaged on route e.g. dropped in port (drops do happen about 1/2000 containers) and importing possibly approximately 100 containers for the site. With this it is possible, although unlikely, that one will be dropped, traffic accident on-route. Involvement in an external fire e.g. at the port or on route. Data indicates installed facility events are 0.001/year. Transport of 100 units per installation assumed to take 4 weeks each so f= 0.008 once in 125 years so the likelihood is very low. A consequence of this could be injuries due to radiation especially amongst first responders and bystanders. Fatalities are unlikely from the heat radiation as not highly flammable nor massive. The construction impact on human and equipment safety - exposure to fire radiation is indicated in **Table 8.71**.

Table 8.71: Construction Impact on human and equipment safety - exposure to fire radiation for SSL BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO FIRE RADIATION									
Without Mitigation	5	2	5	5	2	**34**	**Moderate**	(-)	High
With Mitigation	5	2	5	5	1	**17**	**Low**	(-)	High
Mitigation and Management Measures	— Solid state battery design includes abuse tests such as drop test, impact, rapid discharge etc. Propagation tests for systems, e.g. heat insulating materials between cells/modules. Factory acceptance test prior to prior to leaving manufacture. Batteries are usually stored at 50% charge to prolong life but may be shipped fully discharged. This level of detail should be understood so as to assess the risk during transport and storage. — The appointed contractor should ensure suitably competent transport companies are appointed. The company responsible for transportation should ensure: - Compliance with National Road Traffic Act regulation 8 – dangerous goods. — Port Authorities should be alerted to the overall project and the hazardous nature of the contents of battery containers being imported. Note. If, as per one of the typical suppliers (Tesla) indications, the containers are classified as IMDG Class 9 – the containers will not receive any special care in the ports and may be stored next to flammables. Port emergency response in particular need training on mitigating battery hazards. — Prior to bringing any containers into the country a full Emergency response plan should be in place for the full route from the ship to the site. Drivers trained in the hazards of containerized batteries. Emergency plan to determine and address: What gases would be released in a fire and are there inhalation hazards								

Potential Impact HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO FIRE RADIATION	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
	— Extinguishing has two important elements, put out fire and to provide cooling. Different approaches may be needed for small fire – e.g. put out, and for large fires e.g. cool with copious quantities of water. Note inert gases and foam may put out the initial fire but fail to control thermal runaway or to cool the batteries resulting in reignition. — What initial fire extinguishing medium should be used? — Are there any secondary gases or residues from use of extinguishers? — If water is appropriate, may need outside connections to inside sprinklers. — First responders need to know what media to use, especially if water totally unsuitable and if there are no connection points for water etc. — Must the container be left unopened or opened? — PPE to be specified including possible exposure to chemicals and fumes as well as radiate heat. — Containment of residues/water/damaged equipment. — Suitable safe making and disposal plan for after the event i.e. how do responders deal with partially charged damaged units, contaminated surfaces (e.g. HF residues).									

HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO EXPLOSION OVER PRESSURES

With solid state lithium containers, flammable gases generated by thermal run away reach explosive limits. The consequence of this is potential fatalities amongst first responders; damage to container, transport truck or other nearby items, e.g. other containers in the port. The construction impact on human and equipment safety - exposure to explosion over pressures is indicated in **Table 8.72**.

Table 8.72: Construction Impact on human and equipment safety - exposure to explosion over pressures for SSL BESS

Potential Impact HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO EXPLOSION OVER PRESSURES	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	5	4	5	5	3	57	Moderate	(-)	High
With Mitigation	5	4	5	5	1	19	Low	(-)	High
Mitigation and Management Measures	— During transport this is only likely to happen due to possible inappropriate emergency response, e.g. opening containers when they may be the type that should be left to burn out. — For simplicity one transport route would be preferable. The route needs to be assessed in terms of responding local services, rest places for drivers, refuelling if required, break down services available etc. — Once an import route has been chosen, e.g. Richards Bay or Durban and along N2/N3/N11 etc, then the appointed transport company should ensure key emergency services on route could be given awareness training in battery fire/accident response. — Emergency response planning and training referred to above may be important for key locations such as the mountain passes / tunnels.									

HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO ACUTE TOXIC CHEMICAL AND BIOLOGICAL AGENTS

Human pathogens and diseases, sewage, food waste as well as snakes, insects, wild and domesticated animals and harmful plants can cause illness and at worst without mitigation, possibly extending to fatalities. Effects can vary from discomfort to fatalities for venomous snakes or bee swarms etc. The construction impact on human and equipment safety - exposure to acute toxic chemical and biological agents is indicated in **Table 8.73**.

Table 8.73: Construction Impact on human and equipment safety - exposure to acute toxic chemical and biological agents for SSL BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO ACUTE TOXIC CHEMICAL AND BIOLOGICAL AGENTS									
Without Mitigation	4	2	3	2	3	33	Moderate	(-)	High
With Mitigation	3	2	3	2	2	20	Low	(-)	High
Mitigation and Management Measures	— All necessary good hygiene practices to be in place, e.g. provision of toilets, eating areas, infectious disease controls. — Policies and practice for dealing with known vectors of disease such as Aids, TB, COVID 19 and others. — Awareness training for persons on site, safety induction to include animal hazards. — First aid and emergency response to consider the necessary anti-venom, anti-histamines, topical medicines etc. — Due to isolated locations some distance from town, the ability to treat with anti-venom and extreme allergic reactions on site is critical to mitigate the impacts								

Damaged solid-state batteries release fumes, leak electrolyte, are completely broken exposing hazardous chemicals and thermal runaway and hazardous fumes released can cause mild skin irritation from exposure to small leaks to serious corrosive burns or lung damage. The construction impact on human and equipment safety - exposure to acute toxic chemical and biological agents is indicated in **Table 8.74**.

Table 8.74: Construction Impact on human and equipment safety - exposure to acute toxic chemical and biological agents for SSL BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO ACUTE TOXIC CHEMICAL AND BIOLOGICAL AGENTS									
Without Mitigation	4	3	3	5	3	45	Moderate	(-)	High
With Mitigation	4	3	3	5	2	30	Low	(-)	High
Mitigation and Management Measures	— Appointed transport company to ensure transport in accordance with Regulation 8 of the National Road Traffic Act 93 of 1996, Dangerous Goods. Not permitted to transport prescribed goods in manner not consistent with the prescriptions, e.g. consignor and consignee responsibilities. Prescription found in SANS 10228/29 and international codes for battery transport etc. — Transport in sealed packages that are kept upright, protected from movement damage etc. — Also packaged to ensure no short-circuiting during transport. — Transport to prevent excessive vibration considerations as battery internal may be damaged leading to thermal run-away during commissioning.								

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO ACUTE TOXIC CHEMICAL AND BIOLOGICAL AGENTS									
	— Pre-assembled containers will most likely be supplied. These will be fitted with the necessary protective measures by the supplier considering marine and road transport as well as lifting, setting down etc. — Route selection to consider possible incidents along the way and suitable response, e.g. satellite tracking, mobile communication, 24/7 helpline response. — Standard dangerous goods requirements for Hazmat labels, Trem cards, driver trained in the hazards of the load. — Likelihood similar to fire above.								

HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO VIOLENT RELEASE OF KINETIC OR POTENTIAL ENERGY

Construction moving equipment, heavy loaded, elevated loads, and working at heights can cause injury or possibly fatality, damage to equipment, delays in starting the project and financial losses. The construction impact on human and equipment safety - exposure to violent release of kinetic or potential energy is indicated in **Table 8.75**.

Table 8.75: Construction Impact on human and equipment safety - exposure to violent release of kinetic or potential energy for SSL BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO VIOLENT RELEASE OF KINETIC OR POTENTIAL ENERGY									
Without Mitigation	5	1	5	5	4	64	High	(-)	High
With Mitigation	5	1	5	5	1	16	Low	(-)	High
Mitigation and Management Measures	— The construction phase will be managed according to all the requirements of the Occupational Health and Safety Act 85 of 1993 specifically the Construction Regulations. — SHEQ policy in place. — A detailed construction risk assessment prior to work. — SHE procedure in place. — PPE to be specified. — SHE appointees in place. — Contractors safety files in place and up to date. — SHE monitoring and reporting programs in place. — Standard construction site rules regarding traffic, reversing sirens, rigging controls, cordoning off excavations etc. — Civil and building structures to National Building Regulations and building Standards Act 103 of 1977 SANS 10400 and other relevant codes. — Other constructions such as roads, sewers etc also to relevant SANS standards. — All normal procedures for working at heights, hot work permits, confined space entry, cordon off excavations etc to be in place before construction begins. — Emergency response plan to be in place before construction begins.								

HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO ELECTROMAGNETIC WAVES

Use of electrical machines, generators etc. and hot dry area static generation is highly likely as well as lightning strike. This may cause electrocution, ignition, burns, injury and death, as well as damage to electrical equipment. The construction impact on human and equipment safety - exposure to electromagnetic waves is indicated in **Table 8.76.**

Table 8.76: Construction Impact on human and equipment safety - exposure to electromagnetic waves for SSL BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO ELECTROMAGNETIC WAVES									
Without Mitigation	5	2	5	5	3	51	Moderate	(-)	High
With Mitigation	5	2	5	5	1	17	Low	(-)	High
Mitigation and Management Measures	— Standard maintenance of condition of electrical equipment and safe operating instructions. — Ability to shut off power to systems in use on site. — If persons are decanting fuels or dealing with other highly flammable materials care should be taken regarding possible static discharge, installations to be suitably designed and maintained. — Lightning strike rate in the study area is very high. — Outside work must be stopped during thunderstorms. — Lighting conductors may be required for the final installation, to be confirmed during design phase.								

ENVIRONMENT - EMISSIONS TO AIR

Dust from construction and generally hot dry area may cause adverse impact on employee health. The construction impact on environment - emissions to air is indicated in **Table 8.77**.

Table 8.77: Construction Impact on environment - emissions to air for SSL BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
ENVIRONMENT - EMISSIONS TO AIR									
Without Mitigation	3	2	1	1	4	28	Low	(-)	High
With Mitigation	2	2	1	1	2	12	Very Low	(-)	High
Mitigation and Management Measures	— May need to use dampening on roads etc. as per normal construction practices. — May need PPE (dust masks) for specific construction workers.								

ENVIRONMENT - EMISSIONS TO WATER

Diesel for equipment, paints and solvents, transformer oil spills, sewage and kitchen/mess area wastewater can cause environmental damage, particularly to the surface and underground water in the area. The construction impact on environment - emissions to water is indicated in **Table 8.78**.

Table 8.78: Construction Impact on environment - emissions to water for SSL BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
ENVIRONMENT - EMISSIONS TO WATER									
Without Mitigation	2	2	3	2	3	27	Low	(-)	High

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
ENVIRONMENT - EMISSIONS TO WATER									
With Mitigation	2	2	3	2	2	**18**	**Low**	(-)	High
Mitigation and Management Measures	— Normal construction site practices for preventing and containing fuels/paint/oil etc spills. — Bunding under any temporary tanks, curbing under truck offloading areas and sealed surfaces (e.g. concrete) under truck parking area is particularly important. — Spill clean-up procedures to be in place before commencing construction. — Sewage and any kitchen liquids - containment and suitable treatment/disposal								

ENVIRONMENT - EMISSIONS TO EARTH

Mess area and other solid waste can cause environmental damage. The construction impact on environment - emissions to earth is indicated in **Table 8.79**.

Table 8.79: Construction Impact on environment - emissions to earth for SSL BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
ENVIRONMENT - EMISSIONS TO EARTH									
Without Mitigation	2	2	3	3	3	**30**	**Low**	(-)	High
With Mitigation	1	2	3	3	2	**18**	**Low**	(-)	High
Mitigation and Management Measures	— There will be packaging materials that will need to be disposed of after the entire system is connected and commissioned as well as after regular maintenance. — There will need to be waste segregation (e.g. electronic equipment, chemicals) and management on the site.								

ENVIRONMENT - WASTE OF RESOURCES E.G. WATER, POWER ETC

Water usage that is not controlled and battery containers that may be damaged may cause construction delays due to a waste of resources. The construction impact on environment - waste of resources e.g. water, power etc is indicated in **Table 8.80**.

Table 8.80: Construction Impact on environment - waste of resources e.g. water, power etc for SSL BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
ENVIRONMENT - WASTE OF RESOURCES E.G. WATER, POWER ETC									
Without Mitigation	1	1	1	2	4	**20**	**Low**	(-)	High
With Mitigation	1	1	1	2	2	**10**	**Very Low**	(-)	High
Mitigation and Management Measures	— Water usage to be monitored on site during construction. — Handling protocols to be provided by battery supplier. — End of Life plan needs to be in place before any battery containers enter the country as there may be damaged battery unit from day 1. — Water management plan and spill containment plans to be in place.								

PUBLIC - AESTHETICS

Bright surfaces reflecting light and tall structures in a flat area may cause irritation. The construction impact on public - aesthetics is indicated in **Table 8.81**.

Table 8.81: Construction Impact on public – aesthetics for SSL BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
PUBLIC - AESTHETICS									
Without Mitigation	2	2	3	3	3	**30**	**Low**	(-)	High
With Mitigation	2	2	3	3	3	**30**	**Low**	(-)	High
Mitigation and Management Measures	— Visual impact assessment to include BESS installation when design details become available.								

INVESTORS - FINANCIAL

Defective technology and extreme project delays can cause financial loss. The construction impact on investors - financial is indicated in **Table 8.82**.

Table 8.82: Construction Impact on investors – financial for SSL BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
INVESTORS - FINANCIAL									
Without Mitigation	5	1	3	4	3	**39**	**Moderate**	(-)	High
With Mitigation	3	1	3	4	2	**22**	**Low**	(-)	High
Mitigation and Management Measures	— Design by experienced contractors using internationally recognized and proven technology. — Project management with deviation monitoring.								

EMPLOYEES AND INVESTORS – SECURITY

On route to the construction site there is a risk of potential hi-jacking of valuable but hazardous loads. On site there is a risk of theft of construction equipment and battery installation facilities. There may also be civil unrest or violent strike by employees. This may result in theft, injury to burglars, damage to equipment possibly setting off thermal runaway. The construction impact on employees and investors – security is indicated in **Table 8.83**.

Table 8.83: Construction Impact on employees and investors – security for SSL BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
EMPLOYEES AND INVESTORS – SECURITY									
Without Mitigation	4	1	3	2	4	**40**	**Moderate**	(-)	High
With Mitigation	3	1	3	2	3	**27**	**Low**	(-)	High
Mitigation and Management Measures	— Fencing around electrical infrastructure to SANS standard and Eskom Guidelines. — The hazardous nature of the electrical and battery equipment should be clearly indicated – e.g. Skull and Cross Bones or other signs. — Isolated location both helps and hinders security. — Night lighting to be provided both indoors and outdoors where necessary.								

EMERGENCIES

Fires, explosions, toxic smoke, large spills, traffic accidents, equipment/structural collapse, inadequate emergency response to small events that can lead to escalation, may result in injuries which can turn into fatalities, and small losses become extended down time. The construction impact on emergencies is indicated in **Table 8.84**.

Table 8.84: Construction Impact on emergencies for SSL BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
EMERGENCIES									
Without Mitigation	4	2	3	5	4	**56**	**Moderate**	(-)	High
With Mitigation	4	2	3	5	2	**28**	**Low**	(-)	High
Mitigation and Management Measures	— Fencing around electrical infrastructure to SANS standard and Eskom Guidelines. — The hazardous nature of the electrical and battery equipment should be clearly indicated – e.g. Skull and Cross Bones or other signs. — Isolated location both helps and hinders security. — Night lighting to be provided both indoors and outdoors where necessary. — Emergency procedures need to be practiced prior to commencement of construction. — If batteries are stored at 50% charge, thermal run away can happen while in storage on site waiting for installation. In addition, if involved in an external fire thermal run away can happen even with uncharged batteries. — The company in charge of the containers at each stage in the transport process needs to be very clear so that responsibility for the integrity of the load and protection of the persons involved in transfer and coordination of emergency response on-route. E.g. if purchased from Tesla where does hand over occur to the South African contractor / owner, at the factory door in USA, at the port in RSA, at the site fence. For example, who will be accountable if there's thermal runway event on a truck with a container that stops in a small town for driver refreshments.									

INVESTORS – LEGAL

The battery field is evolving quickly with new guides, codes and regulations happening at the same time as evolving technology. This may result in unknown hazards that may manifest due to using "cheaper supplier or less developed technology". The construction impact on investors – legal is indicated in **Table 8.85**.

Table 8.85: Construction Impact on investors – legal for SSL BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
INVESTORS – LEGAL									
Without Mitigation	3	1	3	3	4	**40**	**Moderate**	(-)	High
With Mitigation	2	1	3	3	2	**18**	**Low**	(-)	High
Mitigation and Management Measures	— Use only internationally reputable battery suppliers who comply with all known regulations/guideline at the time of purchasing. — Ensure only latest state of the art battery system are used and not old technologies prone to fires/explosions etc..									

VRF BESS

HUMAN HEALTH - CHRONIC EXPOSURE TO TOXIC CHEMICAL OR BIOLOGICAL AGENTS

Construction materials such as cement, paints, solvents, welding fumes, truck fumes etc. can cause chronic exposure to toxic chemical or biological agents to employees and contractors. The construction impact on human health - chronic exposure to toxic chemical or biological agents is indicated in **Table 8.86**.

Table 8.86: Construction Impact on human health - chronic exposure to toxic chemical or biological agents for VRF BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN HEALTH - CHRONIC EXPOSURE TO TOXIC CHEMICAL OR BIOLOGICAL AGENTS									
Without Mitigation	3	1	3	4	4	44	Moderate	(-)	High
With Mitigation	1	1	3	4	2	18	Low	(-)	High
Mitigation and Management Measures	— The construction phase will be managed according to all the requirements of the Occupational Health and Safety Act 85 of 1993 specifically the Construction Regulations. — SHEQ policy in place. — A detailed construction risk assessment prior to work. — SHE procedure in place. — PPE to be specified. — SHE appointees in place. — Contractor's safety files in place and up to date. — All necessary health controls/ practices to be in place, e.g. ventilation of welding and painting areas. — SHE monitoring and reporting programs in place. — Emergency response plan to be in place prior to beginning construction and to include aspects such as appointment of emergency controller, provision of first aid, first responder contact numbers.								

HUMAN HEALTH - EXPOSURE TO NOISE

Drilling, piling, generators and air compressors can cause exposure to noise resulting in adverse impact on hearing of workers and possible nuisance factor in near-by areas. The construction impact on human health - exposure to noise is indicated in **Table 8.87**.

Table 8.87: Construction Impact on human health - exposure to noise VRF BESS for VRF BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN HEALTH - EXPOSURE TO NOISE									
Without Mitigation	3	1	5	5	4	56	Moderate	(-)	High
With Mitigation	2	1	5	5	2	26	Low	(-)	High
Mitigation and Management Measures	— Health risk assessment to determine if equipment noise exceeds 85dB at workstation and 61dB at boundary of the site. — Employees to be provided with hearing protection if working near equipment that exceeds the noise limits.								

HUMAN HEALTH - EXPOSURE TO TEMPERATURE EXTREMES AND/OR HUMIDITY

Exposure to extreme temperatures and/or humidity such as heat during the day and cold weather in winter can result in heat stroke or hypothermia. The construction impact on human health - exposure to temperature extremes and/or humidity is indicated in **Table 8.88**.

Table 8.88: Construction Impact on human health - exposure to temperature extremes and/or humidity for VRF BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN HEALTH - EXPOSURE TO TEMPERATURE EXTREMES AND/OR HUMIDITY									
Without Mitigation	3	2	3	1	2	**18**	**Low**	(-)	High
With Mitigation	2	2	3	1	1	**8**	**Very Low**	(-)	High
Mitigation and Management Measures	— Construction site facilities to comply with Occupational Health and Safety Act 85 of 1993 specifically the thermal, humidity, lighting and ventilation requirements of the Environmental Regulations for Workplaces. — Adequate potable water for employees to be provided during all phases of the project. Bore hole, bowser and tank or small water treatment plant may be required to provide potable water for the BESS installation staff during all phases of the project.								

HUMAN HEALTH - EXPOSURE TO PSYCHOLOGICAL STRESS

Large projects bring many contractor workers into a small, isolated community. This may result in lack of sufficient accommodation, entertainment etc. which in turn may increase in alcohol abuse, violence. The construction impact on human health - exposure to psychological stress is indicated in **Table 8.89**.

Table 8.89: Construction Impact on human health - exposure to psychological stress for VRF BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN HEALTH - EXPOSURE TO PSYCHOLOGICAL STRESS									
Without Mitigation	2	3	3	2	2	**20**	**Low**	(-)	High
With Mitigation	2	3	3	2	2	**20**	**Low**	(-)	High
Mitigation and Management Measures	— .Implement mitigation measures as per the Socio-Economic Assessment recommendations								

HUMAN HEALTH - EXPOSURE TO ERGONOMIC STRESS

Lifting heavy equipment and at awkward angles during construction can result in back and other injuries. The construction impact on human health - exposure to ergonomic stress is indicated in **Table 8.90**.

Table 8.90: Construction Impact on human health - exposure to ergonomic stress for VRF BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN HEALTH - EXPOSURE TO ERGONOMIC STRESS									
Without Mitigation	4	1	3	2	3	**30**	**Low**	(-)	High
With Mitigation	4	1	3	2	2	**20**	**Low**	(-)	High
Mitigation and Management Measures	— Training in lifting techniques. — Ensure that despite the isolated location all the necessary equipment is available (and well maintained) during construction. Otherwise employees may revert to unsafe practices. — Isolated location, maintenance of construction equipment to ensure safe operation is critical. Ensure this is in place prior to project beginning.								

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN HEALTH - EXPOSURE TO ERGONOMIC STRESS									
	— First aid provision on site.								

HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO FIRE RADIATION

Involvement in an external fire such as fire involving fuels used in construction vehicles or vehicles themselves (e.g. tyre fire); fire due to uncontrolled welding or other hot-work may result in injuries due to radiation especially amongst first responders and bystanders. Fatalities are unlikely from the heat radiation as not highly flammable nor massive fire. The construction impact on human and equipment safety - exposure to fire radiation is indicated in **Table 8.91**.

Table 8.91: Construction Impact on human and equipment safety - exposure to fire radiation for VRF BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO FIRE RADIATION									
Without Mitigation	4	2	3	5	4	56	Moderate	(-)	High
With Mitigation	4	2	3	5	2	28	Low	(-)	High
Mitigation and Management Measures	— Fuels stored on site in dedicated, demarcated and bunded areas. — Suitable fire-fighting equipment on site near source of fuel, e.g. diesel tank, generators, mess, workshops etc — Emergency plan to be in place prior to commencement of construction. — Fuel spill containment procedures and equipment to be in place. — Hot-work permit and management system to be in place.								

HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO EXPLOSION OVER PRESSURES

There are no credible causes for exposure to explosion over pressures. The construction impact on human and equipment safety - exposure to explosion over pressures is indicated in **Table 8.92**.

Table 8.92: Construction Impact on human and equipment safety - exposure to explosion over pressures for VRF BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO EXPLOSION OVER PRESSURES									
Without Mitigation	1	1	1	1	1	4	Very Low	(-)	High
With Mitigation	1	1	1	1	1	4	Very Low	(-)	High
Mitigation and Management Measures	— N/A								

HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO ACUTE TOXIC CHEMICAL AND BIOLOGICAL AGENTS

Human pathogens and diseases, sewage, food waste as well as snakes, insects, wild and domesticated animals and harmful plants can cause illness and at worst without mitigation, possibly extending to fatalities. Effects can vary from discomfort to fatalities for venomous snakes or bee swarms etc. The construction impact on human and equipment safety - exposure to acute toxic chemical and biological agents is indicated in **Table 8.93**.

Table 8.93: Construction Impact on human and equipment safety - exposure to acute toxic chemical and biological agents for VRF BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO ACUTE TOXIC CHEMICAL AND BIOLOGICAL AGENTS									
Without Mitigation	4	2	3	2	3	33	Moderate	(-)	High
With Mitigation	3	2	3	2	2	20	Low	(-)	High
Mitigation and Management Measures	— All necessary good hygiene practices to be in place, e.g. provision of toilets, eating areas, infectious disease controls. — Policies and practice for dealing with known vectors of disease such as Aids, TB, COVID 19 and others. — Awareness training for persons on site, safety induction to include animal hazards. — First aid and emergency response to consider the necessary anti-venom, anti-histamines, topical medicines etc. — Due to isolated locations some distance from town, the ability to treat with anti-venom and extreme allergic reactions on site is critical to mitigate the impacts								

HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO VIOLENT RELEASE OF KINETIC OR POTENTIAL ENERGY

Construction moving equipment, heavy loaded, elevated loads, and working at heights can cause injury or possibly fatality, damage to equipment, delays in starting the project and financial losses. The construction impact on human and equipment safety - exposure to violent release of kinetic or potential energy is indicated in **Table 8.94**.

Table 8.94: Construction Impact on human and equipment safety - exposure to violent release of kinetic or potential energy for VRF BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO VIOLENT RELEASE OF KINETIC OR POTENTIAL ENERGY									
Without Mitigation	5	1	5	5	4	64	High	(-)	High
With Mitigation	5	1	5	5	1	16	Low	(-)	High
Mitigation and Management Measures	— The construction phase will be managed according to all the requirements of the Occupational Health and Safety Act 85 of 1993 specifically the Construction Regulations. — SHEQ policy in place. — A detailed construction risk assessment prior to work. — SHE procedure in place. — PPE to be specified. — SHE appointees in place. — Contractors safety files in place and up to date. — SHE monitoring and reporting programs in place. — Standard construction site rules regarding traffic, reversing sirens, rigging controls, cordoning off excavations etc. — Civil and building structures to National Building Regulations and building Standards Act 103 of 1977 SANS 10400 and other relevant codes.								

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO VIOLENT RELEASE OF KINETIC OR POTENTIAL ENERGY									
	— Other constructions such as roads, sewers etc also to relevant SANS standards. — All normal procedures for working at heights, hot work permits, confined space entry, cordon off excavations etc to be in place before construction begins. — Emergency response plan to be in place before construction begins.								

HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO ELECTROMAGNETIC WAVES

Use of electrical machines, generators etc. and hot dry area static generation is highly likely as well as lightning strike. This may cause electrocution, ignition, burns, injury and death, as well as damage to electrical equipment. The construction impact on human and equipment safety - exposure to electromagnetic waves is indicated in **Table 8.95.**

Table 8.95: Construction Impact on human and equipment safety - exposure to electromagnetic waves for VRF BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO ELECTROMAGNETIC WAVES									
Without Mitigation	5	2	5	5	3	**51**	**Moderate**	(-)	High
With Mitigation	5	2	5	5	1	**17**	**Low**	(-)	High
Mitigation and Management Measures	— Standard maintenance of condition of electrical equipment and safe operating instructions. — Ability to shut off power to systems in use on site. — If persons are decanting fuels or dealing with other highly flammable materials care should be taken regarding possible static discharge, installations to be suitably designed and maintained. — Lightning strike rate in the study area is very high. — Outside work must be stopped during thunderstorms. — Lighting conductors may be required for the final installation, to be confirmed during design phase.								

ENVIRONMENT - EMISSIONS TO AIR

Dust from construction and generally hot dry area may cause adverse impact on employee health. The construction impact on environment - emissions to air is indicated in **Table 8.96**.

Table 8.96: Construction Impact on environment - emissions to air for VRF BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
ENVIRONMENT - EMISSIONS TO AIR									
Without Mitigation	3	2	1	1	4	**28**	**Low**	(-)	High
With Mitigation	2	2	1	1	2	**12**	**Very Low**	(-)	High
Mitigation and Management Measures	— May need to use dampening on roads etc. as per normal construction practices.								

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
ENVIRONMENT - EMISSIONS TO AIR									
	— May need PPE (dust masks) for specific construction workers.								

ENVIRONMENT - EMISSIONS TO WATER

Diesel for equipment, paints and solvents, transformer oil spills, sewage and kitchen/mess area wastewater can cause environmental damage, particularly to the surface and underground water in the area. The construction impact on environment - emissions to water is indicated in **Table 8.97**.

Table 8.97: Construction Impact on environment - emissions to water for VRF BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
ENVIRONMENT - EMISSIONS TO WATER									
Without Mitigation	2	2	3	2	3	**27**	**Low**	(-)	High
With Mitigation	2	2	3	2	2	**18**	**Low**	(-)	High
Mitigation and Management Measures	— Normal construction site practices for preventing and containing fuels/paint/oil etc spills. — Bunding under any temporary tanks, curbing under truck offloading areas and sealed surfaces (e.g. concrete) under truck parking area is particularly important. — Spill clean-up procedures to be in place before commencing construction. — Sewage and any kitchen liquids - containment and suitable treatment/disposal								

ENVIRONMENT - EMISSIONS TO EARTH

Mess area and other solid waste can cause environmental damage. The construction impact on environment - emissions to earth is indicated in **Table 8.98**.

Table 8.98: Construction Impact on environment - emissions to earth for VRF BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
ENVIRONMENT - EMISSIONS TO EARTH									
Without Mitigation	2	2	3	3	3	**30**	**Low**	(-)	High
With Mitigation	1	2	3	3	2	**18**	**Low**	(-)	High
Mitigation and Management Measures	— There will be packaging materials that will need to be disposed of after the entire system is connected and commissioned as well as after regular maintenance. — There will need to be waste segregation (e.g. electronic equipment, chemicals) and management on the site.								

ENVIRONMENT - WASTE OF RESOURCES E.G. WATER, POWER ETC

Water usage that is not controlled and battery containers that may be damaged may cause construction delays due to a waste of resources. The construction impact on environment - waste of resources e.g. water, power etc is indicated in **Table 8.99**.

Table 8.99: Construction Impact on environment - waste of resources e.g. water, power etc for VRF BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
ENVIRONMENT - WASTE OF RESOURCES E.G. WATER, POWER ETC									
Without Mitigation	1	1	1	2	4	20	Low	(-)	High
With Mitigation	1	1	1	2	2	10	Very Low	(-)	High
Mitigation and Management Measures	— Water usage to be monitored on site during construction. — Handling protocols to be provided by battery supplier. — End of Life plan needs to be in place before any battery containers enter the country as there may be damaged battery unit from day 1. — Water management plan and spill containment plans to be in place.								

PUBLIC - AESTHETICS

Bright surfaces reflecting light and tall structures in a flat area may cause irritation. The construction impact on public - aesthetics is indicated in **Table 8.100**.

Table 8.100: Construction Impact on public - aesthetics for VRF BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
PUBLIC - AESTHETICS									
Without Mitigation	3	2	3	4	4	48	Moderate	(-)	High
With Mitigation	1	2	3	4	2	20	Low	(-)	High
Mitigation and Management Measures	— Visual impact assessment to include BESS installation when design details become available. Confirm any height limitations for VRF BESS building (if utility scale)								

INVESTORS - FINANCIAL

Defective technology and extreme project delays can cause financial loss. The construction impact on investors - financial is indicated in **Table 8.101**.

Table 8.101: Construction Impact on investors - financial for VRF BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
INVESTORS - FINANCIAL									
Without Mitigation	5	1	3	4	3	39	Moderate	(-)	High
With Mitigation	3	1	3	4	2	22	Low	(-)	High
Mitigation and Management Measures	— Design by experienced contractors using internationally recognized and proven technology. — Project management with deviation monitoring.								

EMPLOYEES AND INVESTORS – SECURITY

On route to the construction site there is a risk of potential hi-jacking of valuable but hazardous loads. On site there is a risk of theft of construction equipment and battery installation facilities. There may also be civil unrest or violent strike by employees. This may result in theft, injury to burglars, damage to equipment possibly setting off thermal runaway. The construction impact on employees and investors – security is indicated in **Table 8.102**.

Table 8.102: Construction Impact on employees and investors – security for VRF BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
EMPLOYEES AND INVESTORS – SECURITY									
Without Mitigation	4	1	3	2	4	**40**	**Moderate**	(-)	High
With Mitigation	3	1	3	2	3	**27**	**Low**	(-)	High
Mitigation and Management Measures	— Fencing around electrical infrastructure to SANS standard and Eskom Guidelines. — The hazardous nature of the electrical and battery equipment should be clearly indicated – e.g. Skull and Cross Bones or other signs. — Isolated location both helps and hinders security. — Night lighting to be provided both indoors and outdoors where necessary.								

EMERGENCIES

Fires, explosions, toxic smoke, large spills, traffic accidents, equipment/structural collapse, inadequate emergency response to small events that can lead to escalation, may result in injuries which can turn into fatalities, and small losses become extended down time. The construction impact on emergencies is indicated in **Table 8.103**.

Table 8.103: Construction Impact on emergencies for VRF BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
EMERGENCIES									
Without Mitigation	4	2	3	4	3	**39**	**Moderate**	(-)	High
With Mitigation	4	2	3	4	2	**26**	**Low**	(-)	High
Mitigation and Management Measures	— Fencing around electrical infrastructure to SANS standard and Eskom Guidelines. — The hazardous nature of the electrical and battery equipment should be clearly indicated – e.g. Skull and Cross Bones or other signs. — Isolated location both helps and hinders security. — Night lighting to be provided both indoors and outdoors where necessary. — Emergency procedures need to be practiced prior to commencement of construction.								

