

DRAFT BASIC ASSESSMENT REPORT

PROPOSED DEVELOPMENT OF THE ADAMS BATTERY ENERGY STORAGE SYSTEM (BESS)
AND ASSOCIATED INFRASTRUCTURE

Joe Morolong Local Municipality, Northern Cape Province

DFFE Ref. No: TBC

REVISION: 001

PREPARED FOR:



Enel Green Power South Africa (Pty) Ltd

DATED:

November 22

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PROJECT DETAILS

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ABBREVIATIONS

BAR	- Basic Assessment Report
BESS	- Battery Energy Storage System
BID	- Background Information Document
CA	- Competent Authority
CLO	- Community Liaison Officer
DENC	- Northern Cape Department of Environment and Nature Conservation
DFFE	- Department of Forestry, Fisheries and the Environment
DWS	- Department of Water and Sanitation
EA	- Environmental Authorisation
EAP	- Environmental Assessment Practitioner
ECO	- Environmental Control Officer
EGP	- Enel Green Power South Africa (Pty) Ltd
EMPr	- Environmental Management Programme
GHG	- Greenhouse gas
GWh	- Gigawatt hour
IDP	- Integrated Development Plan
JMLM	- Joe Morolong Local Municipality
NEMA	- National Environmental Management Act, 1998
NWA	- National Water Act, 1998
OHS Act	- Occupational Health and Safety Act, 1993
PPE	- Personal Protective Equipment
PPP	- Public Participation Process
PSDF	- Provincial Spatial Development Framework
REDZ	- Renewable Energy Development Zones
SAHRA	- South African Heritage Resources Agency
SDF	- Spatial Development Framework
SEA	- Strategic Environmental Assessment
SPLUMA	- Spatial Planning and Land Use Management
VRF	- Vanadium Redox Flow

DOCUMENT GUIDE

The table below summarises the requirements of the 2014 NEMA EIA Regulations (as amended in 2017) in terms of the content requirements of EIA reports (Appendix 1 of GNR982) and the relevant sections in the report where these are addressed.

A basic assessment report must contain the information that is necessary for the competent authority to consider and come to a decision on the application, and must include:

Item	Description	Page / Section in this report
1 (a)	Details of -	Section 1.3
	(i) the EAP who prepared the report.	
	(ii) the expertise of the EAP, including a curriculum vitae.	
1 (b)	The location of the activity, including:	Section 6.1
	(i) the 21-digit Surveyor General code of each cadastral land parcel.	
	(ii) where available, the physical address and farm name.	
	(iii) where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties.	
1 (c)	A plan which locates the proposed activity or activities applied for as well as associated structures and infrastructure at an appropriate scale;	Appendix A – Maps & Section 6.1 (Table 9)
	(i) a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or	
	(ii) on land where the property has not been defined, the coordinates within which the activity is to be undertaken.	
1 (d)	A description of the scope of the proposed activity, including	Section 1.1, Table 4 & Section 3
	(i) all listed and specified activities triggered and being applied for; and	
	(ii) a description of the activities to be undertaken including associated structures and infrastructure.	
1 (e)	A description of the policy and legislative context within which the development is proposed including—	Section 2
	(i) an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks, and instruments that are applicable to this activity and have been considered in the preparation of the report;	
	(ii) how the proposed activity complies with and responds to the legislation and policy context, plans, guidelines, tools frameworks, and instruments;	
1 (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
1 (g)	A motivation for the preferred site, activity and technology alternative	Sections 4 & 11
1 (h)	a full description of the process followed to reach the proposed preferred alternative within the site, including—	Refer below:
	(i) details of all the alternatives considered;	Section 4
	(ii) details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs;	Section 7

	(iii) 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	Section 7.5
	(iv) the environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Section 4
	(v) the impacts and risks identified for each alternative, including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts	Sections 9 & 10
	(aa) can be reversed	
	(bb) may cause irreplaceable loss of resources; and	
	(cc) can be avoided, managed or mitigated.	
	(vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks associated with the alternatives	Section 9
	(vii) 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	Sections 10, 11 & 14
	(viii) the possible mitigation measures that could be applied and level of residual risk	Sections 9.3, 10 & 14
	(ix) the outcome of the site selection matrix	Sections 9.3 (Tables 17-20) & 10
	(x) if no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such; and	N/A
	(xi) a concluding statement indicating the preferred alternatives, including preferred location of the activity	Section 11
1 (i)	a full description of the process undertaken to identify, assess and rank the impacts the activity will impose on the preferred location through the life of the activity, including—	Section 9
	(i) a description of all environmental issues and risks that were identified during the environmental impact assessment process; and	
	(ii) 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;	
1 (j)	an assessment of each identified potentially significant impact and risk, including	Section 9
	(i) cumulative impacts	
	(ii) the nature, significance and consequences of the impact and risk	
	(iii) the extent and duration of the impact and risk	
	(iv) the probability of the impact and risk occurring	
	(v) the degree to which the impact and risk can be reversed	
	(vi) the degree to which the impact and risk may cause irreplaceable loss of resources; and	
	(vii) the degree to which the impact and risk can be avoided, managed or mitigated	
1 (k)	where applicable, a summary of the findings and impact management measures identified in 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 report;	Section 10.2 & Section 14.2

1(l)	an environmental impact statement which contains—	Section 11
	(i) a summary of the key findings of the environmental impact assessment	
	(ii) 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	
	(iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives	
1(m)	Based on the assessment, and where applicable, impact management measures from specialist reports, the recording of the proposed impact management outcomes for the development for inclusion in the EMPr;	Section 10
1(n)	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	N/A
1(o)	A description of any assumptions, uncertainties, and gaps in knowledge which relate to the assessment and mitigation measures proposed;	Appendix E - Specialist Reports
1(p)	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;	Sections 13 & 14
1(q)	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;	N/A
1(r)	An undertaking under oath or affirmation by the EAP in relation to—	Section 15.2
	(i) the correctness of the information provided in the reports;	
	(ii) the inclusion of comments and inputs from stakeholders and I&APs;	
	(iii) the inclusion of inputs and recommendations from the specialist reports where relevant; and	
	(iv) any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested and affected parties; and	
1(s)	N/A	N/A
1(t)	Any specific information that may be required by the competent authority; and	Appendix E – Specialist Reports
1(u)	Any other matters required in terms of section 24(4)(a) and (b) of the Act.	N/A
(2)	Where a government notice gazetted by the Minister provides for the basic assessment process to be followed, the requirements as indicated in such a notice will apply.	N/A

EXECUTIVE SUMMARY

Enel Green Power South Africa (Pty) Ltd proposes the construction and operation of a Battery Energy Storage System (BESS) and associated infrastructure at the authorised in the proximity of the existing Adams Solar Photovoltaic Facility (Environmental Authorisation (EA) Ref No: 12/12/20/2567/1) located in the Joe Morolong Local Municipality in the Northern Cape province.

The project will include the development of the BESS of up to 4ha in extent to be located adjacent to (within 100m of) the existing Photovoltaic Facility (PV) and associated substation.

Associated infrastructure includes:

- i. A Substation with a maximum height of - HV busbar up to 10m max and an HV Building up to 4m max.
- ii. Access road to the BESS (the existing access road will be utilized) branching off the existing roads, and internal roads (up to 8m wide) within the footprint of the BESS, as needed.
- iii. MV Cabling (underground or overhead) between the BESS and the HV/MV BESS substation.
- iv. HV Cabling (underground or overhead) between the HV/MV BESS substation and the existing HV substation or for loop in and loop out to the existing HV connection line
- v. Fencing around the BESS and the substation for increased security measures.
- vi. Temporary laydown area within the 4ha footprint of the BESS.
- vii. Possible firebreak around the BESS facility which is to be located within the 4ha BESS footprint.

The general purpose and utilisation of a BESS is to save and store excess electrical output as it is generated, allowing for a timed release of electricity to the grid when the capacity is required. BESS systems therefore provide flexibility in the efficient operation of the electricity grid through decoupling of the energy supply and demand.

The preferred location of the BESS facility and all associated infrastructure is proposed to be on Portion 0 of Farm Adams No. 328. An alternative location, to the North of the Adams Solar Park Photovoltaic (PV) Facility, was considered by the project specialists however at the request of the landowner and due to the suitability for the development of a BESS based on the requirement for such to be in close proximity to the approved and currently existing Adams PV Facility and substation to maximize synergies with existing connection infrastructures and to potentially shift the energy injected into the grid from Adams PV Facility and neighbouring generators to hours of higher demand. Only the one site location was considered for this project.

Specialist studies undertaken in support of this application were as identified through the Department of Forestry, Fisheries and Environment (DFFE) online screening tool and were required to be undertaken in accordance with the relevant Specialist Protocols (GNR320 of 20 March 2020). In this regard, and based on experience within the study area, the following specialist studies were completed:

- Terrestrial Ecology;
- Freshwater Ecology; and
- Heritage Assessment.

In terms of potential impacts assessed as part of the Basic Assessment process, the below summaries refer:

Terrestrial Ecological Impacts - Based on the results of the field survey and conclusions presented in the ecological report, is the opinion of the specialists that the proposed project can be favourably considered should all the mitigation measures be implemented and monitored against to ensure compliance and included in the Environmental Management Programme report (EMPr).

The site does not fall within any Critical Biodiversity Area but that of an area classed Other Natural Area (ONA), and even though the site has medium sensitivity, the mitigation measures provided may reduce the negative risks anticipated with the BESS construction. From an ecological perspective the proposal / preferred site, is supported by the specialist.

Alien vegetation eradication and rehabilitation must be encouraged through the development of an Alien and Invasive Species (AIS) Plan.

Freshwater Ecological Impacts - Based on the results of the combined desktop review and site sensitivity verification in the field, the sensitivity of aquatic biodiversity of the proposed Adams BESS sites is regarded to be **Low**. No sensitive freshwater features are located on or within 500m from the site footprint. The proposed development will not impact on freshwater biodiversity and no specific impact management interventions for freshwater biodiversity features are considered necessary or provided in this respect. Impact management outcomes and monitoring requirements in the EMPr will adequately address storm and or surface water, groundwater, and spill management around the BESS during construction and operation.

Socio-economic context - Based on the results of the desktop review potential economic benefits could be experienced across the entire value chain (e.g., materials, manufacturing, construction, etc.). Beyond the direct impact associated with the manufacturing, installation and operation of a BESS economic development would be increased, at a national level, through increased system reliability and the reduced cost of energy.

The implementation of the no-go alternative will result in the impossibility to store energy generated from Adams Solar Energy Facility and other generators in the region thus limiting sustained electricity supply to the national grid at times when the PV facilities are not producing optimally or Loadshedding is implemented and will, therefore, result in lost opportunity to dispatch additional electricity with no environmental emissions.

Agricultural Impacts – It was determined through an assessment conducted by the EAP and the review of the *Land Use, Soil and Agricultural Potential Assessment (Escience, 2012)* conducted for the Adams PV facility adjacent (north) to the site, that due to the sandy to loamy soils (low water holding capacity) and climatic conditions (low rainfall) of the study area the agricultural potential is considered to be low. It was stated that the cost associated with the preparation of the soils for crop production, including the installation of irrigation systems whilst taking into consideration the climatic conditions and water constraints of the area would deem the site not be practical for crop production. The potential loss of grazing land is not considered significant as the area is not supportive of high stocking rates.

Heritage Resources Impacts – Based on the results of the combined desktop review and site sensitivity verification in the field there are no visible restrictions or negative impacts in terms of heritage resources associated with the site, and it is of low significance, and therefore it is the opinion of the specialist that the proposed project may be authorised. The potential for the discovery of graves and subsurface archaeological and/or historical material during construction is accounted for in the EMPr.

Cumulative Impacts - The contribution of the project to cumulative impacts will be of low significance. There are no identified impacts considered as presenting an unacceptable risk. In addition, no impacts that will result in whole-scale change are expected.

Overall, the preferred BESS alternative is located within the low/medium sensitivity parts of the site where impacts associated with the development would be low and **no environmental fatal flaws** were identified.

Following on, it is the EAP's opinion that the proposed project can be considered favourably as the potential environmental impacts assessed were low and the BESS provide an opportunity to contribute significantly to sustained electricity to the national grid and assist in addressing the current energy crisis within South Africa. The project team has assessed viable site placement options from a terrestrial biodiversity sensitivity perspective, it is recommended the Proposed Alternative should be authorised and developed.

Based on the outcomes of the field surveys and the results and findings presented, it is the collective opinion of the EAP and Specialists that the proposed project can be **Favourably Considered** should all recommended mitigation measures be implemented and monitored and included in the EMPr (Appendix F).

The following are suggested as compulsory recommended conditions for the proposed BESS facility:

- 1) Adhere to the proposed management and mitigation measures during the construction and operation phases as set out in the EMPr.
- 2) The EMPr must be implemented and monitored by an independent Environmental Control Officer (ECO) and all monitoring reports must be submitted to the relevant authority for review.
- 3) Conditions as set out by all specialist studies should form part of the General conditions of the EA.

The EA is required for a period of up to 20 years. Construction activity would likely be concluded within a 2 year from the start of construction. The post monitoring requirements would then be finalised within 6-12 months, after construction is finalised. The need for monitoring of mitigation measures as prescribed in the EMPr and Specialist reports during the operational phase should be included as a condition or set of conditions in the EA for as long as the BESS remains a functionally operational system.

1 INTRODUCTION

1.1 Background Information

Enel Green Power South Africa (Pty) Ltd (**EGP**) intends to apply for Environmental Authorisation (EA) for the development of the Adams Battery Energy Storage System (**BESS**) adjacent to the Adams Photovoltaic Facility (EA Ref. No.: 12/12/20/2567/1) located in Joe Morolong Local Municipality in the Northern Cape province.

The general purpose of a BESS is to save and store excess electrical output as it is generated, allowing for a timed release of electricity to the grid when the capacity is required. BESS systems therefore providing flexibility in the efficient operation of the electricity grid through decoupling of the energy supply and demand.

In recent years battery energy storage at utility scale has increasingly been recognised as an effective solution to several challenges such as inefficiency, network bottlenecks and overloads, within the current grid system.

Typical BESS technology (See **Figure 1**) is modular, and the layout is customised depending on specific functional, technical, and commercial requirements at the time of system implementation.



Figure 1: Typical configuration of a Lithium-Ion BESS installed inside containers and blocks (Renewable Energy World, 2020).

NCC Environmental Services (Pty) Ltd (NCC) were appointed as the Environmental Assessment Practitioner (EAP) to act on behalf of the applicant, EGP, to undertake the legally required EA application process as required.

It has been confirmed that the competent authority (CA) is the National Department of Forestry, Fisheries, and the Environment (DFFE). In terms of GN779 of July 2016, the DFFE has been determined as the Competent Authority (CA) for all projects which relate to the Integrated Resource Plan for Electricity (IRP) 2010 -2030, and any updates thereto.

In terms of the National Environmental Management Act (No. 107 of 1998) (as amended) (NEMA), an EA must be obtained prior to the commencement of any listed activities. In this regard, various listed activities will be required by the proposed Adams BESS and thus a Basic Assessment process (in terms of NEMA Environmental Impact Assessment (EIA) Regulation 983 as amended) must be undertaken to obtain the needed EA. A Basic Assessment Report (this document) in this regard, is compiled and submitted to the CA for consideration.

An Environmental Management Programme report (EMPr) will also be prepared in support of the BA process and provides specific environmental management guidance to the relevant engineers and contractors during the BESS development e.g., construction, rehabilitation, and operations.