INVESTORS – LEGAL

The battery field is evolving quickly with new guides, codes and regulations happening at the same time as evolving technology. This may result in unknown hazards that may manifest due to using "cheaper supplier or less developed technology". The construction impact on investors – legal is indicated in **Table 8.104**.

Table 8.104: Construction Impact on investors – legal for VRF BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
INVESTORS – LEGAL									
Without Mitigation	3	1	3	3	4	**40**	**Moderate**	(-)	High
With Mitigation	2	1	3	3	2	**18**	**Low**	(-)	High

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
INVESTORS – LEGAL									
Mitigation and Management Measures	— Use only internationally reputable battery suppliers who comply with all known regulations/guideline at the time of purchasing. — Ensure only latest state of the art battery system are used and not old technologies prone to fires/explosions etc..								

8.18.2 OPERATIONAL PHASE

SSL BESS

From the details of accidents that have happened both with BESS installations and chemical plants in general, it is clear that many potential problems manifest during the commissioning phase when units are first powered up to test functionality. This phase is critical and all controls, procedures, mitigation measures etc that would be in place for full operation should be in place before commissioning commences.

HUMAN HEALTH - CHRONIC EXPOSURE TO TOXIC CHEMICAL OR BIOLOGICAL AGENTS

Operation and maintenance materials such as spare parts, paints, solvents, welding fumes, transformers oils, lubricating oils and greases etc. can cause occupational illness. The operational impact on human health - chronic exposure to toxic chemical or biological agents is indicated in **Table 8.105**.

Table 8.105: Operational Impact on human health - chronic exposure to toxic chemical or biological agents for SSL BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN HEALTH - CHRONIC EXPOSURE TO TOXIC CHEMICAL OR BIOLOGICAL AGENTS									
Without Mitigation	2	1	3	4	5	50	Moderate	(-)	High
With Mitigation	1	1	3	4	2	18	Low	(-)	High

Mitigation and Management Measures	— The operation and maintenance phase will be managed according to all the requirements of the Occupational Health and Safety Act 85 of 1993.
	— SHEQ policy in place.
	— A detailed risk assessment of all normal operating and maintenance activities on site to be compiled, and form the basis of operating instructions, prior to commencing commissioning.
	— SHE procedure in place, e.g. PPE specified, management of change, integrity monitoring.
	— SHE appointees in place.
	— Training of staff in general hazards on site.
	— All necessary health controls/ practices to be in place, e.g. ventilation of confined areas, occupational health monitoring if required and reporting programs in place.
	— Emergency response plan for full operation and maintenance phase to be in place prior to beginning commissioning and to include aspects such as:
	  — appointment of emergency controller,
	  — emergency isolation systems for electricity,
	  — emergency isolation and containment systems for electrolyte,
	  — provision of PPE for hazardous materials response,								

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN HEALTH - CHRONIC EXPOSURE TO TOXIC CHEMICAL OR BIOLOGICAL AGENTS									
	— provision of emergency facilities for staff at the main office building, — provision of first aid facilities, — first responder contact numbers etc.								

Compromised battery compartment vapours accumulate in the containers, and solids/liquids on surfaces. Maintenance of battery components can cause corrosive and mildly toxic liquid on surfaces. This can result in Dermatitis, and skin /eye/lung irritation. The operational impact on human health - chronic exposure to toxic chemical or biological agents is indicated in **Table 8.106**.

Table 8.106: Operational Impact on human health - chronic exposure to toxic chemical or biological agents for SSL BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN HEALTH - CHRONIC EXPOSURE TO TOXIC CHEMICAL OR BIOLOGICAL AGENTS									
Without Mitigation	3	1	3	5	4	48	Moderate	(-)	High
With Mitigation	1	1	3	5	2	20	Low	(-)	High
Mitigation and Management Measures	— Solids state batteries sealed, individual batteries in modules which are also sealed, pre-packed in the container. — Maintenance procedures will be in place should equipment need to be opened, e.g. pumps drained and decontaminated prior to repair in workshop etc. — PPE will be specified for handling battery parts and other equipment on site. — Training of staff in hazards of chemicals on site. — Possible detectors with local alarms if regulated occupational exposure limits are exceeded etc prior to entry for inspection of battery containers. — Labelling of all equipment. — Confined space entry procedures if entering tanks. — There needs to be careful thought given to procedures to be adopted before entering into the BESS or a container under normal circumstances (confined space) but particularly after a BMS shut down where there may be flammable or toxic gases present, a fire etc. — Safety Data Sheets (SDSs) to be available on site. — Operating manuals to be provided including start-up, shut-down, steady state, monitoring requirements. — Maintenance manuals with make safe, decontamination and repair procedures. — Proposed maintenance schedules e.g. checklists for weekly, monthly, annual etc. — Provided portable equipment for calibration and for testing/verification of defective equipment, e.g. volt/current meters, infrared camera								

HUMAN HEALTH - EXPOSURE TO NOISE

Moving parts inside containers, buildings, pumps, compressors, cooling systems etc. can cause adverse impact on hearing of workers, or may be a nuisance factor at near -by residences or other activities. The operational impact on human health - exposure to noise is indicated in **Table 8.107**.

Table 8.107: Operational Impact on human health - exposure to noise for SSL BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN HEALTH - EXPOSURE TO NOISE									
Without Mitigation	2	1	5	5	4	52	Moderate	(-)	High
With Mitigation	2	1	5	5	2	26	Low	(-)	High
Mitigation and Management Measures	— Design to ensure continuous noise does not exceed 85dB within the facilities or at any other location on site or 61 dB at the site boundary, e.g. emergency generator, air compressor etc. — Employees to be provided with hearing protection if working near equipment that exceeds the noise limits.								

HUMAN HEALTH - EXPOSURE TO TEMPERATURE EXTREMES AND/OR HUMIDITY

Exposure to extreme temperatures and/or humidity such as heat during the day and cold weather in winter can result in heat stroke or hypothermia. Batteries can also generate heat within enclosed buildings / containers and night work requires lighting which can generate heat. The operational impact on human health - exposure to temperature extremes and/or humidity is indicated in **Table 8.108**.

Table 8.108: Operational Impact on human health - exposure to temperature extremes and/or humidity for SSL BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN HEALTH - EXPOSURE TO TEMPERATURE EXTREMES AND/OR HUMIDITY									
Without Mitigation	4	2	3	1	2	20	Low	(-)	High
With Mitigation	3	2	3	1	1	9	Very Low	(-)	High
Mitigation and Management Measures	— Building and container facilities to comply with Occupational Health and Safety Act 85 of 1993 specifically the thermal, humidity, lighting and ventilation requirements of the Environmental Regulations for Workplaces. — Ensure containers are temperature controlled as required to remain within the optimal battery operating temperature range. — Lighting to be provided inside the building, inside the containers, possibly linked to the door opening and outdoors where necessary. — Adequate potable water to be provided during all phases of the project. — Suitable lighting to be provided including emergency lighting for safe building exit in the event of power failure. — PPE for operations and maintenance staff to be suitable for the weather conditions.								

HUMAN HEALTH - EXPOSURE TO PSYCHOLOGICAL STRESS

Isolated workstation and monotonous repetitive work can cause low performance, and system productivity suffers. The operational impact on human health - exposure to psychological stress is indicated in **Table 8.109**.

Table 8.109: Operational Impact on human health - exposure to psychological stress for SSL BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN HEALTH - EXPOSURE TO PSYCHOLOGICAL STRESS									
Without Mitigation	2	3	3	2	2	20	Low	(-)	High
With Mitigation	1	3	3	2	1	9	Very Low	(-)	High

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN HEALTH - EXPOSURE TO PSYCHOLOGICAL STRESS									
Mitigation and Management Measures	— Staff rotation to other activities within the site may be necessary. — Performance monitoring of inspections / maintenance tasks in particular will be necessary.								

HUMAN HEALTH - EXPOSURE TO ERGONOMIC STRESS

Lifting heavy equipment and at awkward angles during maintenance, stretching reaching to high level and bending to low level, working at height if equipment located on top of roofs or elevated electrical equipment (e.g. pylons), can result in back and other injuries. The operational impact on human health - exposure to ergonomic stress is indicated in **Table 8.110**.

Table 8.110: Operational Impact on human health - exposure to ergonomic stress for SSL BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN HEALTH - EXPOSURE TO ERGONOMIC STRESS									
Without Mitigation	5	1	3	2	3	33	Moderate	(-)	High
With Mitigation	4	1	3	2	2	20	Low	(-)	High
Mitigation and Management Measures	— Training in lifting techniques. — Training in working at heights. — If equipment is at height (see OHS Act General Safety Regulation 6), ensure suitable safe (electrically and physically) ladders / harnesses etc. are available. — Working at height procedure to be in place.								

HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO FIRE RADIATION

Involvement in an external fire e.g. veld fire, maintenance vehicle fire, electrical systems fire; manufacturing defects or damage to battery leading to shorting and heating; high humidity condensation of water or ingress of water or flooding leading to shorting; dust accumulation on electrical parts leading to overheating; excessive electrical loads -resulting in surges; operator abuse; BMS failure or software failure; incorrect extinguishing medium; can result in contaminated run off; radiation burns are unlikely to be severe as no highly flammable materials on site; damaged equipment. Fire can also spread to other units or offsite if grass/vegetation is not controlled. The operational impact on human and equipment safety - exposure to fire radiation is indicated in **Table 8.111**.

Table 8.111: Operational Impact on human and equipment safety - exposure to fire radiation for SSL BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO FIRE RADIATION									
Without Mitigation	5	1	5	5	4	64	High	(-)	High
With Mitigation	5	1	5	5	1	16	Low	(-)	High
Mitigation and Management Measures	— Grass cutting and fire breaks around the BESS installations to prevent veld fires. — No combustible materials to be stored in or near the batteries or electrical infrastructure. — Separation of site diesel tank, transformers from BESS and vice versa.								

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance	Character	Confidence
HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO FIRE RADIATION								
	— There are BESS design codes from the USA and standards of practice that can be used e.g. UL9540, NFPA 855 and DNV GL RP 43. — Detailed FMEA/Hazop/Bowtie to done during design at the component level and system levels. Safety integrity level rating of equipment (failure probably) with suitable redundancy if required. — Site Acceptance Testing as part of commissioning of each unit and the overall system. — Abuse tests conducted by supplier. — BMS should be checking individual cell voltage as well as stack, module, container, system voltages/current etc. BMS tripping the cell and possibly the stack/ building unit or module/rack/container, if variations in voltage. — Diagnostics easily accessible. Diagnostics able to distinguish cell from stack or cell from module faults. — Protective systems are only as good as their reliability and functionality testing is important, e.g. testing that all battery trips actually work. — Fire resistant barrier between the batteries and the PCS side if in the same container, or separate containers. — Suitable ingress protection level provided for electrical equipment, e.g. IP55 - 66. — If air cooling into container, suitable dust filters to be provided. — Smoke detectors linked to BMS & alerts in control room. — Effects of battery aging to be considered. Solid state battery life starts to be impacted above 40 deg C and significant impacts above 50 deg C with thermal run away starting at 65-70 deg C. BMS trips system at 50 deg C. Temperature monitoring to be in place. — Regular infrared scanning. Data needs to be stored for trend analysis. — Data indicates an event frequency of 0.001 per installation and with 100 units this would mean an event once 10 years, i.e. a low probability event. — Most events will be small not resulting in injuries, but this is possible if the event is not controlled. — Prior to commencement of cold commissioning, emergency plan from transport and construction phase to be extended to operational phase and to include the hazards of the electrically live system. Procedure to address solid state container fires - extinguishing, ventilating, entering as appropriate or not. PPE for container firefighting include fire retardant, chemically resistant, nitrile gloves, antistatic acid resistant boots, fill face shields, BA sets. — A planned fire response to prevent escalation to an explosion or an environmental event. — Suitable supply of fire extinguishing medium and cooling medium — Consider fire water for cooling adjacent equipment – BESS units. — Can use fogging nozzles to direct smoke. — Ensure procedures in place for clean up after event Lingering HF and other toxic residues in the soil and on adjacent structures.								

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO FIRE RADIATION									
	— Procedures to be in place for IR scanning (or other suitable method) to determine if batteries are still smouldering / are sufficient cooled to handle as batteries may still be active some weeks after an event. — Smoke or gas detector systems that are not part of the original battery container package, need to be linked to the main control panel for the entire system so that issues can be detected and responded to rapidly.								

Power Conversion System (PCS – DC to AC) can cause cooling failure electrical fire. As a result the fire can start in PCS or another section or room and spread to battery area. The operational impact on human and equipment safety - exposure to fire radiation is indicated in **Table 8.112**.

Table 8.112: Operational Impact on human and equipment safety - exposure to fire radiation for SSL BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO FIRE RADIATION									
Without Mitigation	5	2	5	5	4	**68**	**High**	(-)	High
With Mitigation	5	2	5	5	1	**17**	**Low**	(-)	High
Mitigation and Management Measures	— Modern lithium container design put the PCS in another part of the container with a fire rated wall separating it from the battery. Alternately the PCS is another container altogether. — Failure of cooling on PCS or fires on other electrical equipment such as cooling system pump motors etc, and failure to trip the entire system and raise the alert.								

HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO EXPLOSION OVER PRESSURES

Transformer shorting / overheating / explosion or flammable gases generated by thermal run away reach explosive limits. Ignition on hot surfaces can cause static. Lithium Cobalt Oxide generates O2 during decomposition which can cause escalation. This can result in potential fatalities amongst first responders; or damage to container or other nearby items, e.g. other container. The operational impact on human and equipment safety - exposure to explosion over pressures is indicated in **Table 8.113**.

Table 8.113: Operational Impact on human and equipment safety - exposure to explosion over pressures for SSL BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO EXPLOSION OVER PRESSURES									
Without Mitigation	5	1	5	5	2	**32**	**Moderate**	(-)	High
With Mitigation	5	1	5	5	1	**16**	**Low**	(-)	High
Mitigation and Management Measures	— Electrical equipment will be specified to suit application. — Emergency response plan and employee training referred to above is critical. — This is only really likely do happen due to possible inappropriate emergency response, e.g. opening containers when they may be the type that should be left to burn out. — Modern state of the art containers have ventilation systems for vapours.								

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO EXPLOSION OVER PRESSURES									
	— Undertake a hazardous area classification of the inside of the container to confirm the rating of electrical equipment. Emergency response plan and employee training referred to above is critical — Suitable training of selected emergency responders who may be called out to the facilities is critical.								

HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO ACUTE TOXIC CHEMICAL AND BIOLOGICAL AGENTS

Human pathogens and diseases, sewage, food waste as well as snakes, insects, wild and domesticated animals and harmful plants can cause illness and at worst without mitigation, possibly extending to fatalities. Effects can vary from discomfort to fatalities for venomous snakes or bee swarms etc. The operational impact on human and equipment safety - exposure to acute toxic chemical and biological agents is indicated in **Table 8.114**.

Table 8.114: Operational Impact on human and equipment safety - exposure to acute toxic chemical and biological agents for SSL BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO ACUTE TOXIC CHEMICAL AND BIOLOGICAL AGENTS									
Without Mitigation	4	1	3	2	3	**30**	**Low**	(-)	High
With Mitigation	3	1	2	2	2	**16**	**Low**	(-)	High
Mitigation and Management Measures	— All necessary good hygiene practices to be in place, e.g. provision of toilets, eating areas, infectious disease controls. — Policies and practice for dealing with known vectors of disease such as Aids, TB, COVID 19 and others. — Awareness training for persons on site, safety induction to include animal hazards. — First aid and emergency response to consider the necessary anti-venom, anti-histamines, topical medicines etc. — Due to isolated locations some distance from town, the ability to treat with anti-venom and extreme allergic reactions on site is critical to mitigate the impacts.								

Damaged battery components leak electrolyte, are completely broken exposing hazardous chemicals and thermal runaway and hazardous fumes released can cause mild skin irritation from exposure to small leaks to serious corrosive burns for large exposure. The operational impact on human and equipment safety - exposure to acute toxic chemical and biological agents is indicated in **Table 8.115**.

Table 8.115: Operational Impact on human and equipment safety - exposure to acute toxic chemical and biological agents for SSL BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO ACUTE TOXIC CHEMICAL AND BIOLOGICAL AGENTS									
Without Mitigation	4	3	3	5	3	**45**	**Moderate**	(-)	High
With Mitigation	3	3	3	5	2	**28**	**Low**	(-)	High

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO ACUTE TOXIC CHEMICAL AND BIOLOGICAL AGENTS									
Mitigation and Management Measures	— Acid resistant PPE (e.g. overalls, gloves, eyeglasses) to be specified for all operations in electrolyte areas. — PPE to be increased (e.g. full-face shield, aprons, chemical suits) for operations that involve opening equipment and potential exposure, e.g. sampling, maintenance. — All operators/maintenance staff trained in the hazards of chemicals on site. — Batteries contained, modules contained and all inside a container that acts as bund. — Refer to fire above as all the protective measures apply to prevent toxic smoke. — Refer to fire above as all the measures apply to mitigate toxic smoke. — 24/7 helpline response. — Standard dangerous goods requirements for Hazmat labels. — All operators/maintenance staff trained in the hazards.								

HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO VIOLENT RELEASE OF KINETIC OR POTENTIAL ENERGY

Moving equipment, pumps, heavy equipment at elevation, nip points, working at heights, traffic accidents and earthquake/tremors can cause injury or possibly fatality in unlikely worst case, damage to equipment, spills, and environment pollution. The operational impact on human and equipment safety - exposure to violent release of kinetic or potential energy is indicated in **Table 8.116**.

Table 8.116: Operational Impact on human and equipment safety - exposure to violent release of kinetic or potential energy for SSL BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO VIOLENT RELEASE OF KINETIC OR POTENTIAL ENERGY									
Without Mitigation	5	1	5	5	3	**48**	**Moderate**	(-)	High
With Mitigation	5	1	5	5	1	**16**	**Low**	(-)	High
Mitigation and Management Measures	— Apart from pumps, no major moving parts during operation. — Maintenance equipment to be serviced and personnel suitably trained in the use thereof. — Normally just small vehicles on site, bakkies, grass cutting, cherry-pickers etc. Possibly large cranes if large equipment or elevated structure removed/replaced. — Traffic signs, rules etc in place on site. — All normal working at heights, hot work permits, confined space entry, cordon off unsafe areas/works etc to be in place. — Emergency response plan. — Civil design to take seismic activity into account.								

HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO ELECTROMAGNETIC WAVES

Use of electrical machines, generators etc. and hot dry area static generation is highly likely as well as lightning strike. This may cause electrocution, ignition, burns, injury and death, as well as damage to electrical equipment. The operational impact on human and equipment safety - exposure to electromagnetic waves is indicated in **Table 8.117.**

Table 8.117: Operational Impact on human and equipment safety - exposure to electromagnetic waves for SSL BESS

Potential Impact HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO ELECTROMAGNETIC WAVES	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	5	2	5	5	3	51	Moderate	(-)	High
With Mitigation	5	2	5	5	1	17	Low	(-)	High
Mitigation and Management Measures	— Codes and guidelines for electrical insulation. — Suitable PPE to be specified. — Low voltage equipment (e.g. batteries) separated from high voltage (e.g. transmission to grid). — Ensure trained personnel and refer to guideline – IEE — 1657 – 2018. Ensure compliance with Eskom Operating Regulations for high voltage systems including access control, permit to work, safe work procedures, live work, abnormal and emergency situations, keeping records. Electromagnetic fields, impact on other equipment e.g. testing devices, mobile phones – malfunction, permanent damage. — Software also need to be kept as update to date as reasonably practicable. Consider suitably located Emergency stop buttons for the facility and the other equipment on site. — PPE to consider static accumulation for entering the facility, and particularly the battery containers especially after a high temperature shut down where there could possibly be flammable materials. — The procedures for responding to alarm and auto shut down on containers, needs to consider that there may be a dangerous environment inside and how to protect personnel who may enter to respond. — Lightning strike rate in proposed development area is very high. — All outside work must be stopped during thunder storms. — Lighting conductors may be required for the installation, to be confirmed during design									

ENVIRONMENT - EMISSIONS TO AIR

Not expected on a normal basis. Refrigerant may be an asphyxiant if accidentally released indoors it can accumulate and displace oxygen. The operational impact on environment - emissions to air is indicated in **Table 8.118**.

Table 8.118: Operational Impact on environment - emissions to air for SSL BESS

Potential Impact ENVIRONMENT - EMISSIONS TO AIR	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	3	1	1	1	3	18	Low	(-)	High
With Mitigation	3	1	1	1	1	6	Very Low	(-)	High

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
ENVIRONMENT - EMISSIONS TO AIR									
Mitigation and Management Measures	— Especially after any warning alarms have gone off, but possibly even normally the container could be treated as entering a confined space and similar procedures could be in place, e.g. do not enter alone, gas testing prior to entering, ensure adequate ventilation								

ENVIRONMENT - EMISSIONS TO WATER

Cooling water blow-down, laboratory waste (if included in the design), maintenance waste, e.g. oils, spills from batteries, coolant system, diesel trucks, transformers, oil drips from parked vehicles, fire water runoff control, kitchen waste and sewage, refrigerant release, can cause pollution if not contained, excessive disposal costs if emissions not limited. The operational impact on environment - emissions to water is indicated in **Table 8.119**.

Table 8.119: Operational Impact on environment - emissions to water for SSL BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
ENVIRONMENT - EMISSIONS TO WATER									
Without Mitigation	2	2	3	2	3	27	Low	(-)	High
With Mitigation	2	2	3	2	2	18	Low	(-)	High
Mitigation and Management Measures	— Bunding under any outdoors tanks, curbing under truck offloading areas and sealed surfaces (e.g. concrete) under truck parking area is particularly important. — Sewage and any kitchen liquids - containment and suitable treatment/disposal. — Procedures for dealing with damaged/leaking equipment as well as clean-up of spills. — Normal site practices for preventing and containing diesel/paint etc spills. — Waste management plan to be in place e.g. liquid waste treatment or suitable removal and disposal will be provided. — Spill clean-up procedures to be in place before bringing container on site, including spill kits – non-combustible materials, hazmat disposal. — The National Environment Management Act (NEMA) has a list of substances with Reportable spill Quantities, ensure compliance with this.								

ENVIRONMENT - EMISSIONS TO EARTH

Mess area and other solid waste, as well as disposal of solid-state batteries can cause environmental damage. The operational impact on environment - emissions to earth is indicated in **Table 8.120**.

Table 8.120: Operational Impact on environment - emissions to earth for SSL BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
ENVIRONMENT - EMISSIONS TO EARTH									
Without Mitigation	2	2	3	3	3	30	Low	(-)	High
With Mitigation	2	2	3	3	1	10	Very Low	(-)	High
Mitigation and Management Measures	— Implement waste segregation (e.g. electronic equipment, chemicals, domestic) and management on the site.								

ENVIRONMENT - WASTE OF RESOURCES E.G. WATER, POWER ETC

Water usage that is not controlled, disposal of batteries or components, or disposal of containers may cause delays, excessive costs and disposal of large volumes of hazardous waste. The operational impact on environment - waste of resources e.g. water, power etc is indicated in **Table 8.121**.

Table 8.121: Operational Impact on environment - waste of resources e.g. water, power etc for SSL BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
ENVIRONMENT - WASTE OF RESOURCES E.G. WATER, POWER ETC									
Without Mitigation	1	1	1	2	4	**20**	**Low**	(-)	High
With Mitigation	1	1	1	2	2	**10**	**Very Low**	(-)	High
Mitigation and Management Measures	— Water usage to be monitored on site. — Handling protocols to be provided by battery supplier. — Water management plan and spill containment plans to be in place. — Investigate end of Life plan for solid state batteries - reuse / recovery / reconditioning. — Similarly, for decommissioned containers – reuse / recovery / repurpose								

PUBLIC - AESTHETICS

Bright surfaces reflecting light and tall structures in a flat area may cause irritation. The operational impact on public - aesthetics is indicated in **Table 8.122**.

Table 8.122: Operational Impact on public – aesthetics for SSL BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
PUBLIC - AESTHETICS									
Without Mitigation	1	2	4	4	2	**22**	**Low**	(-)	High
With Mitigation	1	2	4	4	2	**22**	**Low**	(-)	High
Mitigation and Management Measures	— Refer to Visual Impact Assessment which is to include the BESS installation once design details are available.								

INVESTORS - FINANCIAL

Defective technology and extreme project delays can cause financial loss. The operational impact on investors - financial is indicated in **Table 8.123**.

Table 8.123: Operational Impact on investors – financial for SSL BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
INVESTORS - FINANCIAL									
Without Mitigation	5	1	3	4	3	**39**	**Moderate**	(-)	High
With Mitigation	3	1	3	4	2	**22**	**Low**	(-)	High
Mitigation and Management Measures	— Design by experienced contractors using internationally recognized and proven technology. — Project management with deviation monitoring. — Project insurance.								

EMPLOYEES AND INVESTORS – SECURITY

On route to the operational site there is a risk of potential hi-jacking of valuable but hazardous loads. On site there is a risk of theft of operational equipment and battery installation facilities. There may also be civil unrest or violent strike by employees. This may result in theft, injury to burglars, damage to equipment possibly setting off thermal runaway. The operational impact on employees and investors – security is indicated in **Table 8.124**.

Table 8.124: Operational Impact on employees and investors – security for SSL BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
EMPLOYEES AND INVESTORS – SECURITY									
Without Mitigation	3	1	3	2	4	**36**	**Moderate**	(-)	High
With Mitigation	3	1	3	2	2	**18**	**Low**	(-)	High
Mitigation and Management Measures	— Fencing around electrical infrastructure to SANS standard and Eskom Guidelines. — Consider motion detection lights and CCTV. — The hazardous nature of the electrical and battery equipment should be clearly indicated – e.g. Skull and Cross Bones or other signs. — Isolated location both helps and hinders security. — Night lighting to be provided both indoors and outdoors where necessary.								

Cyber security attacks aimed at the National Electricity Grid may result in the ransom of the National Electricity Grid. The operational impact on employees and investors – security is indicated in **Table 8.125**.

Table 8.125: Operational Impact on employees and investors – security for SSL BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
EMPLOYEES AND INVESTORS – SECURITY									
Without Mitigation	4	4	3	1	4	**48**	**Moderate**	(-)	High
With Mitigation	4	4	3	1	2	**24**	**Low**	(-)	High
Mitigation and Management Measures	— Cyber security needs monitoring. — Remote access to system needs to be negotiated and controlled. — Password controls, levels of authority etc. Protection of the National Electricity Grid from Cyber-attacks accessing through the BESS. — Cyber emergency procedures – should be in place prior to commissioning.								

EMERGENCIES

Fires, explosions, toxic smoke, large spills, traffic accidents, equipment/structural collapse, inadequate emergency response to small events that can lead to escalation, may result in injuries which can turn into fatalities, and small losses become extended down time. The operational impact on emergencies is indicated in **Table 8.126**.

Table 8.126: Operational Impact on emergencies for SSL BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
EMERGENCIES									
Without Mitigation	4	2	3	4	3	**39**	**Moderate**	(-)	High
With Mitigation	4	2	3	4	2	**26**	**Low**	(-)	High

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
EMERGENCIES									
Mitigation and Management Measures	— All safety measures listed above. — Escape doors should swing open outwards and not into the container. — Doors should be able to be hooked open when persons are inside the container, i.e. they should not be automatically self-closing. — More than one exit from buildings. — Storage of spare batteries (e.g. in stores on site or elsewhere) also needs to consider possible thermal run away.								

INVESTORS – LEGAL

The battery field is evolving quickly with new guides, codes and regulations happening at the same time as evolving technology. This may result in unknown hazards that may manifest due to using "cheaper supplier or less developed technology". The operational impact on investors – legal is indicated in **Table 8.127**.

Table 8.127: Operational Impact on investors – legal for SSL BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
INVESTORS – LEGAL									
Without Mitigation	3	1	3	3	4	**40**	**Moderate**	(-)	High
With Mitigation	3	1	3	3	2	**20**	**Low**	(-)	High
Mitigation and Management Measures	— Use only internationally reputable battery suppliers who comply with all known regulations/guideline at the time of purchasing. — Ensure only latest state of the art battery system are used and not old technologies prone to fires/explosions etc.								

VRF BESS

From the details of accidents that have happened both with BESS installations and chemical plants in general, it is clear that many potential problems manifest during the commissioning phase when units are first powered up to test functionality. This phase is critical and all controls, procedures, mitigation measures etc that would be in place for full operation should be in place before commissioning commences.

HUMAN HEALTH - CHRONIC EXPOSURE TO TOXIC CHEMICAL OR BIOLOGICAL AGENTS

Operation and maintenance materials such as spare parts, paints, solvents, welding fumes, transformers oils, lubricating oils and greases etc. can cause occupational illness. The operational impact on human health - chronic exposure to toxic chemical or biological agents is indicated in **Table 8.128**.

Table 8.128: Operational Impact on human health - chronic exposure to toxic chemical or biological agents for VRF BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN HEALTH - CHRONIC EXPOSURE TO TOXIC CHEMICAL OR BIOLOGICAL AGENTS									
Without Mitigation	2	1	3	4	5	**50**	**Moderate**	(-)	High
With Mitigation	1	1	3	4	2	**18**	**Low**	(-)	High

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN HEALTH - CHRONIC EXPOSURE TO TOXIC CHEMICAL OR BIOLOGICAL AGENTS									

Mitigation and Management Measures	— The operation and maintenance phase will be managed according to all the requirements of the Occupational Health and Safety Act 85 of 1993.
	— SHEQ policy in place.
	— A detailed risk assessment of all normal operating and maintenance activities on site to be compiled, and form the basis of operating instructions, prior to commencing commissioning.
	— SHE procedure in place, e.g. PPE specified, management of change, integrity monitoring.
	— SHE appointees in place.
	— Training of staff in general hazards on site.
	— All necessary health controls/ practices to be in place, e.g. ventilation of confined areas, occupational health monitoring if required and reporting programs in place.
	— Emergency response plan for full operation and maintenance phase to be in place prior to beginning commissioning and to include aspects such as:
	  — appointment of emergency controller,
	  — emergency isolation systems for electricity,
	  — emergency isolation and containment systems for electrolyte,
	  — provision of PPE for hazardous materials response,
	  — provision of emergency facilities for staff at the main office building,
	  — provision of first aid facilities,
	  — first responder contact numbers etc.								

Compromised battery compartment vapours accumulate in the containers, and solids/liquids on surfaces. Maintenance of battery components can cause corrosive and mildly toxic liquid on surfaces. This can result in Dermatitis, and skin /eye/lung irritation. The operational impact on human health - chronic exposure to toxic chemical or biological agents is indicated in **Table 8.129**.

Table 8.129: Operational Impact on human health - chronic exposure to toxic chemical or biological agents for VRF BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN HEALTH - CHRONIC EXPOSURE TO TOXIC CHEMICAL OR BIOLOGICAL AGENTS									
Without Mitigation	2	1	3	5	4	**44**	**Moderate**	(-)	High
With Mitigation	1	1	3	5	2	**20**	**Low**	(-)	High
Mitigation and Management Measures	— VRF Batteries facilities normally within buildings but may be containerized. — Maintenance procedures will be in place should equipment need to be opened, e.g. pumps drained and decontaminated prior to repair in workshop etc. — PPE will be specified for handling battery parts and other equipment on site. — Training of staff in hazards of chemicals on site. — Labelling of all equipment. — Confined space entry procedures if entering tanks.								

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN HEALTH - CHRONIC EXPOSURE TO TOXIC CHEMICAL OR BIOLOGICAL AGENTS									
	— Safety Data Sheets (SDSs) to be available on site. — Operating manuals to be provided including start-up, shut-down, steady state, monitoring requirements. — Maintenance manuals with make safe, decontamination and repair procedures. — Proposed maintenance schedules e.g. checklists for weekly, monthly, annual etc. — Provided portable equipment for calibration and for testing/verification of defective equipment, e.g. volt/current meters, infrared camera								

HUMAN HEALTH - EXPOSURE TO NOISE

Moving parts inside containers, buildings, pumps, compressors, cooling systems etc. can cause adverse impact on hearing of workers, or may be a nuisance factor at near -by residences or other activities. The operational impact on human health - exposure to noise is indicated in **Table 8.130**.

Table 8.130: Operational Impact on human health - exposure to noise for VRF BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN HEALTH - EXPOSURE TO NOISE									
Without Mitigation	2	1	5	5	4	**52**	**Moderate**	(-)	High
With Mitigation	2	1	5	5	2	**26**	**Low**	(-)	High
Mitigation and Management Measures	— Design to ensure continuous noise does not exceed 85dB within the facilities or at any other location on site or 61 dB at the site boundary, e.g. emergency generator, air compressor etc. — Employees to be provided with hearing protection if working near equipment that exceeds the noise limits.								

HUMAN HEALTH - EXPOSURE TO TEMPERATURE EXTREMES AND/OR HUMIDITY

Exposure to extreme temperatures and/or humidity such as heat during the day and cold weather in winter can result in heat stroke or hypothermia. Batteries can also generate heat within enclosed buildings / containers and night work requires lighting which can generate heat. The operational impact on human health - exposure to temperature extremes and/or humidity is indicated in **Table 8.131**.