An EMPr was drafted in accordance with Section 19 of the EIA Regulations published in Government Notice No. R. 982 dated 4 December 2014 (as amended) (EIA Regulations).

1.2 Applicant Details Information

Details of the Applicant and responsible contact person are provided in Table 1.

Table 1: Details of Applicant.

Applicant Name:	Enel Green Power South Africa (Pty) Ltd
Contact Person	Manuele Battisti
Position in company	Director
RSA Id No./ Passport No.:	YA7235785
Postal address:	PO Box 651286, Benmore
Telephone:	(010) 344 0246
E-mail:	janna.bedford-owen@enel.com

1.3 Environmental Assessment Practitioner

NCC Environmental Services (Pty) Ltd (**NCC**) was appointed to undertake the required EA process for the proposed BESS development in terms of the regulatory EIA frameworks, including the required public participation processes and development of the BAR and EMPr.

Details and expertise of the EAP who prepared the EIA Report is provided in Table 3: **Details of the** Reviewer EAP.

and Curriculum Vitae is appended in [APPENDIX I – EAP CV's](#)

Table 2: Details of EAP

EAP:	Nicholas Gates
Company:	NCC Environmental Services (Pty) Ltd
Qualifications:	B Soc Sci (EGS)
Experience:	14 years
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Tel:	021 702 2884
Fax:	086 555 0693
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Table 3: Details of the Reviewer EAP.

EAP:	Nico Ronaldo-Retief
Company:	NCC Environmental Services (Pty) Ltd
Qualifications:	Msc. Zoology
EAPASA Reg. No.:	2019/181
Experience:	17 years
Address:	26 Bell Close, Westlake Business Park, Westlake, Cape Town
Tel:	021 702 2884
Fax:	086 555 0693
Email:	ronaldor@ncc-group.co.za

2 POLICY AND PLANNING CONTEXT

This chapter provides an overview of the policy and legislative context within which the proposed BESS and associated infrastructure is to operate. It identifies environmental legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to this activity and are to be considered in the assessment process which may be applicable or have relevance to the project.

2.1 NEMA 2014 EIA Regulations and Applicable Listed Activities

According to section 2, subsections 1, 2 & 3 of NEMA, all organs of state must apply certain principles set out in the Act when taking decisions that may significantly affect the environment. The key principles of this Act include that all “actions” approved must be economically, socially, and environmentally sustainable.

It further states that “*environmental management must place people and their needs at the forefront of its concern*” and that their collective interests must be served equitably.

Sections 24 and 44 of NEMA make provision for the promulgation of regulations that identify activities which may not commence without an EA issued by the CA. In this context, the EIA Regulations that came into effect on 8 December 2014 (and as amended in April 2017 and June 2021), promulgated in terms of NEMA, govern the process, methodologies, and requirements for the undertaking of EIAs in support of EA application processes. Listing Notices 1-3 in terms of NEMA list activities that require an EA. These are referred to as NEMA listed activities.

GN R 982 of the EIA Regulations prescribes two authorisation processes which must be completed in order to obtain an EA. Depending on the type of activity that is proposed, and which listed activities are to be undertaken, either a Basic Assessment (BA) process or a Scoping & Environmental Impact Report (S&EIR) process may be required. Listing Notice 1 lists activities that require a BA process, while Listing Notice 2 lists activities that require Scoping & Environmental Impact Report (S&EIR). Listing Notice 3 lists activities in certain sensitive geographic areas that require a BA process.

The regulations for both processes, BA and S&EIR, stipulate that:

- Public participation must be undertaken as part of the assessment process.
- The assessment must be conducted by an independent EAP.
- The relevant authorities must respond to applications and submissions within stipulated timeframes.
- Decisions taken by the authorities can be appealed by the proponent or any other Interested and Affected Party (I&AP); and
- A draft EMPr must be compiled and released for public comment.

GN R 982 further sets out the procedures to be followed and content of resulting reports to be compiled during completion of a BA or S&EIR processes.

In accordance with Section 24(5) of NEMA and the EIA Regulations (GNR 982), as amended, the proposed development of the Adams BESS and associated infrastructure requires an EA be obtained through the completion of a BA process. **Figure 2** provides a broad overview of the Basic Assessment Process. The identified Listed Activities in terms of NEMA for the EA is being applied for are detailed in **Table 4**.

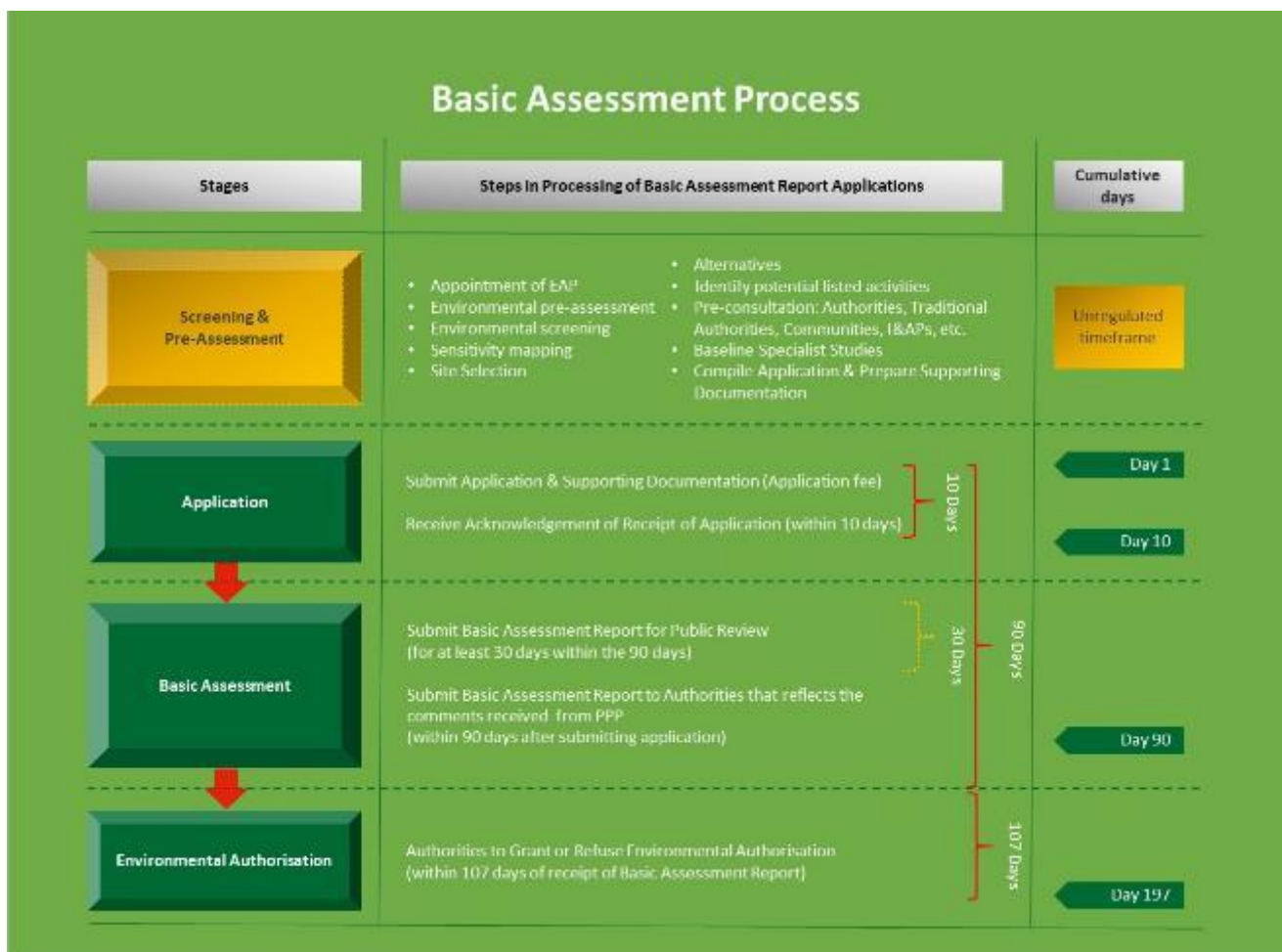


Figure 2: BA Process.

Further to the above, on 16 February 2018, Minister Edna Molewa published Government Notice (GN) No. 114 in Government Gazette No. 41445 which identified 8 Renewable Energy Development Zones (REDZ) important for the development of large-scale wind and solar photovoltaic facilities. The Government Notice included procedure to be followed when applying for an EA for large scale wind and solar photovoltaic energy facilities when occurring in these REDZs.

On 26 February 2021, Minister Barbara Dallas Creecy, published GN No. 142, 144 and 145 in GN No. 44191 which identified three (3) additional REDZs for implementation as well as the procedures to be followed when applying for an EA for electricity transmission or distribution infrastructure or large-scale wind and solar photovoltaic energy facilities in these REDZs.

The proposed Adams BESS project does not fall within a REDZ.

The timeframe for decision-making as contained in Part 2 of Chapter 5 of the NEMA EIA Regulations for purposes of an application for EA is 107 days.

Table 4: Listed activities in terms of GNR 983 Listing Notice 1 of 2014 (as amended).

Activity No(s):	The relevant Basic Assessment Activity(ies) in writing as per Listing Notice 1 (GN No. R. 983)	Description of the activity
11	<p>The development of facilities or infrastructure for the transmission and distribution of electricity—</p> <p>(i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts; or</p> <p>(ii) inside urban areas or industrial complexes with a capacity of 275 kilovolts or more;</p> <p>excluding the development of bypass infrastructure for the transmission and distribution of electricity where such bypass infrastructure is—</p> <p>(a) temporarily required to allow for maintenance of existing infrastructure</p> <p>(b) 2 kilometres or shorter in length</p> <p>(c) within an existing transmission line servitude; and</p> <p>(a) will be removed within 18 months of the commencement of development.</p>	<p>The site is in a rural area and the capacity of the distribution exceeds 33kV.</p> <p>The BESS would be connected to the grid by means of a cable to connect the BESS substation to the existing HV substation or with a loop in loop out to the existing HV line.</p> <p>The capacity of the cable would be 132kV</p> <p>The connection will be roughly 50-80m in length.</p>
14	<p>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.</p>	<p>Depending on the technology to be considered upon implementation, (specifically for Flow Battery and depending on the battery supplier), there may be instances where a battery is not fully assembled and the electrolyte (or substances making up such electrolyte) intended for such battery, may potentially be stored on site, in a container (e.g. tanks). In this instance, where the electrolyte, or the substances making up the electrolyte, are stored in a container, such facility or infrastructure will indeed be regarded as a facility or infrastructure for the storage, or storage and handling of a dangerous good. The total amount of hazardous materials stored on site, as a result of this development, will not exceed 500 m³.</p>
27	<p>The clearance of an area of 1 hectare or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for—</p> <p>(i) the undertaking of a linear activity; or</p> <p>(ii) maintenance purposes undertaken in accordance with a maintenance management plan.</p>	<p>Although the site has transformed grassland due to anthropogenic activities, approximately 3-4 ha of indigenous vegetation would be cleared to accommodate the development of the BESS and associated facilities (This includes the laydown areas, substation, access road and MV and HV cabling to connect the BESS to the HV Substation or the loop in loop out to the existing HV line) more than 1 hectare but up to 4 ha of indigenous vegetation would need to be cleared for the proposed development.</p>

28	<p>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:</p> <p>(i) will occur inside an urban area, where the total land to be developed is bigger than 5 hectares; or</p> <p>(ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare</p> <p>excluding where such land has already been developed for residential, mixed, retail, commercial, industrial or institutional purposes.</p>	<p>The BESS and associated infrastructure represent an industrial development outside of an urban area where the total land to be developed will be bigger than 1 hectare.</p> <p>The site proposed for the BESS is currently utilised for agricultural purposes.</p> <p>The Applicant would apply for the necessary rezoning certificate</p>
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2.2 Other Relevant Legislation and/or Guidelines

A broad list of applicable environmental legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks, and instruments that are applicable to the proposed development project is provided below:

2.1.1 National and Provincial Legislation and Regulations

- Agricultural Pests Act of 1983 (Act 36 of 1983)
- Alien and Invasive Species Regulations, 2014
- Animals Protection Act of 1962 (Act 71 of 1962)
- Conservation of Agricultural Resources Act (Act 43 of 1983)
- Electricity Regulation Act, 2006 (Act 4 of 2006)
- Environment Conservation Act (Act 73 of 1989)
- Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act (Act 36 of 1947)
- Hazardous Substances Act (Act 15 of 1973)
- Hazardous Substances Act (Act 15 of 1973)
- Health Act (Act 63 of 1977)
- Mineral and Petroleum Resources Development Act (Act 28 of 2002)
- Mountain Catchment Areas Act (Act 63 of 1970)
- National Dust Control Regulations, 2013
- National Environmental Management Act (Act 107 of 1998) (as amended)
- National Environmental Management: Air Quality Act (Act 39 of 2004)
- National Environmental Management: Biodiversity Act (Act 10 of 2004)
- National Environmental Management: Protected Areas Act (Act 57 of 2003)
- National Environmental Management: Waste Management Act (Act 59 of 2008)
- National Forest Act (Act 84 of 1998)
- National Health Act (Act 61 of 2003)
- National Heritage Resources Act (Act 25 of 1999)
- National Road Traffic Act (Act 93 of 1996)
- National Road Traffic Regulations 2000 (as amended)
- National Veld and Forest Fire Act of 1998 (Act 101 of 1998)
- National Water Act (Act 36 of 1998)
- NEMA EIA Regulations, 2014 (as amended)
- Noise Control Regulations GN R 154 in GG No. 13717 of 10 January 1992 (published in terms of Section 25 of the Environment Conservation Act 73 of 1989)

- Occupational Health and Safety Act (Act 85 of 1993)
- The Constitution of the Republic of South Africa (Act 108 of 1996)
- Water Services Act (Act 108 1997)
- World Heritage Convention Act (Act 49 of 1999)

2.1.2 Other Documentation

- The White Paper on the Energy Policy of the Republic of South Africa (December 1998)
- Integrated Resources Plan 2010-2030 (IRP 2010)
- John Taolo Gaetsewe District Municipality Integrated Development Plan 2021/2022
- Joe Morolong Local Municipality Spatial Development Framework (SDF) 2012
- Northern Cape Provincial Spatial Development Framework (PSDF) 2012
- National Biodiversity Assessment (NBA) & National Vegetation Map
- National Freshwater Ecosystem Priority Area (NFEPA) Assessment
- The White Paper on Renewable Energy (November 2003)

2.3 Planning Context

2.3.1 National Level

2.3.1.1 Integrated Resource Plan (IRP) 2010 -2030

The Integrated Resource Plan (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.

The Minister, in consultation with NERSA, acting under section 34(1) of the Electricity Regulation Act, 2006 (Act No. 4 of 2006) (as amended) (the ERA) and the Electricity Regulations on New Generation Capacity (published as GNR. 399 in Government Gazette No. 34262 dated 4 May 2011, has *inter alia* determined as follows:

- That new generation capacity needs to be procured to contribute towards energy security, accordingly:
 - 513MW should be procured to be generated from storage, which represents the capacity allocated under the heading 'Storage', for the year 2022, in Table 5 of the Integrated Resource Plan for Electricity 2019 – 2030 (published as GN 1360 of 18 October 2019 in Government Gazette No. 42784 ('IRP 2019').
 - The electricity must be purchased by Eskom Holdings SOC Limited.
 - The electricity must be purchased from Independent Power Producers.

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 IRP is a strategic electricity plan for the country to meet the forecast annual peak and energy demand, plus an established reserve margin, through a combination of supply side and demand-side resources over a specified future period. It is developed to ensure security of electricity supply for the country when looking into the future at least cost to the consumer, while ensuring a balance of multiple country policy objectives.

The IRP 2010 stated that at the very least the IRP should be revised by the DoE every two years. However, this was never done and resulted in an energy mix that failed to adequately meet the constantly changing supply and demand scenarios in South Africa, nor did it reflect global technological advancements in the efficient and responsible generation of energy.

In terms of the Electricity Regulation Act, No. 4 of 2006 (ERA), the National Energy Regulator of South Africa (NERSA) is required to issue rules designed to implement the IRP. It is notable that NERSA has not issued any such rules since the IRP 2010 was first published. Instead, the DoE implemented the IRP2010 by issuing Ministerial Determinations in line with s34 of the ERA in order to give effect to the procurement of new generation capacity.

On 27 August 2018, the then Minister of Energy published a draft IRP which was issued for public comment (Draft IRP). This lengthy public participation and consultation process has culminated in the issue of the overdue IRP2019 which updates the energy forecast from the current period to the year 2030.

The main objective of the IRP is to develop an electricity investment strategy that is sustainable for the transmission infrastructure and generation capacity of South Africa for the next 20 years.

Generation capacity procured and developed under the IRP2010

Since the promulgated IRP2010, the following capacity developments have taken place:

- A total 6,422MW under the government led Renewable Energy Independent Power Producers Programme (RE IPP Procurement Programme) has been procured, with 3,876MW currently operational and made available to the grid.
- In addition, IPPs have commissioned 1,005MW from two Open Cycle Gas Turbine (OCGT) peaking plants.
- Under the Eskom build programme, the following capacity has been commissioned: 1,332MW of Ingula pumped storage, 1,588MW of Medupi, 800MW of Kusile and 100MW of Sere Wind Farm.

In total, 18,000MW of new generation capacity has been committed to.

Provision has been made for the following new additional capacity by 2030:

- 1,500MW of coal.
- 2,500MW of hydro.
- 6,000MW of solar PV.
- 14,400MW of wind.
- 1,860MW of nuclear.
- 2,088MW for storage.
- 3,000MW of gas/diesel; and
- 4,000MW from other distributed generation, co-generation, biomass and landfill technologies.

The changes from the Draft IRP capacity allocations see an increase in solar PV and wind, and a significant decrease in gas and diesel; and new inclusions include nuclear and storage. It is notable that embedded generation (previously described as generation for own use allocation) has effectively been replaced with the concept of “distributed generation” (described as all generation facilities in circumstances in which the facility is operated solely to supply electricity to an end-use customer within the same property with the facility) and allocated with other technologies of co-generation, biomass and landfill gas. Once again there has been no allocation for solar CSP.

The IRP2019 explains that it is developed within a context characterised by very fast changes in energy technologies, and uncertainty with regard to the impact of the technological changes on the future energy provision system. It further states that this technological uncertainty is expected to continue and calls for caution on the assumptions and commitments for the future in a rapidly changing environment. Accordingly, the approach taken is that long range commitments are to be avoided as much as possible to eliminate the risk that they might prove costly and ill-advised. At the same time, there is also a recognition that some of the technology options will require some level of long-range decisions due to long lead times.

Accordingly, what we see is an IRP2019 with a fair amount of flexibility which identifies potential risk areas and seeks to provide mitigation measures should the risk materialise.

(The Integrated Resource Plan 2019: A promising future roadmap for generation capacity in South Africa, Cliffe Dekker Hofmeyr, www.cliffedekkerhofmeyr.com, 2022)

2.3.1.2 Integrated Energy Plan (IEP)

The IEP takes into consideration the crucial role that energy plays in the entire economy of the country and is informed by the output of analyses founded on a solid fact base. Eight key objectives were identified which relate mainly to the security, cost, access, diversity, efficiency, impact in terms of emissions, conservation and social benefits in terms of energy planning. The IEP recognises the potential of renewable energy for power generation. With the additional renewable energy to be generated by Adams Solar Facility, stored within the proposed Adams BESS and associated infrastructure and later evacuated to the national grid, a contribution to this objective will be achieved.

Also, with the previously developed Adams Solar Facility and the proposed Adams BESS and associated infrastructure, the eight key objectives in terms of energy planning will be met, even if only to a limited extent.

2.3.1.3 The White Paper on Renewable Energy Policy (Renewable Energy White Paper)

The White Paper on renewable energy (DME, 2003) supplements the energy policy and sets out the government's strategic goals, vision, policy principles and objectives implementing and promoting renewable energy in South Africa. South Africa has various sources of renewable resources, particularly solar and wind, and therefore this policy supports the rationale that from a fuel resource perspective, renewable application is proven to be the least costly, especially from an environmental and social perspective. Meeting technical and economic as well other constraints is one of the major concerns of the government policy on renewable energy.

South Africa set a 10 year 10 000 GWh target for renewable energies by 2013 to be produced mainly from solar, wind and biomass as well small-scale hydro-electric plants. This amounted to approximately 4% of the country's estimated demand by 2013.

2.3.1.4 National Climate Change Response White Paper,

Climate change has been identified as one (1) of the greatest threats to sustainable development in South Africa. The National Climate Change Response White Paper obligates the country to make a fair contribution to the global effort to achieve the stabilisation of GHG concentrations in the atmosphere. The proposed Adams BESS, required for the Adams 2 PV Facility, is in accordance with the National Climate Change Response White Paper as it will provide an alternative source of electricity, to fossil fuel-derived electricity, which will contribute to climate change mitigation

2.3.1.5 Spatial Planning and Land Use Management Act (Act 16 of 2013)

SPLUMA provides a framework for spatial planning and land use management in South Africa. It specifies the relationship between the spatial planning and the land use management system and other kinds of planning. It also ensures that the system of spatial planning and land use management promotes social and economic inclusion. SPLUMA also provides for:

- Development principles and norms and standards.
- Sustainable and efficient use of land.
- Cooperative government and intergovernmental relations amongst the national, provincial and local spheres of government.
- Redresses of the imbalances of the past by ensuring that there is equity in the application of spatial development planning and land use management systems.

Chapter 2 of Spatial Planning and Land Use Management Act (SPLUMA) highlights key development principles, norms and standards that lay the foundation of this assignment. These principles include:

- Spatial Justice
- Spatial Sustainability
- Efficiency • Spatial Resilience

Chapter 4 of this Act talks more specifically on the preparation and functioning of spatial development frameworks. According to this act, the national and provincial spheres of government and each municipality must prepare spatial development frameworks. A Municipal Planning Tribunal at a local government level, may then make decisions that are consistent with the spatial development framework¹.

¹ Sol Plaatje Local Municipality, *Draft Spatial Development Framework 2018-2023*. Oct 2020

2.3.2 Provincial Level

2.3.2.1 Northern Cape Provincial Spatial Development Framework (PSDF), 2012

The PSDF is a policy document that promotes a developmental state in accordance with national and provincial legislation and directives. It aligns with the Northern Cape Provincial Growth and Development Strategy discussed above. The NC PSDF will put forward comprehensive plans and strategies, which collectively will indicate which type of land use should be promoted in the Province, where such land use should take place, and how it should be implemented and managed. In broader terms, the PSDF will:

- Indicate the spatial implications of the core development objectives of the Northern Cape Provincial Growth and Development Strategy.
- Serve as a spatial plan that facilitates local economic development.
- Lay down strategies, proposals and guidelines as it relates to sustainable development
- Facilitate cross-boundary co-operation between district and local municipalities, adjoining provinces, and bordering countries.
- Serve as a manual for integration and standardisation of the planning frameworks of all spheres of government in the Province with specific reference to the following:
 - Guiding district and local municipalities in the preparation of their spatial development frameworks.
 - Facilitating land-use classification in a standard format in accordance with defined Spatial Planning Categories².

The Northern Cape Provincial Spatial Development Framework (PSDF) states that the overarching goal for the province is to enable sustainability through sustainable development.

The overall energy objective for the province includes promoting the development of renewable energy supply schemes which are considered to be strategically important for increasing the diversity of domestic energy supply and avoiding energy imports, while also minimising the detrimental environmental impacts. The implementation of sustainable renewable energy is also to be promoted within the province through appropriate financial and fiscal instruments. With the developed and proposed independent power producer capacity (including the Adams Energy Facility), the province will produce more than 100% of its own electrical power needs from renewable energy resources (although this energy will be fed into the national grid for national use). The development of the Adams BESS and associated infrastructure (through the Adams Solar Energy Facility) will enable additional storage and uptake of renewable energy into the national grid which will promote the province's objectives.

² Sol Plaatje Local Municipality, *Draft Spatial Development Framework 2018-2023*. Oct 2020

2.3.3 Local Level

2.3.3.1 Integrated Development Plan and Spatial Development Framework

The proposed project does not directly speak to the Joe Morolong Local Municipality Integrated Development Plan (IDP) as it is aimed at addressing the energy crisis at a national level, however as the Municipality is mandated for the bulk supply of electricity, which includes for the purposes of such supply, the transmissions, distribution and, where applicable, the generation of electricity.

As a licensed distributor of electricity it receives electricity from the National Grid, either from Eskom or other service providers, this project aides the municipality in delivering on their mandate for the delivery of key services such as electricity.

It has been identified within the IDP that for majority of the wards reliable supply is an issue. This is mainly due to ageing infrastructure however the persist issue of the unreliability of supply by Eskom to municipalities and the aging infrastructure of generation has contributed to supply issue by the municipality.

In terms of the Local Economic Development Strategy it highlights that dependency on non-renewable energy resources leaves the district at risk and that alternative means of energy and mixed modes of transport should be introduced to curb the impact of this risk. The added likelihood of a steep rise in temperatures towards the end of the century compounds this risk but will also change the environmental conditions in the district.

This will in turn affect the district economy in more ways than one.

The IDP strongly outlines the need to create employment opportunities in the District. The IDP identifies a need to ensure equity in the activities of the Municipality that reflects its population demographics, both in terms of service delivery, as well as in terms of employment equity. In this regard, gender, racial and disability population demographics are important. Special interest groups, such as youth, women and persons with disabilities must focus specifically in the strategic priorities of the Municipality.

Relevant challenges in the district are highlighted as follows:

- The clear comparative disadvantage of the Joe Morolong Municipality in relation to the other municipalities in the district.
- The educational levels among the population of the district are relatively low. 27,6% of the population has no formal education, while only 67,4% has some school education. Only 1,83% of the population has some tertiary education. These statistics have obvious implications for the employment potential of the population, and therefore also for the district's local economic development and job creation initiatives.
- A total of 75% of the district's population has no recordable income. This is extremely high and puts extreme pressure on the Municipalities operating in the district. The result of such high level of unemployment is that communities cannot pay for basic services and that severe pressure is put on municipal resources due to demands for services to a poverty-stricken population.

The long term sustainability of all land development practices is identified as a key factor in the environmental and economic future of this predominantly mining and agricultural region, with specific attention needing to be given to the building of capacity amongst especially emerging land users (both miners and farmers) and the provision of a management framework to all land users within the municipality.

The following relevant principles of Spatial Development Planning, in terms of the district Spatial Development Framework (SDF), in the district were considered during the EIA:

- Land use and development decisions must promote harmonious relationships between the built and natural environment
- Land development and planning should protect natural, environmental and cultural resources
- Land used for agricultural purposes may only be reallocated to another use where real need exists, and prime agricultural land should as far as possible remain available for production
- Land use regulators and planning authorities must ensure that previous disadvantaged communities and areas receive benefit and opportunities flowing from land development; and
- Appropriateness of land use must be determined on the basis of its impact on society as a whole rather than only the applicant or immediate neighbours.

The proposed project is deemed to complement the desired spatial form of the district, in that the Adams PV sites would contribute to local economic development in the area.

2.4 DFFE Screening Tool

In terms of GN R960 (promulgated on 5 July 2019) and Regulation 16(1)(b)(v) of the 2014 EIA Regulations (as amended), the submission of a Screening Report generated from the national web-based environmental screening tool is compulsory for the submission of an EA application in terms of Regulation 19 and 21 of the 2014 EIA Regulations.

Table 5 provides a summary of the specialist assessment requirements identified for the project site in terms of the screening tool (based on the identified 500m assessment zone surrounding the Adams BESS) (refer to Appendix L for the report) and responses to each assessment requirement based on the nature and extent of the project.

Table 5: A summary of the proposed specialist studies and sensitivity ratings as per the online tool.

No.	Specialist Assessment	Sensitivity rating as per the online tool	Comment
1	Agricultural Theme	Low	Agricultural potential was identified as low and therefore it was determined that no study was deemed necessary and therefore not commissioned. This was confirmed further through the review of the Soil and Agricultural Potential study compiled for the existing Adams 2 PV facility. Refer to Section 6.9: Agricultural and Soil Potential .
2	Animal Species Assessment	Low	A Terrestrial biodiversity impact was commissioned and conducted for this project. See attached as Appendix F .
3	Aquatic Biodiversity Impact Assessment	Very high	A freshwater specialist study was commissioned and conducted. See attached as Appendix E .
4	Archaeological and Cultural Heritage Impact Assessment	Low	A heritage study, including Paleo, was commissioned, and conducted for this project. See attached as Appendix G .
5	Civil Aviation	Low	No studies were deemed necessary as the structures are not high enough to pose any risk to civil aviation.
6	Defence Theme	Low	No studies were deemed necessary as the site does not fall within the proximity of any defence sites.
7	Palaeontology Impact Assessment	Medium	A heritage study, including Paleo, was commissioned, and conducted for this project. See attached as Appendix G .
8	Plant Species Assessment	Low	A Terrestrial biodiversity impact was commissioned and conducted for this project. See attached as Appendix F .

9	Landscape/Visual Impact Assessment	None specified	<p>The proposed Adams BESS and associated infrastructure will be located directly adjacent to the existing Adams PV Facility.</p> <p>No visual impact assessment was therefore conducted for this Basic Assessment. Refer to Section 6.2. Proposed Site and Surrounds.</p>
10	Socio-Economic Assessment	None specified	<p>The Adams BESS and associated infrastructure will be located immediately adjacent to the existing PV facility.</p> <p>The project is not expected to result in socio-economic impacts which are not able to be assessed by the EAP in the BAR. Refer to Section 5, Need and Desirability, and Section 6.8 Socio Economic Context</p>
11	Terrestrial Biodiversity Impact Assessment	Low	<p>Ecological assessment (flora, fauna and surface water) was commissioned and conducted for this project.</p> <p>See attached as Appendix E2</p>

Based on the Screening Report and desktop literature review, the following specialist studies (Table 6: Specialist studies undertaken as part of the BA process.) were undertaken as part of this BA process.

Table 6: Specialist studies undertaken as part of the BA process.

Specialist Name	Specialist Company	Specialist Area of Expertise	Appendices
Nico-Ronaldo Retief	NCC Environmental Service (Pty) Ltd	Terrestrial Biodiversity	Appendix E2
Leonie Marias-Botes	Leonie Marais Heritage Practitioner	Heritage (including Archaeology & Palaeontology)	Appendix E3
Craig Burne	NCC Environmental Service (Pty) Ltd	Freshwater Biodiversity	Appendix E1

3 PROJECT DESCRIPTION

The proposed BESS will be housed inside containers or similar structures with a total footprint of up to 4ha in extent. It will be located adjacent to the existing Adams Solar Facility.

Both Lithium-ion and Redox-flow technology are being considered for the project, depending on which is most feasible at the time of implementation.

The proposed size of the BESS will have a total footprint of up to 4ha in extent.