Table 8.131: Operational Impact on human health - exposure to temperature extremes and/or humidity for VRF BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN HEALTH - EXPOSURE TO TEMPERATURE EXTREMES AND/OR HUMIDITY									
Without Mitigation	4	2	3	1	2	**20**	**Low**	(-)	High
With Mitigation	3	2	3	1	1	**9**	**Very Low**	(-)	High
Mitigation and Management Measures	— Building and container facilities to comply with Occupational Health and Safety Act 85 of 1993 specifically the thermal, humidity, lighting and ventilation requirements of the Environmental Regulations for Workplaces. — Ensure containers are temperature controlled as required to remain within the optimal battery operating temperature range..								

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN HEALTH - EXPOSURE TO TEMPERATURE EXTREMES AND/OR HUMIDITY									
	— Lighting to be provided inside the building, inside the containers, possibly linked to the door opening and outdoors where necessary. — Adequate potable water to be provided during all phases of the project. — Suitable lighting to be provided including emergency lighting for safe building exit in the event of power failure. — PPE for operations and maintenance staff to be suitable for the weather conditions.								

HUMAN HEALTH - EXPOSURE TO PSYCHOLOGICAL STRESS

Isolated workstation and monotonous repetitive work can cause low performance, and system productivity suffers. The operational impact on human health - exposure to psychological stress is indicated in **Table 8.132**.

Table 8.132: Operational Impact on human health - exposure to psychological stress for VRF BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN HEALTH - EXPOSURE TO PSYCHOLOGICAL STRESS									
Without Mitigation	2	3	3	2	2	20	Low	(-)	High
With Mitigation	1	3	3	2	1	9	Very Low	(-)	High
Mitigation and Management Measures	— Staff rotation to other activities within the site may be necessary. — Performance monitoring of inspections / maintenance tasks in particular will be necessary.								

HUMAN HEALTH - EXPOSURE TO ERGONOMIC STRESS

Lifting heavy equipment and at awkward angles during maintenance, stretching reaching to high level and bending to low level, working at height if equipment located on top of roofs or elevated electrical equipment (e.g. pylons), can result in back and other injuries. The operational impact on human health - exposure to ergonomic stress is indicated in **Table 8.133**.

Table 8.133: Operational Impact on human health - exposure to ergonomic stress for VRF BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN HEALTH - EXPOSURE TO ERGONOMIC STRESS									
Without Mitigation	5	1	3	2	3	33	Moderate	(-)	High
With Mitigation	4	1	3	2	2	20	Low	(-)	High
Mitigation and Management Measures	— Training in lifting techniques. — Training in working at heights. — If equipment is at height (see OHS Act General Safety Regulation 6), ensure suitable safe (electrically and physically) ladders / harnesses etc. are available. — Working at height procedure to be in place.								

HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO FIRE RADIATION

Involvement in an external fire e.g. veld fire, maintenance vehicle fire, electrical systems fire; manufacturing defects or damage to battery leading to shorting and heating; high humidity condensation of water or ingress of water or flooding leading to shorting; dust accumulation on electrical parts leading to overheating; excessive electrical loads -resulting in surges; operator abuse; BMS failure or software failure; incorrect extinguishing medium; can result in contaminated run off; radiation burns are unlikely to be severe as no highly flammable materials on site; damaged equipment. Fire can also spread to other units or offsite if grass/vegetation is not controlled. The operational impact on human and equipment safety - exposure to fire radiation is indicated in **Table 8.134**.

Table 8.134: Operational Impact on human and equipment safety - exposure to fire radiation for VRF BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO FIRE RADIATION									
Without Mitigation	5	1	5	5	3	**48**	**Moderate**	(-)	High
With Mitigation	5	1	5	5	1	**16**	**Low**	(-)	High
Mitigation and Management Measures	— Grass cutting and fire breaks around the BESS installations to prevent veld fires. — No combustible materials to be stored in or near the batteries or electrical infrastructure, e.g. separation of site diesel tank. — Fire resistant barrier between the batteries and the PCS side if in the same container. — Design codes from USA and standards of practice UL9540, NFPA 855 and DNV GL RP 43. — Detailed FMEA/Hazop/Bowtie to done during design at the component level and system levels. — Safety integrity level rating of equipment (failure probably) with suitable redundancy if required. — Site Acceptance Testing as part of commissioning of each unit and the overall system. — BMS should be checking individual cell voltage as well as stack, module, container, system voltages/current etc. BMS tripping the cell and possibly the stack/ building unit or module/rack/container, if variations in voltage. Diagnostics easily accessible. Diagnostics able to distinguish cell from stack or cell from module faults. As per SANS Standards, suitable ingress protection (IP) level provided for electrical equipment, e.g. IP55 - 66. If air cooling into container / building, suitable dust filters to be provided if needed. Smoke detectors may be needed linked to BMS and alerts in the main control room. Effects of battery aging to be considered. Temperature monitoring, regular infrared scanning. Data stored for trend analysis.. — Protective systems functionality testing. — Prior to commencement of cold commissioning, emergency plan from transport and construction phase to extended to operational phase and to include the hazards of the electrically live system. Procedure to address suitable extinguishing media, ventilating, entering container as appropriate or not. PPE for firefighting may need to include fire retardant, chemically resistant, nitrile gloves, antistatic acid resistant boots, fill face shields, BA sets. — A planned fire response to prevent escalation to an environmental event is critical. Suitable fire extinguishing medium, cooling medium and adequate supply of both is critical e.g. cooling adjacent equipment and can use fogging nozzles to direct smoke. — Ensure procedures in place to clean up after event Lingering toxic residues in the soil and on adjacent structures.									

Power Conversion System (PCS – DC to AC) can cause cooling failure electrical fire. As a result the fire can start in PCS or another section or room and spread to battery area. The operational impact on human and equipment safety - exposure to fire radiation is indicated in **Table 8.135**.

Table 8.135: Operational Impact on human and equipment safety - exposure to fire radiation for VRF BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO FIRE RADIATION									
Without Mitigation	5	2	5	5	3	51	Moderate	(-)	High
With Mitigation	5	2	5	5	1	17	Low	(-)	High
Mitigation and Management Measures	— VRF building systems PCS in another area separating it from the batteries and other equipment								

HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO EXPLOSION OVER PRESSURES

Transformer shorting / overheating / explosion or flammable gases generated by thermal run away reach explosive limits. Ignition on hot surfaces can cause static. Lithium Cobalt Oxide generates O2 during decomposition which can cause escalation. This can result in potential fatalities amongst first responders; or damage to container or other nearby items, e.g. other container. The operational impact on human and equipment safety - exposure to explosion over pressures is indicated in **Table 8.136**.

Table 8.136: Operational Impact on human and equipment safety - exposure to explosion over pressures for VRF BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO EXPLOSION OVER PRESSURES									
Without Mitigation	5	1	5	5	2	32	Moderate	(-)	High
With Mitigation	5	1	5	5	1	16	Low	(-)	High
Mitigation and Management Measures	— Electrical equipment will be specified to suit application. — Emergency response plan and employee training referred to above is to be in place.								

HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO ACUTE TOXIC CHEMICAL AND BIOLOGICAL AGENTS

Human pathogens and diseases, sewage, food waste as well as snakes, insects, wild and domesticated animals and harmful plants can cause illness and at worst without mitigation, possibly extending to fatalities. Effects can vary from discomfort to fatalities for venomous snakes or bee swarms etc. The operational impact on human and equipment safety - exposure to acute toxic chemical and biological agents is indicated in **Table 8.137**.

Table 8.137: Operational Impact on human and equipment safety - exposure to acute toxic chemical and biological agents for VRF BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO ACUTE TOXIC CHEMICAL AND BIOLOGICAL AGENTS									
Without Mitigation	4	1	3	2	3	30	Low	(-)	High
With Mitigation	3	1	2	2	2	16	Low	(-)	High
Mitigation and Management Measures	— All necessary good hygiene practices to be in place, e.g. provision of toilets, eating areas, infectious disease controls. — Policies and practice for dealing with known vectors of disease such as Aids, TB, COVID 19 and others. — Awareness training for persons on site, safety induction to include animal hazards.								

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO ACUTE TOXIC CHEMICAL AND BIOLOGICAL AGENTS									
	— First aid and emergency response to consider the necessary anti-venom, anti-histamines, topical medicines etc. — Due to isolated locations some distance from town, the ability to treat with anti-venom and extreme allergic reactions on site is critical to mitigate the impacts.								

Damaged battery components leak electrolyte, are completely broken exposing hazardous chemicals and thermal runaway and hazardous fumes released can cause mild skin irritation from exposure to small leaks to serious corrosive burns for large exposure. The operational impact on human and equipment safety - exposure to acute toxic chemical and biological agents is indicated in **Table 8.138**.

Table 8.138: Operational Impact on human and equipment safety - exposure to acute toxic chemical and biological agents for VRF BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO ACUTE TOXIC CHEMICAL AND BIOLOGICAL AGENTS									
Without Mitigation	4	3	3	5	3	45	Moderate	(-)	High
With Mitigation	3	3	3	5	2	28	Low	(-)	High
Mitigation and Management Measures	— Corrosion resistant PPE (e.g. overalls, gloves, eyeglasses) to be specified for all operations in electrolyte areas. — PPE to be increased (e.g. full-face shield, aprons, chemical suits) for operations that involve opening equipment and potential exposure, e.g. sampling, maintenance. — All operators/maintenance staff trained in the hazards of chemicals on site. — Electrolyte contained, modules contained inside a building that is bunded. — 24/7 helpline response. — Standard dangerous goods requirements for Hazmat labels. — All operators/maintenance staff trained in the hazards.								

HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO VIOLENT RELEASE OF KINETIC OR POTENTIAL ENERGY

Moving equipment, pumps, heavy equipment at elevation, nip points, working at heights, traffic accidents and earthquake/tremors can cause injury or possibly fatality in unlikely worst case, damage to equipment, spills, and environment pollution. The operational impact on human and equipment safety - exposure to violent release of kinetic or potential energy is indicated in **Table 8.139**.

Table 8.139: Operational Impact on human and equipment safety - exposure to violent release of kinetic or potential energy for VRF BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO VIOLENT RELEASE OF KINETIC OR POTENTIAL ENERGY									
Without Mitigation	5	1	5	5	3	48	Moderate	(-)	High

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO VIOLENT RELEASE OF KINETIC OR POTENTIAL ENERGY									
With Mitigation	5	1	5	5	1	**16**	**Low**	(-)	High
Mitigation and Management Measures	— Maintenance equipment to be serviced and personnel suitably trained in the use thereof. — Traffic signs, rules etc in place on site. — All normal working at heights, hot work permits, confined space entry, cordon off unsafe areas/works etc to be in place. — Emergency response plan. — Civil design to take seismic activity into account.								

HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO ELECTROMAGNETIC WAVES

Use of electrical machines, generators etc. and hot dry area static generation is highly likely as well as lightning strike. This may cause electrocution, ignition, burns, injury and death, as well as damage to electrical equipment. The operational impact on human and equipment safety - exposure to electromagnetic waves is indicated in **Table 8.140.**

Table 8.140: Operational Impact on human and equipment safety - exposure to electromagnetic waves for VRF BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO ELECTROMAGNETIC WAVES									
Without Mitigation	5	2	5	5	3	**51**	**Moderate**	(-)	High
With Mitigation	5	2	5	5	1	**17**	**Low**	(-)	High
Mitigation and Management Measures	— Codes and guidelines for electrical insulation. — Suitable PPE to be specified. — Low voltage equipment (e.g. batteries) separated from high voltage (e.g. transmission to grid). — Ensure trained personnel and refer to guideline – IEE — 1657 – 2018. Ensure compliance with Eskom Operating Regulations for high voltage systems including access control, permit to work, safe work procedures, live work, abnormal and emergency situations, keeping records. — Electromagnetic fields, impact on other equipment e.g. testing devices, mobile phones – malfunction, permanent damage. — Software also need to be kept as update to date as reasonably practicable — Consider suitably located Emergency stop buttons for the facility and the other equipment on site. — PPE to consider static accumulation for entering the facility, and particularly the battery containers especially after a high temperature shut down where there could possibly be flammable materials. — The procedures for responding to alarm and auto shut down on containers, needs to consider that there may be a dangerous environment inside and how to protect personnel who may enter to respond. — Lightning strike rate in proposed development area is very high. — All outside work must be stopped during thunder storms.								

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO ELECTROMAGNETIC WAVES									
	— Lighting conductors may be required for the installation, to be confirmed during design								

ENVIRONMENT - EMISSIONS TO AIR

Not expected on a normal basis. Refrigerant may be an asphyxiant if accidentally released indoors it can accumulate and displace oxygen. The operational impact on environment - emissions to air is indicated in **Table 8.141**.

Table 8.141: Operational Impact on environment - emissions to air for VRF BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
ENVIRONMENT - EMISSIONS TO AIR									
Without Mitigation	3	1	1	1	3	**18**	**Low**	(-)	High
With Mitigation	3	1	1	1	1	**6**	**Very Low**	(-)	High
Mitigation and Management Measures	— Especially after any warning alarms have gone off, but possibly even normally the container could be treated as entering a confined space and similar procedures could be in place, e.g. do not enter alone, gas testing prior to entering, ensure adequate ventilation								

ENVIRONMENT - EMISSIONS TO WATER

Cooling water blow-down, laboratory waste (if included in the design), maintenance waste, e.g. oils, spills from batteries, coolant system, diesel trucks, transformers, oil drips from parked vehicles, fire water runoff control, kitchen waste and sewage, refrigerant release or VRF electrolyte purging, can cause pollution if not contained, excessive disposal costs if emissions not limited. The operational impact on environment - emissions to water is indicated in **Table 8.142**.

Table 8.142: Operational Impact on environment - emissions to water for VRF BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
ENVIRONMENT - EMISSIONS TO WATER									
Without Mitigation	3	2	3	2	3	**30**	**Low**	(-)	High
With Mitigation	3	2	3	2	2	**20**	**Low**	(-)	High
Mitigation and Management Measures	— Electrolyte areas fully bunded to 110% of largest tank, or more. — Bunding under any outdoors tanks, curbing under truck offloading areas and sealed surfaces (e.g. concrete) under truck parking area is particularly important. — Sewage and any kitchen liquids - containment and suitable treatment/disposal. — Procedures for dealing with damaged/leaking equipment as well as clean-up of spills. — Normal site practices for preventing and containing diesel/paint etc spills. — Waste management plan to be in place e.g. liquid waste treatment or suitable removal and disposal will be provided. — Spill clean-up procedures to be in place before bringing container on site, including spill kits – non-combustible materials, hazmat disposal.								

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
ENVIRONMENT - EMISSIONS TO WATER									
	— The National Environment Management Act (NEMA) has a list of substances with Reportable spill Quantities, ensure compliance with this. Process controls in place to prevent contamination and deterioration of electrolyte leading to excessive purging. — Ensure proposed locations of the BESS facilities are a suitable distance from the closest water course. In the event of a major spill if this is too close it may not allow time for mitigation to be taken. Adequate secondary and possibly tertiary containment systems may then be needed on site.								

ENVIRONMENT - EMISSIONS TO EARTH

Mess area and other solid waste, as well as disposal of solid-state batteries can cause environmental damage. The operational impact on environment - emissions to earth is indicated in **Table 8.143**.

Table 8.143: Operational Impact on environment - emissions to earth for VRF BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
ENVIRONMENT - EMISSIONS TO EARTH									
Without Mitigation	2	2	3	3	3	30	Low	(-)	High
With Mitigation	2	2	3	3	1	10	Very Low	(-)	High
Mitigation and Management Measures	— Implement waste segregation (e.g. electronic equipment, chemicals, domestic) and management on the site.								

ENVIRONMENT - WASTE OF RESOURCES E.G. WATER, POWER ETC

Water usage that is not controlled, disposal of batteries or components, or disposal of containers may cause delays, excessive costs and disposal of large volumes of hazardous waste. The operational impact on environment - waste of resources e.g. water, power etc is indicated in **Table 8.144**.

Table 8.144: Operational Impact on environment - waste of resources e.g. water, power etc for VRF BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
ENVIRONMENT - WASTE OF RESOURCES E.G. WATER, POWER ETC									
Without Mitigation	2	1	1	2	4	24	Low	(-)	High
With Mitigation	2	1	1	2	2	12	Very Low	(-)	High
Mitigation and Management Measures	— Water usage to be monitored on site. — Handling protocols to be provided by battery supplier. — Water management plan and spill containment plans to be in place. — Investigate end of Life plan for solid state batteries - reuse / recovery / reconditioning. — Similarly, for decommissioned containers – reuse / recovery / repurpose								

PUBLIC - AESTHETICS

Bright surfaces reflecting light and tall structures in a flat area may cause irritation. The operational impact on public - aesthetics is indicated in **Table 8.145**.

Table 8.145: Operational Impact on public - aesthetics for VRF BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
PUBLIC - AESTHETICS									
Without Mitigation	2	2	4	4	4	48	Moderate	(-)	High
With Mitigation	1	2	3	4	2	20	Low	(-)	High
Mitigation and Management Measures	— Visual impact assessment to include BESS installation when design details become available. Confirm any height limitations for VRFB BESS building (if utility scale)								

INVESTORS - FINANCIAL

Defective technology and extreme project delays can cause financial loss. The operational impact on investors - financial is indicated in **Table 8.146**.

Table 8.146: Operational Impact on investors - financial for VRF BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
INVESTORS - FINANCIAL									
Without Mitigation	5	1	3	4	3	39	Moderate	(-)	High
With Mitigation	3	1	3	4	2	22	Low	(-)	High
Mitigation and Management Measures	— Design by experienced contractors using internationally recognized and proven technology. — Project management with deviation monitoring. — Project insurance.								

EMPLOYEES AND INVESTORS – SECURITY

On route to the operational site there is a risk of potential hi-jacking of valuable but hazardous loads. On site there is a risk of theft of operational equipment and battery installation facilities. There may also be civil unrest or violent strike by employees. This may result in theft, injury to burglars, damage to equipment possibly setting off thermal runaway. The operational impact on employees and investors – security is indicated in **Table 8.147**.

Table 8.147: Operational Impact on employees and investors – security for VRF BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
EMPLOYEES AND INVESTORS – SECURITY									
Without Mitigation	3	1	3	2	4	36	Moderate	(-)	High
With Mitigation	3	1	3	2	2	18	Low	(-)	High
Mitigation and Management Measures	— Fencing around electrical infrastructure to SANS standard and Eskom Guidelines. — Consider motion detection lights and CCTV. — The hazardous nature of the electrical and battery equipment should be clearly indicated – e.g. Skull and Cross Bones or other signs. — Isolated location both helps and hinders security.								

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
EMPLOYEES AND INVESTORS – SECURITY									
	— Night lighting to be provided both indoors and outdoors where necessary.								

Cyber security attacks aimed at the National Electricity Grid may result in the ransom of the National Electricity Grid. The operational impact on employees and investors – security is indicated in **Table 8.148**.

Table 8.148: Operational Impact on employees and investors – security for VRF BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
EMPLOYEES AND INVESTORS – SECURITY									
Without Mitigation	4	4	3	1	4	48	Moderate	(-)	High
With Mitigation	4	4	3	1	2	24	Low	(-)	High
Mitigation and Management Measures	— Cyber security needs monitoring. — Remote access to system needs to be negotiated and controlled. — Password controls, levels of authority etc. Protection of the National Electricity Grid from Cyber-attacks accessing through the BESS. — Cyber emergency procedures – should be in place prior to commissioning.								

EMERGENCIES

Fires, explosions, toxic smoke, large spills, traffic accidents, equipment/structural collapse, inadequate emergency response to small events that can lead to escalation, may result in injuries which can turn into fatalities, and small losses become extended down time. The operational impact on emergencies is indicated in **Table 8.149**.

Table 8.149: Operational Impact on emergencies for VRF BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
EMERGENCIES									
Without Mitigation	4	2	3	4	3	39	Moderate	(-)	High
With Mitigation	4	2	3	4	2	26	Low	(-)	High
Mitigation and Management Measures	— All safety measures listed above. — Emergency procedures need to be practiced prior to commencement of operations. — Escape doors should swing open outwards and not into the building/container. — More than one exit from buildings								

INVESTORS – LEGAL

The battery field is evolving quickly with new guides, codes and regulations happening at the same time as evolving technology. This may result in unknown hazards that may manifest due to using "cheaper supplier or less developed technology". The operational impact on investors – legal is indicated in **Table 8.150**.

Table 8.150: Operational Impact on investors – legal for VRF BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
INVESTORS – LEGAL									
Without Mitigation	3	1	3	3	4	**40**	**Moderate**	(-)	High
With Mitigation	3	1	3	3	2	**20**	**Low**	(-)	High
Mitigation and Management Measures	— Use only internationally reputable battery suppliers who comply with all known regulations/guideline at the time of purchasing.								

8.18.3 DECOMMISSIONING PHASE

SSL AND VRF BESS

Battery components may have a limited lifespan, there are damaged equipment, waste electrolyte etc. There could already be "waste" on the first day of commissioning and plans should be in place to deal with this. Ideally an End-of-Life plan needs to be in place before the first electrolyte / container / equipment is brought on site.

All decommissioning activities must comply with the relevant regulations at the time. Decommissioning will ultimately need to be informed by the regulatory requirements at the time, which may be different to present requirements. The impact rating are not possible to determine now given the uncertainties in mitigations applicable at that time, hence they have been left as neutral.

HUMAN HEALTH - CHRONIC EXPOSURE TO TOXIC CHEMICAL OR BIOLOGICAL AGENTS

Operation and maintenance materials such as spare parts, paints, solvents, welding fumes, transformers oils, lubricating oils and greases etc. can cause occupational illness. The decommissioning impact on human health - chronic exposure to toxic chemical or biological agents is indicated in **Table 8.151**.

Table 8.151: Decommissioning Impact on human health - chronic exposure to toxic chemical or biological agents for both BESS types

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN HEALTH - CHRONIC EXPOSURE TO TOXIC CHEMICAL OR BIOLOGICAL AGENTS									
Without Mitigation	1	1	1	1	1	**4**	**Very Low**	(-)	High
With Mitigation	1	1	1	1	1	**4**	**Very Low**	(-)	High
Mitigation and Management Measures	— As per construction and operational phases.								

HUMAN HEALTH - EXPOSURE TO NOISE

Moving parts inside containers, buildings, pumps, compressors, cooling systems etc. can cause adverse impact on hearing of workers, or may be a nuisance factor at near -by residences or other activities. The decommissioning impact on human health - exposure to noise is indicated in **Table 8.152**.

Table 8.152: Decommissioning Impact on human health - exposure to noise for both BESS types

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN HEALTH - EXPOSURE TO NOISE									
Without Mitigation	1	1	1	1	1	**4**	**Very Low**	(-)	High
With Mitigation	1	1	1	1	1	**4**	**Very Low**	(-)	High
Mitigation and Management Measures	— As per construction and operational phases.								

HUMAN HEALTH - EXPOSURE TO TEMPERATURE EXTREMES AND/OR HUMIDITY

Exposure to extreme temperatures and/or humidity such as heat during the day and cold weather in winter can result in heat stroke or hypothermia. Batteries can also generate heat within enclosed buildings / containers and night work requires lighting which can generate heat. The decommissioning impact on human health - exposure to temperature extremes and/or humidity is indicated in **Table 8.153**.

Table 8.153: Decommissioning Impact on human health - exposure to temperature extremes and/or humidity for both BESS types

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN HEALTH - EXPOSURE TO TEMPERATURE EXTREMES AND/OR HUMIDITY									
Without Mitigation	1	1	1	1	1	**4**	**Very Low**	(-)	High
With Mitigation	1	1	1	1	1	**4**	**Very Low**	(-)	High
Mitigation and Management Measures	— As per construction and operational phases.								

HUMAN HEALTH - EXPOSURE TO PSYCHOLOGICAL STRESS

Isolated workstation and monotonous repetitive work can cause low performance, and system productivity suffers. The decommissioning impact on human health - exposure to psychological stress is indicated in **Table 8.154**.

Table 8.154: Decommissioning Impact on human health - exposure to psychological stress for both BESS types

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN HEALTH - EXPOSURE TO PSYCHOLOGICAL STRESS									
Without Mitigation	1	1	1	1	1	**4**	**Very Low**	(-)	High
With Mitigation	1	1	1	1	1	**4**	**Very Low**	(-)	High
Mitigation and Management Measures	— As per construction and operational phases.								

HUMAN HEALTH - EXPOSURE TO ERGONOMIC STRESS

Lifting heavy equipment and at awkward angles during maintenance, stretching reaching to high level and bending to low level, working at height if equipment located on top of roofs or elevated electrical equipment (e.g. pylons), can result in back and other injuries. The decommissioning impact on human health - exposure to ergonomic stress is indicated in **Table 8.155**.

Table 8.155: Decommissioning Impact on human health - exposure to ergonomic stress for both BESS types

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN HEALTH - EXPOSURE TO ERGONOMIC STRESS									
Without Mitigation	1	1	1	1	1	**4**	**Very Low**	(-)	High
With Mitigation	1	1	1	1	1	**4**	**Very Low**	(-)	High
Mitigation and Management Measures	— As per construction and operational phases.								

HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO FIRE RADIATION

Involvement in an external fire e.g. veld fire, maintenance vehicle fire, electrical systems fire; manufacturing defects or damage to battery leading to shorting and heating; high humidity condensation of water or ingress of water or flooding leading to shorting; dust accumulation on electrical parts leading to overheating; excessive electrical loads -resulting in surges; operator abuse; BMS failure or software failure; incorrect extinguishing medium; can result in contaminated run off; radiation burns are unlikely to be severe as no highly flammable materials on site; no affected bystanders; damaged equipment. Fire can also spread to other units or offsite if grass/vegetation is not controlled. The decommissioning impact on human and equipment safety - exposure to fire radiation is indicated in **Table 8.156**.

Table 8.156: Decommissioning Impact on human and equipment safety - exposure to fire radiation for both BESS types

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO FIRE RADIATION									
Without Mitigation	1	1	1	1	1	**4**	**Very Low**	(-)	High
With Mitigation	1	1	1	1	1	**4**	**Very Low**	(-)	High
Mitigation and Management Measures	— As per construction and operational phases.								

HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO EXPLOSION OVER PRESSURES

Transformer shorting / overheating / explosion or flammable gases generated by thermal run away reach explosive limits. Ignition on hot surfaces can cause static. Lithium Cobalt Oxide generates O2 during decomposition which can cause escalation. This can result in potential fatalities amongst first responders; or damage to container or other nearby items, e.g. other container. The decommissioning impact on human and equipment safety - exposure to explosion over pressures is indicated in **Table 8.157**.

Table 8.157: Decommissioning Impact on human and equipment safety - exposure to explosion over pressures for both BESS types

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO EXPLOSION OVER PRESSURES									
Without Mitigation	1	1	1	1	1	**4**	**Very Low**	(-)	High
With Mitigation	1	1	1	1	1	**4**	**Very Low**	(-)	High
Mitigation and Management Measures	— As per construction and operational phases.								

HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO ACUTE TOXIC CHEMICAL AND BIOLOGICAL AGENTS

Human pathogens and diseases, sewage, food waste as well as snakes, insects, wild and domesticated animals and harmful plants can cause illness and at worst without mitigation, possibly extending to fatalities. Effects can vary from discomfort to fatalities for venomous snakes or bee swarms etc. The decommissioning impact on human and equipment safety - exposure to acute toxic chemical and biological agents is indicated in **Table 8.158**.

Table 8.158: Decommissioning Impact on human and equipment safety - exposure to acute toxic chemical and biological agents for both BESS types

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO ACUTE TOXIC CHEMICAL AND BIOLOGICAL AGENTS									
Without Mitigation	1	1	1	1	1	**4**	**Very Low**	(-)	High
With Mitigation	1	1	1	1	1	**4**	**Very Low**	(-)	High
Mitigation and Management Measures	— As per construction and operational phases.								

HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO VIOLENT RELEASE OF KINETIC OR POTENTIAL ENERGY

Moving equipment, pumps, heavy equipment at elevation, nip points, working at heights, traffic accidents and earthquake/tremors can cause injury or possibly fatality in unlikely worst case, damage to equipment, spills, and environment pollution. The decommissioning impact on human and equipment safety - exposure to violent release of kinetic or potential energy is indicated in **Table 8.159**.

Table 8.159: Decommissioning Impact on human and equipment safety - exposure to violent release of kinetic or potential energy for both BESS types

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO VIOLENT RELEASE OF KINETIC OR POTENTIAL ENERGY									
Without Mitigation	1	1	1	1	1	**4**	**Very Low**	(-)	High
With Mitigation	1	1	1	1	1	**4**	**Very Low**	(-)	High
Mitigation and Management Measures	— As per construction and operational phases.								

HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO ELECTROMAGNETIC WAVES

Use of electrical machines, generators etc. and hot dry area static generation is highly likely as well as lightning strike. This may cause electrocution, ignition, burns, injury and death, as well as damage to electrical equipment. The decommissioning impact on human and equipment safety - exposure to electromagnetic waves is indicated in **Table 8.160.**

Table 8.160: Decommissioning Impact on human and equipment safety - exposure to electromagnetic waves for both BESS types

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
HUMAN AND EQUIPMENT SAFETY - EXPOSURE TO ELECTROMAGNETIC WAVES									
Without Mitigation	1	1	1	1	1	**4**	**Very Low**	(-)	High
With Mitigation	1	1	1	1	1	**4**	**Very Low**	(-)	High
Mitigation and Management Measures	— As per construction and operational phases.								

ENVIRONMENT - EMISSIONS TO AIR

Not expected on a normal basis. Refrigerant may be an asphyxiant if accidentally released indoors it can accumulate and displace oxygen. The decommissioning impact on environment - emissions to air is indicated in **Table 8.161**.

Table 8.161: Decommissioning Impact on environment - emissions to air for both BESS types

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
ENVIRONMENT - EMISSIONS TO AIR									
Without Mitigation	1	1	1	1	1	**4**	**Very Low**	(-)	High
With Mitigation	1	1	1	1	1	**4**	**Very Low**	(-)	High
Mitigation and Management Measures	— As per construction and operational phases.								

ENVIRONMENT - EMISSIONS TO WATER

Cooling water blow-down, laboratory waste (if included in the design), maintenance waste, e.g. oils, spills from batteries, coolant system, diesel trucks, transformers, oil drips from parked vehicles, fire water runoff control, kitchen waste and sewage, refrigerant release, can cause pollution if not contained, excessive disposal costs if emissions not limited. The decommissioning impact on environment - emissions to water is indicated in **Table 8.162**.

Table 8.162: Decommissioning Impact on environment - emissions to water for both BESS types

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
ENVIRONMENT - EMISSIONS TO WATER									
Without Mitigation	1	1	1	1	1	4	Very Low	(-)	High
With Mitigation	1	1	1	1	1	4	Very Low	(-)	High
Mitigation and Management Measures	— As per construction and operational phases.								

ENVIRONMENT - EMISSIONS TO EARTH

Batteries / equipment will reach its end of life and may leak. This may result in environment damage from heavy metal ions. The decommissioning impact on environment - emissions to earth is indicated in **Table 8.163**.

Table 8.163: Decommissioning Impact on environment - emissions to earth for both BESS types

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
ENVIRONMENT - EMISSIONS TO EARTH									
Without Mitigation	4	3	3	5	4	60	Moderate	(-)	High
With Mitigation	4	3	3	5	2	30	Low	(-)	High
Mitigation and Management Measures	— End of Life shutdown procedure including a risk assessment of the specific activities involved. — Where possible re-purpose the solid-state batteries / containers and equipment with associated Environmental impact considered. — Disposal according to local regulations and other directives such as the European Batteries Directive. — End of life, which is affected by temperature and time, cycles, etc, should be predefined and the monitoring should be in place to determine if it has been reached.								

ENVIRONMENT - WASTE OF RESOURCES E.G. WATER, POWER ETC

Water usage that is not controlled, disposal of batteries or components, or disposal of containers may cause delays, excessive costs and disposal of large volumes of hazardous waste. The decommissioning impact on environment - waste of resources e.g. water, power etc is indicated in **Table 8.164**.

Table 8.164: Decommissioning Impact on environment - waste of resources e.g. water, power etc for both BESS types

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
ENVIRONMENT - WASTE OF RESOURCES E.G. WATER, POWER ETC									
Without Mitigation	1	1	1	1	1	4	Very Low	(-)	High
With Mitigation	1	1	1	1	1	4	Very Low	(-)	High
Mitigation and Management Measures	— As per construction and operational phases.								

PUBLIC - AESTHETICS

Bright surfaces reflecting light and tall structures in a flat area may cause irritation. The decommissioning impact on public - aesthetics is indicated in **Table 8.165**.

Table 8.165: Decommissioning Impact on public - aesthetics for both BESS types

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
PUBLIC - AESTHETICS									
Without Mitigation	1	1	1	1	1	4	Very Low	(-)	High
With Mitigation	1	1	1	1	1	4	Very Low	(-)	High
Mitigation and Management Measures	— As per construction and operational phases.								

INVESTORS - FINANCIAL

Defective technology and extreme project delays can cause financial loss. The decommissioning impact on investors - financial is indicated in **Table 8.166**.

Table 8.166: Decommissioning Impact on investors - financial for both BESS types

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
INVESTORS - FINANCIAL									
Without Mitigation	1	1	1	1	1	4	Very Low	(-)	High
With Mitigation	1	1	1	1	1	4	Very Low	(-)	High
Mitigation and Management Measures	— As per construction and operational phases.								