Proposed associated infrastructure includes:

- i. A Substation with a maximum height of - HV busbar up to 10 m max and an HV Building up to 4 m max.
- ii. Access road to the BESS (6 existing access road), and internal roads (up to 8m wide) within the footprint of the BESS, as needed.
- iii. MV Cabling (underground or overhead) between the BESS and the HV/MV BESS substation.
- iv. HV Cabling (underground or overhead) between the HV/MV BESS substation and the HV substation or for loop in and loop out to the existing HV connection line.
- v. Fencing around the BESS and the substation for increased security measures.
- vi. Temporary laydown area within the 4ha footprint of the BESS.
- vii. Possible firebreak around the BESS facility which is to be located within the 4ha BESS footprint.

Storage systems are fundamental to the renewable energies and the energy transition. They store electricity and make it available also when there is greater need in the national grid and or the renewable resource energy availability is low, acting as a balance between supply and demand, and helping stabilize the grid. Moreover, BESS can deliver ancillary services to balance network frequency and voltage during normal network operation and be available as reserves during contingency events, replacing the support that is generally provided by thermal generators.

Batteries – connected in series – are now some of the most common storage systems and are going through a significant technological revolution. Year after year, new materials and cutting-edge technological solutions are introduced, providing greater efficiency, lower cost, and a design-to-recycle approach, to obtain a more sustainable BESS product.

Batteries may be classified as either solid state or flow batteries. Solid state batteries use solid electrodes and electrolytes. Flow batteries on the other hand use solid electrodes and liquid electrolytes.

Each type has its own advantages and disadvantages.

The liquid electrolyte in a flow battery is typically held in tanks separate to the cell (or cells) of the reactor. Flow batteries can be recharged by replacing the electrolyte liquid. The discharge duration of flow batteries can thus

be easily increased by adding more electrolyte and additional tanks without having to increase the capacity of the battery itself. This is termed scalability. The layout for flow batteries is flexible due to the separation of the electrolyte and battery stack. In addition, unlike the solid-state batteries, all cells contain the same charge and therefore equalization of the cells, a process which can produce hydrogen gas, is not required. Flow batteries do however require a larger footprint than solid state batteries and have a lower energy density.

Furthermore, the design is more complex than solid state batteries due to the external electrolyte tanks and their associated components. The nature of the electrolytes used pose a flammability and explosion risk.

Solid state batteries have a greater energy density than flow batteries, they are more tolerant to high temperatures and don't store potentially flammable and toxic electrolytes as flow batteries do. The compression of the anode, cathode and electrolyte produces the added benefit of taking up less space than a flow battery.

Lithium Ion

Li-ion batteries get their name from the transfer of lithium ions between the electrodes, both when energy is injected for storage purposes and when it is extracted (See **Figure 3**). Within the lithium family there are a variety of different chemistries and designs from numerous suppliers.

Instead of metallic lithium, Li-ion batteries use lithiated metal oxides as the cathode, and carbon typically serves as the anode. Unlike other batteries with electrodes that change by charging and discharging, Li-ion batteries offer better efficiency because the ion movements leave electrode structures intact.

The solid-state lithium-ion battery differs from the conventional flow version as it uses a solid such as ceramic as the electrolyte rather than the typical lithium salt liquid. Solid-state batteries compress the anode, cathode, and electrolyte into three flat layers instead of suspending the electrodes in a liquid electrolyte. This makes for a battery with greater energy density and safer conditions.

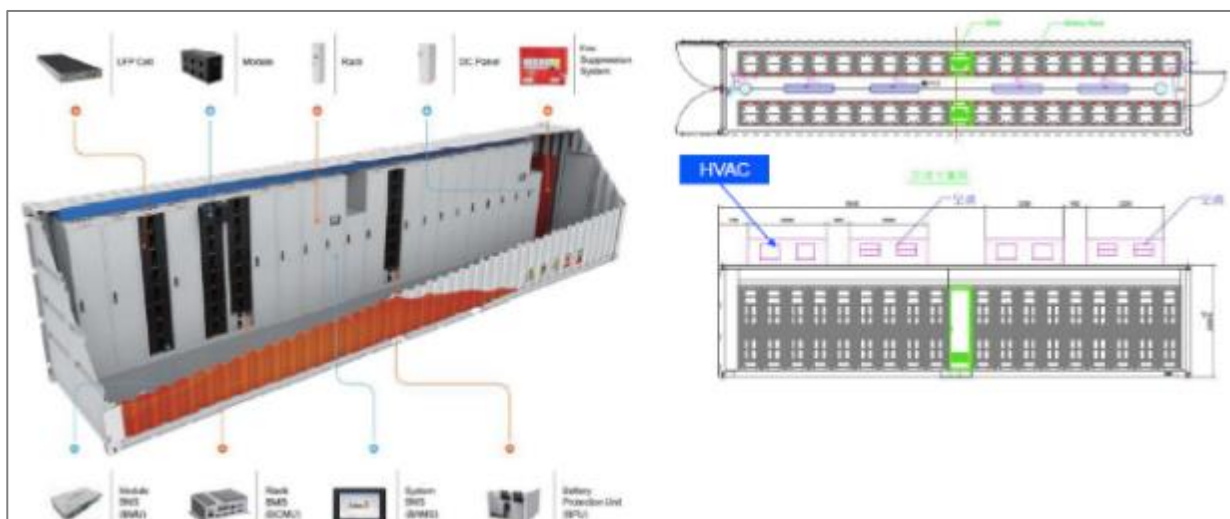


Figure 3: Typical composition of a Lithium-Ion BESS battery container.

Lithium-ion-based energy storage systems may have cycle durations up to 8 hours. The expected lifetime is related to the cycling Depth of Discharge (DoD). Li-ion batteries' lives are generally limited to less than 80% DoD to ensure an adequate life. Most utility scale applications have an approximate 10–20-year lifetime. Longer lifetimes can be achieved by means of batteries replacement.

The modularity of the Li-ion cells allows them to be constructed as modules and scaled. Battery packs can then be combined with inverters and controls systems and packaged into BESS at manufacturing facilities. When packaged into standard shipping container sizes, shipping the BESS around the world via truck, rail, or ship is greatly facilitated. Containerised BESS can be sited on pads or simple foundations and electrically connected to switchgear. Containerisation significantly reduced the costs for local labour and on-site construction.



Figure 4: Typical configuration of Lithium-Ion BESS installed inside containers and blocks (EGP, 2022).

The BESS will be made up of multiple 40ft (~12m) long battery containers or strings of battery blocks, with inverters and transformers spaced between them and 3-5 extra containers for electrical connections and controls. See **Figure 5** below giving an indicative layout of a BESS with Li-ion technology.

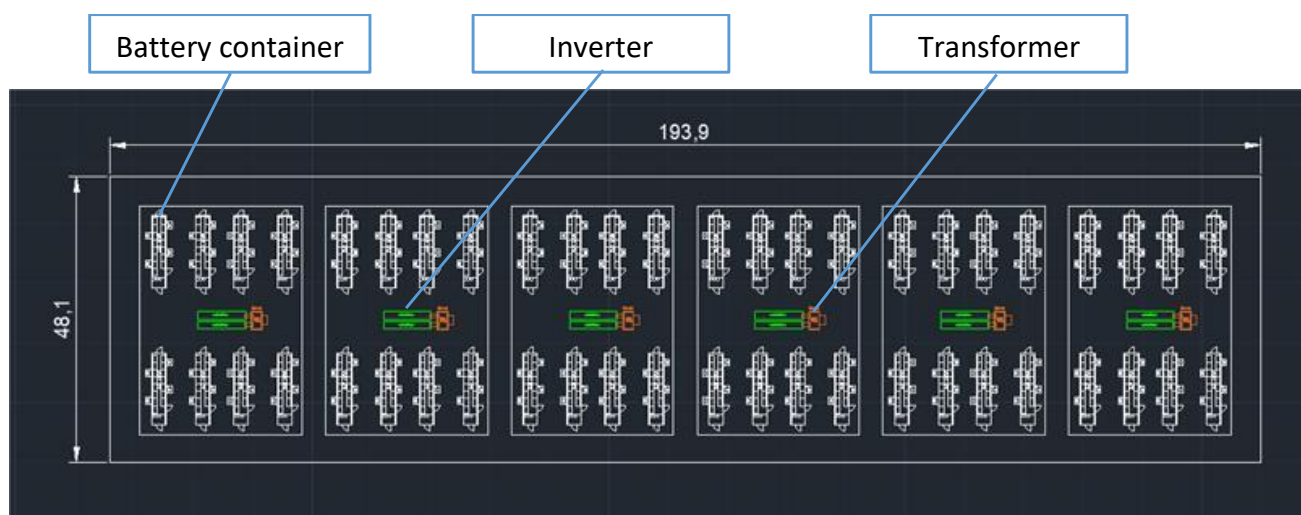


Figure 5: Indicative layout of a Lithium-Ion BESS on a 1ha site (EGP, 2022).

The greatest maintenance issue for Li-ion batteries is generally the monitoring and replacement of individual cells/modules later in life as replacement can be required. Modularized and packaged systems offer ease of system removal from site for disposal at end of life. Site contamination is unlikely, and site restoration would include infrastructure removal and revegetation. The materials used in Li-ion batteries are typically considered non-hazardous waste. The metals in the system can be recycled, but they do not represent a high salvage value.

Vanadium Redox Flow (VRF)

The VRF is based on redox reactions of different ionic forms of vanadium. During battery charge, V^{3+} ions are converted to V^{2+} ions at the negative electrode through the acceptance of electrons. Meanwhile, at the positive electrode, V^{4+} ions are converted to V^{5+} ions through the release of electrons (See **Figure 6**). Both of these reactions absorb the electrical energy put into the system and store it chemically. During discharge, the reactions run in the opposite direction, resulting in the release of the chemical energy as electrical energy. Both electrolytes in the VRF are composed of vanadium ions in an aqueous sulphuric acid solution at very low pH. The acidity of the sulphuric acid is comparable to that of the electrolyte found in lead-acid batteries, with a pH of between 0.1 and 0.5.

The electrodes used in VRF are composed of high-surface area carbon materials. The membrane physically separates the two vanadium-based electrolyte solutions, preventing self-discharge while allowing for the flow of ions to complete the circuit. The vanadium electrolytes are stored in separate large electrolyte tanks outside the cell stack. The electrolyte tanks and associated pipes, valves etc. must be composed of materials that are resistant to corrosion in the very low pH environment. The cell stack is generally environmentally benign. The only material in the stack that might be considered toxic is the ion exchange membrane, which is composed of highly acidic (or alkaline) material.

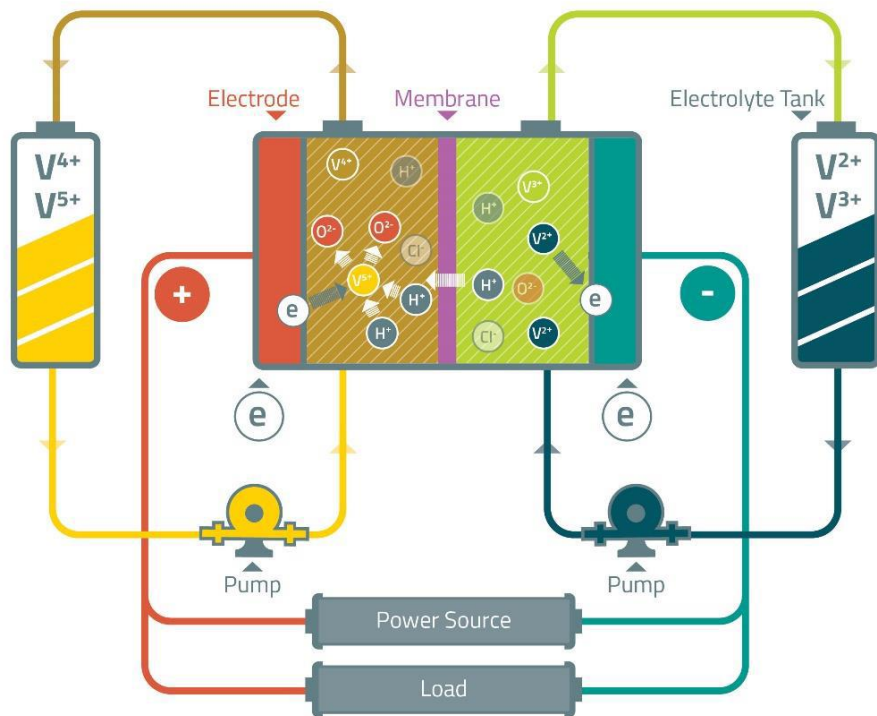


Figure 6: Schematic of Vanadium Redox Flow Battery.

The VRF is the most technically mature of the flow-type battery chemistries with the first operational VRF being successfully demonstrated in the late 1980s.

A VRF offers a relatively high cell voltage, which is favourable for higher power and energy density. Cross-transport of vanadium ions across the membrane has however been reported as a challenge as the membranes can be vulnerable to fouling, wherein vanadium ions become irreversibly trapped in the membrane and increase resistive losses in the cell.

Notwithstanding the type of BESS technology chosen, the following construction activities are predicted as necessary for developing the BESS:

- Clearing and Grubbing
- Fencing
- Culvert installations
- Cut to spoil
- Cut to fill
- Levelling and compacting
- Roadbed construction
- Selected layer construction

4 PROJECT ALTERNATIVES

4.1 Site/Location alternatives

Description of preferred site/location alternative.

Two (2) site/locations were initial considered, one located to the North of existing PV Facility, and the other located to the South (Preferred). Specialists explored both sites however due to the landowner not agreeing with the Northern site it was considered a no-go and not included as an alternative option.

Only the southern site (Preferred Alternative) was therefore considered.

The preferred site alternative is located to the south of an existing PV facility, substation, and transmission line.

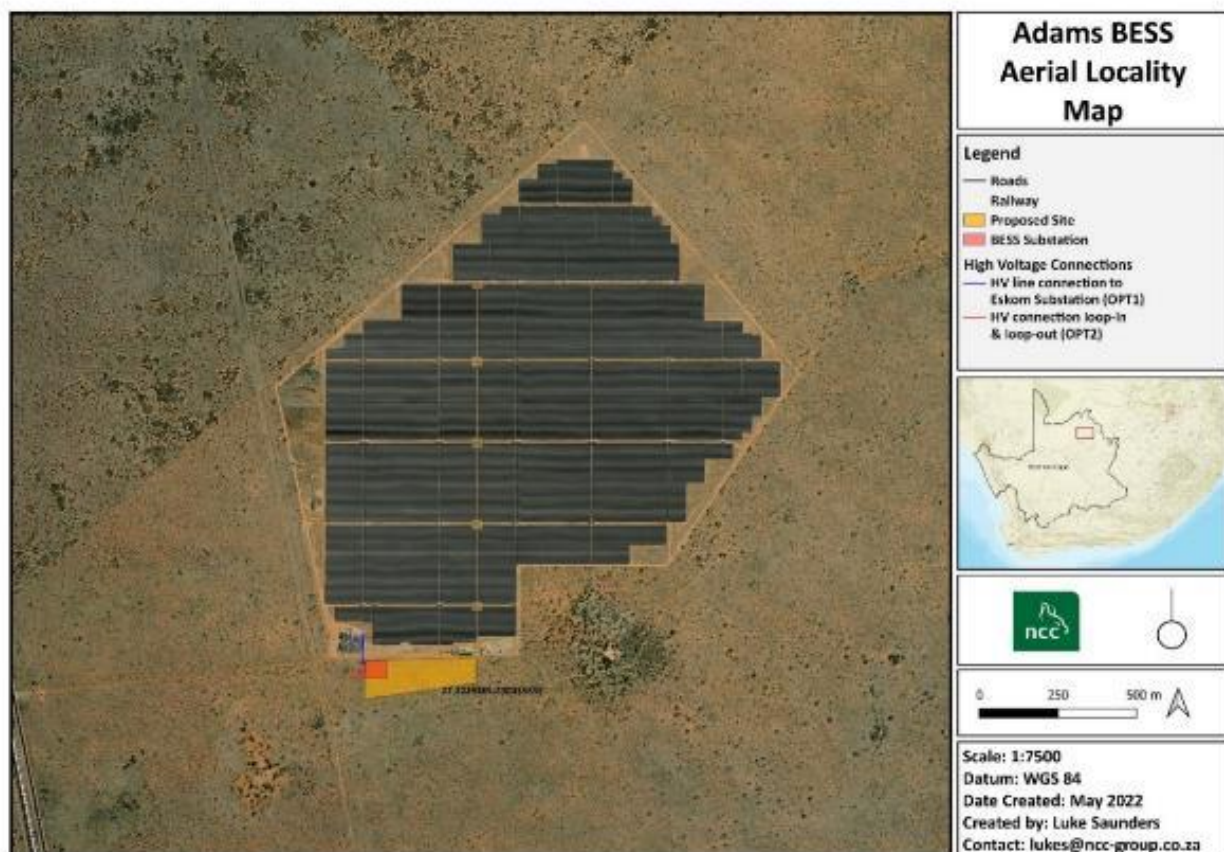
The proposed site is located within the least threatened Kathu Bushveld regional vegetation unit within the Savanna Biome.

Medium-tall tree layer with *Acacia erioloba* in places, but mostly open and including *Boscia albitrunca* as the prominent trees. Shrub layer generally most important with, for example, *A. mellifera*, *Diospyros lycioides* and *Lycium hirsutum*. Grass layer is variable in cover. (Mucina & Rutherford, 2006).

The properties surrounding the proposed site are dominated by mines and farms containing game and grazing cattle.

In the case of the preferred alternative the grasslands have been altered through anthropogenic activities.

No water courses were identified to be impacted upon by the preferred alternative



Description of any other site alternatives investigated.

Two (2) site/locations were initial considered, one located to the North of existing PV Facility, and the other located to the South (Preferred). Specialists explored both sites however due to the landowner not agreeing with the Northern site it was considered a no-go and not included as an alternative option.

Only the southern site (Preferred Alternative) was therefore considered.

Motivation for the preferred site alternative.

Within the site, there was little apparent variation in the vegetation composition.

The Preferred site location is altered which is evidenced by monospecific stands of indigenous encroacher species *Senegalia mellifera*.

The preferred alternative is considered as the site has been altered due to anthropological activities (livestock grazing) and has low number of protected trees in comparison to the surrounds.

No water courses were identified in the vicinity of the proposed facility.

Due to landowner constraints no other site alternatives were investigated.

Motivation for not considering site alternative/s

As the BESS is required to be located in close proximity to the authorised PV Facility, no feasible location alternatives were identified.

No other site locations were considered after consultation with the landowner.

4.2 Activity alternatives

Description of preferred activity alternative.

The proposed BESS will enable energy from the PV facility to be stored and then released when customers need power most

BESS technology is modular, and the layout is customised depending on specific functional, technical, and commercial requirements at the time of system implementation.

Description of other activity alternatives investigated.

The remaining area on the site could continue as a grazing and farm area for the landowner but then the potential for grid support falls short and so in terms of the planned BESS for Adams, this activity is deemed best.

Motivation for the preferred activity alternative.

Recent increase in the development of BESS has been driven by a combination of the effects of load shedding coupled with the falling price of Lithium-Ion batteries.

As a storage system BESS are of interest because of their flexibility of use in many different applications independent of location, in contrast, for example, to pumped hydro storage.

A challenge with renewable energy is that resource availability (e.g., the sun) does not always coincide with demand of the customer.

This is especially problematic for residential or commercial customers, who are often not allowed to supply their excess PV energy back to the utility (generated when there is more solar supply than demand at their premises).

BESS facilities save excess energy for later use when demand is required.

BESS allows for the redistribution of energy sourced from areas that are capable of renewable resources

Motivation for not considering activity alternatives

No activity alternatives were considered as there is no economically suitable substitute for the battery storage at the facility.

4.3 Technology Alternatives

Description of preferred technology alternative.

Both Lithium-ion and Redox-flow technology are being considered as the preferred technology alternative for the project, depending on which is most feasible at the time of implementation. Section 3 above provides detailed descriptions of each.

While Li-ion batteries are dominating the stationary energy storage sector at present, other technologies, such as Redox Flow Battery (RFB), are being developed to create a more competitive energy storage system market.

The Applicant has taken cognisance of the fact that the technology within a BESS frequently advances and as such has not determined the specific technology that will be utilised at this stage. Two technology types however are envisaged, both of which have been assessed in this report to ensure that all impacts related to both types have been addressed:

- Lithium-Ion technology (e.g., Lithium Ferrophosphate (LFP), Nickel Manganese Cobalt Oxide (NMC) or similar technology and chemistries); and
- Redox-flow technology (e.g., vanadium flow battery, or similar technology and chemistries).

Description of other technology alternative investigated.

1.	Lead-Acid Batteries	Lead-acid batteries date from the 19 th century and are the most common batteries; they are low-cost and adaptable to numerous uses (e.g., electric vehicles, off-grid power systems, uninterruptible power supplies, etc.). "Advanced" lead-acid battery technology adds ultra-capacitors, increasing efficiency, lifetimes and improve partial state of-charge operability	<ul style="list-style-type: none"> • Poor ability to operate in a partially charged state • Relatively poor depth of discharge and short lifespan • Acid based electrolyte
2.	Sodium batteries	"High temperature" / "liquid-electrolyte-flow" sodium batteries have high power and energy density and are designed for large commercial and utility scale projects; "low temperature" batteries are designed for residential and small commercial applications	<ul style="list-style-type: none"> • Although mature, inherently higher costs—low temperature batteries currently have a higher cost with lower efficiency • Potential flammability issues for high-temperature batteries • Poor cycling capability
3	Zinc Batteries	Zinc batteries cover a wide range of possible technology variations, including metal-air derivatives; they are non-toxic, non-combustible and potentially low-cost due to the abundance of the primary metal; however, this technology remains unproven in	<ul style="list-style-type: none"> • Currently unproven commercially • Lower efficiency • Poor cycling/rate of charge/discharge

		widespread commercial deployment	
4	Flywheel	Flywheels are mechanical devices that spin at high speeds, storing electricity as rotational energy, which is released by decelerating the flywheel's rotor, releasing quick bursts of energy (i.e., high power and short duration) or releasing energy slowly (i.e., low power and long duration), depending on short-duration or long- duration flywheel technology, respectively	<ul style="list-style-type: none"> • Relatively low energy capacity • High heat generation • Sensitive to vibrations
5	Pumped Hydro	Pumped hydro storage uses two vertically separated water reservoirs, using low-cost electricity to pump water from the lower to the higher reservoir and running as a conventional hydro power plant during high electricity cost periods	<ul style="list-style-type: none"> • Relatively low energy density • Limited available sites (i.e., water availability required) • Cycling generally limited to once per day
6	Expanding the distribution network	The medium and low voltage network expansion can only solve the distribution capacity limitation and partly the voltage problems.	<ul style="list-style-type: none"> • It will not fully solve the power fluctuations and loss • Quick deployment of power supply is not guaranteed • Will not be possible to store the predictable PV & WP generation

Motivation for the preferred technology alternative.

Lithium-ion batteries have historically been used in electronics and advanced transportation industries; they are increasingly replacing lead-acid batteries in many applications, and have relatively high energy density, low self-discharge, and high charging efficiency.

Lithium-ion systems designed for energy applications are designed to have a higher efficiency and longer life at slower discharges, while systems designed for power applications are designed to support faster charging and discharging rates, requiring extra capital equipment.

Flow batteries store energy through chemically changing the electrolyte (vanadium) or plating zinc (zinc bromide). Physically, systems typically contain two electrolyte solutions in two separate tanks, circulated through two independent loops, separated by a membrane. Emerging alternatives allow for simpler and less costly designs utilizing a single tank, single loop, and no membrane.

The subcategories of flow batteries are defined by the chemical composition of the electrolyte solution; the most prevalent of such solutions are vanadium and zinc-bromide. Other solutions include zinc-chloride, ferrochrome, and zinc chromate.

Both Lithium-ion and Redox-flow technologies include batteries housed within containers which are fully enclosed and self-contained. It is important to note that while both types are detailed and assessed in this report, no specific technology is proposed as the preferred for authorisation, as both are expected to have similar impacts due to their design and functions being closely related. Therefore, the assessment proposes both technologies for authorisation (i.e., a BESS of either Lithium-Ion or Redox-flow type), to allow the proponent to determine the precise technology when the project is implemented, on the understanding that further investigation into the specific technologies available at the time of being awarded preferred bidder status will allow for one of two to be selected and ultimately developed.

Given appropriate controls, the impacts associated with the construction, operation, and decommissioning of the facility are anticipated to be similar irrespective of the BESS technology type selected for implementation. Preferred alternatives in terms of technology type are therefore not determined in this Basic Assessment report.

Motivation for not considering technology alternative

Refer to *Description of other technology alternative investigated* in Section 4.4, *Technology Alternatives*.

4.4 No-Go Alternative

The No-Go alternative is the option of not constructing the BESS.

Should this alternative be selected, there would be no direct environmental impacts within the designated BESS footprint. The implementation of the no-go alternative will result in the impossibility to store energy generated from Adams Solar Energy Facility and other generators in the region and supply additional generated electricity to the national grid at times when the PV is not producing optimally and will, therefore, result in lost opportunity to dispatch additional electricity, and to realise positive environmental impacts.

Based on the outcomes of the specialist studies undertaken (as outlined in this chapter of the report), it can be concluded that limited environmental impacts are anticipated at a local and site-specific level and what impact may arise are considered acceptable provided the mitigation measures as outlined in the BA report and the EMPr are implemented.

The potential environmental impacts could include:

- A loss of biodiversity, flora and fauna due to the clearing of land approximately 4ha for the construction and utilisation of land for the BESS and associated infrastructure. The ecological assessment determined the impacts to be low.

These impacts are expected at a local level and can be effectively mitigated and managed.

As detailed above, the No-Go Alternative will result in a number of lost opportunities and will conserve only a minor (~4ha) portion of degraded vegetation and habitat within the broader Adams footprint. The No-Go Alternative is not considered to have a significant benefit when compared to the implementation of the proposed BESS and is therefore not considered as a preferred alternative.

The socio-economic benefits of the proposed development would also be lost should the BESS project not be implemented. Economic benefits could be experienced across the entire value chain (e.g., materials, manufacturing, construction, operations, and maintenance, etc.). Benefits could include the sustained support of local businesses through the purchasing of equipment and materials, contribute to the local community through both temporary and permanent job creation, and contribute to the direct and continued supply of electricity to the national grid.

The potential also exists for South Africa to fabricate major system components (including electrolyte) for flow batteries.

Environmentally, the no-go alternative assumes the site remains in its current state, i.e., unutilized land. This would mean no negative environmental impacts such as vegetation loss or the potential contamination of surface and groundwater. Specifics around the exact contribution of the BESS to the energy network have not

been quantified, however both technologies will contribute to a reduced usage of fossil fuel plants and will support increased renewable energy generation through the smoothing of renewables.

5 NEED AND DESIRABILITY

Battery Energy Storage Systems are devices that enable energy from renewables, like solar and wind, or from any other generator connected to the grid, to be stored and then released when customers/grid operators need most. The role of storage is a key enabler to higher penetration of renewable generation in the energy mix to overcome the fact that wind and sun are unpredictable by nature and, consequently, not very reliable.

A battery storage system can be charged by electricity generated from renewables for example, and even charging energy from the grid when there is excess, and the cost is lower. The storage of energy makes it available on demand at any time of the day.

Storage systems are fundamental to the renewable energies and the energy transition. They store electricity and make it available when there is greater need and during periods when renewable resources are not able to produce, in the case of a PV facility, at night-time, and act as a balance between supply and demand, and help to stabilize the grid. Moreover, BESS can deliver ancillary services to balance network frequency and voltage during normal network operation and be available as reserves during contingency events, replacing the support that is generally provided by thermal generators.

Everyday engineers operating electricity grids worldwide level must match supply with demand. Managing these peaks and troughs becomes more challenging when the target is to achieve net zero carbon production. This can be achieved by the phasing out of fossil fuel plants that have traditionally been used as a back-up to provide a reliable, steady energy supply. Storage enables renewable generation to provide reliable and steady energy supply. BESS represents a significant opportunity for pairing energy storage with solar/wind projects in delivering on reliable and steady energy supply.

More and more grid operators are launching utility scale storage incentive programmes to have energy reserve available when needed for ancillary services, i.e., frequency/voltage regulation. This approach will not only allow many grid operators in the world to finalise grid corridors upgrades with less concern, but it will also avoid outage of energy supply to many customers at times of highest demand, creating the conditions on having new available energy for the grid and pushing to bring innovation into the country.^{3&4}

BESS can complement and supplement the countries primary generation systems where BESS can respond to voltage spikes and sags, whilst assisting in reducing the dependency on alternative peaking supplies such as diesel-powered generators as uninterrupted power supply during power outages.

³ Concurrence with the ministerial determination on the procurement of new generation capacity from Renewables (Wind and PV), Storage, Gas and Coal technologies By Department of Mineral Resources and Energy (DMRE) - No date

⁴ Consultation Paper Concurrence with the Ministerial Determination on the Procurement of Eskom's 404mw Of New Generation Capacity (Battery Energy Storage Systems And Solar PV) Published On 11 November 2021

At National level, on 21 February 2020, NERSA received the proposed determination from the Minister in terms of section 34 of the Act, as detailed below.

The IRP was subsequently updated in 2019 and contains a newly revised generation plan until 2030, as depicted in **Figure 7** below.

	Coal	Coal Decomm	Nuclear	Hydro	Storage	PV	Wind	CSP	Gas & Diesel	Other (DG, CoGen, Biomass, Landfill)
Current Balance	37 149		1 860	2 100	2 912	1 474	1 980	300	3 830	499
2019	2 155	-3 878					244	300		Allocation to the extent of the short term capacity and energy gap
2020	1 433	-537				114	300			
2021	1 433	-1 403				300	818			
2022	711	-844			513	400	1 000	1 600		
2023	750	-555				1 000	1 600			
2024			1 860				1 600		1 000	500
2025						1 000	1 600			500
2026		-1 219					1 600			500
2027	750	-847					1 600		2 000	500
2028		-475				1 000	1 600			500
2029		-1 694			1 575	1 000	1 600			500
2030		-1 850			2 500	1 000	1 600			500
Total Installed by 2030 (MW)	33 364		1 860	4 600	5 000	7 288	17 742	600	6 830	
% Total Installed Capacity (% of MW)	43		2,36	5,84	6,35	10,52	22,53	0,76	8,1	
% Annual Energy Contribution (% of MWh)	58,8		4,5	8,4	1,2	6,3	17,8	0,6	1,3	
Installed Capacity										
Committed / Already Contracted Capacity										
Capacity Decommissioned										
New Additional Capacity										
Extension of Koeberg Plant Design Life										
Includes Distributed Generation Capacity for own use										

Figure 7: New energy generation plan 2019-2030.

The IRP recognises the expeditious and continued development in battery energy storage technology and in section 5.3.8, it acknowledges that. The IRP model selected the need for additional storage, ahead of the use of gas, in the period to 2030; storage it states that roughly 2088MW (513 MW in 2022 and 1575MW in 2029) is required.