EMPLOYEES AND INVESTORS – SECURITY

On route to the decommissioning site there is a risk of potential hi-jacking of valuable but hazardous loads. On site there is a risk of theft of decommissioning equipment and battery installation facilities. There may also be civil unrest or violent strike by employees. This may result in theft, injury to burglars, damage to equipment possibly setting off thermal runaway. The decommissioning impact on employees and investors – security is indicated in **Table 8.167**.

Table 8.167: Decommissioning Impact on employees and investors – security for both BESS types

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
EMPLOYEES AND INVESTORS – SECURITY									
Without Mitigation	1	1	1	1	1	4	Very Low	(-)	High
With Mitigation	1	1	1	1	1	4	Very Low	(-)	High
Mitigation and Management Measures	— As per construction and operational phases.								

EMERGENCIES

Fires, explosions, toxic smoke, large spills, traffic accidents, equipment/structural collapse, inadequate emergency response to small events that can lead to escalation, may result in injuries which can turn into fatalities, and small losses become extended down time. The decommissioning impact on emergencies is indicated in **Table 8.168**.

Table 8.168: Decommissioning Impact on emergencies for both BESS types

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
EMERGENCIES									
Without Mitigation	1	1	1	1	1	4	Very Low	(-)	High
With Mitigation	1	1	1	1	1	4	Very Low	(-)	High

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
EMERGENCIES									
Mitigation and Management Measures	— As per construction and operational phases.								

INVESTORS – LEGAL

Disposal of hazardous "waste" is rife with difficulties and numerous regulations that need to be complied with. The decommissioning impact on investors – legal is indicated in **Table 8.169**.

Table 8.169: Decommissioning Impact on investors – legal for both BESS types

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
INVESTORS – LEGAL									
Without Mitigation	3	1	3	3	4	**40**	**Moderate**	(-)	High
With Mitigation	3	1	3	3	3	**30**	**Low**	(-)	High
Mitigation and Management Measures	— Applicants should seek the opinion from a waste consultant on how to correctly dispose of hazardous waste.								

9 CUMULATIVE IMPACT ASSESSMENT

Although the S&EIR process is essential to assessing and managing the environmental and social impacts of individual projects, it often may be insufficient for identifying and managing incremental impacts on areas or resources used or directly affected by a given development from other existing, planned, or reasonably defined developments at the time the risks and impacts are identified.

IFC PS 1 recognizes that, in some instances, cumulative effects need to be considered in the identification and management of environmental and social impacts and risks. For private sector management of cumulative impacts, IFC considers good practice to be two pronged:

- effective application of and adherence to the mitigation hierarchy in environmental and social management of the specific contributions by the project to the expected cumulative impacts; and
- best efforts to engage in, enhance, and/or contribute to a multi-stakeholder, collaborative approach to implementing management actions that are beyond the capacity of an individual project proponent.

Even though Performance Standard 1 does not expressly require, or put the sole onus on, private sector clients to undertake a cumulative impact assessment (CIA), in paragraph 11 it states that the impact and risk identification process "*will take into account the findings and conclusions of related and applicable plans, studies, or assessments prepared by relevant government authorities or other parties that are directly related to the project and its area of influence*" including "*master economic development plans, country or regional plans, feasibility studies, alternatives analyses, and cumulative, regional, sectoral, or strategic environmental assessments where relevant*."

Cumulative impacts are those that result from the successive, incremental, and/or combined effects of an action, project, or activity when added to other existing, planned, and/or reasonably anticipated future ones. For practical reasons, the identification and management of cumulative impacts are limited to those effects generally recognized as important on the basis of scientific concerns and/or concerns of affected communities (IFC GPH).

Evaluation of potential cumulative impacts is an integral element of an impact assessment. In reference to the scope for an impact assessment, IFC's Performance Standards specify that "*Risks and impacts will be analysed in the context of the project's area of influence. This area of influence encompasses…areas potentially impacted by cumulative impacts from further planned development of the project, any existing project or condition, and other project-related developments that are realistically defined at the time the Social and Environmental Assessment is undertaken; and (iv) areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location.*" (IFC 2006).

A cumulative impact assessment is the process of (a) analysing the potential impacts and risks of proposed developments in the context of the potential effects of other human activities and natural environmental and social external drivers on the chosen Valued Environmental and Social Components (VECs) over time, and (b) proposing concrete measures to avoid, reduce, or mitigate such cumulative impacts and risk to the extent possible (IFC GPH).

Cumulative impacts with existing and planned facilities may occur during construction and operation of the Facility. While one project may not have a significant negative impact on sensitive resources or receptors, the collective impact of the projects may increase the severity of the potential impacts.

According to the South African Renewable Energy EIA Application Database from DFFE, there are currently no registered applications involving planned renewable solar energy projects within a 30km radius around the proposed development. The closest known and approved renewable energy project is a solar PV plant located approximately 47km southwest of the proposed Camden I SEF. Therefore, with the exception of the other proposed Camden developments (Camden I WEF, Camden II WEF, Green Hydrogen Plant and associated grid connection infrastructure) forming part of the Camden Renewable Energy Complex, no other renewable energy projects within a 30km radius have been considered in this S&EIA process. It is noted that there is existing electrical infrastructure in the broader area which includes the Camden Power Station and associated power lines. Cumulative impacts assessed for the respective specialist studies are discussed in the sub-sections below.

AGRICULTURAL POTENTIAL

The potential cumulative agricultural impact of importance is a regional loss (including by degradation) of future agricultural production potential.

According to the DFFE database, there are no other renewable energy projects within a 30 km radius of the Camden 1 site. There is, however, the associated Camden 1 and 2 Wind Energy Facilities. In quantifying the cumulative impact, the area of land taken out of agricultural use as a result of these projects (total generation capacity of up to 550 MW) will amount to a total of approximately 495 hectares. This is calculated using the industry standards of 2.5 and 0.3 hectares per megawatt for solar and wind energy generation respectively, as per the DEA Phase 1 Wind and Solar Strategic Environmental Assessment (SEA) (2015). As a proportion of the total area within a 30km radius (approximately 282,700 ha), this amounts to only 0.18% of the surface area. That is considered to be within an acceptable limit in terms of loss of agricultural land.

The risk of a loss of agricultural potential by soil degradation can effectively be mitigated for renewable energy developments. If the risk for each individual development is low, then the cumulative risk is also low.

Due to all of the considerations discussed above, the cumulative impact of loss of agricultural land use will not have an unacceptable negative impact on the agricultural production capability of the area. The proposed development is therefore acceptable in terms of cumulative impact, and it is therefore recommended that it is approved.

AQUATIC ECOLOGY

In the assessment of this project, any similar projects were assessed (e.g Camden II). The cumulative impact on aquatic ecology is indicated in **Table 9.1**.

Table 9.1: Cumulative Impact on aquatic ecology

Potential Impact AQUATIC ECOLOGY	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	4	4	5	4	2	**34**	**Moderate**	(-)	High
With Mitigation	2	2	2	2	2	**16**	**Low**	(-)	High

TERRESTRIAL BIODIVERSITY

INDIGENOUS NATURAL VEGETATION

The regional terrestrial vegetation type in the broad study area is listed as Vulnerable and is impacted across its range by historical activities. Loss of habitat will definitely occur for the project, which will be a small area in comparison to the total area of the vegetation type. However, the total loss of habitat due to a number of projects together will be greater than for any single project, so a cumulative effect will occur. The area lost in total will be very small compared to the total area of the vegetation type concerned. The cumulative effect will therefore be high for vegetation loss, as indicated in **Table 9.2**.

Table 9.2: Cumulative Impact on indigenous natural vegetation

Potential Impact CLEARING OF NATURAL HABITAT FOR CONSTRUCTION	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	2	3	3	5	5	**65**	**High**	(-)	High

ECOLOGICAL PROCESSES

There are various ecological processes that may be affected at a landscape level by the presence of multiple projects. This includes population processes, such as migration (movement of species through the landscape), pollination (can be disrupted if insect pollinators are blocked from movement)and dispersal, but also more difficult to interpret factors, such as spatial heterogeneity (the diversity of habitats and their spatial relationship to one another), community composition (the species that occur in the landscape) and environmental gradients, that can become disrupted when landscapes are disturbed at a high level. Disturbance can alter the pattern of variation in the structure or function of ecosystems. Fragmentation is the breaking up of a habitat, ecosystem, or land-use type into smaller parcels. An important consequence of repeated, random clearing is that contiguous cover can break down into isolated patches. This happens when the area cleared exceed a critical level and landscapes start to become disconnected. Spatially heterogenous patterns can be interpreted as individualistic responses to environmental gradients and lead to natural patterns in the landscape. Disrupting gradients and creating disturbance edges across wide areas is very disruptive of natural processes and will lead to fundamental changes in ecosystem function.

The current project has been designed to mostly occupy areas that are already disturbed. Where infrastructure is located in natural areas, it is near to edges or follows existing roads. There are few places where it intrudes significantly into natural areas.

Table 9.3: Cumulative Impact on ecological processes

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
DISRUPTION OF ECOLOGICAL PROCESSES AT LANDSCAPE LEVEL									
Without Mitigation	3	3	3	4	4	**52**	**Moderate**	(-)	High

SPREAD OF DECLARED WEEDS AND ALIEN INVADER PLANTS

There is a moderate possibility that alien plants could be introduced to areas within the footprint of the proposed infrastructure from surrounding areas in the absence of control measures. The greater the number of projects, the more likely this effect will happen; therefore, the effect is cumulative. For the current site, the impact is predicted to be low due to the current absence of invasive species on site and the high ability to control any additional impact. The significance will therefore be low, especially if control measures are implemented. However, the increased overall disturbance of the landscape will create opportunities and, if new invasions are not controlled, can create nodes that spread to new locations due to the heightened disturbance levels.

Table 9.4: Cumulative Impact on ecological processes

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
ESTABLISHMENT AND SPREAD OF DECLARED WEEDS AND ALIEN INVADER PLANTS									
Without Mitigation	3	3	3	4	4	**52**	**Moderate**	(-)	High

TERRESTRIAL PLANT SPECIES

LOSS OF INDIVIDUALS OF SPECIES OF CONSERVATION CONCERN

Construction activities will require clearing of natural habitat, to be replaced by the infrastructure. This will result in possible loss of populations of SCC. The cumulative impact of the loss of individuals of Species of Conservation Concern from the project and other projects in the area is indicated in **Table 9.5**.

Table 9.5: Cumulative Impact on loss of individuals of Species of Conservation Concern

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
LOSS OF INDIVIDUALS OF SPECIES OF CONSERVATION CONCERN									
Without Mitigation	3	3	5	5	3	**48**	**Moderate**	(-)	High

TERRESTRIAL ANIMAL SPECIES

LOSS OF FAUNAL HABITAT

Construction activities will require clearing of natural habitat, to be replaced by the infrastructure. This will result in the possible loss of faunal habitat. The cumulative impact of the loss of faunal habitat from the project and other projects in the area is indicated in **Table 9.6**.

Table 9.6: Cumulative Impact on loss of faunal habitat

Potential Impact	Magnitude	Extent	Reversibility	Du.	Probability	Significance		Character	Confidence
LOSS OF FAUNAL HABITAT									
Without Mitigation	3	3	3	5	4	**56**	**Moderate**	(-)	High

DIRECT MORTALITY OF FAUNA DURING CONSTRUCTION ACTIVITIES

Construction activities will require use of heavy machinery and vehicles, as well as placement of various obstructions that may be hazardous. This will result in the possible direct mortality of fauna. The cumulative impact of the mortality of fauna during construction activities from the project and other projects in the area is indicated in **Table 9.7**.

Table 9.7: Cumulative Impact on direct mortality of fauna during construction activities

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
DIRECT MORTALITY OF FAUNA DURING CONSTRUCTION ACTIVITIES									
Without Mitigation	3	3	1	2	4	**36**	**Moderate**	(-)	High

DIRECT MORTALITY OF FAUNA DURING OPERATION

Direct mortality of fauna may occur in the decommissioning phase through traffic, illegal collecting, poaching and collisions and/or entanglement with infrastructure. The cumulative impact of the mortality of fauna during operation from the project and other projects in the area is indicated in **Table 9.8**.

Table 9.8: Cumulative Impact on direct mortality of fauna during operation

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
DIRECT MORTALITY OF FAUNA DURING OPERATION									
Without Mitigation	3	3	1	4	4	**44**	**Moderate**	(-)	High

AVIFAUNA

The total area of similar habitat (excluding opencast mining and urban areas) available to birds in the 30km radius around the project area (including the project area) is approximately 4 258 km². The land parcels affected by the planned renewable energy facilities, including the Camden I SEF, in this radius takes up a total of ~124km², which is 2.9% of the available habitat. The impact on avifauna of the currently planned renewable energy projects within this area, including the Camden I SEF, is therefore considered to be Low, and the impact could be reduced if the recommended mitigation at the two Camden wind projects and the Camden I SEF is diligently implemented.

Table 9.9: Cumulative Impact on displacement of priority species due to disturbance associated with the construction of the solar panels and associated infrastructure

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
DISPLACEMENT OF PRIORITY SPECIES DUE TO DISTURBANCE ASSOCIATED WITH THE CONSTRUCTION OF THE SOLAR PANELS AND ASSOCIATED INFRASTRUCTURE									
Without Mitigation	4	3	3	3	4	**52**	**Moderate**	(-)	High

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
DISPLACEMENT OF PRIORITY SPECIES DUE TO DISTURBANCE ASSOCIATED WITH THE CONSTRUCTION OF THE SOLAR PANELS AND ASSOCIATED INFRASTRUCTURE									
With Mitigation	3	3	3	2	3	33	Moderate	(-)	High

Table 9.10: Cumulative Impact on displacement of priority species due to habitat transformation associated with the construction of the solar panels and associated infrastructure

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
DISPLACEMENT OF PRIORITY SPECIES DUE TO HABITAT TRANSFORMATION ASSOCIATED WITH THE CONSTRUCTION OF THE SOLAR PANELS AND ASSOCIATED INFRASTRUCTURE									
Without Mitigation	3	3	4	4	4	56	Moderate	(-)	High
With Mitigation	3	3	3	4	3	39	Moderate	(-)	High

Table 9.11: Cumulative Impact on mortality of priority species due to collisions with the solar panels

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
MORTALITY OF PRIORITY SPECIES DUE TO COLLISIONS WITH THE SOLAR PANELS									
Without Mitigation	2	1	1	4	2	16	Low	(-)	High
With Mitigation	2	1	1	4	2	16	Low	(-)	High

Table 9.12: Cumulative Impact on mortality of priority species due to collisions with the medium voltage overhead power lines

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
MORTALITY OF PRIORITY SPECIES DUE TO COLLISIONS WITH THE MEDIUM VOLTAGE OVERHEAD POWER LINES									
Without Mitigation	4	3	4	4	4	60	Moderate	(-)	High
With Mitigation	3	3	3	4	4	52	Moderate	(-)	High

Table 9.13: Cumulative Impact on electrocution of priority species on the medium voltage infrastructure

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
ELECTROCUTION OF PRIORITY SPECIES ON THE MEDIUM VOLTAGE INFRASTRUCTURE									
Without Mitigation	5	3	4	4	4	64	High	(-)	High
With Mitigation	2	3	2	4	3	33	Moderate	(-)	High

The BESS will transform an area of approximately 5 ha. Given the available habitat of 4 258km² within a 30km radius around the project site, the cumulative impact of displacement and habitat transformation caused by the BESS is Low due to the small footprint.

Table 9.14: Cumulative Impact on displacement of priority species due to disturbance associated with the construction of the BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
DISPLACEMENT OF PRIORITY SPECIES DUE TO DISTURBANCE ASSOCIATED WITH THE CONSTRUCTION OF THE BESS									
Without Mitigation	2	1	1	2	4	24	Low	(-)	High
With Mitigation	2	1	1	2	3	18	Low	(-)	High

Table 9.15: Cumulative Impact on displacement of priority species due to habitat transformation associated with the construction of the BESS

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
DISPLACEMENT OF PRIORITY SPECIES DUE TO HABITAT TRANSFORMATION ASSOCIATED WITH THE CONSTRUCTION OF THE BESS									
Without Mitigation	3	1	5	4	2	26	Low	(-)	High
With Mitigation	3	1	5	4	2	26	Low	(-)	High

BATS

No cumulative impacts for the proposed Camden I SEF Project are identified, since no other PV facilities are proposed within a 30km radius of the Camden I site.

TRAFFIC

The only known potential development in the vicinity of Camden I is the Camden II WEF. This facility will also take access off the N11 via the D260 during the construction and operational phases.

The maximum traffic generation of the Camden I and Camden II facility is expected to occur at the same time, as the facilities will be developed and operated concurrently.

It should be noted that the Significance of the transport impact of the Camden II facility is lower than the expected significance of the Camden I facility.

HERITAGE

Cumulative impacts considered as an effect caused by the proposed action that results from the incremental impact of an action when added to other past, present, or reasonably foreseeable future actions. (Cornell Law School Information Institute, 2020). Cumulative impacts occur from the combination of effects of various impacts on heritage resources. The importance of identifying and assessing cumulative impacts is that the whole is greater than the sum of its parts. In the case of this project, impacts can be mitigated to an acceptable level. However, this and other projects in the area can have a negative impact on heritage sites in the area where these sites have been destroyed unknowingly.

PALAEONTOLOGY

Based on the geology of the area and the palaeontological record as we know it, it can be assumed that the formation and layout of the dolomites, sandstones, shales and sands are typical for the country and only some do contain fossil plant, insect, invertebrate and vertebrate material. The site visit and walk through confirmed that there are no fossils present on the land surface. It is not known if there are any fossils below the land surface. The sands of the Quaternary period and the Jurassic dolerite would not preserve fossils.

VISUAL

Existing mining / quarrying and electrical infrastructure have already resulted in large scale visual impacts, mostly along the N2 national route, extending south-eastwards from Ermelo to Camden Power Station. These developments have significantly altered the sense of place and visual character in the broader region.

Renewable energy facilities have the potential to cause large-scale visual impacts, and although the level of transformation already present in the landscape will reduce the contrast and overall visual impact of the new development, the incremental change in the landscape will be increased and the visual impacts on surrounding visual receptors would be exacerbated. Although the South African Renewable Energy EIA Application Database from DFFE does not record any existing or proposed renewable projects within 35kms of the Camden 1 SEF project area, a cumulative assessment must include all elements of the proposed Camden Renewable Energy Complex. This complex, including wind, solar and green hydrogen energy facilities as well as associated grid connection infrastructure, will affect a large portion of the study area.

From a visual perspective, the concentration of renewable energy facilities as proposed will further change the visual character of the area and alter the inherent sense of place, extending an increasingly industrial character into the broader area, and resulting in significant cumulative impacts. It is however anticipated that these impacts could be mitigated to acceptable levels with the implementation of the recommended mitigation measures. In addition, it is possible that these developments in close proximity to each other could be seen as one large Renewable Energy Facility (REF) rather than several separate developments. Although this will not necessarily reduce impacts on the visual character of the area, it could potentially reduce the cumulative visual impacts on the landscape.

Table 9.16: Cumulative Impact on visual

Potential Impact VISUAL	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	5	3	3	5	4	64	High	(-)	Med
With Mitigation	4	3	3	4	4	56	Moderate	(-)	Med
Mitigation and Management Measures	— Carefully plan to minimise the construction period and avoid construction delays. — Position laydown areas and related storage/stockpile areas in unobtrusive positions in the landscape, where possible. — Minimise vegetation clearing and rehabilitate cleared areas as soon as possible. — Where possible, the operation and maintenance buildings should be consolidated to reduce visual clutter. — As far as possible, limit the number of maintenance vehicles which are allowed to access the facility. — Ensure that dust suppression techniques are implemented on all gravel access roads. — As far as possible, limit the amount of security and operational lighting present on site. — Light fittings for security at night should reflect the light toward the ground and prevent light spill. — Lighting fixtures should make use of minimum lumen or wattage whilst adhering to safety standards. — Mounting heights of lighting fixtures should be limited, or alternatively foot-light or bollard level lights should be used. — If possible, make use of motion detectors on security lighting. — The operations and maintenance (O&M) buildings should not be illuminated at night, unless required to maintain safety standards.								

SOCIAL

SENSE OF PLACE

The potential cumulative impacts on the areas sense of place will be largely linked to potential visual impacts. In this regard the Scottish Natural Heritage (2005) describes a range of potential cumulative landscape impacts associated with wind farms on landscapes. These impacts are also likely to apply to SEFs. The relevant issues identified by Scottish Natural Heritage study include:

— Combined visibility (whether two or more wind (solar) farms will be visible from one location).
— Sequential visibility (e.g., the effect of seeing two or more wind (solar) farms along a single journey, e.g., road or walking trail).
— The visual compatibility of different wind (solar) farms in the same vicinity.
— Perceived or actual change in land use across a character type or region.
— Loss of a characteristic element (e.g., viewing type or feature) across a character type caused by developments across that character type.

The guidelines also note that cumulative impacts need to be considered in relation to dynamic as well as static viewpoints. The experience of driving along a tourist road, for example, needs to be considered as a dynamic sequence of views and visual impacts, not just as the cumulative impact of several developments on one location. The viewer may only see one renewable energy facility and the associated infrastructure at a time, but if each successive stretch of the road is dominated by views of renewable energy facilities, then that can be argued to be a cumulative visual impact (National Wind Farm Development Guidelines, DRAFT - July 2010).

The establishment of the Camden I SEF and proposed Camden I and II WEFs in the area will create the potential for combined and sequential visibility impacts. However, the impact on the areas sense of place should be viewed within the context of the impact of the Camden Power Station and associated transmission lines on areas sense of place. The areas sense of place has also been impacted by large-sale coal mining operations. The potential visual impact on the areas sense place is therefore likely to be limited. In addition, none of the affected landowners interviewed raised concerns about potential visual impacts associated with the proposed project. The potential cumulative impact on the areas sense of place is therefore likely to be limited, as indicated in **Table 9.17**.

Table 9.17: Cumulative Impact on sense of place

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
SENSE OF PLACE									
Without Mitigation	2	2	3	4	2	**26**	**Low**	(-)	Med
With Mitigation	2	3	3	4	3	**36**	**Moderate**	(-)	Med
Mitigation and Management Measures	— The recommendations contained in the VIA should be implemented.								

LOCAL SERVICES AND ACCOMODATION

The objective will be to source as many low and semi-skilled workers for the construction phase from the MM, specifically Ermelo. This will reduce the pressure on local services and accommodation in Ermelo. For a single SEF project ~ 100-150 workers require accommodation. In the event of the construction phase for 2-3 projects overlapping, the total number of workers requiring accommodation would be between 200 and 450. The potential pressure on local services will depend on the number of locally based contractors and workers that are employed during the construction phase.

The potential impact should also be viewed within the context of the potential positive cumulative impacts for the local economy associated with the establishment of the proposed facility and associated renewable energy projects in the MM. These benefits will create opportunities for investment in the MM, including the opportunity to up-grade and expand existing services and the construction of new houses. Socio-economic development (SED) contributions also represent an important focus of the REIPPPP and is aimed at ensuring that the build programme secures sustainable value for the country and enables local communities to benefit directly from the investments attracted into the area. The proposed SEF is also required to contribute a percentage of projected revenues accrued over the 20-year period to SED. This will provide revenue that can be used by the MM to invest in up-grading local services where required. In should also be noted that it is the function of national, provincial, and local government to address the needs created by development and provide the required services. The additional demand for services and accommodation created by the establishment of development renewable energy projects should therefore be addressed in the Integrated Development Planning process undertaken by the MM.

The cumulative impact on the local services and accommodation is indicated in **Table 9.17**.

Table 9.18: Cumulative Impact on local services and accommodation

Potential Impact LOCAL SERVICES AND ACCOMODATION	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	2	2		2	2	**12**	**Very Low**	(-)	Med
With Mitigation	3	3		3	2	**18**	**Low**	(-)	Med
Mitigation and Management Measures	— The proponent should assess the availability of accommodation in Ermelo should the project be approved.								

LOCAL ECONOMY

In addition to the potential negative impacts, the establishment of renewable energy facilities and associated infrastructure, including the proposed SEF, will also create several socio-economic opportunities for the ULM. The positive cumulative opportunities include creation of employment, skills development and training opportunities, and downstream business opportunities.

The review of the REIPPPP (June 2020) indicates that the SED contributions associated with 68 operational projects has amounted to R 1.2 billion to date. In terms of Enterprise Development (ED), R 7.2 billion has been committed for BW1 to BW4, 1S2 and 2S2. Assuming an equal distribution of revenue over the 20-year project operational life, enterprise development contributions would be R360 million per annum. Of the total commitment, R5.6 billion is specifically committed directly within the local communities where the IPPs operate, contributing significantly to local enterprise development. Up until the end of June 2020 a total of R 384.2 million had already been made to the local communities located in the vicinity of the 68 operating IPPs. This represents 93% of the total R384.2 million enterprise development contributions made to date).

The potential cumulative benefits for the local and regional economy are therefore associated with both the construction and operational phase of renewable energy projects and associated infrastructure and extend over a period of 20-25 years. However, steps must be taken to maximise employment opportunities for members from the local communities in the area and support skills development and training programmes.

The cumulative impact on the local economy is indicated in **Table 9.17**.

Table 9.19: Cumulative Impact on local economy

Potential Impact LOCAL SERVICES AND ACCOMODATION	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	2	2		4	4	**32**	**Moderate**	(+)	Med
With Mitigation	4	3		4	5	**55**	**Moderate**	(+)	Med
Mitigation and Management Measures	— The proponent should create opportunities for local SMMEs during the operational phase.								

10 ENVIRONMENTAL IMPACT STATEMENT

The essence of any impact assessment process is aimed at ensuring informed decision-making, environmental accountability, and to assist in achieving environmentally sound and sustainable development. In terms of NEMA, the commitment to sustainable development is evident in the provision that "*development must be socially, environmentally and economically sustainable…. and requires the consideration of all relevant factors…*". NEMA also imposes a duty of care, which places an obligation on any person who has caused, is causing, or is likely to cause damage to the environment to take reasonable steps to prevent such damage. In terms of NEMA's preventative principle, potentially negative impacts on the environment and on people's environmental rights (in terms of the Constitution of the Republic of South Africa, Act No. 108 of 1996) should be anticipated and prevented, and where they cannot be prevented altogether, they must be minimised and remedied in terms of "reasonable measures".

In assessing the environmental feasibility of the proposed construction of the SEF, the requirements of all relevant legislation have been considered. The identification and development of appropriate mitigation measures that should be implemented to minimise potentially significant impacts associated with the project, has been informed by best practice principles, past experience, and the relevant legislation (where applicable).

The conclusions of this EIR are the result of comprehensive assessments. These assessments were based on issues identified through the S&EIR process and public participation undertaken to date. The EIR will be subject to public review, which will be undertaken according to the requirements of NEMA with every effort made to include representatives of all stakeholders within the process. The EIR will be updated and finalised taking into consideration all comments received during the public review period before being submitted to the CA for consideration.

10.1 ENVIRONMENTAL SENSITIVITIES

The following environmental sensitivities were identified for the Camden I SEF and associated infrastructure, as a result of the Project location and proposed activities and will require specific applications or measures for mitigation to minimise impact.

- **Agriculture Assessment**
  - High agricultural sensitivity because of both its land capability and because of its status as cropland
- **Aquatic Ecology Assessment**
  - Riverine Floodplains with Riparian Vegetation or wetland areas
  - Valley Bottom Wetlands
  - Endorheic Pans
  - Seepage Wetlands
  - Artificial dams or mine works
- **Terrestrial Ecology Assessment**
  - Wetlands: These are described here only in terms of being a unique botanical habitat and not in the sense of a formal wetland delineation, which is normally assessed in a separate specialist study. The wetlands must be delineated according to "DWAF, 2003: A Practical Guideline Procedure for the Identification and Delineation of Wetlands and Riparian Zones". Restrictions in terms of infrastructure within these areas should be according to the National Water Act (Act 36 of 1998).
  - Listed ecosystems: Chrissiesmeer Panveld is listed as Endangered, and Eastern Highveld Grassland and Eastern Temperate Freshwater Wetlands are both listed as Vulnerable in the National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011).
  - Grasslands: Grassland vegetation, in a general sense has been identified as threatened nationally as a habitat type. Indications are that loss of any grassland habitat is permanent in an ecological and biodiversity sense, and it is not possible to restore grassland to a natural state after they have been disturbed. They should therefore be treated as sensitive and all efforts made to minimize impacts on any

area of grassland. If possible, the footprint of any proposed infrastructure should be kept to a minimum within any undisturbed, natural grasslands, especially those in a moderate to good condition.

— **Avifaunal Assessment**
  - High value habitat unit (wetlands, pans and grassland)
  - Presence of Red List priority species
— **Bats**
  - Stands and clusters of tall trees;
  - Pans and depressions;
  - Dams;
  - Drainage lines capable of supporting riparian vegetation which in turn increases localised insect abundance; and
  - Other water bodies and other sensitivities such as manmade structures, buildings, houses, barns, sheds.
— **Heritage**
  - Burial sites
  - Demolished remains of structures

The above sensitivities are discussed in the sub-sections below. The combined environmental sensitivities of the proposed Project footprint are shown in Figure 10.17.

10.1.1 AGRICULTURE

Agricultural sensitivity, as used in the national web-based environmental screening tool, is a direct function of the capability of the land for agricultural production. The general assessment of agricultural sensitivity that is employed in the national web-based environmental screening tool, identifies all arable land that can support viable crop production, as high (or very high) sensitivity. This is because there is a scarcity of arable production land in South Africa and its conservation for agricultural use is therefore a priority. Land which cannot support viable crop production is much less of a priority to conserve for agricultural use and is rated as medium or low agricultural sensitivity.

The screening tool classifies agricultural sensitivity according to only two independent criteria – the land capability rating and whether the land is used for cropland or not. All cropland is classified as at least high sensitivity, based on the logic that if it is under crop production, it is indeed suitable for it, irrespective of its land capability rating.

The screening tool sensitivity categories in terms of land capability are based upon the Department of Agriculture's updated and refined, country-wide land capability mapping, released in 2016. The data is generated by GIS modelling. Land capability is defined as the combination of soil, climate and terrain suitability factors for supporting rain fed agricultural production. It is an indication of what level and type of agricultural production can sustainably be achieved on any land, based on its soil, climate and terrain. The higher land capability values (≥8 to 15) are likely to be suitable as arable land for crop production, while lower values are only likely to be suitable as non-arable grazing land.

A map of the proposed development area overlaid on the screening tool sensitivity is given in **Figure 10.1**.

The land capability of the site on the screening tool is predominantly 10 but varies from 7 to 11. The small scale differences in land capability across the project area are not very accurate or significant at this scale and are more a function of how the land capability data is generated by modelling, than actual meaningful differences in agricultural potential on the ground. However, the southern part of the site that is rated with the lowest land capability (7 and 8) is on shallow rocky soils. Values of 7 to 8 translate to a medium agricultural sensitivity, values of 9 to 10 translate to a high agricultural sensitivity and values of 11 translate to a very high agricultural sensitivity.

In reality the soils (and therefore the land capability) vary in a fairly complex pattern across the landscape, which is not reflected at the scale of the land capability data. The most reliable indication of soil cropping potential is historical land use. The suitable versus the unsuitable soils have been identified over time through trial and error. In an agricultural environment like the one being assessed, all the suitable soils are generally cropped, and uncropped soils can therefore fairly reliably be considered to be unsuitable for crop production.

Much of the site is classified as high agricultural sensitivity because of both its land capability and because of its status as cropland. The agricultural sensitivity, as identified by the screening tool, is confirmed by the specialist assessment.

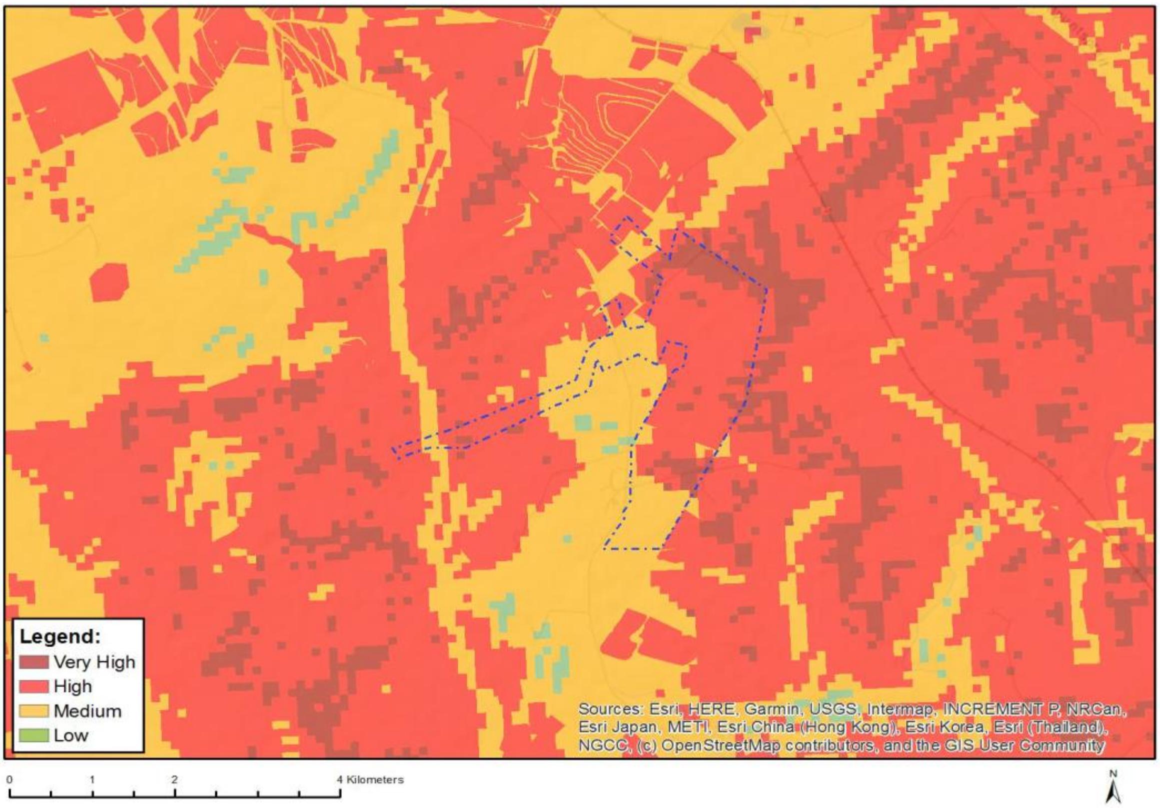


Figure 10.1: Agriculture Theme Sensitivity, DFFE Screening Report

10.1.2 AQUATIC BIODIVERSITY

The DFFE National Screening Tool classifies parts of the study area as very high sensitivity due to the presence of CBAs and rivers (**Figure 10.2)**

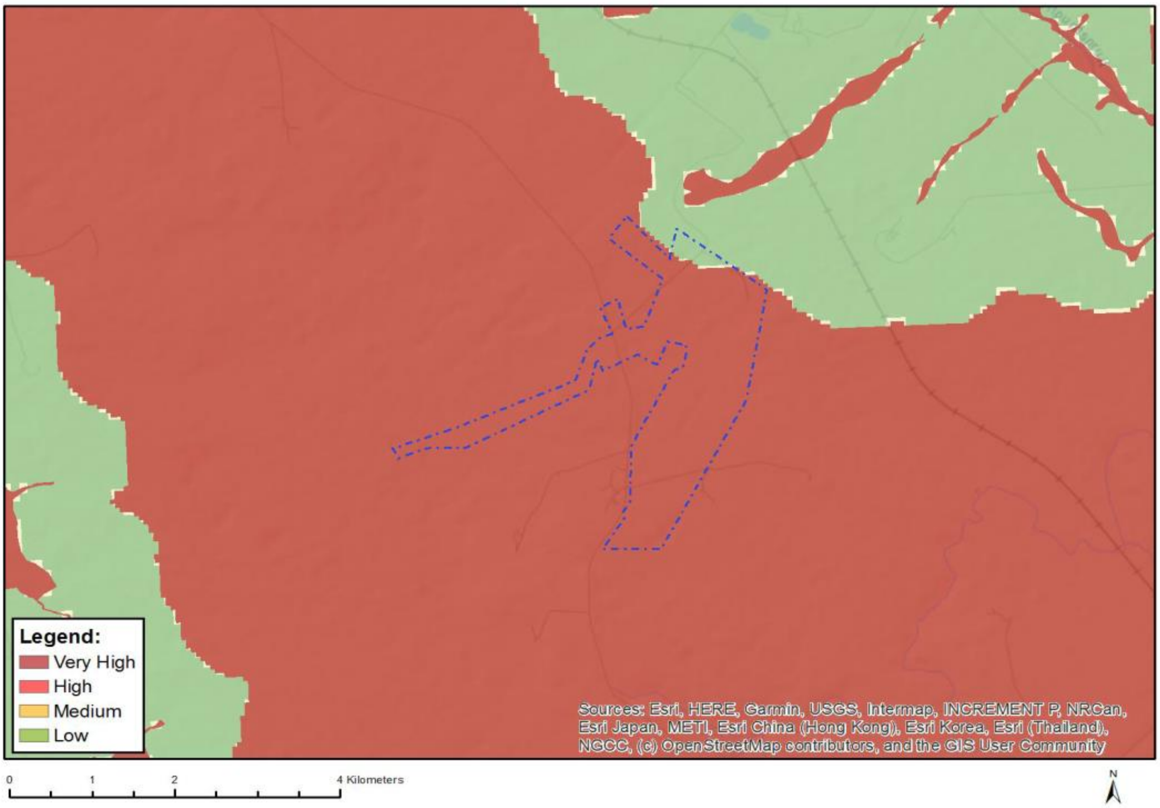


Figure 10.2: Aquatic Biodiversity Theme Sensitivity, DFFE Screening Report

Based on the above outcomes, the specialist agrees with the environmental sensitivities identified on site. The findings have been informed by a site visit undertaken by Dr Brian Colloty in August 2020.

Using the baseline description and field data while considering the current disturbances and site characteristics, the following features were identified, then categorised into one of a number of pre-determined sensitivity categories to provide protection and/or guide the layout planning and design processes of the SEF. **Table 10.1** outlines the Aquatic sensitivity mapping categories used to categorise features or areas (with their buffers).

Table 10.1: Sensitivity Categories

No Go	Legislated "no go" areas or setbacks and areas or features that are considered of such significance that impacting them may be regarded as fatal flaw or strongly influence the project impact significance profile Therefore areas or features that are considered to have a high sensitivity or where project infrastructure would be highly constrained and should be avoided as far as possible. Infrastructure located in these areas are likely to drive up impact significance ratings and mitigations
Medium	Buffer areas and or areas that are deemed to be of medium sensitivity but should still be avoided where possible as this would minimise impacts and or the need for additional Water Use Authorisation
Low	Areas of low sensitivity or constraints, such as artificial systems
Neutral	Unconstrained areas (left blank in mapping)

Table 10.2 below provides an overview of the sensitivity of various aquatic features (with buffers distances included) as it relates to the main project component types for the project. The features are shown spatially in **Figure 10.3**. The sensitivity ratings of No go, Medium and Low were determined through an assessment of the aquatic habitat sensitivity and related constraints. However, these No-Go areas (with buffers) relate in general terms to the project and there are areas where encroachment on these areas would occur (i.e. existing road crossings within wetlands) but this is considered acceptable since these areas have already been impacted.

These proposed constraints / buffers do not include bird and or bat specialist buffers / constraints as theirs buffers along aquatic features are at times far larger around aquatic features, than those required for the known aquatic species within this region.

Table 10.2: Results of the sensitivity rating / constraints assessment

DEVELOPMENT COMPONENT	WATERBODY TYPE	SENSITIVITY RATING OF THE RESPECTIVE WATERBODY TYPE AGAINST THE DEVELOPMENT TYPE AND THE REQUIRED BUFFER	SENSITIVITY RATING OVERRIDE, IF AN IMPACT SUCH AS A ROAD ALREADY OCCURS WITHIN THE PROPOSED FOOTPRINT
Solar Panels	Riverine Floodplains with Riparian Vegetation or wetland areas	No-Go with 95m buffer	
	Seepage Wetlands	No-Go with 62m buffer	
	Artificial dams or mine works		
Buildings / Substations & BESS	Riverine Floodplains with Riparian Vegetation or wetland areas	No-Go with 95m buffer	
	Seepage Wetlands	No-Go with 62m buffer	
	Artificial dams or mine works		
Roads & Hardstands	Riverine Floodplains with Riparian Vegetation or wetland areas	No-Go with 95m buffer	Moderate if an existing crossing / road or impact is already present, that must then be included in the potential road network. However if the road network can't be aligned with existing impacted areas, then any such crossings must be evaluated prior to construction on a case by case basis, by the aquatic specialist, preferably with the engineers and a site visit
	Seepage Wetlands	No-Go with 62m buffer	
	Artificial dams or mine works		
Overhead Lines	Riverine Floodplains with Riparian Vegetation or wetland areas	Assumption is that the overhead lines could span these areas, but the towers/pylons should adhere to the buffer distances as indicated as far as possible where areas are too large to span (buffers) then these tower positions must be evaluated on a case by case basis prior to construction.	
	Seepage Wetlands		
	Artificial dams or mine works		

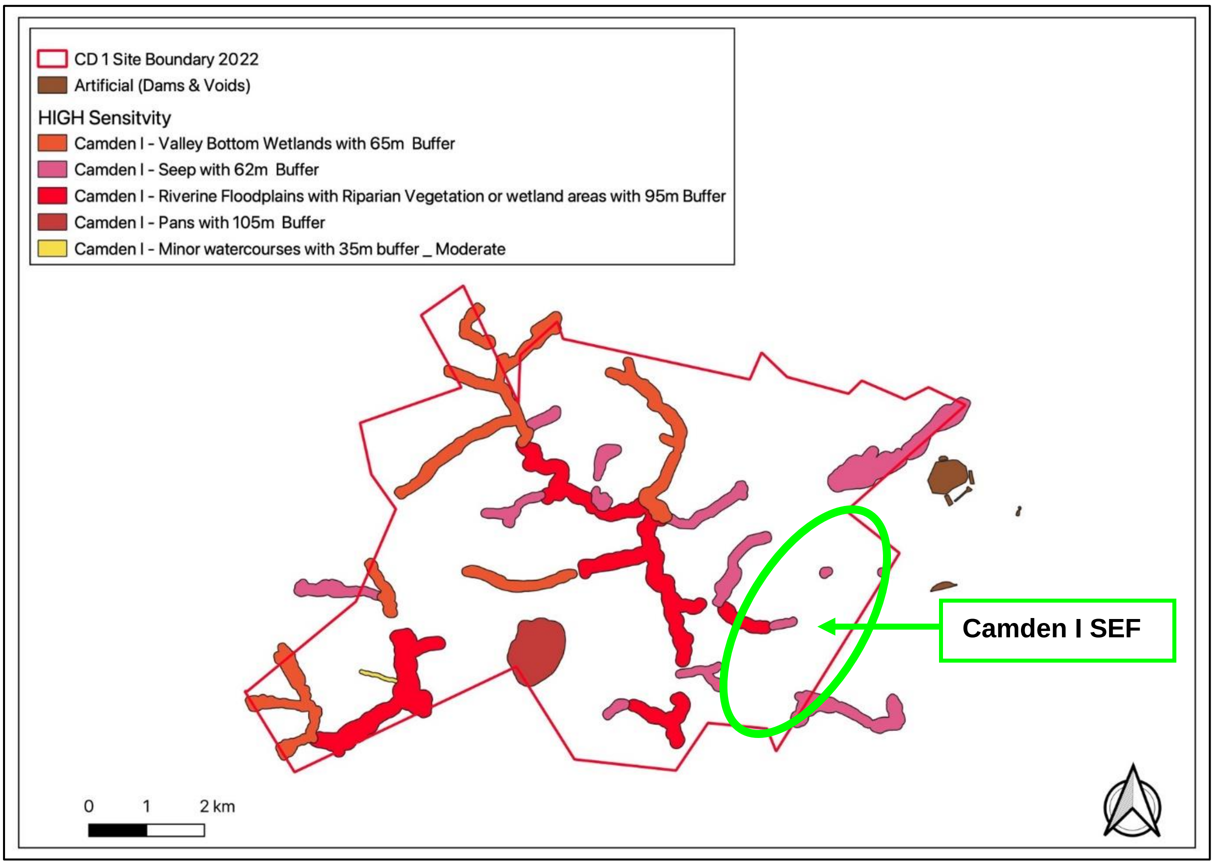


Figure 10.3: The delineated waterbodies inclusive of the respective buffer distances

In conclusion, the DFFE Screening Tool identified two sensitivity ratings within the development footprint, namely, very high and low. Although there is some overlap with the findings on site and the Screening Tool's outcome, the development footprint contains various sensitivities (very high, and Moderate) that were identified following the undertaking of the site visit and spatial input considerations.

The environmental sensitivity input received from the aquatic ecology specialist has been considered and appropriate layout and development restrictions were implemented within the development footprint to ensure that the impact to aquatic ecology is deemed acceptable by the aquatic ecologist.

10.1.3 TERRESTRIAL BIODIVERSITY

The terrestrial biodiversity theme indicates that the site is within one sensitivity class, namely VERY HIGH (**Figure 10.4**).

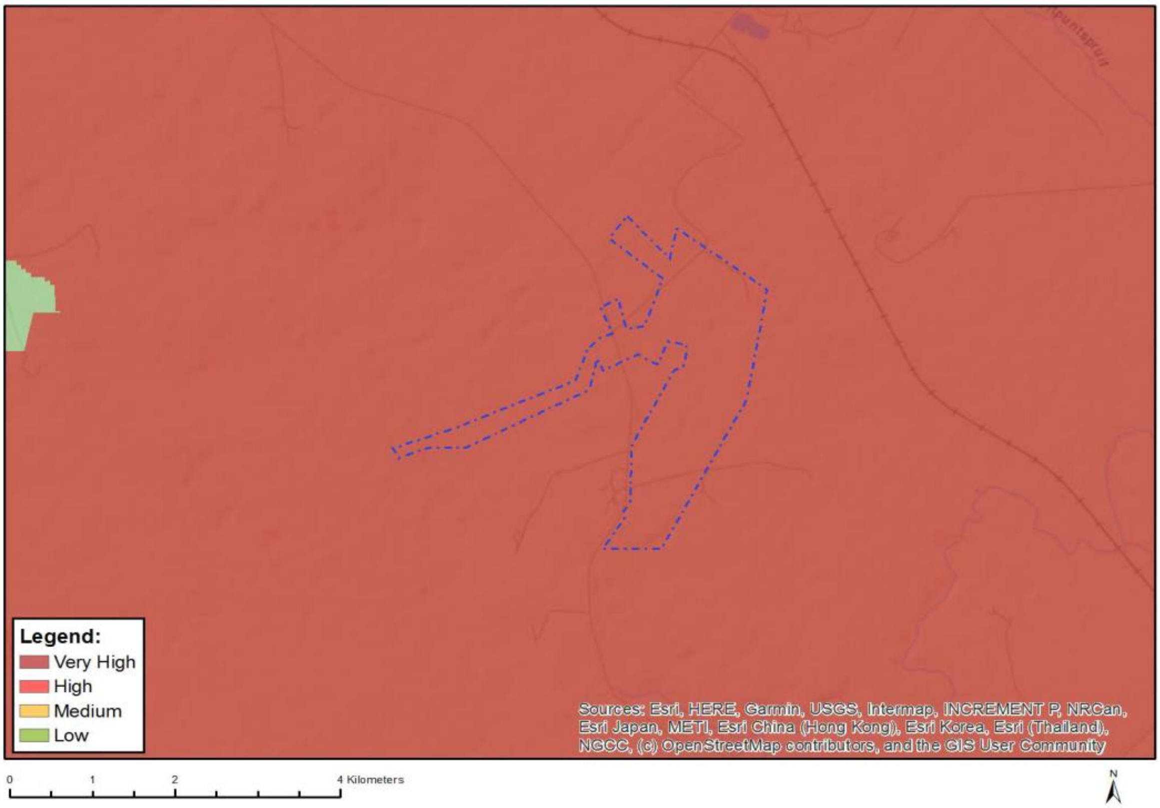


Figure 10.4: Terrestrial Biodiversity Theme Sensitivity, DFFE Screening Report

Table 10.3: Sensitivity features are indicates as follows

SENSITIVITY	FEATURES
Low	Low Sensitivity
Very High	Critical biodiversity area 1
Very High	Critical biodiversity area 2
Very High	Ecological support area: local corridor
Very High	FEPA Sub-catchments
Very High	Langcarel Private Nature Reserve
Very High	Endangered ecosystem
Very High	Vulnerable Ecosystem
Very High	Protected Areas Expansion Strategy
Very High	Strategic Water Source Areas

A summary of sensitivities that occur on site and that may be vulnerable to damage from the proposed project are as follows:

— **Wetlands**: These are described here only in terms of being a unique botanical habitat and not in the sense of a formal wetland delineation, which is normally assessed in a separate specialist study. The wetlands must be delineated according to “DWAF, 2003: A Practical Guideline Procedure for the Identification and Delineation of Wetlands and Riparian Zones”. Restrictions in terms of infrastructure within these areas should be according to the National Water Act (Act 36 of 1998).

— **Listed ecosystems**: Chrissiesmeer Panveld is listed as Endangered, and Eastern Highveld Grassland and Eastern Temperate Freshwater Wetlands are both listed as Vulnerable in the National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011).

— **Grasslands**: Grassland vegetation, in a general sense has been identified as threatened nationally as a habitat type. Indications are that loss of any grassland habitat is permanent in an ecological and biodiversity sense, and it is not possible to restore grassland to a natural state after they have been disturbed. They should therefore be treated as sensitive and all efforts made to minimize impacts on any area of grassland. If possible, the footprint of any proposed infrastructure should be kept to a minimum within any undisturbed, natural grasslands, especially those in a moderate to good condition.

This information was used in conjunction with methodology to calculate Site Ecological Importance, described below. A map of habitat sensitivity on site is provided in **Figure 10.5**.

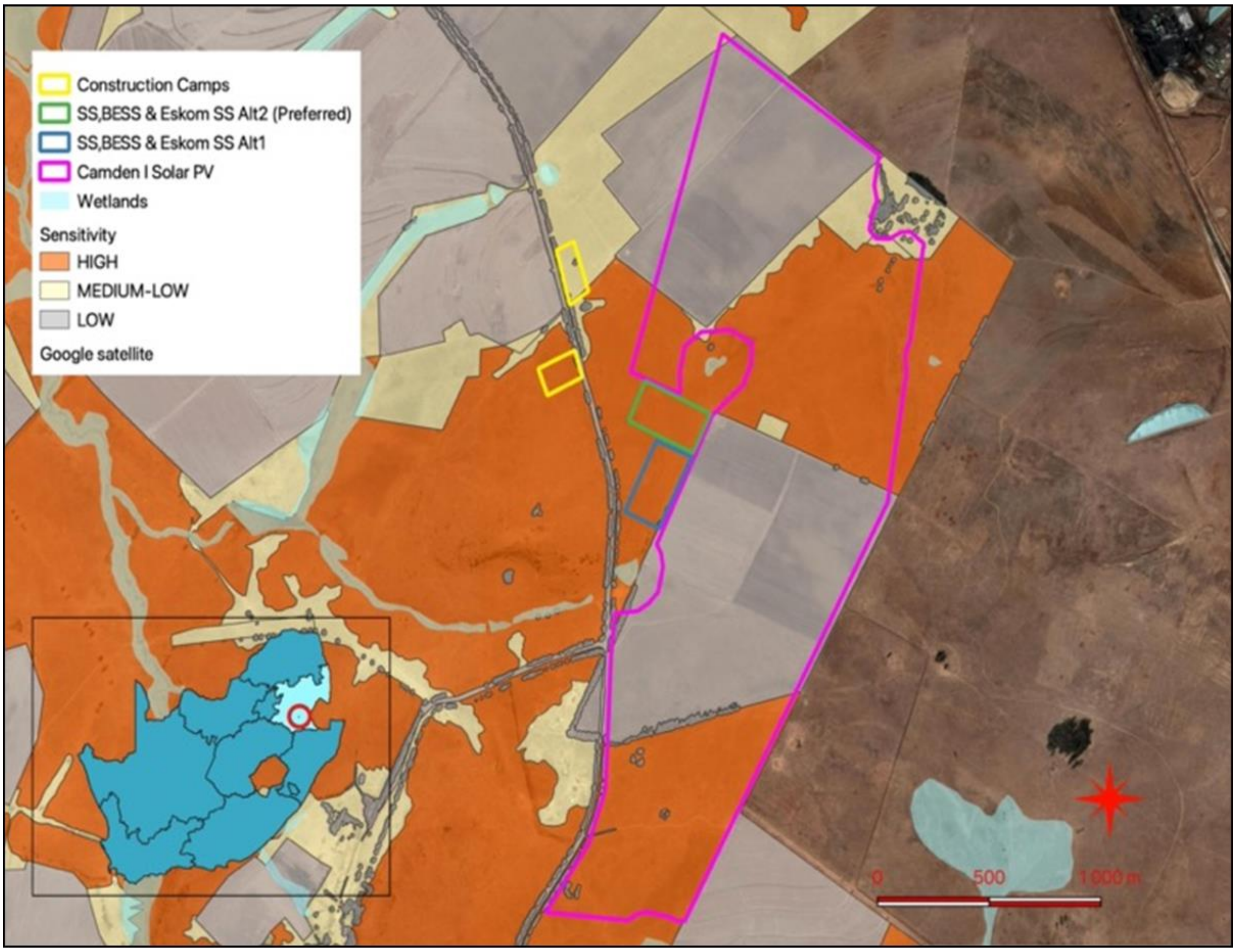


Figure 10.5: Habitat sensitivity of the study area, including consideration of CBAs

10.1.4 PLANT SPECIES

The DFFE Screening Tool report for the area (**Figure 10.4**) indicates the ecological sensitivities in **Table 10.4**.

Table 10.4: Ecological sensitivities

THEME	VERY HIGH SENSITIVITY	HIGH SENSITIVITY	MEDIUM SENSITIVITY	LOW SENSITIVITY
Plant Species Theme			X	

The plant species theme was highlighted as being of Medium sensitivity due the potential presence of the species indicated in **Table 10.5**:

Table 10.5: Plant species

SENSITIVITY	FEATURES
Low	Low Sensitivity
Medium	*Khadia carolinensis*
Medium	Sensitive species 1201
Medium	*Aspidoglossum xanthosphaerum*
Medium	Sensitive species 41
Medium	Sensitive species 691
Medium	*Pachycarpus suaveolens*
Medium	Sensitive species 851

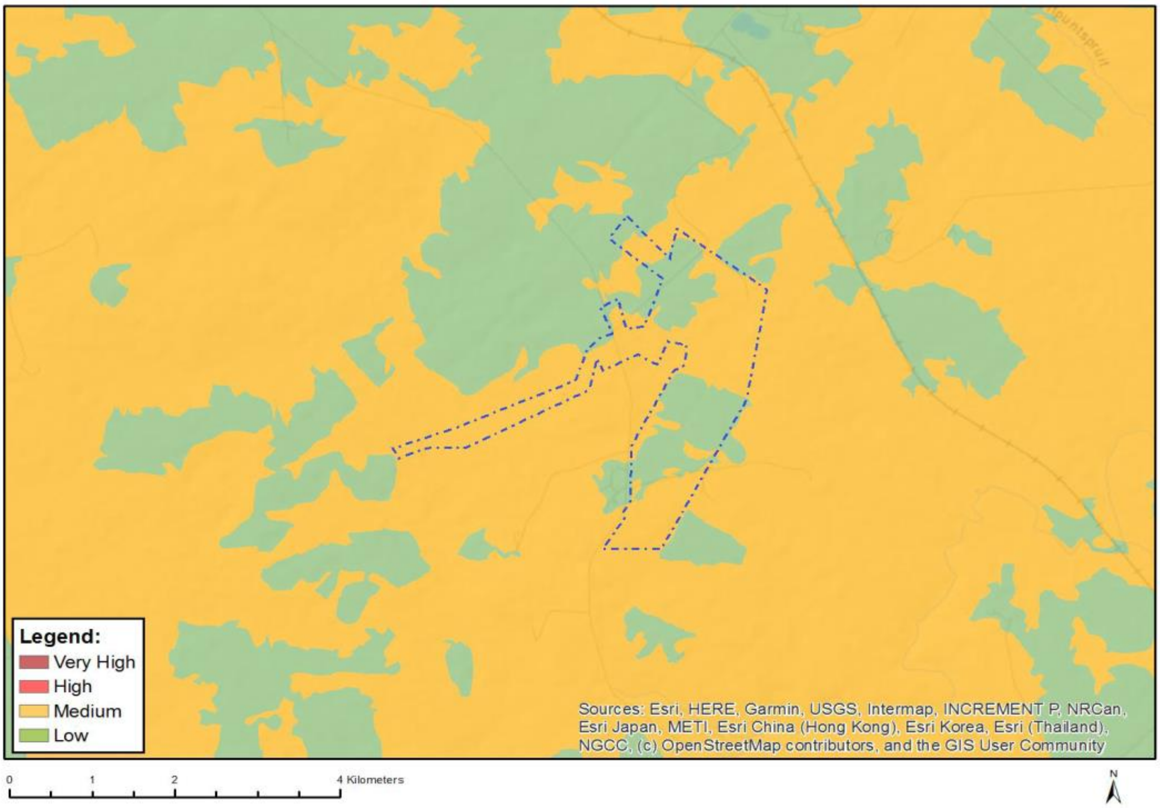


Figure 10.6: Plant Species Theme Sensitivity, DFFE Screening Report

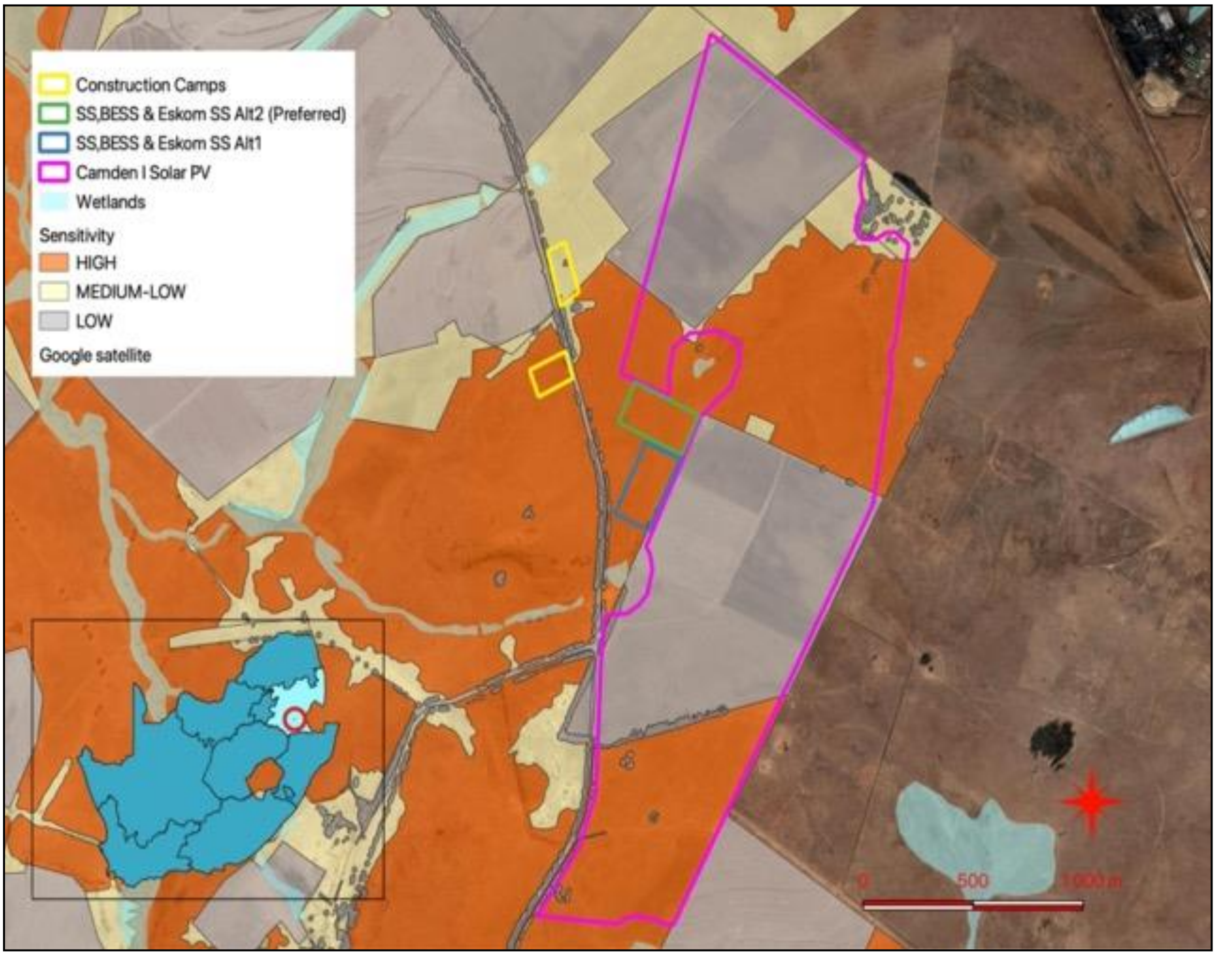


Figure 10.7: Location of proposed infrastructure relative to plant species sensitivity of the study area

10.1.5 ANIMAL SPECIES

The DFFE Screening Tool report for the area (**Figure 10.8**) indicates the ecological sensitivities in **Table 10.8**.

Table 10.6: Ecological sensitivities

THEME	VERY HIGH SENSITIVITY	HIGH SENSITIVITY	MEDIUM SENSITIVITY	LOW SENSITIVITY
Animal Species Theme		X		

The animal species theme was highlighted as being of High sensitivity due the potential presence of the species indicated in **Table 10.9**.

Table 10.7: Animal species

SENSITIVITY	FEATURES
High	Sensitive species
High	Aves-Geronticus calvus
Medium	Aves-Tyto capensis
Medium	Sensitive species 2

Medium	Aves-Geronticus calvus
Medium	Mammalia-Crocidura maquassiensis
Medium	Mammalia-Ourebia ourebi ourebi

The DFFE National Screening Tool classifies parts of the study area as highly sensitive from an animal species theme perspective, based on the potential presence of Southern Bald Ibis (Globally and Regionally Vulnerable) and African Grass Owl (Locally Vulnerable). This classification was confirmed during the surveys at the site and immediate environment, based on the presence of recorded species of conservation concern (SCC), namely Secretarybird (Globally Endangered, Regionally Vulnerable) White-bellied Bustard (Regionally Vulnerable), Blue Crane (Globally Vulnerable, Regionally Near-threatened), Grey Crowned Crane (Globally and Regionally Endangered), Martial Eagle (Globally and Regionally Endangered), Lanner Falcon (Regionally Vulnerable), Greater Flamingo (Regionally Near-threatened), Lesser Flamingo (Globally and Regionally Near-threatened), Black Harrier (Regionally and Globally Endangered), Southern Bald Ibis (Regionally and Globally Vulnerable), Blue Korhaan (Globally Near-threatened), African Grass Owl (Regionally Vulnerable) and Cape Vulture (Globally Vulnerable and Regionally Endangered).