As a portion of the Eskom ageing fleet of fossil fuel driven power generation plant are reaching their end of life, it was indicated that 5 400MW will be decommissioned by 2022; this will increase to 10 500MW by 2030. Furthermore, the coal fleet's plant performance has declined over the past decade, which has resulted in a loss of security of electricity supply to the country. The decommissioning of identified coal fleet that are reaching their end of life, as well as the environmental commitments that the country has made to reduce greenhouse gas emissions, is resulting in an energy transition within the electricity sector. New capacity is needed to continue to meet the current and future demand. Environmental targets call for cleaner technologies to be included in the energy mix by closing the supply gap and being aligned to the policy position of diversifying energy sources. BESS technology is able to complement renewable power generation projects by allowing them to deliver on reliable, steady and near continual energy supply in that it is able to store and deliver energy when facilities are unable to produce such as windless days for a Wind Energy Facility or at night time for a PV facility.

This concurrence is aimed at ensuring that, at any given time when looking at the short/medium to long term, the supply–demand balance is maintained. The procured capacity must therefore be built on time, thereby promoting the orderly development of the electricity industry, as well as guaranteeing security of supply. Furthermore, NERSA must assess that the capacity to be procured is still appropriate and aligned to both country imperatives and global best practices.

The IRP 2019 presents an outlook of increased renewable energy share in the South African power system. The shortcomings associated with the renewable energy generation is that it is not dispatchable and it is also variable depending on the resource availability. BESS is required to provide a level of flexibility to the System Operator and provide system security. In addition to energy support, the BESS will be applied for provision of ancillary services to the power system.

The following provides details on the impact on the National System that can be anticipated with energy storage:

- 513MW of energy storage should be procured to be generated from storage to cover short-term variations in electricity generated capacity to meet the demand. The system requirements present an opportunity to diversify the energy mix. The set capacity procured under energy storage will also contribute to ancillary services to ensure that system stability is not compromised.
- The System Operator is encouraged to conduct network studies that are aimed at ensuring that the energy storage technologies can contribute positively to minimise forced outages and partial load losses and can be used as hybrid solution to renewable energy technologies and as reserve requirements.
- The system requires battery storage that can be used as a complementary resource for renewables from IPPs, especially Wind and PV. The System Operator can use the historic profiles from year 2013 to 2019 of all contracted build of REIPP from Bid Window 1 to Bid Window 4, to create a median profile that will determine how much energy can be stored during periods of low demand, to be used later during peak hours.
- The system requires reserves to balance the system when unexpected events occur, such as customer demand fluctuations, changes in the availability of supply capacity, and generation variations from intermittent plant. Therefore, energy storage from the system perspective can play a major role in providing these reserves.
- The energy storage can also help the system from a stability perspective. This would result in a reduced need for demand response that the System Operator normally utilises by reducing certain loads by instruction, thereby increasing Eskom's sales.
- Energy storage has been determined in line with best practices as it will reduce the carbon footprint caused by coalfired power stations.

- Energy storage has been determined in line with best practices, as it can play a major role in the provision of reliable energy generation that the System Operator can dispatch according to the scheduling and dispatch rules. These include:
 - Demand smoothing and energy arbitrage. This concept promotes storing of excess energy produced by renewables to be used later when it is needed most, such as during peak-periods. Energy arbitrage lowers the cost of dumped energy in take-or-pay Power Purchase Agreements and reduces the need to generate more electricity or to use expensive peaking plants like Open Cycle Gas Turbines (OCGTs).
 - Complementing renewables and reducing emissions. In this case, energy storage is used as a solution to store energy from renewable energy sources, such as Wind and Solar power, that are intermittent and variable, so that when the wind is not blowing and the sun is not shining, they can still produce clean energy that has been stored, thus reducing emissions caused by fossil fuels.
 - The above roles of energy storage are the best practices relevant at the time and ensure the mandate of security of supply. It also meets the objective of ensuring the use of diverse energy sources and energy efficiency.
- Energy storage will play a crucial role in enabling the next phase of energy transition due to the expected decommissioning of approximately 24 100MW of coal power plants in the period beyond 2030, until 2050.
- Storage can bring the following network benefits to the national Grid at different business wires (Generation, Transmission and Distribution).

Over the long-term, the IRP reflects committed and new build options until 2030 where energy storage will be required in 2022 and 2029. The development of new power stations therefore needs to consider a trade-off between three fundamental issues namely (i) security of supply (the country should always have sufficient electricity and primary energy resources as an enabler for economic growth), (ii) environmental concerns (South Africa will pursue low carbon generation options going forward, to contribute positively to climate change initiatives) and (iii) economic efficiency and cost (electricity infrastructure development and a globally

competitive supply chain should be a driver of macro-economic development). The BESS development supports the supply security, environmental sustainability, and economic efficiency⁵.

Eskom's integrated report 2020 prioritised strategic initiatives, called "*seven pillars*", which were put in place to enable the utility to achieve sustainability in the current business environment and set up the Eskom of the future.

Under Pillar 5 - "*Innovation and transformation to create new revenue sources*", Eskom's strategy is to partner with various role players in battery storage technology to improve dispatchability of variable energy from the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) plants as well as provide alternative solutions of grid support to the distribution-constrained networks.

There is a complementary relationship between Smart Grid systems, energy storage, and non-dispatchable renewable energy technologies based on wind and solar PV. The traditional power delivery model is being disrupted by technological developments related to energy storage, and more renewable energy can be harnessed despite the reality that the timing of its production might be during low-demand periods.

Storage technologies including battery systems, compressed air energy storage, flywheel energy storage, hydrogen fuel cells etc. are developments which can address this issue, especially in the South African context where over 6 GW of renewable energy has been introduced, yet the power system does not have the requisite storage capacity or flexibility.

BESS projects offer several benefits and solutions to some of the challenges which is faced by the energy crisis:

- Reduction in carbon emissions in the country's power generation infrastructure
- Unlocking constrained networks (Reduction in loading/ congestion of upstream High Voltage networks)
- Reducing voltage drops and improve quality of supply
- Deferment or replacement of future capital expansion projects
- Supports mini grids in areas with limited access to bulk power; and
- Peak load reduction - 4 hours of battery storage increases dispatch time (thereby extending baseload and offset carbon emissions).

⁵ Concurrence with the ministerial determination on the procurement of new generation capacity from Renewables (Wind and PV), Storage, Gas and Coal technologies By Department of Mineral Resources and Energy (DMRE) - No date

⁵ Consultation Paper Concurrence with the Ministerial Determination on the Procurement of Eskom's 404mw Of New Generation Capacity (Battery Energy Storage Systems And Solar PV) Published On 11 November 2021

The BESS project has the potential to reduce carbon emissions in South Africa's power generating infrastructure which can be achieved in two ways:

- a) By reducing the reliance on fossil fuel powered peaking plants that are used to managed variability on the power from renewable energy installations, and
- b) By storing excess power generated by renewable energy projects when demand is low, but wind (for example, is high) and feeding this back into the grid when demand is high and power generation from renewables is low.

Retrofitting a BESS to an existing renewable/cleaner energy further enhances the desires of the National Deployment Plan (NDP) in its efforts in ensuring South Africa will have an energy sector that provides reliable and efficient energy service at competitive rates; that is socially equitable through expanded access to energy at affordable tariffs; and that is environmentally sustainable through reduced emissions and pollution.

Table 7: The Guideline on the Need and Desirability's list of questions to determine the "Need and Desirability" of a proposed project.

QUESTION	RESPONSE
1. How will this development (and its separate elements/aspects) impact on the ecological integrity of the area?	
1.1. How were the following ecological integrity considerations taken into account?	Specialists have utilised national and international standards and recommendations and relevant guidelines in terms of South African law in their respective reports. These reports accompany the draft BAR as Appendix E . Threatened ecosystems, sensitive habitats, etc are indicated in the respective specialist studies and maps, if any.
1.1.1. Threatened Ecosystems	
1.1.2. Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure	
1.1.3. Critical Biodiversity Areas ("CBAs") and Ecological Support Areas ("ESAs")	
1.1.4. Conservation targets	
1.1.5. Ecological drivers of the ecosystem	
1.1.6. Environmental Management Framework	
1.1.7. Spatial Development Framework, and	
1.1.8. Global and international responsibilities relating to the environment (e.g. RAMSAR sites, Climate Change, etc.).	
1.2. How will this development disturb or enhance ecosystems and/or result in the loss or protection of biological diversity? What measures were explored to firstly avoid these negative impacts, and where these negative impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?	<p>The EAP has indicated the recommendations and mandatory requirements for inclusion before any decision could be taken by the competent authority in the draft BAR.</p> <p>Refer to Section 4 Project Alternatives, Section 8 Environmental Management Programme and Appendices E (Freshwater), F (Ecological) and G (Heritage).</p>

<p>1.3. How will this development pollute and/or degrade the biophysical environment? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?</p>	<p>Mitigation measures are provided in the EMPr and these consider the findings by the specialists. Refer to Appendix H, I and J.</p>
<p>1.4. What waste will be generated by this development? What measures were explored to firstly avoid waste, and where waste could not be avoided altogether; what measures were explored to minimise, reuse and/or recycle the waste? What measures have been explored to safely treat and/or dispose of unavoidable waste?</p>	<p>The waste to be generated will be construction related waste, and domestic waste during the operation. Waste management measures and other related waste activities have been included in this draft BAR and managed within the EMPr. Refer to Appendix H, I and J.</p>
<p>1.5. How will this development disturb or enhance landscapes and/or sites that constitute the nation's cultural heritage? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?</p>	<p>A heritage specialist report provided their opinion on the proposed development in which they indicated that no heritage resources will be impacted upon. Refer to Appendix G: Heritage.</p>
<p>1.6. How will this development use and/or impact on non-renewable natural resources? What measures were explored to ensure responsible and equitable use of the resources? How have the consequences of the depletion of the non-renewable natural resources been considered? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?</p>	<p>A wetland, ecological and heritage assessment are appended to the DBAR. The BESS facility and associated infrastructure will not impact on any watercourse. Refer to Appendix E, F, and G. The significance of the ecological aspects on the site is low. Alternatives were explored and assessed which resulted in a preferred alternative. See Section 4, Project Alternatives.</p>

<p>1.7. How will this development use and/or impact on renewable natural resources and the ecosystem of which they are part? Will the use of the resources and/or impact on the ecosystem jeopardise the integrity of the resource and/or system taking into account carrying capacity restrictions, limits of acceptable change, and thresholds? What measures were explored to firstly avoid the use of resources, or if avoidance is not possible, to minimise the use of resources? What measures were taken to ensure responsible and equitable use of the resources? What measures were explored to enhance positive impacts?</p> <p>1.7.1. Does the proposed development exacerbate the increased dependency on increased use of resources to maintain economic growth or does it reduce resource dependency (i.e. de-materialised growth)? (note: sustainability requires that settlements reduce their ecological footprint by using less material and energy demands and reduce the amount of waste they generate, without compromising their quest to improve their quality of life)</p> <p>1.7.2. Does the proposed use of natural resources constitute the best use thereof? Is the use justifiable when considering intra- and intergenerational equity, and are there more important priorities for which the resources should be used (i.e. what are the opportunity costs of using these resources of the proposed development alternative?)</p> <p>1.7.3. Do the proposed location, type and scale of development promote a reduced dependency on resources?</p>	<p>The proposed project will strive to not only supply renewable energy to support the green economy but should itself be developed in a 'green' and sustainable way. The facility will form part of a renewable energy programme which aims to reduce reliance on non-renewable natural resources.</p> <p>Refer to Sections 2: Policy and Planning Context and Section 5: Needs and Desirability.</p>
<p>1.8 How were a risk-averse and cautious approach applied in terms of ecological impacts?</p> <p>1.8.1 What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?</p> <p>1.8.2 What is the level of risk associated with the limits of current knowledge?</p> <p>1.8.3 Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?</p>	<p>Each specialist has indicated their assumptions and limitations for performing their respective specialist studies. These are contained in Section 11.5 and under Appendix E.</p>
<p>1.9. How will the ecological impacts resulting from this development impact on people's environmental right in terms following:</p> <p>1.9.1. Negative impacts: e.g. access to resources, opportunity costs, loss of amenity (e.g. open space), air and water quality impacts, nuisance (noise, odour, etc.), health impacts, visual impacts, etc. What measures were taken to firstly avoid negative impacts, but if</p>	<p>An impact assessment and input from specialist studies has been included in this BAR.</p> <p>Referred to Appendices E, F, G.</p>

<p>avoidance is not possible, to minimise, manage and remedy negative impacts?</p> <p>1.9.2. Positive impacts: e.g. improved access to resources, improved amenity, improved air or water quality, etc. What measures were taken to enhance positive impacts?</p>	
<p>1.10. Describe the linkages and dependencies between human wellbeing, livelihoods and ecosystem services applicable to the area in question and how the development's ecological impacts will result in socio-economic impacts (e.g. on livelihoods, loss of heritage site, opportunity costs, etc.)?</p>	<p>Refer to Section 5 Needs and Desirability.</p>
<p>1.11. Based on all of the above, how will this development positively or negatively impact on ecological integrity objectives / targets / considerations of the area?</p>	<p>An impact assessment and input from specialist studies has been added to this Draft BAR under Section 10. Environmental aspects had low to medium negative significance which included aquatics, fauna, flora, wetlands, while positive social and economic impacts are anticipated. Please refer to Section 10: Findings, Impact Management, and Mitigation</p>
<p>1.12. Considering the need to secure ecological integrity and a healthy biophysical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of the "best practicable environmental option" in terms of ecological considerations?</p>	<p>The specialists utilised the best practice and recommendations in their specialist studies respectively.</p> <p>Note that the proposed development footprint devised for all alternatives assessed have been equally conscientious in terms of avoiding identified sensitive areas and that the impact significance would be similarly low for all alternatives.</p>
<p>1.13. Describe the positive and negative cumulative ecological/biophysical impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and existing and other planned developments in the area?</p>	<p>Refer to Section 9.4 which highlights Cumulative Impacts anticipated as per the specialist studies contained under Appendix E. More cumulative impacts are found in this appendix under each specialist study respectively.</p>
<p>2.1. What is the socio-economic context of the area, based on, amongst other considerations, the following considerations?</p>	
<p>2.1.1. The IDP (and its sector plans' vision, objectives, strategies, indicators and targets) and any other strategic plans, frameworks of policies applicable to the area,</p>	<p>Refer to report Section 2 which elaborates on the projects role in the context of a policy and planning context.</p>
<p>2.1.2. Spatial priorities and desired spatial patterns (e.g. need for integrated of segregated communities, need to upgrade informal settlements, need for densification, etc.)</p>	<p>Refer to report Section 2 which elaborates on the projects role in the context of a policy and planning context.</p>