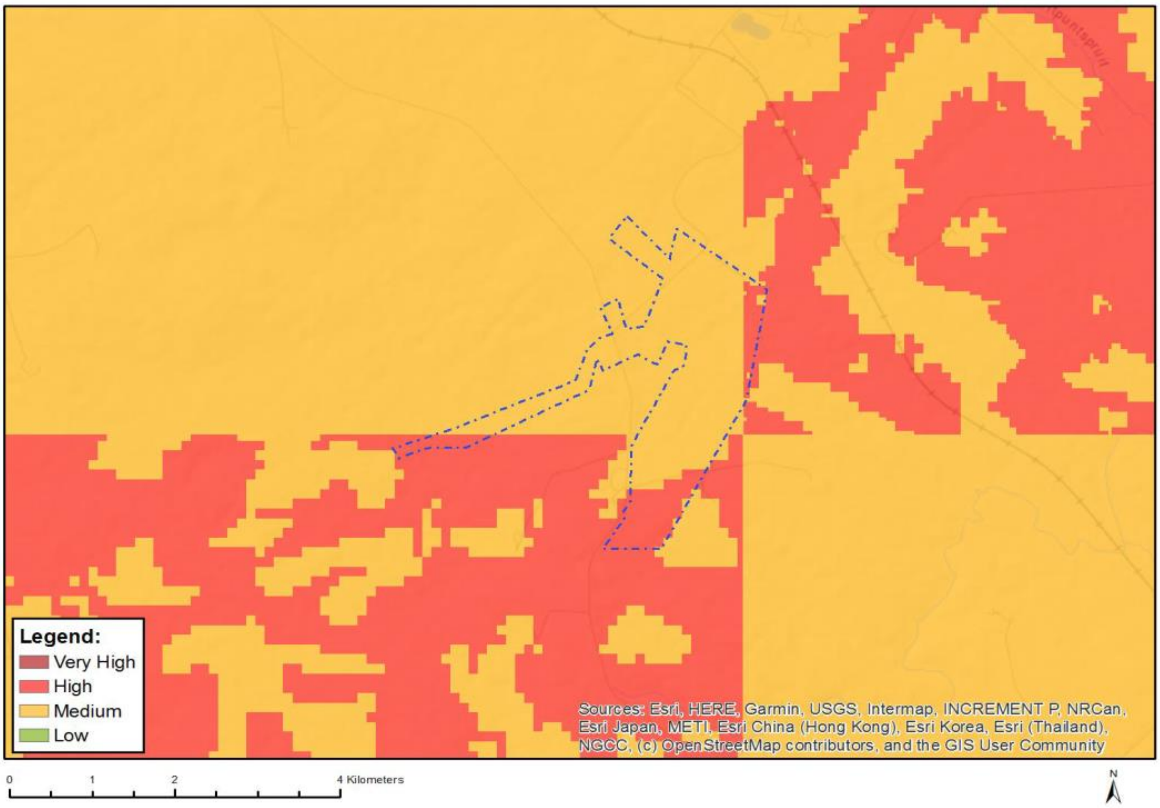


Figure 10.8: Animal Species Theme Sensitivity, DFFE Screening Report

10.1.6 AVIFAUNA

The avifauna theme indicates that a portion of the site is within the Medium sensitivity class (**Figure 10.9).**

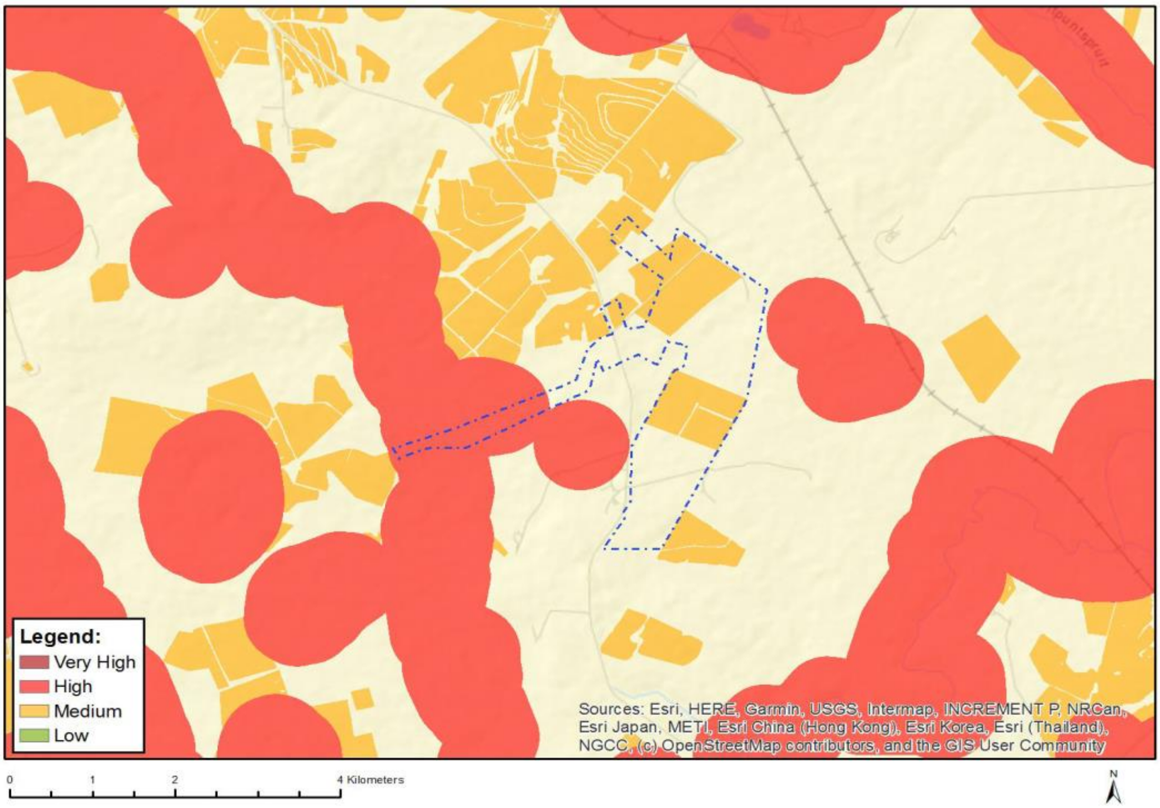


Figure 10.9: Avifauna Theme Sensitivity, DFFE Screening Report

The following specific environmental sensitivities have been identified from an avifaunal perspective:

- **100m all infrastructure exclusion zone around drainage lines, associated wetlands and pans excluding essential road and grid crossings..** Wetlands are important breeding, roosting and foraging habitat for a variety of Red List priority species, most notably for African Grass Owl (SA status Vulnerable), Grey Crowned Crane (SA status Endangered) and African Marsh Harrier (SA status Endangered).
- **High sensitivity grassland - Limited infrastructure zone**. Development in the remaining high sensitivity grassland must be limited as far as possible. Where possible, infrastructure must be located near margins, with shortest routes taken from the existing roads. The grassland is vital breeding, roosting and foraging habitat for a variety of Red List priority species. These include Blue Crane (SA status near-threatened), Blue Korhaan (Global status near -threatened), White-bellied Bustard (SA Status Vulnerable), Denham's Bustard (SA Status Vulnerable).

The avifaunal sensitivities identified for the Camden I SEF are shown in **Figure 10.10**.

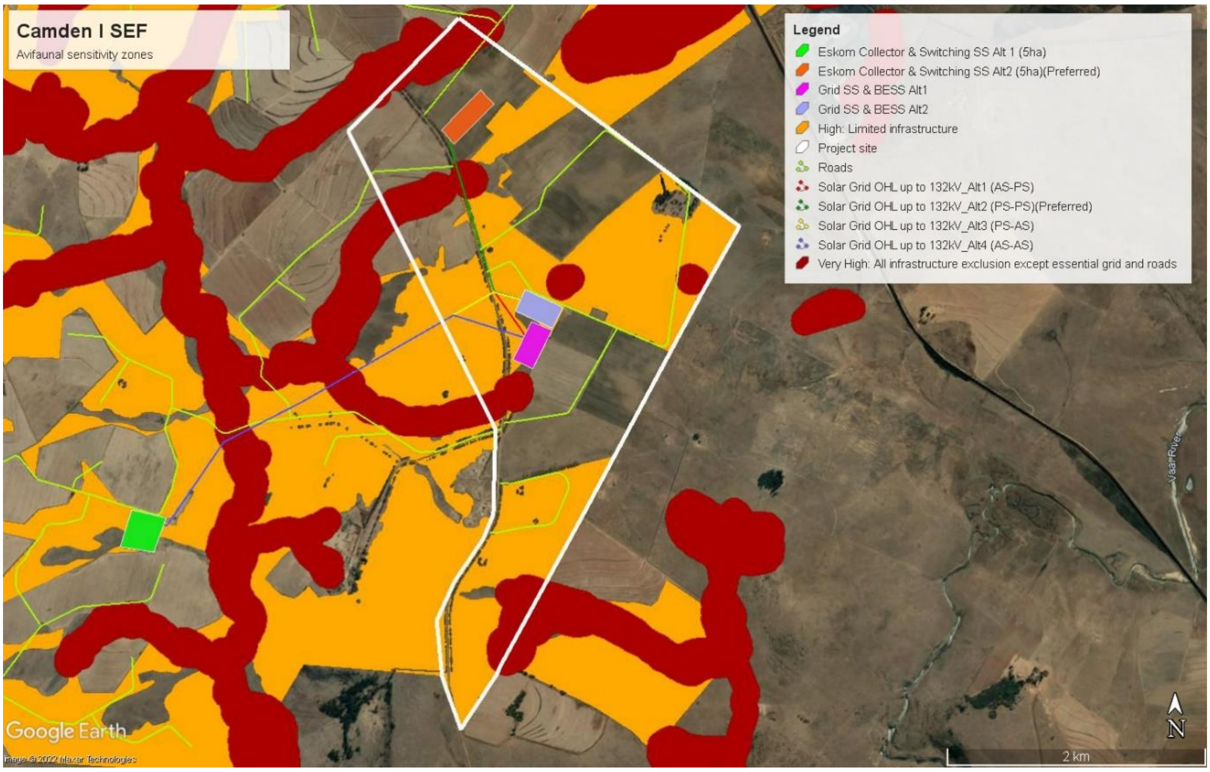


Figure 10.10: Proposed avifaunal sensitivities at the Camden I SEF (Chris van Rooyen Consulting, 2021).

10.1.7 BATS

The DFFE Screening Tool was consulted and there is no sensitivity for the bat theme (Figure 10.11).

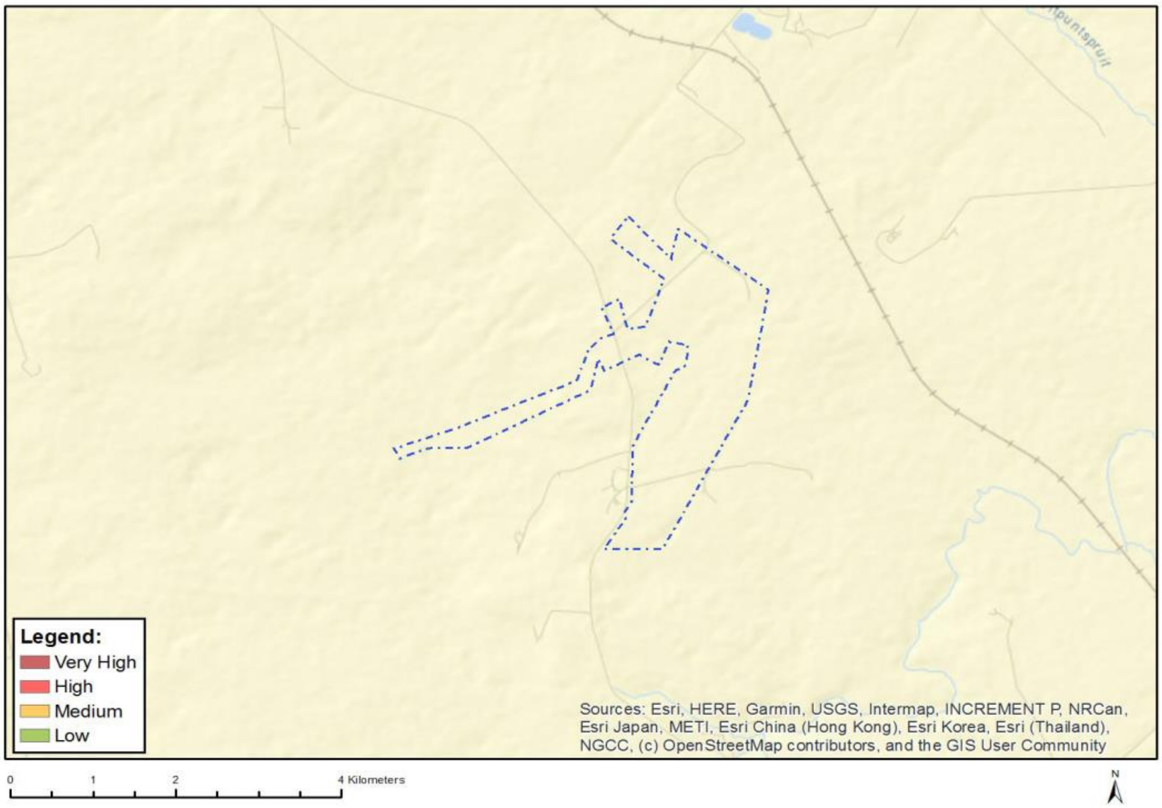


Figure 10.11: Bat Theme Sensitivity, DFFE Screening Report

Google Earth satellite imagery and verifications during site visits were used to spatially demarcate areas of the site with high and medium sensitivities relating to bat species ecology and habitat preferences, where high sensitivities are no-go zones for infrastructure specified in **Table 10.8** and **Table 10.9**. Medium sensitivities indicate areas of probable increased risk due to seasonal fluctuations in bat activity. **Figure 10.12** depicts the sensitive areas of the site, based on features identified to be important for foraging and roosting of the species that are most likely to occur on site.

Table 10.8: Description of parameters used in the development of the sensitivity map

SENSITIVITY	PARAMETERS
High Sensitivities	Stands and clusters of tall trees
	Pans and depressions
	Dams
	Drainage lines capable of supporting riparian vegetation which in turn increases localised insect abundance.
	Other water bodies and other sensitivities such as manmade structures, buildings, houses, barns, sheds.
Medium Sensitivities	Seasonal wetlands
	Seasonal drainage lines

Table 10.9: The significance of sensitivity map categories for each infrastructure component

SENSITIVITY	PV PANELS AND BUILDINGS	ROADS AND CABLES	INTERNAL OVERHEAD TRANSMISSION LINES	SUBSTATION AND CONSTRUCTION CAMP/YARDS)
High Sensitivity	These areas are 'no-go' zones for infrastructure where earthworks and vegetation clearing are required.	Preferably keep to a minimum within these areas where practically feasible.	Allowed inside these areas.	Avoid these areas.
Medium Sensitivity	Not favourable for infrastructure where earthworks and vegetation clearing are required, excluding the other infrastructure mentioned in this table.	Allowed inside these areas.	Allowed inside these areas.	Allowed inside these areas.

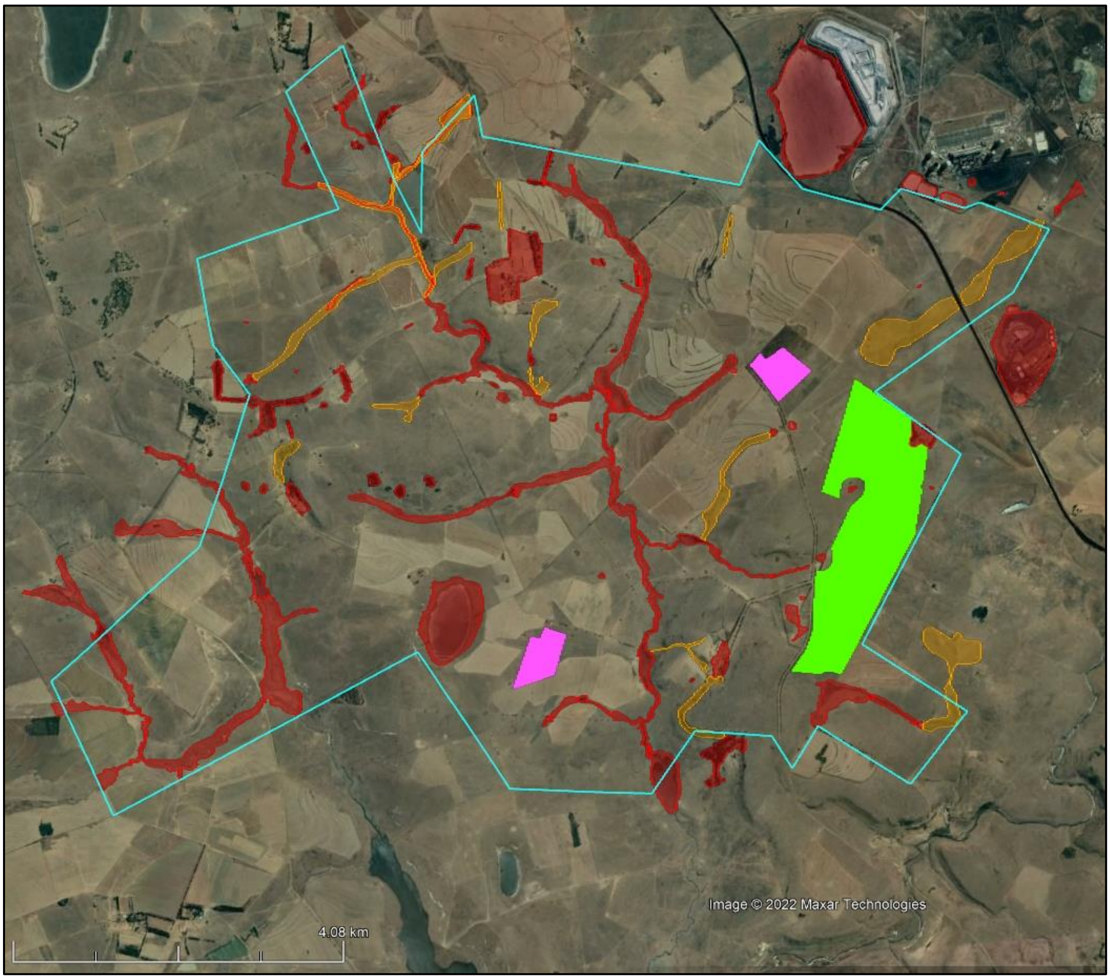


Figure 10.12: Bat sensitivity map (Animalia, 2022)

10.1.8 HERITAGE

The DFFE National Screening Tool classifies the Archaeological and Cultural Heritage theme as low sensitivity (**Figure 10.13**).

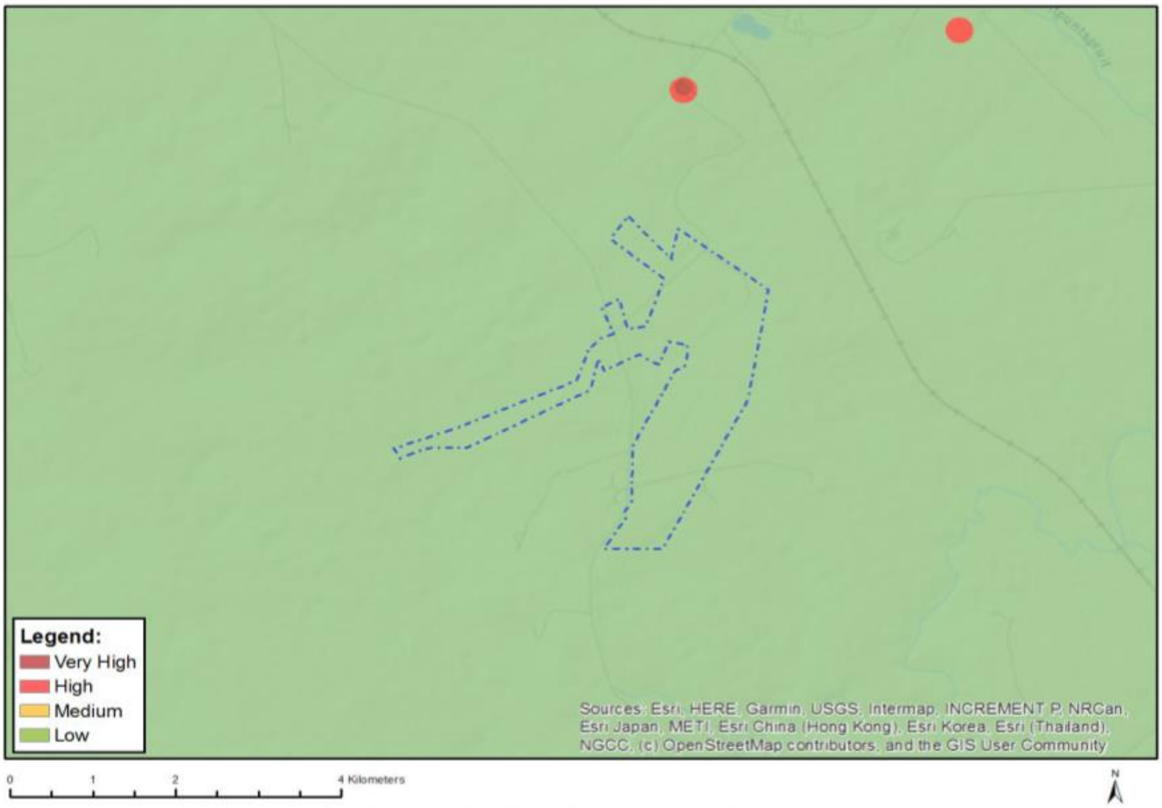


Figure 10.13: Archaeological and Cultural Heritage Theme Sensitivity, DFFE Screening Report

The Heritage Assessment focusses on the Camden 1 SEF and other Projects in the immediate vicinity that are being evaluated by the proponent. Heritage finds are limited to a burial site and the demolished remains of structures in the greater area (**Figure 10.14**).

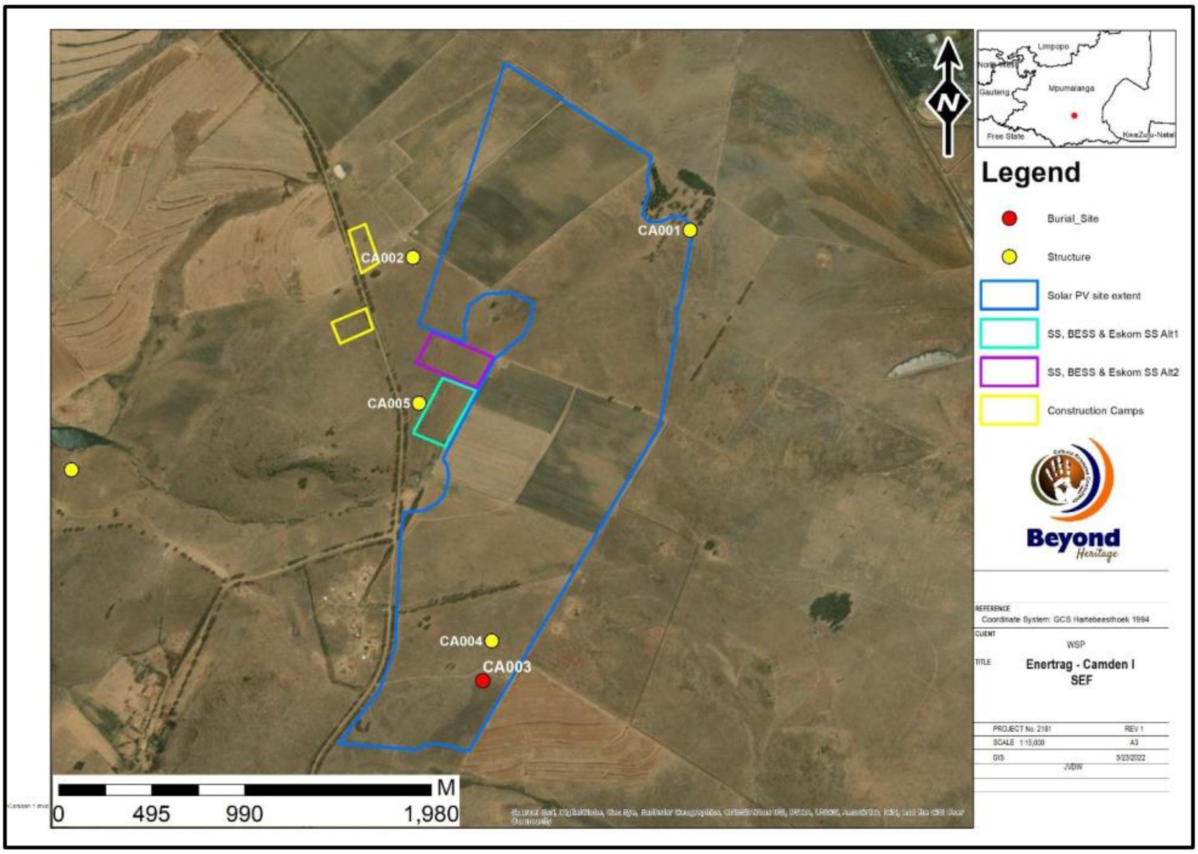


Figure 10.14: Heritage observation points in relation to the project (Beyond Heritage, 2022)

10.1.9 PALAEONTOLOGY

The DFFE National Screening Tool classifies parts of the study area as very high sensitivity due to the presence of features with a very high palaeontological sensitivity **(Figure 10.15**).

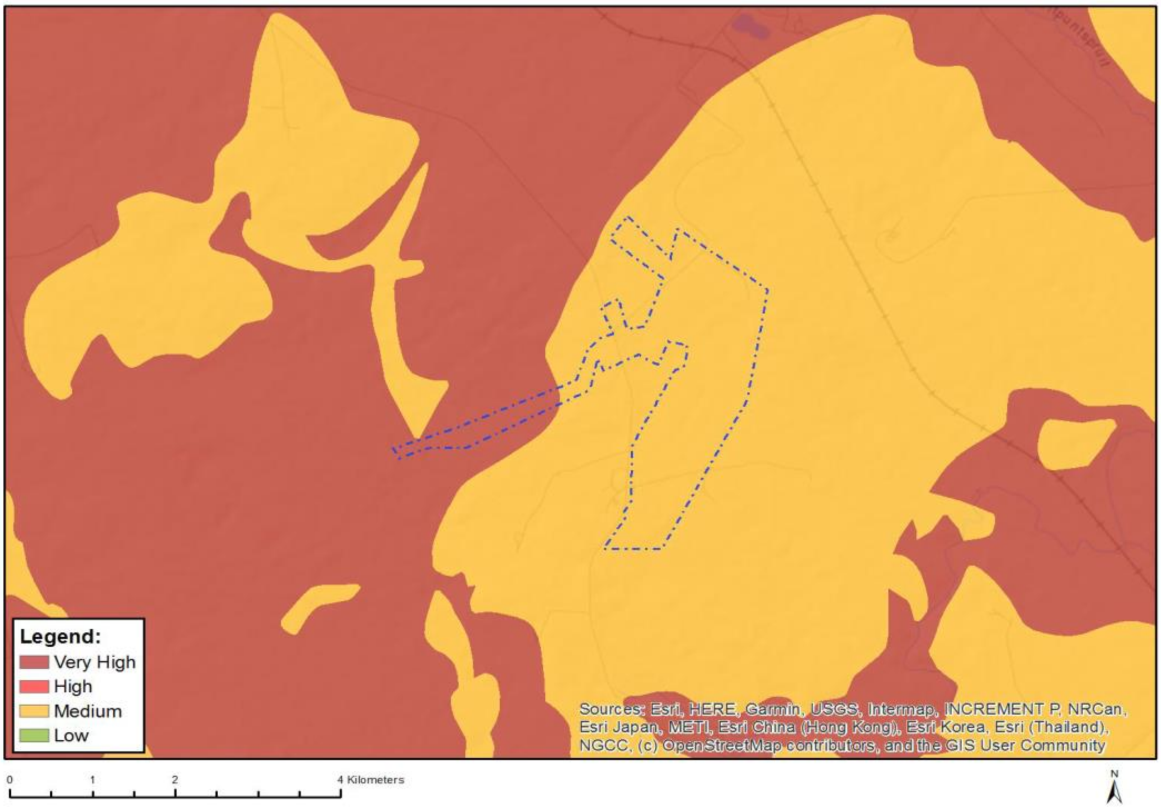


Figure 10.15: The DFFE screening tool rating for the Palaeontological Theme

Based on the fossil record but confirmed by the site visit and walk through, there are **no fossils** of the Glossopteris flora even though fossils have been recorded from rocks of a similar age and type in South Africa. It is extremely unlikely that any fossils would be preserved in the overlying soils and sands of the Quaternary. There is a very small chance that fossils may occur below the ground surface in the shales of the Vryheid Formation (Ecca Group, Karoo Supergroup)

10.1.10 VISUAL

In assessing visual sensitivity of the proposed SEF, consideration was given to the Landscape Theme of the National Environmental Screening Tool. Under the Landscape Theme, as shown in **Figure 10.16** below, the tool identifies the entire Camden I SEF project area as “Very High” sensitivity in respect of SEF development. According to the Screening Tool, this rating is associated with the presence of a demarcated protected area (Langcarel Private Nature Reserve) as well as natural features such as mountain tops, high ridges and steep slopes.

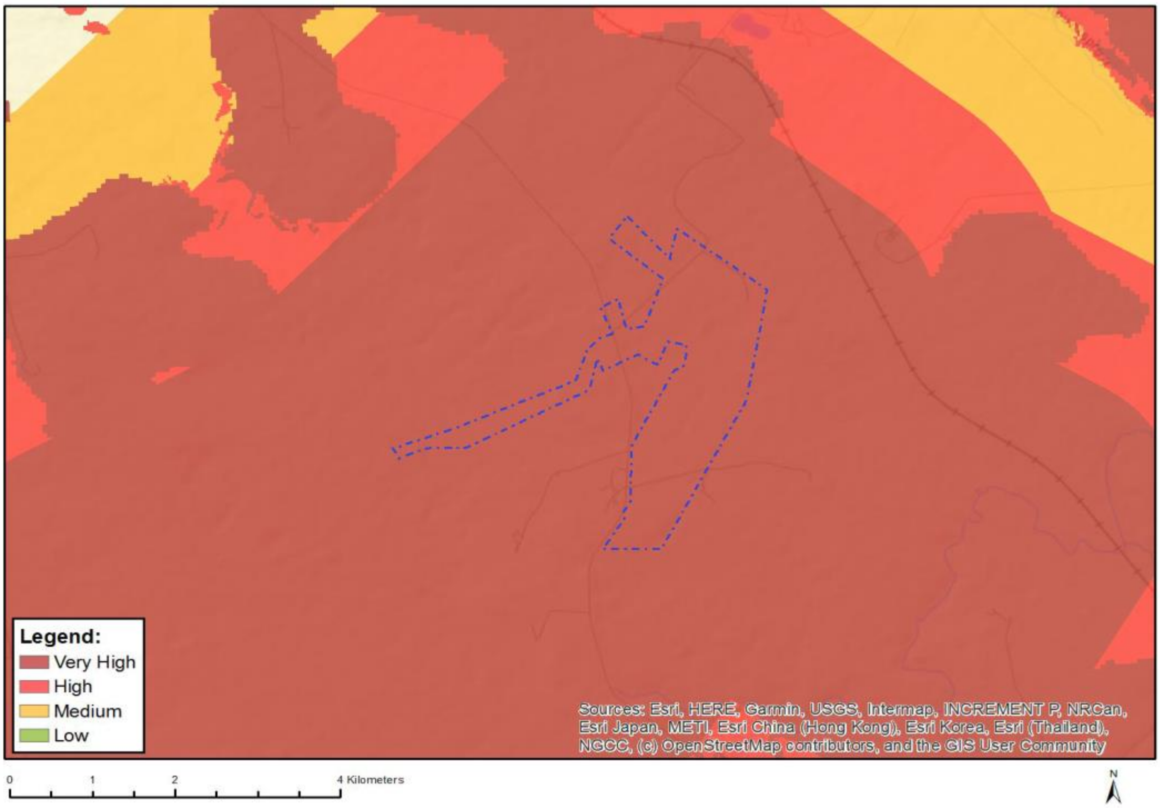


Figure 10.16: DFFE Screening Tool relative landscape sensitivity

The Screening Tool provides a very high level, desktop assessment and as such the results of the study must be viewed against the findings of the field investigation as well as factors affecting visual impact, such as:

— The presence of visual receptors;
— The distance of those receptors from the proposed development; and
— The likely visibility of the development from the receptor locations.

Although the Screening Tool identifies significant areas of very high landscape sensitivity, the site sensitivity verification exercise conducted in respect of this VIA found little evidence to support this sensitivity rating. The sensitivity rating for this site is heavily influenced by the Langcarel Private Nature Reserve which is identified in the South African Protected Areas Database. As stated however, the area is entirely managed for commercial agriculture with no conservation activities present and no evidence of public access to the site. Any landscape value or visual appeal has therefore been reduced. Accordingly, the site is not subject to the usual visual / landscape sensitivity associated with nature reserves.

In addition, the desktop topographic assessment of the area did not indicate the presence of mountaintops, high ridges or any significantly steep slopes. This assessment, informed by the field investigation, indicated that the site is largely characterised by flat to gently undulating terrain and as such, no areas of landscape sensitivity were identified on the site.

10.2 SENSITIVITY MAPPING

A consolidated environmental sensitivity map (**Figure 10.17**) has been compiled based on the sensitivities and buffers outlined in the specialist studies.

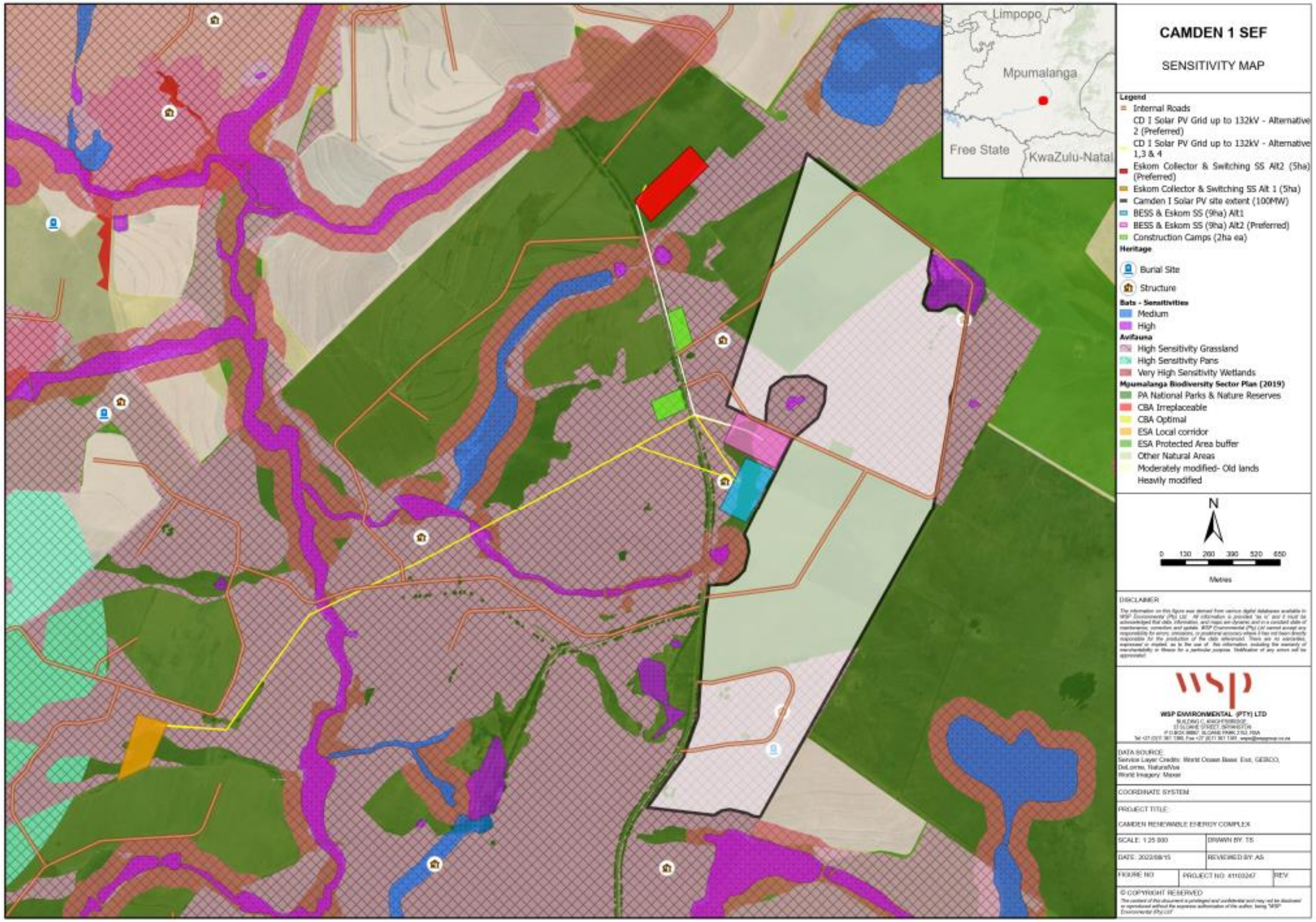


Figure 10.17: Combined Sensitivity map

10.3 SPECIALIST CONCLUSIONS

10.3.1 AGRICULTURAL POTENTIAL

The development will generate a significant (at the scale of an individual farm), reliable and predictable additional income for the directly affected farming enterprise, without significantly compromising the existing farming income or requiring expense and effort on behalf of the landowner (i.e. passive income). In this manner it also promotes multiple land uses on the existing property. It will also generate additional income and employment in the local economy. In addition, it will contribute to the country's need for energy generation, particularly renewable energy that has lower environmental and agricultural impact on a national scale than existing, coal powered energy generation. The renewable energy complex also aims to beneficially utilise existing infrastructure by connecting into the Camden Power Station, infrastructure otherwise intended for decommissioning. In supplying generated energy to the hydrogen and ammonia plant associated with the Camden Renewable Energy Developments, the project is indirectly stimulating the green hydrogen economy and in particular hydrogen-specific skills and market participation in green hydrogen and ammonia fuel products, both of which have large-scale potential in international and local markets. This in turn therefore supports the indirect diversification of the local economy and assists in maintaining existing ammonia supply chains, and promoting future hydrogen supply chains.