<p>2.1.3. Spatial characteristics (e.g. existing land uses, planned land uses, cultural landscapes, etc.)</p>	<p>The location factors favour this land use for a number of reasons e.g.:</p> <ul style="list-style-type: none"> • The size of the land is appropriate in that it is large enough for the type of development proposed. • The energy grid network will be enhanced. • The area will contribute with the positive economic and social impacts. • No cultural landscapes are within the study site. <p>Please refer to report Section 2 for more details.</p>
<p>2.1.4. Municipal Economic Development Strategy ("LED Strategy").</p>	<p>Refer to report Section 2 which elaborates on the projects role in the context of a policy and planning context.</p>
<p>2.2. Considering the socio-economic context, what will the socio-economic impacts be of the development (and its separate elements/aspects), and specifically also on the socio-economic objectives of the area?</p> <p>2.2.1. Will the development complement the local socio-economic initiatives (such as local economic development (LED) initiatives), or skills development programmes?</p> <p>2.3. How will this development address the specific physical, psychological, developmental, cultural and social needs and interests of the relevant communities?</p> <p>2.4. Will the development result in equitable (intra- and inter-generational) impact distribution, in the short- and long-term? Will the impact be socially and economically sustainable in the short- and long-term?</p>	<p>Refer to report Section 2 which elaborates on the projects role in the context of a policy and planning context.</p>
<p>2.5. In terms of location, describe how the placement of the proposed development will:</p>	
<p>2.5.1. result in the creation of residential and employment opportunities in close proximity to or integrated with each other</p>	<p>There will be employment opportunities created in areas which would benefit from such opportunity and economic upliftment. Both temporary and permanent, temporary during construction and permanent during operations.</p>
<p>2.5.2. reduce the need for transport of people and goods</p>	<p>The proposed project would reduce the need for transporting people and goods through requiring employment of local labour and goods as far as possible. The project does not give access to public transport, but it is not a public transport project.</p>
<p>2.5.3. result in access to public transport or enable non-motorised and pedestrian transport (e.g. will the development result in densification and the achievement of thresholds in terms public transport)</p>	
<p>2.5.4. compliment other uses in the area</p>	
<p>2.5.5. be in line with the planning for the area</p>	<p>N/A</p>
<p>2.5.6. for urban related development make use of underutilised land available with the urban edge</p>	
<p>2.5.7. optimise the use of existing resources and infrastructure</p>	<p>Existing access roads and transport networks, existing electrical infrastructure, etc are available.</p>
<p>2.5.8. opportunity costs in terms of bulk infrastructure expansions in non- priority areas (e.g. not aligned with the bulk infrastructure planning for the settlement that reflects the spatial reconstruction priorities of the settlement)</p>	<p>The project does not relate to bulk infrastructure provision. It will improve the supply of green energy/electricity.</p>

2.5.9. discourage "urban sprawl" and contribute to compaction/ densification	
2.5.10. contribute to the correction of the historically distorted spatial patterns of settlements and to the optimum use of existing infrastructure in excess of current needs	The Project does not contribute to urban sprawl. The site was selected to make use of land that has limited agricultural viability and no conservation value.
2.5.11. encourage environmentally sustainable land development practices and processes	The project supports sustainable development because it is a renewable energy project. Other aspects of sustainable development are reflected in the EMPr.
2.5.12. take into account special locational factors that might favour the specific location (e.g. the location of a strategic mineral resource, access to the port, access to rail, etc.)	The BESS site is best suited as it is located directly adjacent to an existing solar PV facility (where solar energy is consistently and abundantly available in the country) and which the BESS will be an extension of. The site is therefore in a favourable location.
2.5.13. the investment in the settlement or area in question will generate the highest socio-economic returns (i.e. an area with high economic potential)	The project is not an income generating project for the local area but will assist in terms of income generation at a national level.
2.5.14. impact on the sense of history, sense of place and heritage of the area and the socio-cultural and cultural-historic characteristics and sensitivities of the area	The project site location was selected due an existing PV facility. The BESS project is a retrofitting to the existing facility in order to create an energy storage capacity to feed into the national grid. No heritage resources of importance were identified.
2.5.15. in terms of the nature, scale and location of the development promote or act as a catalyst to create a more integrated settlement?	This aspect is not relevant for this proposed project. Only integrated settlement is that local labour and skills can be used, as far as possible.
2.6. How was a risk-averse and cautious approach applied in terms of socio-economic impacts?	
2.6.1. What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?	Assumptions and Limitations are highlighted in Section 11.5 of this BAR, while each specialist complied with the EIA Regulations, 2014 (as amended) to state their respective assumptions. Please refer to specialist reports appended to this report. A risk averse approach was followed by the EAP and Specialists. The overall and combined level of risk posed by the development is low.
2.6.2. What is the level of risk (note: related to inequality, social fabric, livelihoods, vulnerable communities, critical resources, economic vulnerability and sustainability) associated with the limits of current knowledge?	
2.6.3. Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?	
2.7. How will the socio-economic impacts resulting from this development impact on people's environmental rights in terms following:	
2.7.1. Negative impacts: e.g. health (e.g. HIV-Aids), safety, social ills, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts?	As the area has a very low employment rate of 16%, the project will enhance the positive impact of employment opportunities primarily during construction. Various ecological specialist studies were undertaken to assess the area. The site sensitivity is deemed to be of low to medium significance.
2.7.2. Positive impacts. What measures were taken to enhance positive impacts?	

2.8. Considering the linkages and dependencies between human wellbeing, livelihoods and ecosystem services, describe the linkages and dependencies applicable to the area in question and how the development's socio-economic impacts will result in ecological impacts (e.g. over utilisation of natural resources, etc.)?	The property is largely degraded due to anthropological influences such as farming and an existing PV facility. An existing mining operation exists to the west.
2.9. What measures were taken to pursue the selection of the "best practicable environmental option" in terms of socio-economic considerations?	The proposed project is intended to deliver on a much larger scale than at a local level and is in support of a national programme to rectify the countries energy crisis.
2.10. What measures were taken to pursue environmental justice so that adverse environmental impacts shall not be distributed in such a manner as to unfairly discriminate against any person, particularly vulnerable and disadvantaged persons (who are the beneficiaries and is the development located appropriately)? Considering the need for social equity and justice, do the alternatives identified, allow the "best practicable environmental option" to be selected, or is there a need for other alternatives to be considered?	The BESS project is a retrofitting to much larger PV facility which is consistent with national and provincial development policy as reflected in the extracts of policy documents which were reviewed during the EIA process conducted for the PV and provided in the accompanying specialist report (GSA, 2012).
2.11. What measures were taken to pursue equitable access to environmental resources, benefits and services to meet basic human needs and ensure human wellbeing, and what special measures were taken to ensure access thereto by categories of persons disadvantaged by unfair discrimination?	Successful completion of the proposed project (in combination with other renewable energy projects) will provide people in the province and country with access to energy and reduce the burden of loadshedding which has affected people in South Africa for over a decade.
2.12. What measures were taken to ensure that the responsibility for the environmental health and safety consequences of the development has been addressed throughout the development's life cycle?	All specialist mitigation measures have been included in the EMPr for all phases of development. Refer to Appendix H .
2.13. What measures were taken to:	
2.13.1. ensure the participation of all interested and affected parties	Public Participation will be undertaken in terms of legislated requirements. Please refer to Section F of this BAR.
2.13.2. provide all people with an opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation	
2.13.3. ensure participation by vulnerable and disadvantaged persons	
2.13.4. promote community well-being and empowerment through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means	The EMPr contains an environmental education component for workers, and the EMPr (and socio-economic report) indicate the requirement for use of local labour and materials where possible.
2.13.5. ensure openness and transparency, and access to information in terms of the process	All documents would be made available in full to I&APs can indicate the manner in which they'd like to receive the information. Please refer to Section 7 of this BAR.

<p>2.13.6. ensure that the interests, needs and values of all interested and affected parties were taken into account, and that adequate recognition were given to all forms of knowledge, including traditional and ordinary knowledge</p>	<p>The EIA process has taken cognisance of all interests, needs and values adopted by all interested and affected parties via the socio-economic impact assessment (and incorporation of the associated recommendations in the EMPr) and also through the PPP process, noting that this report is currently under a 30-day public review period.</p>
<p>2.13.7. ensure that the vital role of women and youth in environmental management and development were recognised and their full participation therein was promoted.</p>	<p>Public participation of all I&APs has been promoted and opportunities for engagement have been provided during the EIA process. Refer to Appendix J.</p>
<p>2.14. Considering the interests, needs and values of all the interested and affected parties, describe how the development will allow for opportunities for all the segments of the community (e.g., a mixture of low-, middle-, and high-income housing opportunities) that is consistent with the priority needs of the local area (or that is proportional to the needs of an area)?</p>	<p>The BESS project is considered a project of national importance. Local companies, labour and employment will be utilised as far as possible.</p>

6 DESCRIPTION OF THE RECEIVING ENVIRONMENT

6.1 Site Location

The proposed site is located on the Portion 0 of Farm Adams No. 328 within the Joe Morolong Local Municipality, John Taolo Gaetsewe District Municipality, Northern Cape Province, for the establishment of a retrofitted BESS to associated to the existing solar energy facility with associated infrastructure (Table 8).

Table 8: Property Details.

Property Details		
GPS co-ordinates	27° 22' 29.8"S	23° 00' 34.9"E
District Municipality	John Taolo Gaetsewe District Municipality	
Local Municipality	Joe Morolong Local Municipality	
Nearest Town	Hotazel	
Ward	4 (34501004)	
SG key	C04100000000032800000	

Joe Morolong Local Municipality formerly known as Moshaweng Local Municipality is an average small area spreading over about 9477km². It is located in Northern Cape Province of South Africa within John Taolo Gaetsewe District Municipality. The area is mostly rural with about 60% of it compromising virgin land surface. The total population of the area is less than 100 000 with only 58% of it being economically active.

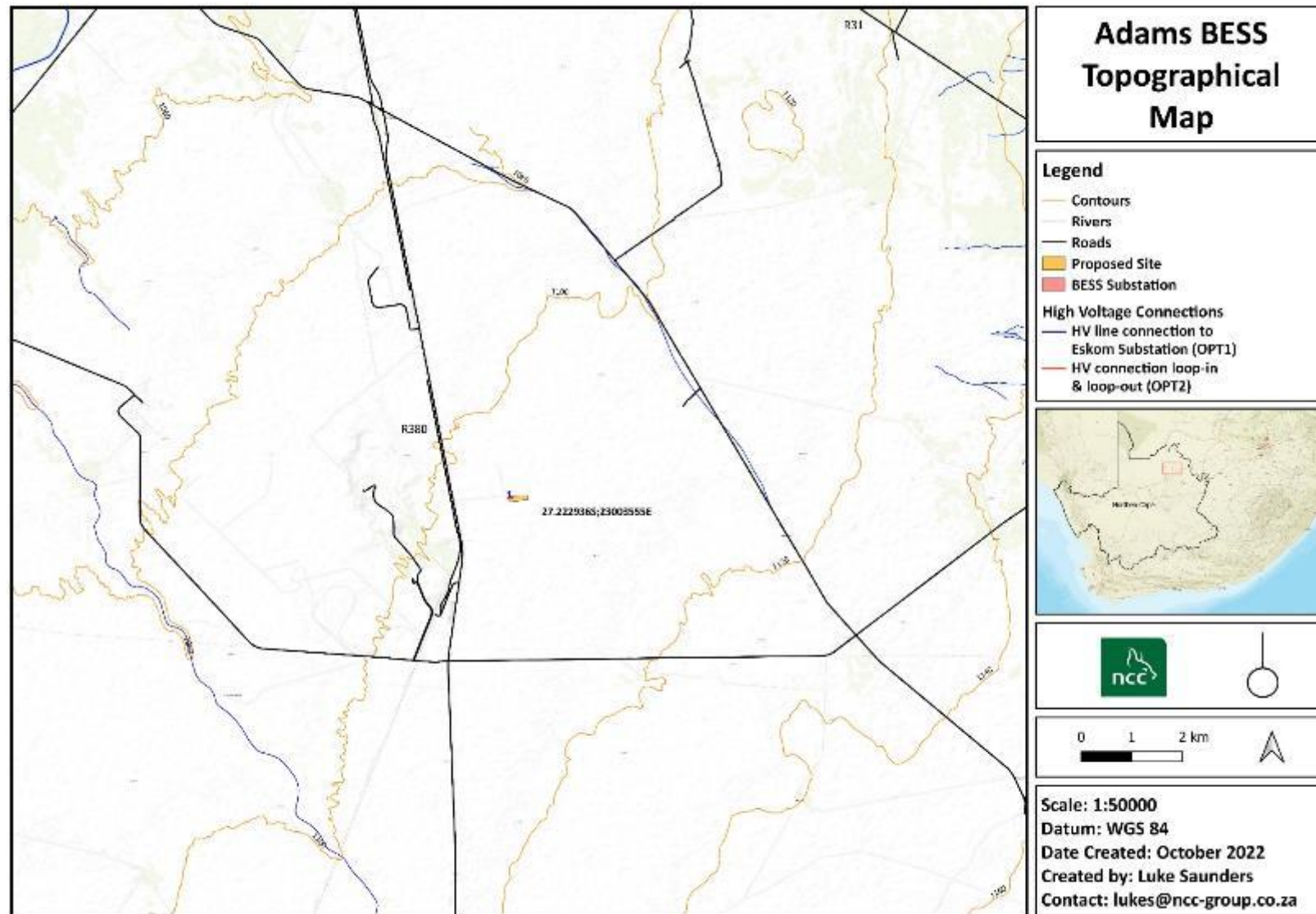


Figure 8: Site Locality Map (Topographical map).

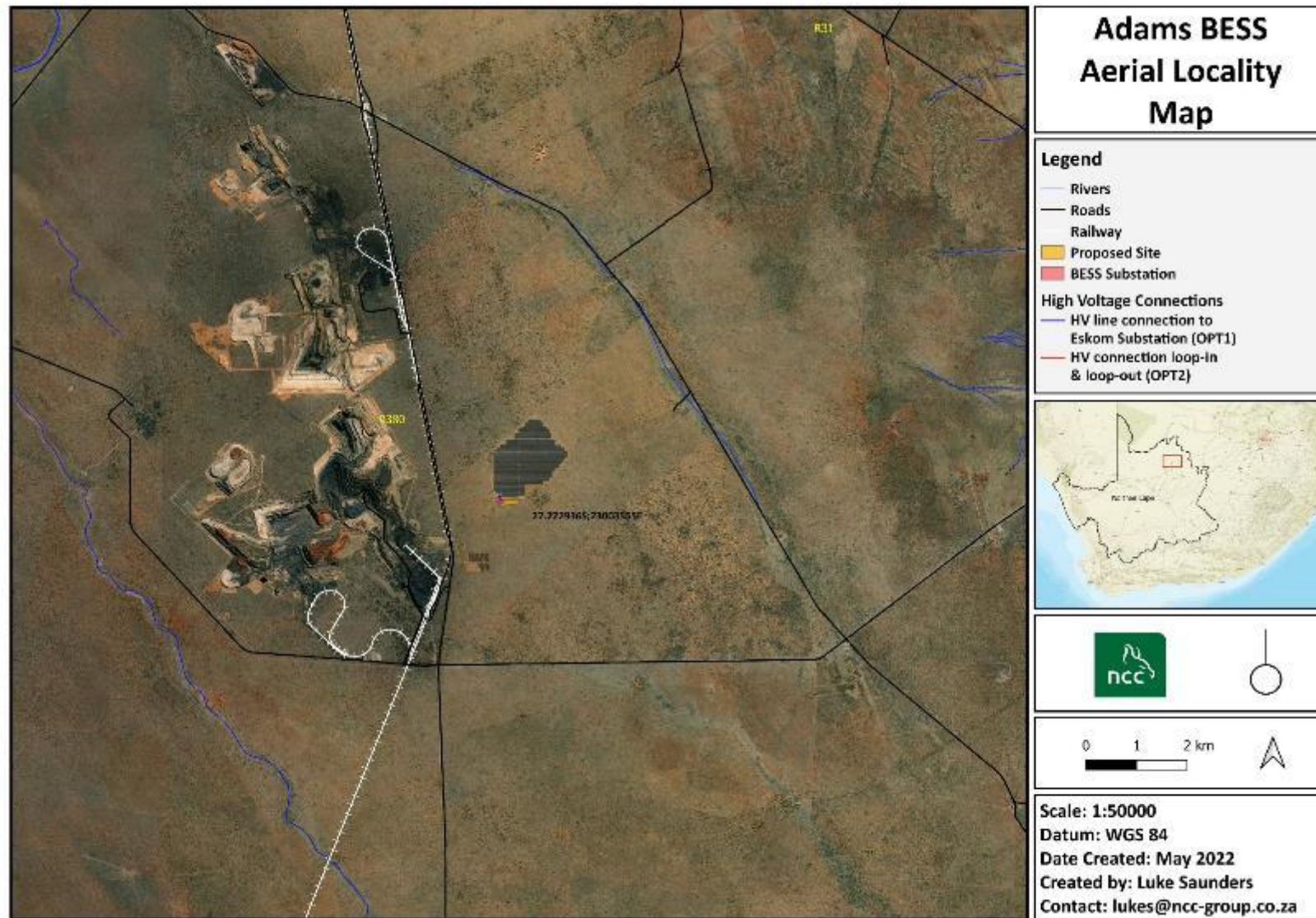


Figure 9: Site Locality Map (Aerial Photograph).