The agricultural impact of the proposed development is acceptable because:

- It is a necessary part of the greater Camden renewable energy project which offers benefits to agriculture that can only be realised if the project includes a solar component which must necessarily impinge partially on cropland. The trade-off for agriculture of losing 114 hectares of cropland is likely to be more than compensated by the agricultural benefits of the greater project. These include increased economic viability for agricultural operations on site, security benefits against stock theft and other crime, an improved road network, with associated storm water handling system, that can be used for farming operations, and that the project will decrease the need for coal power and thereby contribute to reducing the large agricultural impact that open cast coal mining has on highly productive agricultural land in the area.
- The proposed development will also have the wider societal benefits of generating additional income and employment in the local economy.
- In addition, the proposed development will contribute to the country's urgent need for energy generation, particularly renewable energy that has much lower environmental and agricultural impact than existing, coal powered energy generation.

The impact of the proposed development on the agricultural production capability of the site is assessed as being acceptable because of the above factors. Therefore, from an agricultural impact point of view, it is recommended that the development be approved.

The conclusion of this assessment on the acceptability of the proposed development and the recommendation for its approval is not subject to any conditions, other than recommended mitigation.

10.3.2 AQUATIC IMPACT ASSESSMENT

During this assessment, several sensitive aquatic habitats were observed and are shown in the maps provided in this report. Noteworthy areas, that should be avoided, include the main riverine systems with wetlands, valley bottom wetlands, seeps and the endorheic pans.

The current layouts have, to a large degree, avoided these sensitive features and buffer areas, greatly reducing the potential overall impact and risk to Aquatic resources. The overall and cumulative impacts, as assessed, are linked to instances where complete avoidance was not possible, or the nature of the activities involve a potential risk to aquatic resources even at great distance. Overall, it is expected that the impact on the aquatic environment would be Low (-) post mitigation and with the assumptions listed above.

Based on the findings of this study, the specialist finds no reason to withhold to an authorisation of any of the proposed activities for the various projects, assuming that key mitigations measures are implemented. Lastly no preference is provided with regard any of the grid connections, as it assumed based on the characteristics of the site, that all the aquatic systems could be spanned or avoided, while making use of existing tracks, only. This also applies to the various substation / construction and laydown positioning as none of these have a direct impact on the aquatic environment are anticipated for each of the projects. However due consideration must be given to the installation of the water pipeline as mentioned above to try and minimize any impacts, and this must be done in consultation with the specialist during the micrositing process. This must be coupled to a detailed monitoring plan must be developed prior to the construction phase.

10.3.3 TERRESTRIAL BIODIVERSITY ASSESSMENT

The vegetation type that occurs on site is Eastern Highveld Grassland, is listed as Vulnerable. All areas on site within Eastern Highveld Grassland also fall within another listed ecosystem, Chrissiesmeer Panveld, listed as Vulnerable, and defined independently to the vegetation types. The site is therefore within two listed ecosystems that overlap.

There is a proclaimed conservation area on site, the Langcarel Private Nature Reserve. This area has not been managed as a protected area and has undergone similar levels of degradation as surrounding areas due primarily to overgrazing, but also partially due to alien invasive plants. In addition, no conservation management activities were evident on site during the field assessment. This pattern of over-utilization affects all grasslands on site, resulting in them being in moderate to poor condition. A separate process is underway to have it (or part thereof) de-proclaimed as part of ongoing province-wide reserve verification efforts by the provincial authorities. The habitat has been used for livestock production and is impacted by this land-use. It is therefore the author's opinion on the basis of the current land use and levels of modification, that the private nature reserve does not align with the objective and purpose of the protected area status.

Natural grassland on site is in moderate to poor condition, primarily due to heavy overgrazing. There are significant areas of low grass cover and bare areas, and plant species composition has been degraded by grazing effects.

The relative impact on the Vulnerable Eastern Highveld Grassland is dependent on final placement of infrastructure. Assuming a worst-case scenario, the proposed project (all infrastructure components together) affects 117 ha of the remaining natural habitat on site, which could be reduced to only 8 ha if grasslands are avoided.

Assessed impact with moderate significance after mitigation is "Loss of indigenous natural vegetation". Although the amount of natural vegetation lost would be very small, the impact is assessed as moderate because of being permanent and definite. The extent of the impact is limited due to the layout avoiding most areas of sensitivity. On this basis, the project is therefore deemed acceptable from a terrestrial biodiversity perspective and it is recommended the Environmental Authorisation be granted. The author is of the opinion that the impacts associated with the project are moderate but very small in scale and can therefore be mitigated to acceptable levels provided the recommended mitigation measures identified are implemented.

10.3.4 TERRESTRIAL PLANT SPECIES ASSESSMENT

There are seven plant species of conservation concern flagged by the screening tool that could possibly occur on site, as well as additional species from historical records from SANBI databases, but none were seen during general field surveys. A targeted walk-through survey of footprint of construction areas is required prior to the commencement of construction, to determine whether or not any occur in the footprint of the development. This survey can take place at the same time as the required walk-through surveys for permitting purposes, or it can be undertaken as a separate targeted survey. It is recommended that this is undertaken in optimum growing season where possible.

For permitting purposes, the following flora survey is required prior to construction activities taking place:

Detailed floristic walk-through survey of all footprint areas in order to document composition, especially of protected species. It is suggested this be undertaken after an appropriate time-period after rainfall, where possible, to allow emergence of any species of potential concern. The survey must also cover all footprint areas, including final road alignments. Renewable energy projects similar to the one assessed here tend to have high fluidity in terms of layout and technology, due to the current rapid evolution of the technology, which allows more efficient deployment of infrastructure. However, this means that "final" layouts regularly change. The walk-through survey:

- Must assess the footprint that will be constructed – if this changes then the new footprint areas must be subject to a walk-through survey in full;
- Must be undertaken in the correct season, if possible, taking administrative processes into account;
- Must be adequately resourced to ensure it is done properly;
- Must be undertaken by a competent botanist with knowledge of the area.

10.3.5 TERRESTRIAL ANIMAL SPECIES ASSESSMENT

There are a number of threatened animal species that are flagged for the site, as well as others not directly flagged that may occur there. The majority of the flagged animal species are birds, which are assessed in a dedicated avifaunal assessment and not covered in detail here. The two non-bird species flagged for the site are the Maquassie Musk Shrew and the Oribi. Both could possibly occur on site, but the likelihood is not high. These animals may make use of various habitats available on site, which consists mostly of grasslands and wetlands within shallow drainage valleys.

The proposed project consists of an array of solar panels, substations, and construction camps. The proposed layout for solar panels has a moderately small footprint area relative to the entire cluster of projects. Those natural areas that are affected are generally in relatively poor condition due to overgrazing. It has been calculated here that if all infrastructure components are placed within natural areas (worst-case scenario) then it affects a total of 117 hectares of natural habitat of a total of 3222 hectares of natural habitat on the site of the entire cluster of projects (approximately 3.5%). The solar project therefore potentially has a very small footprint area which results in a small area of impact.

The main concern in terms of threatened animal species is direct loss of habitat, but this will be limited for this project. Fragmentation of habitat is assessed but will be very limited due to the placement of infrastructure as well as existing patterns of transformation on site. There may also be direct mortality of individual animals, but this is not very likely due to the placement of most of the infrastructure away from natural habitats.

An assessment of these impacts indicates that they will have a significance of low or very low.

10.3.6 AVIFAUNA ASSESSMENT

The proposed solar energy facility will have a moderate impact on priority avifauna which, in most instances, could be reduced to a low impact through appropriate mitigation, although some instances moderate residual impacts will still be present after mitigation. No fatal flaws were discovered during the onsite investigations. The proposed SEF development is therefore supported, provided the mitigation measures listed in this report are strictly implemented.

The proposed BESS will have a low impact on priority avifauna which, could be reduced to a very low level in most instances through appropriate mitigation, although some instances low residual impacts will still be present after mitigation. No fatal flaws were discovered during the onsite investigations. The proposed BESS development is therefore supported, provided the mitigation measures listed in this report are strictly implemented.

10.3.7 BATS ASSESSMENT

This Bat Environmental Impact Assessment Report considered information gathered from site visits between August 2020 and October 2021, literature, and satellite imagery. The bat species most likely to be impacted on by the proposed SEF are *Laephotis* (formally *Neoromicia*) *capensis*. This species is of special importance based on their likelihood of being impacted by the proposed SEF, due to their habit of roosting readily in building roofs and stands of tall trees. These more abundant species are of a large value to the local ecosystems as they provide a greater contribution to most ecological services than the rarer species, due to their higher numbers.

Currently there is no evidence of PV facilities posing a direct threat of fatality impact on bats during operation. However, roosting and foraging habitats may be significantly impacted during the construction phase. This is primarily due the fact that such facilities require large areas of land to be cleared, and in some cases, earthworks are required for levelling purposes. This can result in habitat that is suitable for micro roosts, such as clumps of trees and certain vegetation being destroyed, which can also be fatal to bats residing in such roosts. Natural vegetation can support higher insect food quantities and diversity than cleared land, therefore foraging habitat can also be displaced, especially by solar facilities.

The presence of security lights on and around these facilities creates significant light pollution that can impact bat feeding habits and species compositions negatively, by artificially discouraging photophobic (light averse) species and favouring species that readily forage around insect-attracting lights. Additionally, if the buildings and associated infrastructure for these facilities are placed close to wind turbines, the light pollution at these buildings can attract photophilic bat species, thereby significantly increasing their chances of being killed by moving blades of turbines within close proximity.

The SEA assigns 5km buffers to large bat roosts for PV energy, therefore any of the existing or possible cave/roost locations may be assigned a buffer up to 5km if they are found to be supporting large enough bat colonies. All of the above locations are further than 5km from the proposed site. **Figure 7.33** shows the dolomitic geology of the greater area, with an approximate 100km site boundary radius shown in red. At its nearest, the dolomite extends to approximately 65km north-east of the REC. Dolomite is known to be prone to good cave formation, and many bat colonies are supported in such caves in the country, particularly in the province of Gauteng. Museum records of bats collected from two caves and two mines within approximately 100km of the site exist. Specimens of *Miniopterus. natalensis* and *Rhinolophus clivosus* were collected from River Cave (96km north of site); *R. simulator*, *Myotus tricolor* and *Cloeotis percivali* from a mine tunnel on Waterval Farm (91km north), *R. simulator, R. blasii, R. clivosus* and *Miniopterus fraterculus* from Kalkoenkrans Cave (64km north-east) and *Miniopterus natalensis* from Barites mine (108km northeast). All of the above locations are further than 50km from the proposed site.

A sensitivity map (**Figure 10.12**) was drawn up indicating potential roosting and foraging areas. The High Bat Sensitivity areas are expected to have elevated levels of bat activity and support greater bat diversity. High Bat Sensitivity areas are 'no–go' areas for specific infrastructure specified in **Table 10.9**. Avoidance is the most affective mitigation measure for reducing the impact on bats, and should be implemented as the first layer of mitigation. The proposed layout adheres to the sensitivity map provided.

From a bat impact perspective, no reasons have been identified for the proposed Camden I SEF not to proceed to the Environmental Authorisation phase.

10.3.8 TRAFFIC ASSESSMENT

The expected traffic increase on the local access roads during the construction phase could result in deterioration of the unsurfaced roads, as they are not designed for abnormal vehicles.

The transport route/s between the origin of the PV components to the facility may be National, Provincial or Local roads; and each authority will be required to provide the necessary permits for the transportation of any oversized or abnormally heavy components.

The trip generation during the Operational phase of the Solar PV facility is expected to be low due to the low number of permanent staff. The associated transport impact on the surrounding road network will be negligible.

The safety of the intersections off the National roads may be compromised due to the increase in especially heavy vehicle volumes. It is recommended that additional temporary and permanent road signage is installed at the intersections of the D260/N11, the D1107/N11 and the D1264/N2 to improve the safety of the intersections.

It is not possible to determine the volume of traffic that will be generated during the decommissioning phase. It can however be expected that the volumes will be lower than during the construction phase, and the resultant transport impact on the local access roads will be lower than during the Construction phase. Any damage to the road caused by the decommissioning phase traffic should be repaired at the cost of the contractor.

The overall significance of each impact during the Construction Phase of the facility is Low without mitigation, and Very Low with mitigation. The impacts are limited to the peak construction period only, site only/local or regional, and fully reversible. The proposed mitigating measures are easy to implement and will assist to either prevent or reduce the impacts of increased vehicle engine and tyre noise, exhaust fumes and generation of dust on unsurfaced roads.

The maximum traffic generation of the Camden I and Camden II facility is expected to occur at the same time, as the facilities will be developed and operated concurrently. It should be noted that the Significance of the transport impact of the Camden II facility is expected to be similar to the Camden I WEF during construction, namely Low (without with mitigation), and Very Low (with mitigation).

It is concluded that the proposed Camden I Facility will have a low transport impact on the adjacent road network, if the recommended upgrades and mitigation measures are implemented, and it is recommended that the TIA should be accepted as part of the EIA application.

10.3.9 HERITAGE ASSESSMENT

The Project area is a characterised by agricultural activities (mainly grazing and cultivated fields) without any major focal points like pans or hills that would have attracted human occupation in antiquity and is considered to be of low archaeological potential. This was confirmed during the field survey and no archaeological sites of significance were noted and finds were limited to ruins (CA001) and ephemeral stone packed features (CA002, CA004 and CA005) in the wider impact area and a cemetery in the proposed impact area (CA003). The impact of the project on the recorded heritage resources is high but can be mitigated to an acceptable level.

Recommendations include:

— The study area should be monitored by the ECO during construction;
— CA001 should be recorded before a destruction permit can be applied for;
— Recorded heritage features (CA002, CA004, CA005) should be monitored by the ECO during construction; and
— The recorded cemetery (CA003) must be avoided with a 30 m buffer zone. The site must be fenced and access for family members must be ensured, alternatively the graves can be relocated adhering to all legal requirements.

10.3.10 PALAEONTOLOGY ASSESSMENT

Based on the fossil record but confirmed by the site visit and walk through, there are NO FOSSILS of the Glossopteris flora even though fossils have been recorded from rocks of a similar age and type in South Africa. It is extremely unlikely that any fossils would be preserved in the overlying soils and sands of the Quaternary. There is a very small chance that fossils may occur below the ground surface in the shales of the Vryheid Formation (Ecca Group, Karoo Supergroup) so a Fossil Chance Find Protocol should be added to the EMPr. If fossils are found by the environmental officer, or other responsible person once excavations and drilling for foundations and amenities have commenced, then they should be rescued and a palaeontologist called to assess and collect a representative sample.

The site for the Camden I SEF is on non-fossiliferous dolerite but some of the grid connections are not. The Fossil Chance Find Protocol is not relevant for the Solar PV Footprint because it will be on dolerite.

10.3.11 VISUAL ASSESSMENT

The VIA has demonstrated that the study area has a somewhat mixed visual character, transitioning from the heavily transformed urban / peri-urban landscape associated with Camden Power Station, Camden residential area and Mooiplaats Colliery in the north / north-east to a more rural / pastoral character across the remainder of the study area. Hence, although a solar PV and power line development would alter the visual character and contrast with this rural / pastoral character, the location of the proposed SEF and grid connection infrastructure in relatively close proximity to Camden Power Station and the associated power lines, mining activity and rail infrastructure will significantly reduce the level of contrast.

One formal protected area (Langcarel Private Nature Reserve) was identified within the study area, although the area is entirely managed for commercial agriculture with no conservation activities present and no evidence of public access to the site. Any landscape value or visual appeal has therefore been reduced.

The area is not typically valued for its tourism significance and relatively few leisure-based tourism facilities (lodges/accommodation facilities) were identified inside the study area. This factor in conjunction with the high levels of transformation in the north and north-east have reduced the overall visual sensitivity of the broader area.

A total of fifteen (15) potentially sensitive receptors were identified in the study area. Only one (1) of the identified receptor locations was found to be sensitive (SR3), this being a residence whose occupants have previously expressed some concern about elements of the proposed Camden Renewable Energy Complex. This receptor was however found to be outside the viewshed for the Camden 1 SEF project.

The remaining fourteen (14) receptor locations, are all believed to be farmsteads that are regarded as potentially sensitive visual receptors as the proposed development will likely alter natural or semi-natural vistas experienced from these locations. Nine of these farmsteads are not expected to experience any visual impacts as a result of the proposed development as they are either outside the viewshed for the proposed PV arrays, or located more than 5km from the proposed PV arrays.

One of the remaining receptors (VR15) would experience high levels of visual impact, largely as a result of proximity to the proposed PV arrays. Impacts are however likely to be reduced by the presence of trees along sections of the District Road D260. In addition, this receptor is located within the Camden I WEF project area and it has been confirmed by the Proponent that the relevant land owners are in support of the overall Camden Renewable Energy Complex project. As such, they are not expected to perceive the proposed development in a negative light and this would reduce the level of visual impact experienced at this location. Four potentially sensitive receptor locations are expected to experience moderate levels of impact as a result of the SEF development, while one receptor only will experience low levels of visual impact.

It is SiVEST's opinion that the potential visual impacts associated with the proposed Camden I SEF are negative and of low to moderate significance. Given the relatively low number of potentially sensitive receptors and the significant level of human transformation and landscape degradation in areas near the proposed development, the project is deemed acceptable from a visual perspective and the respective EA should be granted. SiVEST is of the opinion that the impacts associated with the construction, operation and decommissioning phases can be mitigated to acceptable levels provided the recommended mitigation measures are implemented.

10.3.12 SOCIO-ECONOMIC ASSESSMENT

The findings of the SIA indicate that the proposed up to 100 MW Camden I SEF project will create a number of social and socio-economic benefits, including creation of employment and business opportunities during both the construction and operational phase. The project will also contribute to local economic development through socio-economic development (SED) contributions. In addition, the development will improve energy security and reduce the carbon footprint associated with energy generation.

The findings of the SIA also indicate that the potential negative impacts associated with both the construction and operational phase are likely to be Low Negative with mitigation. The potential negative impacts can therefore be effectively mitigated if the recommended mitigation measures are implemented. The up to 100 MW Camden I SEF is therefore supported by the findings of the SIA.

The loss of high-quality agricultural land should be avoided and or minimised by careful planning of the final layout of the proposed SEF facility, where possible.

Affected landowners should be notified about the timing of construction related activities in advance of the commencement of the construction phase.

10.3.13 SAFETY, HEALTH AND ENVIRONMENTAL ASSESSMENT

This risk assessment has found that with suitable preventative and mitigative measures in place, none of the identified potential risks are excessively high, i.e., from a SHE perspective no fatal flaws were found with the proposed VRF or LSS BESS installations at the Camden I SEF.

At a large facility, without installation of the state-of-the art battery technology that includes protective features, there can be significant risks to employees and first responders. The latest battery designs include many preventative and mitigative measures to reduce these risks to tolerable levels. State-of-the-art technology should be used, i.e. not old technology as it presents higher risks.

The design should be subject to a full Hazard and Operability Study (HAZOP) prior to commencement of procurement. A HAZOP is a detailed technical systematic study that looks at the intricacies of the design, the control system, the emergency system etc. and how these may fail under abnormal operating conditions. Additional safeguards may be suggested by the team doing the study.

VRF BATTERY INSTALLATIONS

The most significant hazard with VRF battery units is the possibility of spills of corrosive and environmentally toxic electrolyte. Many preventative and mitigative features will be included in the design and operation, e.g., full secondary containment, level control on tanks, leak detection on equipment etc.

VRF batteries do not present significant fire and electrical arcing hazards provided they are correctly designed, operated, maintained and managed. Suitable Battery Management System (BMS), safety procedures, operating instructions, maintenance procedures, trips, alarms and interlocks should be in place.

LSS CONTAINERIZED BATTERIES

With LSS batteries, the most significant hazard with battery units is the possibility of thermal runaway and the generation of toxic and flammable gases. There have been numerous such incidents around the world with batteries at all scales and modern technology providers include many preventative and mitigative features in their designs. This type of event also generates heat which may possibly propagate the thermal runaway event to neighbouring batteries if suitable state of the art technology is not employed.

The flammable gases generated may ignite leading to a fire which accelerates the runaway process and may spread the fire to other parts of the BESS or other equipment installed near the BESS.

If the flammable gases accumulate within the container before they ignite, they may eventually ignite with explosive force. This type of event is unusual but has happened with an older technology container installed at McMicken in the USA in 2019.

Due to a variety of causes, thermal runaway could happen at any point during transport to the facility, during construction or operation / maintenance at the facility or during decommissioning and safe making for disposal.

Due to the containerized approach as well as the usual good practice of separation between containers, which should be applied on this project, and therefore the likely restriction of events to one container at a time, the main risks are close to the containers i.e. to transport drivers, employees at the facilities and first responders to incidents.

In terms of a worst conceivable case container fires, the significant impact zone is likely to be limited to within 10m of the container and mild impacts to 20m. Based on the current proposed layouts, impacts at the closest isolated farmhouses are not expected.

In terms of a worst conceivable case explosion, the significant impact zone is likely to be limited to with 10m of the container and minor impacts such as debris within 50m. Based on the current proposed layouts, impacts at the closest isolated farmhouses are not expected.

In terms of a worst reasonably conceivable toxic smoke scenario, provided the units are placed suitably far apart to prevent propagation from one unit to another and large external fires are prevented, the amount of material burning should be limited to one container at any one time. In this case, beyond the immediate vicinity of the fire, the concentrations of harmful gases within the smoke should be low. Both the alternative BESS installation's locations are over 500m from any occupied farmhouse, although location 1 is closer to farmhouses which may be a slight disadvantage. Nevertheless, the risks posed by BESS to the closest isolated farmhouses are negligible.

RECOMMENDATIONS

There are numerous different battery technologies but using one consistent battery technology system for the BESS installations associated with all the Enertrag projects in the Camden area would allow for ease of training, maintenance, emergency response and could significantly reduce risks.

Where reasonably practicable, state-of-the-art battery technology should be used with all the necessary protective features e.g., draining of cells during shutdown and standby-mode, full BMS with deviation monitoring and trips, leak detection systems.

Neither battery technology type presents any safety or health fatal flaws.

Technical and systems suggestions for managing and reducing risks have been included as part of the assessment. Ensure the items listed in these tables under preventative and mitigative measures are included in the design.

The overall design should be subject to a full Hazop prior to finalization of the design.

For the VRF systems an end of life (and for possible periodic purging requirements) solution for the large quantities of hazardous electrolyte should be investigated, e.g., can it be returned to the supplier for re-conditioning.

Prior to bringing any solid-state battery containers into the country, the contractor should ensure that:

— An Emergency Response Plan is in place that would be applicable for the full route from the ship to the site. This plan would include details of the most appropriate emergency response to fires both while the units are in transit and once they are installed and operating.
— An End-of-Life plan is in place for the handling, repurposing or disposal of dysfunctional, severely damaged batteries, modules and containers.

The site layout and spacing between lithium solid-state containers should be such that it mitigates the risk of a fire or explosion event spreading from one container to another.

Under certain weather conditions, the noxious smoke from a fire in a lithium battery container could travel some distance from the unit. The smoke will most likely be acrid and could cause irritation, coughing, distress etc. Close to the source of the smoke, the concentration of toxic gases may be high enough to cause irreversible harmful effects. Location of the facilities needs to ensure a suitable separation distance from public facilities/residences etc. All the current proposed BESS locations are over 500m from isolated farmhouses, although Option 1 is closer to local farmhouses which may be a slight disadvantage.

Under certain weather conditions, the noxious smoke from a fire in a lithium battery container could travel some distance from the unit. The smoke will most likely be acrid and could cause irritation, coughing, distress etc. Close to the source of the smoke, the concentration of toxic gases may be high enough to cause irreversible harmful effects. Location of the facilities needs to ensure a suitable separation distance from public facilities/residences etc. All the current proposed BESS locations are over 500m from isolated farmhouses and are suitable, although Option 1 is closer to local farmhouses which may be a slight disadvantage.

Where there is a choice of alternative locations for the BESS, those that are further from water courses would be preferred. VRFB hazards are mostly related to possible loss of containment of electrolyte and solid-state systems may experience fires that may result in loss of containment of liquids or the use of large amounts of fire water which could be contaminated. One would not want these run-offs to enter water courses directly. The buffer distance between water bodies and the facilities containing chemicals should be set in consultation with a water specialist and is therefore not specified in the SHE RA. However, it is noted that the Option 1 alternative location for the BESS borders on a stream that tributes to the Vaal River system. This proximity to an important water course is a disadvantage of this location, but with suitable mitigation measures in place, the risks are acceptably low and this option remain a viable option.

From the above it is clear that from a SHE point of view there is a slight preference for BESS location Option 2, although both options remain viable. Finally, it is suggested once the technology has been chosen and more details of the actual design are available, the necessary updated risk assessments should be in place.

10.4 IMPACT SUMMARY

A summary of the identified impacts and corresponding significance ratings for the proposed project is provided in **Table 10.10** below.

Table 10.10: Impact Summary

ASPECT	IMPACT DESCRIPTION	PHASE	WITHOUT MITIGATION		WITH MITIGATION	
			SIGNIFICANCE	STATUS	SIGNIFICANCE	STATUS
Air Quality	Generation of Dust and PM	Construction	**Moderate**	(-)	**Low**	(-)
Noise	Construction Noise	Construction	**Low**	(-)	**Low**	(-)
Agricultural Potential	Decrease In Agricultural Production Potential	All Phases	**Moderate**	(-)	**Moderate**	(-)
Aquatic Ecology	Loss Of Very High Sensitivity Systems	Construction	**Low**	(-)	**Low**	(-)
	Damage Or Loss Of Riparian And Riverine Systems	Construction	**Low**	(-)	**Low**	(-)
	Water Quality	Construction	**Moderate**	(-)	**Low**	(-)
	Habitat Change And Fragmentation Related To Hydrological Regimes	Construction	**Moderate**	(-)	**Low**	(-)
	Increase In Surface Water Runoff	Operational	**Low**	(-)	**Very Low**	(-)
Terrestrial Biodiversity	Loss Of Indigenous Natural Vegetation Due To Clearing	Construction	**Moderate**	(-)	**Moderate**	(-)
	Establishment and spread of declared weeds and alien invader plants	Construction	**Low**	(-)	**Very Low**	(-)
	Continued disturbance to natural habitats	Operational	**Moderate**	(-)	**Low**	(-)
	Continued establishment and spread of alien invasive plant species	Operational	**Moderate**	(-)	**Very Low**	(-)

ASPECT	IMPACT DESCRIPTION	PHASE	WITHOUT MITIGATION		WITH MITIGATION	
			SIGNIFICANCE	STATUS	SIGNIFICANCE	STATUS
	Runoff and erosion	Operational	**Moderate**	(-)	**Low**	(-)
	Loss and disturbance of natural vegetation	Decommissioning	**Low**	(-)	**Low**	(-)
	Continued establishment and spread of declared weeds and alien invader plants	Decommissioning	**Moderate**	(-)	**Low**	(-)
Terrestrial Plant Species	Loss of species of conservation concern	Construction	**Moderate**	(-)	**Very Low**	(-)
Terrestrial Animal Species	Loss of faunal habitat	Construction	**Moderate**	(-)	**Low**	(-)
	Direct mortality of fauna	Construction	**Low**	(-)	**Very Low**	(-)
	Direct mortality of fauna	Operational	**Low**	(-)	**Very Low**	(-)
	Loss of faunal habitat	Decommissioning	**Moderate**	(-)	**Low**	(-)
	Direct mortality of fauna	Decommissioning	**Low**	(-)	**Very Low**	(-)
Avifauna	Displacement of priority species due to disturbance for SEF Construction	Construction	**High**	(-)	**Moderate**	(-)
	Displacement of priority species due to habitat transformation for SEF construction	Construction	**High**	(-)	**Moderate**	(-)
	Displacement of priority species due to disturbance for BESS construction	Construction	**Low**	(-)	**Very Low**	(-)

ASPECT	IMPACT DESCRIPTION	PHASE	WITHOUT MITIGATION		WITH MITIGATION	
			SIGNIFICANCE	STATUS	SIGNIFICANCE	STATUS
	Displacement of priority species due to habitat transformation for BESS construction	Construction	**Low**	(-)	**Low**	(-)
	Collision mortality of priority species caused by solar panels	Operational	**Low**	(-)	**Low**	(-)
	Mortality due to entrapment in perimeter fences	Operational	**Low**	(-)	**Very Low**	(-)
	Collission mortality of priority species caused by overhead lines	Operational	**Moderate**	(-)	**Low**	(-)
	Mortality of priority species caused by electrocution from overhead lines	Operational	**Moderate**	(-)	**Low**	(-)
	Displacement of priority species due to disturbance associated with dismantling of the solar panels	Decommissioning	**Moderate**	(-)	**Low**	(-)
	Displacement of priority species due to disturbance linked to dismantling activities	Decommissioning	**Low**	(-)	**Very Low**	(-)
Bats	Loss of foraging habitat	Construction	**Moderate**	(-)	**Low**	(-)
	Roost destruction	Construction	**Moderate**	(-)	**Very Low**	(-)
	Increase in bat mortalities	Operational	**Moderate**	(-)	**Low**	(-)

ASPECT	IMPACT DESCRIPTION	PHASE	WITHOUT MITIGATION		WITH MITIGATION	
			SIGNIFICANCE	STATUS	SIGNIFICANCE	STATUS
Traffic	Noise, dust and exhaust pollution due to vehicle trips on-site	Construction	**Low**	(-)	**Very Low**	(-)
	Noise, dust and exhaust pollution due to additional trips on the national and district roads	Construction	**Low**	(-)	**Very Low**	(-)
Heritage	Destruction or damage to recorded ruins	Construction	**Low**	(-)	**Very Low**	(-)
	Destruction or damage to recorded graves	Construction	**High**	(-)	**Low**	(-)
Palaeontology	Impact to fossils that may occur	Construction	**Very Low**	(-)	**Very Low**	(+)
Visual	Construction related visual impacts	Construction	**Moderate**	(-)	**Low**	(-)
	Operational related visual impacts	Operational	**Moderate**	(-)	**Moderate**	(-)
	Decommissioning related visual impacts	Decommissioning	**Moderate**	(-)	**Low**	(-)
Socio-Economic	Creation of employment and business opportunities	Construction	**Low**	(+)	**Moderate**	(+)
	Construction workers on local communities	Construction	**Low**	(-)	**Low**	(-)
	Influx of job seekers	Construction	**Low**	(-)	**Low**	(-)
	Risk to safety, livestock, and farm infrastructure	Construction	**Low**	(-)	**Low**	(-)

ASPECT	IMPACT DESCRIPTION	PHASE	WITHOUT MITIGATION		WITH MITIGATION	
			SIGNIFICANCE	STATUS	SIGNIFICANCE	STATUS
	Noise, dust and safety impacts	Construction	**Low**	(-)	**Very Low**	(-)
	Potential loss of livestock and grazing and damage to farm infrastructure associated with increased incidence of grass fires	Construction	**Low**	(-)	**Low**	(-)
	Loss of farmland	Construction	**Moderate**	(-)	**Low**	(-)
	Improve energy security and support renewable sector	Operational	**Moderate**	(+)	**Moderate**	(+)
	Creation of employment and business opportunities	Operational	**Very Low**	(+)	**Moderate**	(+)
	Generation of additional income for affected land owners	Operational	**Low**	(+)	**Moderate**	(+)
	Benefits associated with socio-economic development contributions	Operational	**Moderate**	(+)	**Moderate**	(+)
	Visual impact and impact on sense of place	Operational	**Low**	(-)	**Low**	(-)
	Property values	Operational	**Low**	(-)	**Very Low**	(-)
	Impact on tourism in the region during the operational phase	Operational	**Low**	(-)	**Very Low**	(-)
Waste Management	Improper waste management and littering	Construction	**Moderate**	(-)	**Very Low**	(-)

ASPECT	IMPACT DESCRIPTION	PHASE	WITHOUT MITIGATION		WITH MITIGATION	
			SIGNIFICANCE	STATUS	SIGNIFICANCE	STATUS
Safety, health and environmental risk	Human health - chronic exposure to toxic chemical or biological agents for SSL BESS	Construction	**Moderate**	(-)	**Low**	(-)
	Human health - exposure to noise for SSL BESS	Construction	**Moderate**	(-)	**Low**	(-)
	Human health - exposure to temperature extremes and/or humidity for SSL BESS	Construction	**Low**	(-)	**Very Low**	(-)
	Human health - exposure to psychological stress for SSL BESS	Construction	**Low**	(-)	**Low**	(-)
	Human health - exposure to ergonomic stress for SSL BESS	Construction	**Low**	(-)	**Low**	(-)
	Human and equipment safety - exposure to fire radiation for SSL BESS	Construction	**Moderate**	(-)	**Low**	(-)
	Human and equipment safety - exposure to fire radiation for SSL BESS	Construction	**Moderate**	(-)	**Low**	(-)
	Human and equipment safety - exposure to explosion over pressures for SSL BESS	Construction	**Moderate**	(-)	**Low**	(-)

ASPECT	IMPACT DESCRIPTION	PHASE	WITHOUT MITIGATION		WITH MITIGATION	
			SIGNIFICANCE	STATUS	SIGNIFICANCE	STATUS
	Human and equipment safety - exposure to acute toxic chemical and biological agents for SSL BESS	Construction	**Moderate**	(-)	**Low**	(-)
	Human and equipment safety - exposure to acute toxic chemical and biological agents for SSL BESS	Construction	**Moderate**	(-)	**Low**	(-)
	Human and equipment safety - exposure to violent release of kinetic or potential energy for SSL BESS	Construction	**High**	(-)	**Low**	(-)
	Human and equipment safety - exposure to electromagnetic waves for SSL BESS	Construction	**Moderate**	(-)	**Low**	(-)
	Environment - emissions to air for SSL BESS	Construction	**Low**	(-)	**Very Low**	(-)
	Environment - emissions to water for SSL BESS	Construction	**Low**	(-)	**Low**	(-)
	Environment - emissions to earth for SSL BESS	Construction	**Low**	(-)	**Low**	(-)
	Environment - waste of resources e.g. water, power etc for SSL BESS	Construction	**Low**	(-)	**Very Low**	(-)
	Public – aesthetics for SSL BESS	Construction	**Low**	(-)	**Low**	(-)

ASPECT	IMPACT DESCRIPTION	PHASE	WITHOUT MITIGATION		WITH MITIGATION	
			SIGNIFICANCE	STATUS	SIGNIFICANCE	STATUS
	Investors – financial for SSL BESS	Construction	**Moderate**	(-)	**Low**	(-)
	Employees and investors – security for SSL BESS	Construction	**Moderate**	(-)	**Low**	(-)
	Emergencies for SSL BESS	Construction	**Moderate**	(-)	**Low**	(-)
	Investors – legal for SSL BESS	Construction	**Moderate**	(-)	**Low**	(-)
	Human health - chronic exposure to toxic chemical or biological agents for VRF BESS	Construction	**Moderate**	(-)	**Low**	(-)
	Human health - exposure to noise for VRF BESS	Construction	**Moderate**	(-)	**Low**	(-)
	Human health - exposure to temperature extremes and/or humidity for VRF BESS	Construction	**Low**	(-)	**Very Low**	(-)
	Human health - exposure to psychological stress for VRF BESS	Construction	**Low**	(-)	**Low**	(-)
	Human health - exposure to ergonomic stress for VRF BESS	Construction	**Low**	(-)	**Low**	(-)
	Human and equipment safety - exposure to fire radiation for VRF BESS	Construction	**Moderate**	(-)	**Low**	(-)

ASPECT	IMPACT DESCRIPTION	PHASE	WITHOUT MITIGATION		WITH MITIGATION	
			SIGNIFICANCE	STATUS	SIGNIFICANCE	STATUS
	Human and equipment safety - exposure to explosion over pressures for VRF BESS	Construction	**Very Lowe**	(-)	**Very Low**	(-)
	Human and equipment safety - exposure to acute toxic chemical and biological agents for VRF BESS	Construction	**Moderate**	(-)	**Low**	(-)
	Human and equipment safety - exposure to violent release of kinetic or potential energy for VRF BESS	Construction	**High**	(-)	**Low**	(-)
	Human and equipment safety - exposure to electromagnetic waves for VRF BESS	Construction	**Moderate**	(-)	**Low**	(-)
	Environment - emissions to air for VRF BESS	Construction	**Low**	(-)	**Very Low**	(-)
	Environment - emissions to water for VRF BESS	Construction	**Low**	(-)	**Low**	(-)
	Environment - emissions to earth for VRF BESS	Construction	**Low**	(-)	**Low**	(-)
	Environment - waste of resources e.g. water, power etc for VRF BESS	Construction	**Low**	(-)	**Very Low**	(-)
	Public – aesthetics for VRF BESS	Construction	**Moderate**	(-)	**Low**	(-)

ASPECT	IMPACT DESCRIPTION	PHASE	WITHOUT MITIGATION		WITH MITIGATION	
			SIGNIFICANCE	STATUS	SIGNIFICANCE	STATUS
	Investors – financial for VRF BESS	Construction	**Moderate**	(-)	**Low**	(-)
	Employees and investors – security for VRF BESS	Construction	**Moderate**	(-)	**Low**	(-)
	Emergencies for VRF BESS	Construction	**Moderate**	(-)	**Low**	(-)
	Investors – legal for VRF BESS	Construction	**Moderate**	(-)	**Low**	(-)
	Human health - chronic exposure to toxic chemical or biological agents for SSL BESS	Operational	**Moderate**	(-)	**Low**	(-)
	Human health - chronic exposure to toxic chemical or biological agents for SSL BESS	Operational	**Moderate**	(-)	**Low**	(-)
	Human health - exposure to noise for SSL BESS	Operational	**Moderate**	(-)	**Low**	(-)
	Human health - exposure to temperature extremes and/or humidity for SSL BESS	Operational	**Low**	(-)	**Very Low**	(-)
	Human health - exposure to psychological stress for SSL BESS	Operational	**Low**	(-)	**Very Low**	(-)
	Human health - exposure to ergonomic stress for SSL BESS	Operational	**Moderate**	(-)	**Low**	(-)

ASPECT	IMPACT DESCRIPTION	PHASE	WITHOUT MITIGATION		WITH MITIGATION	
			SIGNIFICANCE	STATUS	SIGNIFICANCE	STATUS
	Human and equipment safety - exposure to fire radiation for SSL BESS	Operational	**High**	(-)	**Low**	(-)
	Human and equipment safety - exposure to fire radiation for SSL BESS	Operational	**High**	(-)	**Low**	(-)
	Human and equipment safety - exposure to explosion over pressures for SSL BESS	Operational	**Moderate**	(-)	**Low**	(-)
	Human and equipment safety - exposure to acute toxic chemical and biological agents for SSL BESS	Operational	**Low**	(-)	**Low**	(-)
	Human and equipment safety - exposure to acute toxic chemical and biological agents for SSL BESS	Operational	**Moderate**	(-)	**Low**	(-)
	Human and equipment safety - exposure to violent release of kinetic or potential energy for SSL BESS	Operational	**Moderate**	(-)	**Low**	(-)
	Human and equipment safety - exposure to electromagnetic waves for SSL BESS	Operational	**Moderate**	(-)	**Low**	(-)
	Environment - emissions to air for SSL BESS	Operational	**Low**	(-)	**Very Low**	(-)

ASPECT	IMPACT DESCRIPTION	PHASE	WITHOUT MITIGATION		WITH MITIGATION	
			SIGNIFICANCE	STATUS	SIGNIFICANCE	STATUS
	Environment - emissions to water for SSL BESS	Operational	**Low**	(-)	**Low**	(-)
	Environment - emissions to earth for SSL BESS	Operational	**Low**	(-)	**Very Low**	(-)
	Environment - waste of resources e.g. water, power etc for SSL BESS	Operational	**Low**	(-)	**Very Low**	(-)
	Public – aesthetics for SSL BESS	Operational	**Moderate**	(-)	**Low**	(-)
	Investors – financial for SSL BESS	Operational	**Moderate**	(-)	**Low**	(-)
	Employees and investors – security for SSL BESS	Operational	**Moderate**	(-)	**Low**	(-)
	Employees and investors – security for SSL BESS	Operational	**Moderate**	(-)	**Low**	(-)
	Emergencies for SSL BESS	Operational	**Moderate**	(-)	**Low**	(-)
	Investors – legal for SSL BESS	Operational	**Moderate**	(-)	**Low**	(-)
	Human health - chronic exposure to toxic chemical or biological agents for VRF BESS	Operational	**Moderate**	(-)	**Low**	(-)
	Human health - chronic exposure to toxic chemical or biological agents for VRF BESS	Operational	**Moderate**	(-)	**Low**	(-)
	Human health - exposure to noise for VRF BESS	Operational	**Moderate**	(-)	**Low**	(-)

ASPECT	IMPACT DESCRIPTION	PHASE	WITHOUT MITIGATION		WITH MITIGATION	
			SIGNIFICANCE	STATUS	SIGNIFICANCE	STATUS
	Human health - exposure to temperature extremes and/or humidity for VRF BESS	Operational	**Low**	(-)	**Very Low**	(-)
	Human health - exposure to psychological stress for VRF BESS	Operational	**Low**	(-)	**Very Low**	(-)
	Human health - exposure to ergonomic stress for VRF BESS	Operational	**Moderate**	(-)	**Low**	(-)
	Human and equipment safety - exposure to fire radiation for VRF BESS	Operational	**Moderate**	(-)	**Low**	(-)
	Human and equipment safety - exposure to fire radiation for VRF BESS	Operational	**Moderate**	(-)	**Low**	(-)
	Human and equipment safety - exposure to explosion over pressures for VRF BESS	Operational	**Moderate**	(-)	**Low**	(-)
	Human and equipment safety - exposure to acute toxic chemical and biological agents for VRF BESS	Operational	**Low**	(-)	**Low**	(-)
	Human and equipment safety - exposure to acute toxic chemical and biological agents for VRF BESS	Operational	**Moderate**	(-)	**Low**	(-)

ASPECT	IMPACT DESCRIPTION	PHASE	WITHOUT MITIGATION SIGNIFICANCE	STATUS	WITH MITIGATION SIGNIFICANCE	STATUS
	Human and equipment safety - exposure to violent release of kinetic or potential energy for VRF BESS	Operational	**Moderate**	(-)	**Low**	(-)
	Human and equipment safety - exposure to electromagnetic waves for VRF BESS	Operational	**Moderate**	(-)	**Low**	(-)
	Environment - emissions to air for VRF BESS	Operational	**Low**	(-)	**Very Low**	(-)
	Environment - emissions to water for VRF BESS	Operational	**Low**	(-)	**Low**	(-)
	Environment - emissions to earth for VRF BESS	Operational	**Low**	(-)	**Very Low**	(-)
	Environment - waste of resources e.g. water, power etc for VRF BESS	Operational	**Low**	(-)	**Very Low**	(-)
	Public – aesthetics for VRF BESS	Operational	**Moderate**	(-)	**Low**	(-)
	Investors – financial for VRF BESS	Operational	**Moderate**	(-)	**Low**	(-)
	Employees and investors – security for VRF BESS	Operational	**Moderate**	(-)	**Low**	(-)
	Emergencies for VRF BESS	Operational	**Moderate**	(-)	**Low**	(-)
	Investors – legal for VRF BESS	Operational	**Moderate**	(-)	**Low**	(-)

ASPECT	IMPACT DESCRIPTION	PHASE	WITHOUT MITIGATION		WITH MITIGATION	
			SIGNIFICANCE	STATUS	SIGNIFICANCE	STATUS
	Human health - chronic exposure to toxic chemical or biological agents for both BESS types	Decommissioning	**Very Low**	(-)	**Very Low**	(-)
	Human health - exposure to noise for both BESS types	Decommissioning	**Very Low**	(-)	**Very Low**	(-)
	Human health - exposure to temperature extremes and/or humidity for both BESS types	Decommissioning	**Very Low**	(-)	**Very Low**	(-)
	Human health - exposure to psychological stress for both BESS types	Decommissioning	**Very Low**	(-)	**Very Low**	(-)
	Human health - exposure to ergonomic stress for both BESS types	Decommissioning	**Very Low**	(-)	**Very Low**	(-)
	Human and equipment safety - exposure to fire radiation for both BESS types	Decommissioning	**Very Low**	(-)	**Very Low**	(-)
	Human and equipment safety - exposure to explosion over pressures for both BESS types	Decommissioning	**Very Low**	(-)	**Very Low**	(-)
	Human and equipment safety - exposure to acute toxic chemical and biological agents for both BESS types	Decommissioning	**Very Low**	(-)	**Very Low**	(-)

ASPECT	IMPACT DESCRIPTION	PHASE	WITHOUT MITIGATION		WITH MITIGATION	
			SIGNIFICANCE	STATUS	SIGNIFICANCE	STATUS
	Human and equipment safety - exposure to violent release of kinetic or potential energy for SSL BESS	Decommissioning	**Very Low**	**(-)**	**Very Low**	**(-)**
	Human and equipment safety - exposure to electromagnetic waves for SSL BESS	Decommissioning	**Very Low**	**(-)**	**Very Low**	**(-)**
	Environment - emissions to air for SSL BESS	Decommissioning	**Very Low**	**(-)**	**Very Low**	**(-)**
	Environment - emissions to water for SSL BESS	Decommissioning	**Very Low**	**(-)**	**Very Low**	**(-)**
	Environment - emissions to earth for SSL BESS	Decommissioning	**Moderate**	**(-)**	**Low**	**(-)**
	Environment - waste of resources e.g. water, power etc for SSL BESS	Decommissioning	**Very Low**	**(-)**	**Very Low**	**(-)**
	Public – aesthetics for SSL BESS	Decommissioning	**Very Low**	**(-)**	**Very Low**	**(-)**
	Investors – financial for SSL BESS	Decommissioning	**Very Low**	**(-)**	**Very Low**	**(-)**
	Employees and investors – security for SSL BESS	Decommissioning	**Very Low**	**(-)**	**Very Low**	**(-)**
	Emergencies for SSL BESS	Decommissioning	**Very Low**	**(-)**	**Very Low**	**(-)**
	Investors – legal for SSL BESS	Decommissioning	**Moderate**	**(-)**	**Low**	**(-)**

10.5 ALTERNATIVES ASSESSMENT

Project alternatives in terms of activity, technology, location and layout were considered as part of the EIA Process. The alternatives are discussed in **Section 6.5** and the preferred alternative is discussed in **Table 10.11**. However, it is important to note that while there are preferences specified, all alternatives are considered feasible from an environmental impact perspective.

Table 10.11: Alternatives assessment

ALTERNATIVE TYPE	PREFERRED ALTERNATIVE	COMMENT
Site Alternative	There is no site alternative for the Camden I SEF. The site is considered suitable for the reasons provided. The investigation of an alternative site is not currently proposed within this S&EIA. The Camden I SEF Development area is on: — Portion 1 of Welgelegen Farm No. 322	The Camden site was selected because it is strategically located due to the following factors: — Proximity to the Eskom grid and collector substation — Land Availability — Strategic Approach — Road and labour pool accessibility — Environment
Technology - Solar	The Camden 1 SEF will utilise solar PV technology to generate power. Therefore, no technology alternatives are being considered for this project.	Motivation for the use of solar technology includes: — Availability of solar resource in the Mpumalanga region — The surrounding landscape has a relatively flat topography — With regards to renewable energy facilities, there is minimal competition in the area — Agrivoltaics is being considered in the design to allow for crop production on the same land.
Technology - BESS	It is important to note that the selection of specific technology will only be determined following EPC, therefore both types of battery technologies have been considered in the EIA. The potential risks and impacts of the proposed BESS at the Camden I SEF have been assessed as part of this EIA and the Risk Assessment is included in **Appendix H-15**. Both options have been investigated in **Section 7.4** of this report and assessed in **Section 8.18**. From a safety and health point of view, the risk assessment shows that risks posed by VRF systems may be slightly lower than those of SSL facilities, particularly with respect to fire and explosion risks. From an environmental spill and pollution point of view the VRF systems present higher short-term risks than the SSL systems. However, the above conclusions may be due to the fact that the VRF technology is not as mature as SSL technology and therefore there is not as much operating experience and accident information available for the VRF.	Both BESS technologies were assessed and no fatal flaws were identified. However, the Solid-State lithium-ion technology is preferred.

ALTERNATIVE TYPE	PREFERRED ALTERNATIVE	COMMENT
Layout	The project layout has been narrowed down from the broader study area based on specialist sensitivities and therefore the current layout is optimised and considered most suitable. Two site locations have been identified for the on-site substation, which include the BESS. Alternative 2 is preferred as it provides the shorter connection to the preferred collector substation. Both Alternatives are considered feasible and reasonable,	The Visual Impact Assessment noted that no fatal flaws were identified for any of the proposed site alternatives for the substation, BESS and/or and construction camps for the Camden SEF. No preference was determined for any of the site alternatives and both alternatives were found to be favourable. The Avifaunal Assessment identified Alternative 1 and Alternative 2 both located in the same habitat type, namely partially in low and in high sensitivity grassland. Both alternatives will therefore have the same potential displacement impact on priority avifauna, therefore no preferred alternative can be selected. However, both options are acceptable, due to the low impact of the small footprint. From a SHE risk assessment point of view, where there is a choice of location that is further from public roads, water courses or isolated farmhouses, this would be preferred. VRF hazards are mostly related to possible loss of containment of electrolyte and SSL batteries to fires producing toxic smoke and fire fighting which may result in contaminated of firewater runoff. One would not want these liquids to enter water courses nor the smoke to pass close to houses / public traffic The Option 1 alternative location for the BESS borders on a stream that tributes to the Vaal River system. This proximity to an important water course is a disadvantage of this location 1. From a SHE point of view location Alternative 2 is the preferred alternative for the on-site substation which includes the BESS. As no preferred alternative was identified by the specialists (apart from the SHE risk assessment which is preferred Alternative 2), the technically preferred option is Alternative 2 as it provides the shorter connection to the preferred collector substation.

Alternative 2 for the on-site substation is preferred with the following coordinates:

- A2- A: 26°39'30.94"S 30° 4'20.71"E
- A2- B: 26°39'35.59"S 30° 4'31.86"E
- A2- C: 26°39'42.51"S 30° 4'27.94"E
- A2- D: 26°39'37.67"S 30° 4'16.90"E

These corner coordinates are illustrated in **Figure 10.18.**

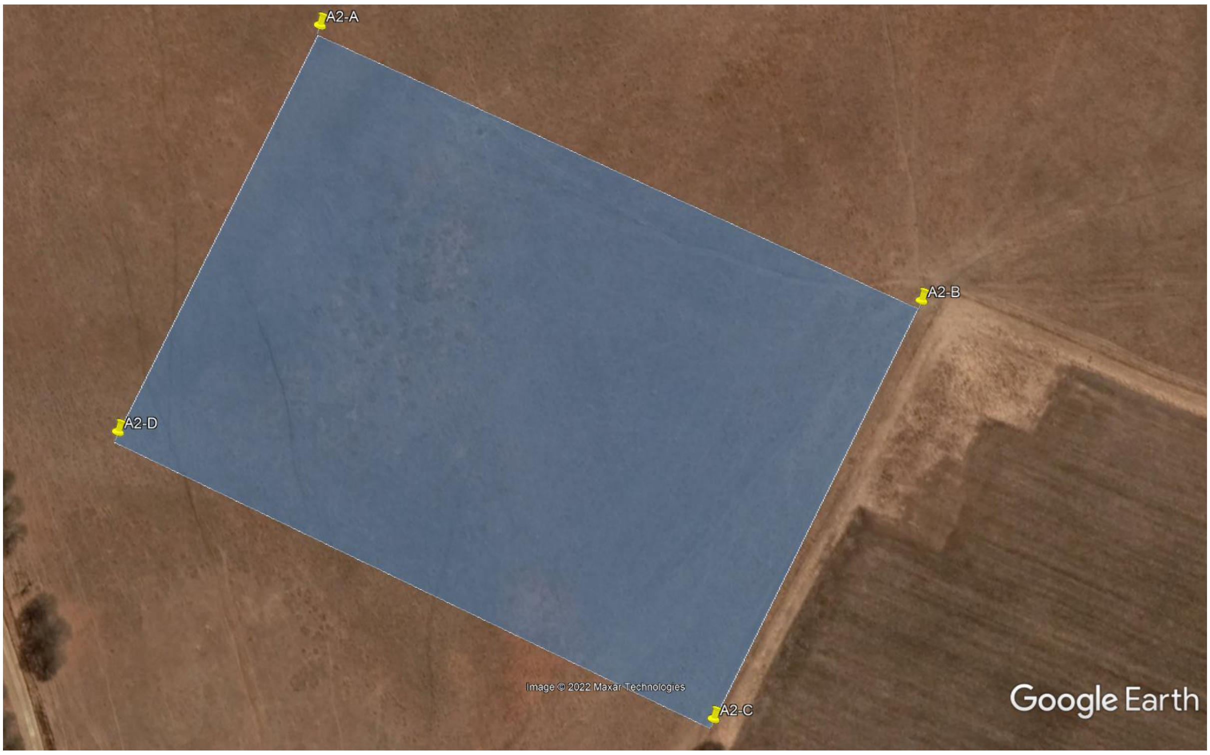


Figure 10.18: Corner points for On-Site Substation Alternative 2

NO-GO ALTERNATIVE

As part of the Agriculture Potential Assessment the no-go alternative was considered. The no-go alternative considers impacts that will occur to the agricultural environment in the absence of the proposed development. There are no agricultural impacts of the no-go alternative. However it should be noted that any future coal mining on the site will have a significant and much greater agricultural impact than the proposed solar energy facility.

The facility is located partially on cropland because options for the location of the solar component are constrained by a number of competing factors that include engineering and other environmental constraints. The proposed site has been chosen to balance the competing constraints. The majority of the 290 hectare site (61%) has been located off cropland, but 114 hectares of cropland need to be included in the site. No site that could balance competing constraints without impinging partially on cropland is available elsewhere on the site.

The Visual Assessment, Terrestrial Biodiversity Assessment, Avifauna Assessment and Socio-Economic Assessment indicate that if the no-go option is implemented and the project does not go ahead, the current status quo will continue.

This will involve continued use of the land for cultivation and livestock production, as well as the possibility of future mining. Historical aerial imagery shows that cultivation patterns have not changed much in recent history. This is probably due to the fact that most areas that were viable for crop production were already cultivated in the early 1900s and that there is no benefit to cultivating any new areas, usually due to soil depth limitations.

In terms of livestock production, the agricultural specialist report indicated that the long-term grazing capacity of the general area is fairly high at 4.5 hectares per large stock unit (DAFF, 2018). To illustrate general stocking rates in the area, Welgelen 1 and 2 comprises ca. 2018ha, which implies a sustainable grazing numbers on site of ca. 448 head of cattle. These two properties currently occupy ca. 700 head of cattle (not counting the sheep), and therefore the land is heavily overstocked, which is reflected in the condition of the grasslands on site. These are obviously overgrazed and the site is on a long term over-grazing trajectory. This implies that stocking rates, and therefore profitability, will need to be reduced to avert land degradation, putting financial strain on producers. An alternative income stream associated with financial benefits from hosting renewable energy projects is likely to improve the financial viability of any land manager, which in turn reduces the pressure to carry unsustainable stock numbers. This reduces pressure on the land, which reduces the likelihood of grazing-induced degradation. In summary, the No-Go option will increase the rate of land degradation due to over-grazing, especially under adverse future climate scenarios, whereas there is a possibility of this effect being lessened in the case of the project promoting local economic diversity. There is also a moderate to high risk of loss of natural areas due to expansion of coal mining. From a strictly avifaunal perspective, the ‘no-go’ option would eliminate any additional impact on the ecological integrity of the proposed SEF development site, as far as avifauna is concerned, bearing in mind that there have already been extensive impacts in the project area in the form of agriculture.

In the “no project” alternative, the Camden I SEF project will not be developed. In this scenario, there could be a missed opportunity to address the need for South Africa to improve energy security and supplement its current energy needs with clean, renewable energy. Given South Africa’s current energy security challenges and its position as one of the highest per capita producers of carbon emissions in the world, this would represent a significant negative social cost. Conversely, negative environmental impacts of the project (as outlined in **Section 8**) associated with the development of the Camden I SEF would be avoided.

10.6 IMPACT STATEMENT

The overall objective of the EIA is to provide sufficient information to enable informed decision-making by the authorities. This was undertaken through consideration of the proposed project components, identification of the aspects and sources of potential impacts and subsequent provision of mitigation measures.

It is the opinion of WSP that the information contained in this document (read in conjunction the final scoping report) is sufficient for the DFFE to make an informed decision for the environmental authorisation being applied for in respect of this project.

Mitigation measures have been developed where applicable for the above aspects and are presented within the EMPr (**Appendix I**). It is imperative that all impact mitigation recommendations contained in the EMPr, of which the environmental impact assessment took cognisance, are legally enforced.

Considering the findings of the respective studies, no fatal flaws were identified for the proposed Project. Should the avoidance and mitigation measures prescribed be implemented, the significance of the considered impacts for all negative aspects pertaining to the environmental aspects is expected to be low. It is thus the opinion of the EAP that the Project can proceed, and that all the prescribed mitigation measures and recommendations are considered by the issuing authority.

EA AUTHORISATION PERIOD

Appendix 1(3)(1)(q) of the NEMA EIA Regulations 2014, as amended requires “where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required, the date on which the activity will be concluded, and the post construction monitoring requirements finalised” must be included in the EIA Report.

The EA is required to be valid for a period of 10 years from the date of issuance of the EA. This is considered a reasonable period to allow the Applicant time to conduct relevant internal processes which can only begin after issuance of the EA.

FINALISATION OF THE EMPR AND LAYOUT

It is important to note that the EMPr (**Appendix I**) and project layout included in this EIR are not final and although included in this EIR, these are not submitted for approval at this stage. Subsequent to the decision-making phase, if environmental authorisation is granted for the Camden I SEF, the EMPr will have to be amended to include measures as dictated by the final layout map and micro-siting, including the requirements of the EA. The amended EMPr and final layout subjected to micro-siting will be submitted to the DFFE for review and approval following detailed design.

ASPECTS TO BE INCLUDED AS CONDITIONS IN THE EA

The following key aspects are recommended to be included as conditions of authorisation:

— The layouts submitted in the EIR are not final. The final layouts are to be submitted to the DFFE for approval prior to construction;
— The EMPr submitted in the EIR is not final. The final EMPr is to be submitted to the DFFE for approval prior to construction;

- Construction must only commence once the Protected Area status has been changed for the directly affected properties (i.e. Portion 1 & 2 of Farm No. 322 (Welgelegen));
- The EMPr and EIR mitigation measures must be adhered to;
- Recommendations for the layout as provided by the relevant specialists must be implemented as far as possible;
- The final EMPr must form part of all contractual documents with contractors during construction and operational phases of the project. Furthermore, a dedicated Environmental Control Officer (ECO) must be appointed to ensure compliance to all EA conditions and EMPr commitments throughout the construction phase;
- Applications for all relevant and required permits must be submitted prior to construction; and
- Where required, water use authorisation under NWA is to be obtained from the Department of Water and Sanitation prior to construction.

11 CONCLUSION

ENERTRAG is proposing the development of a Camden Renewable Energy Complex within the vicinity of the Camden Power Station in Mpumalanga. **This report is specific to the Camden I SEF (up to 100MW)**. The proposed Camden I SEF is located south-west of Ermelo, in Mpumalanga and falls within the Msukaligwa Local Municipality and the Dr Pixley Ka Seme Local Municipality of the Gert Sibande District Municipality.

This S&EIA process considered the biophysical location of the proposed development, as well as a feasibility assessment by the proponent, which *inter alia* served to identify site options that would be optimal for energy production and grid interconnection. As discussed previously, the purpose of the proposed Camden I SEF is to contribute to the national energy targets of diversification of energy supply and the promotion of clean energy. The project will also aid in overcoming the national power shortages that are currently faced in the country. Other socio-economic benefits would result from the proposed project, including the increase of energy supply, employment opportunities and local economic development.

The anticipated environmental and social impacts associated with the proposed Camden I SEF have been identified and assessed by the various specialists. Based on the findings of the Specialists, the current layout avoids sensitivities as much as possible.

Based on the Specialist findings, a revised layout was developed to avoid sensitive features and buffer areas, and mitigate against overall impact. Based on the findings of the Specialists, the current layout avoids sensitivities as much as possible. According to the Terrestrial Biodiversity Assessment, the proposed layout for solar panels has a moderately small footprint area relative to the entire cluster of projects. Those natural areas that are affected are generally in relatively poor condition due to overgrazing. It has been calculated here that if all infrastructure components are placed within natural areas (worst-case scenario) then it affects a total of 117 hectares of natural habitat of a total of 3222 hectares of natural habitat on the site of the entire cluster of projects (approximately 3.5%). The solar project therefore potentially has a very small footprint area which results in a limited spatial impact.

Furthermore, in terms of the assessed terrestrial impacts, the extent of the impact on the loss of indigenous natural vegetation is negligible.

It is also important to note that although there is a proclaimed conservation area on Portion 1 of Farm No. 322 (Welgelegen), which is a declared Private Nature Reserve (Langcarel Private Nature Reserve), the area is not being managed as a nature reserve and a separate process is underway to have it deproclaimed (or partially deproclaimed) as part of ongoing province-wide reserve verification efforts by the provincial authorities. Furthermore, no evidence was observed on site of any conservation management activities during the Terrestrial Biodiversity field assessment. Following assessment, the Biodiversity Specialist is of the opinion that the impacts associated with the project can be mitigated to acceptable levels provided the recommended mitigation measures identified are implemented, and that on the basis of the current land use and levels of modification, that the private nature reserve status does not align with the objective and purpose of the protected area status.

Based on the findings of the impact assessment and specialist studies, the proposed project is considered to have an overall **Low** to **Moderate** negative environmental impact and an overall **Low** to **Moderate** positive socio-economic impact, with the implementation of the relative mitigation measures. All of the specialists have recommended that the proposed project receive EA if the recommended mitigation measures are implemented.

In consideration of the findings of the S&EIA Process, as well as the national, provincial and local strategic requirements to support sustainable development whilst promoting socio-economic development, it is the opinion of the EAP that the proposed project will make a positive contribution towards socio-economic development in the Gert Sibande District Municipality in addition to national benefits in terms of renewable energy generation. It is recommended that the project receive EA in terms of the EIA Regulations (as amended), provided that the outlined mitigation measures of this S&EIA process are implemented effectively.

This draft EIAR is available for public review from **07 September 2022 to 10 October 2022.**

All issues and comments submitted to WSP during the scoping phase have been incorporated in the CRR (Appendix G of the FSR (i.e. SER)). The Final EIR will be submitted to the DFFE, as the competent authority

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APPENDIX

A

EAP CV

APPENDIX

B EAP DECLARATION

APPENDIX

C SPECIALISTS DECLARATIONS

APPENDIX

D STAKEHOLDER ENGAGEMENT REPORT

APPENDIX

E MAPS

APPENDIX

F DFFE ACCEPTANCE OF APPLICATION

APPENDIX

G SCOPING PHASE APPROVAL

APPENDIX

H SPECIALIST STUDIES

APPENDIX

H-1 *AGRICULTURE*

APPENDIX

H-2 *AQUATIC ECOLOGY*

APPENDIX

H-3 *GEOTECHNICAL DESKTOP ASSESSMENT*

APPENDIX

H-4 TERRESTRIAL ECOLOGY

APPENDIX

H-5 TERRESTRIAL PLANT SPECIES

APPENDIX

H-6 TERRESTRIAL ANIMAL SPECIES

APPENDIX

H-7 *AVIFAUNA*

APPENDIX

H-8 *BATS*

H-9 *TRAFFIC*

APPENDIX

H-10 *HERITAGE*

APPENDIX

H-11 PALEONTOLOGY

H-12 VISUAL

APPENDIX

H-13 SOCIO-ECONOMIC

APPENDIX

H-14 SHE RISK ASSESSMENT

APPENDIX

EMPR

APPENDIX

J DFFE SCREENING TOOL

APPENDIX

K

PRE-APPLICATION MEETING MINUTES