6.2 Proposed Site and Surrounds

The proposed project is located on the same property as the Adams Solar Park a photovoltaic (PV) facility, more specifically it is located directly south of the said facility.

The R380 road between Kathu and Hotazel is located approximately 1km to the west of the BESS site, while the Mamatwane Manganese mine and sinter plant are situated west thereof.

An existing 132kV transmission line servicing the current PV solar facility runs adjacent to the West of the existing facility and the proposed BESS site. Other activities in the area consist largely of mining with farms and other renewable energy facilities.

Table 9: GPS positions BESS Facility

Activity – BESS Facility		
Point	Latitude (S)	Longitude (E)
A	27°22'27.57"S	23° 0'29.25"E
B	27°22'27.07"S	23° 0'42.05"E
C	27°22'30.01"S	23° 0'42.05"E
D	27°22'31.96"S	23° 0'29.10"E

Table 10: GPS positions BESS Facility substation

Activity – BESS Facility		
Point	Latitude (S)	Longitude (E)
A	27°22'27.57"S	23° 0'29.25"E
B	27°22'27.40"S	23° 0'31.76"E
C	27°22'29.40"S	23° 0'31.65"E
D	27°22'29.40"S	23° 0'29.19"E

Table 11: GPS positions linear structures – Overhead Lines (Option A: Substation to Substation)

Activity – BESS Facility		
Point	Latitude (S)	Longitude (E)
A (BESS)	27°22'27.86"S	23° 0'29.11"E
B (Turn)	27°22'24.47"S	23° 0'28.98"E
C (Existing Substation)	27°22'25.16"S	23° 0'28.07"E

Table 12: GPS positions linear structures – Overhead Lines (Option B Loop In & Loop Out)

Activity – BESS Facility		
Point	Latitude (S)	Longitude (E)
A (BESS)	27°22'28.60"S	23° 0'29.16"E
B (Existing Line)	27°22'28.64"S	23° 0'27.57"E

Two grid connection options have been explored, option A (connection from the BESS Substation to the loop in and loop out to the existing HV connection line) and option B (connection from the BESS Substation to the existing HV substation).

The remaining surrounding properties are utilised for agricultural purposes.

The proposed BESS will be no greater than 4ha in comparison to the 189ha Adams PV Facility.

The proposed BESS facility accounts for 2% of the size of the existing PV facility.



Photo 1. The R380, entrance to the existing facility and proposed entrance to the proposed BESS



Photo 2. Site location (Preferred BESS Alternative).



Photo 3. Access to the proposed BESS will be on an existing access road with gate control located to the east.



Photo 4: View towards the proposed BESS site location. Facing in easterly direction.



Photo 5: View towards the proposed BESS site location. Facing in a south direction.



Photo 6: View towards the proposed BESS site location and existing powerlines. Facing in a south westerly direction.

6.3 Topography

The study area is relatively flat with no major topological constraints to the proposed development. On a localised level the site is flat, with minimal change in elevation throughout with an average slope of 0.6 degrees (0.6%) (0.6° East West and 0.6° North South). The study area has an average elevation of 1114 mamsl. The lowest elevation within the study area was recorded at 1107mamsl and highest point recorded at 1119 mamsl. This indicates a height difference of 12m. The general slope of the area is considered to be 0.6° in a south-westerly direction.

6.4 Geology

The proposed site is located just east of the Mamatwane Manganese mine and located on the southern tip of the Kalahari manganese field in the Griqualand West region of the Northern Cape Province. The morphology is dominated by flat plains intersected by generally North-South striking ranges of the Gamagara Ridge, Klipfontein Hills and the Asbestos Hills. These plains are characterised by thick calcretes and wind-blown Kalahari sands (Preston, 2001). The relative location of the site is within the Griqualand west region.

6.5 Climate

The Northern Cape region is semi-arid and receives an annual rainfall of between 250 to 500 millimetres, with the majority of rain falling in the summer months between October and March. On average the heaviest rains fall in the mid-to late summer, with February and March being the wettest months of the year. Thunderstorms are a common occurrence of the summer climate and hail often accompanies summer thunderstorms.

6.5.1 Temperature

The annual average temperature for the area where the site is located is 19°C. The average maximum temperature (experienced in December) is ~33°C whilst the minimum temperatures (-2°C) typically occur in July.

6.5.2 Rainfall

Mean monthly and annual rainfall (Past 50 years)

The mean annual rainfall in the Kuruman area (42km east of the site) is 460mm, of which the majority falls in summer.

Table 13: Average monthly rainfall in the Kuruman area.

Rainfall Record (Average Monthly Rainfall in Milliliters)											
J	F	M	A	M	J	J	A	S	O	N	D
48	111	102	50	5	7	0	1	18	29	32	54

The predicted rainfall for the quaternary catchment however is only 352mm per annum, which is likely to be a more accurate reflection of average rainfall at the Adams site.

Maximum rainfall intensities per month

The recorded maximum rainfall intensities (Kuruman Weather Station).

Table 14: Rainfall intensity in the Kuruman area.

Rainfall Intensity	
Duration / time period	Rainfall (mm)
60 minutes	56.0
24 hours	99.0
24 hours/50 years	92.9
24 hours/100 year storm events	104.6

6.6 Freshwater Resources

The study area is located within the Lower Vaal Water Management Area (WMA) in quaternary catchment D41K.

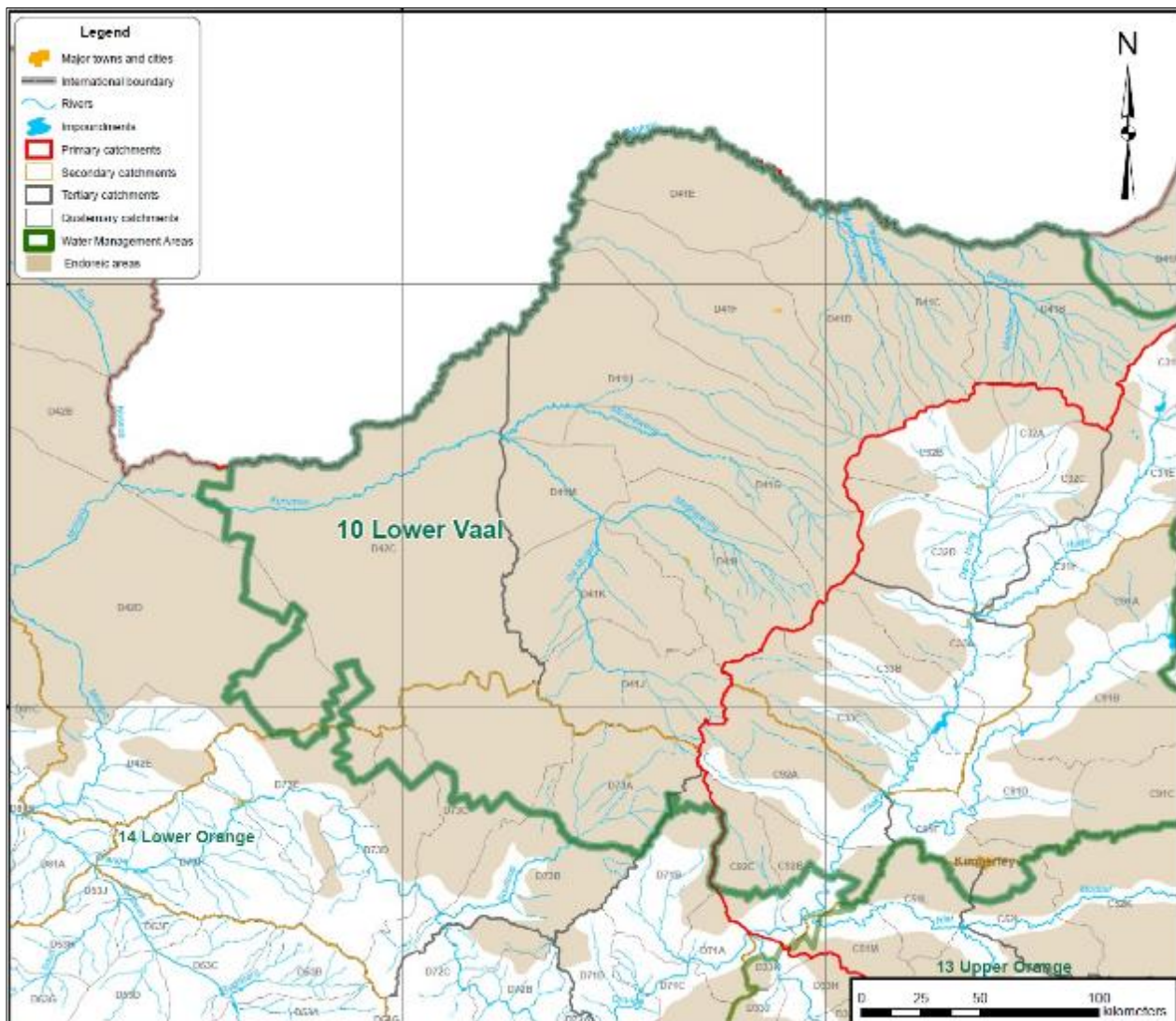


Figure 10: Study area site location in the Lower Vaal WMA in quaternary catchment D41K (Source: Bailey and Pitman, 2016).

According to the initial desktop assessment no natural freshwater features are indicated to occur within the footprint of the property or within close proximity to the property. The map shows that no freshwater resources (wetlands or watercourses) occur within either 100m or 500m from the proposed BESS site. Refer to Figure 11: Site map indicating no freshwater resources (watercourses or wetlands) occur within the regulated area.

A field visit and ground-truthing exercise was undertaken with no identification of any natural drainage features on either of the alternative sites and no hydro-geomorphological landscape features indicating the presence of a watercourse i.e. stream, river or wetland. No hydrophytic, wetland or riparian vegetation or riparian habitats were present or observed. The vegetation is terrestrial in nature consisting of a mosaic of trees comprising species such as *Senegalia (Acacia) mellifera*, (blackthorn) and *Grewia flava* (raisin tree) with a perennial grass understorey and scattered shrubs.

The Witleegte River, a tributary of the Kuruman River, is located >3.5km to the north and north-east from the site and several small artificial and natural wetlands occur to the west, >5km, from the site. It is a non-perennial first order river with episodic flows and for that likely reason has not yet had a Present Ecological State (**PES**) category assigned to it (DWS, 2012). At a desktop level the Subquaternary (**SQ**) reach is D41K-02181, which is in catchment D41K, has been assessed to have a Low mean Ecological Importance (EI) and a **D** default Ecological Categaory (**EC**) (DWS, 2012).

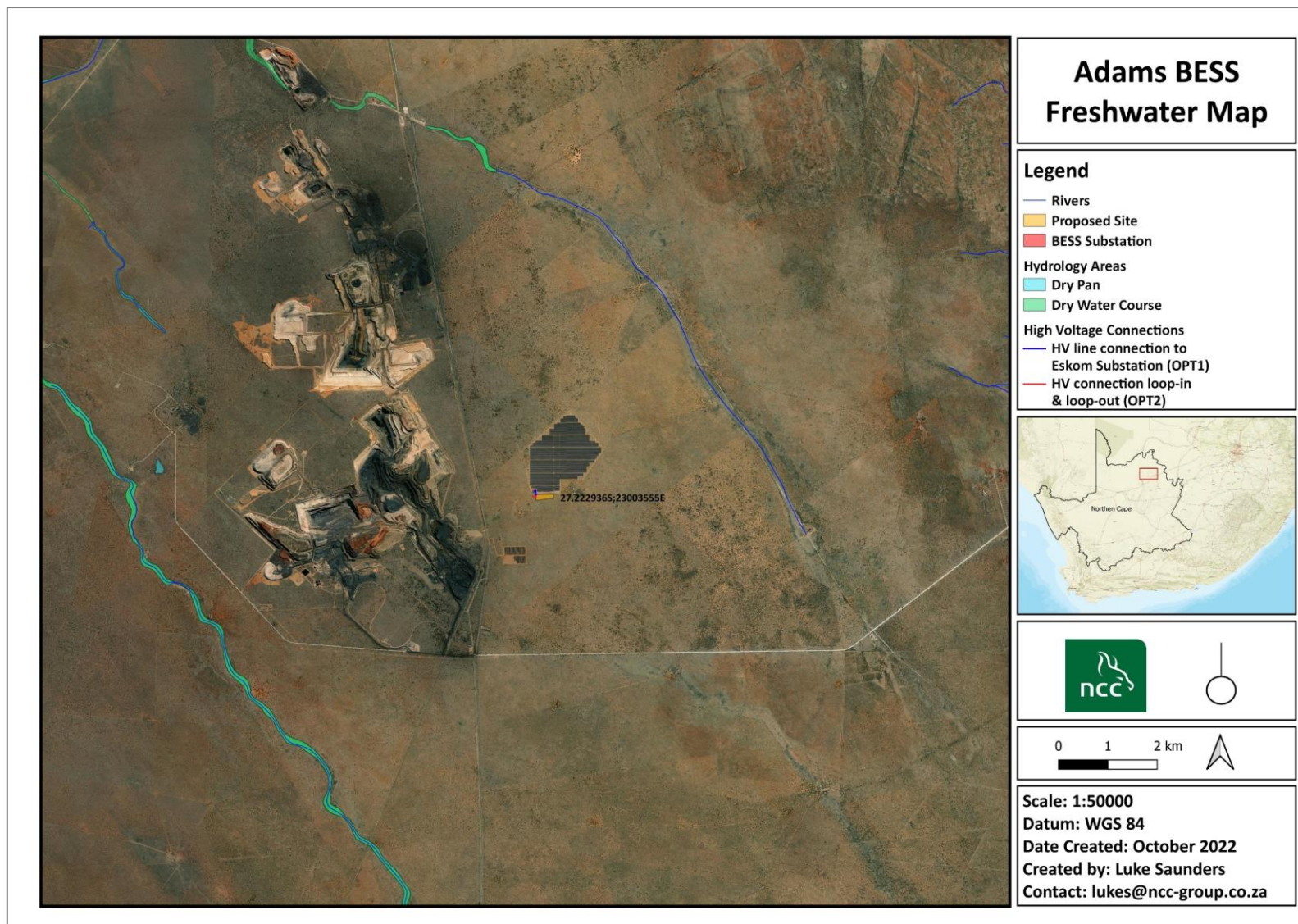


Figure 11: Site map indicating no freshwater resources (watercourses or wetlands) occur within the regulated area.

6.7 Terrestrial Ecology

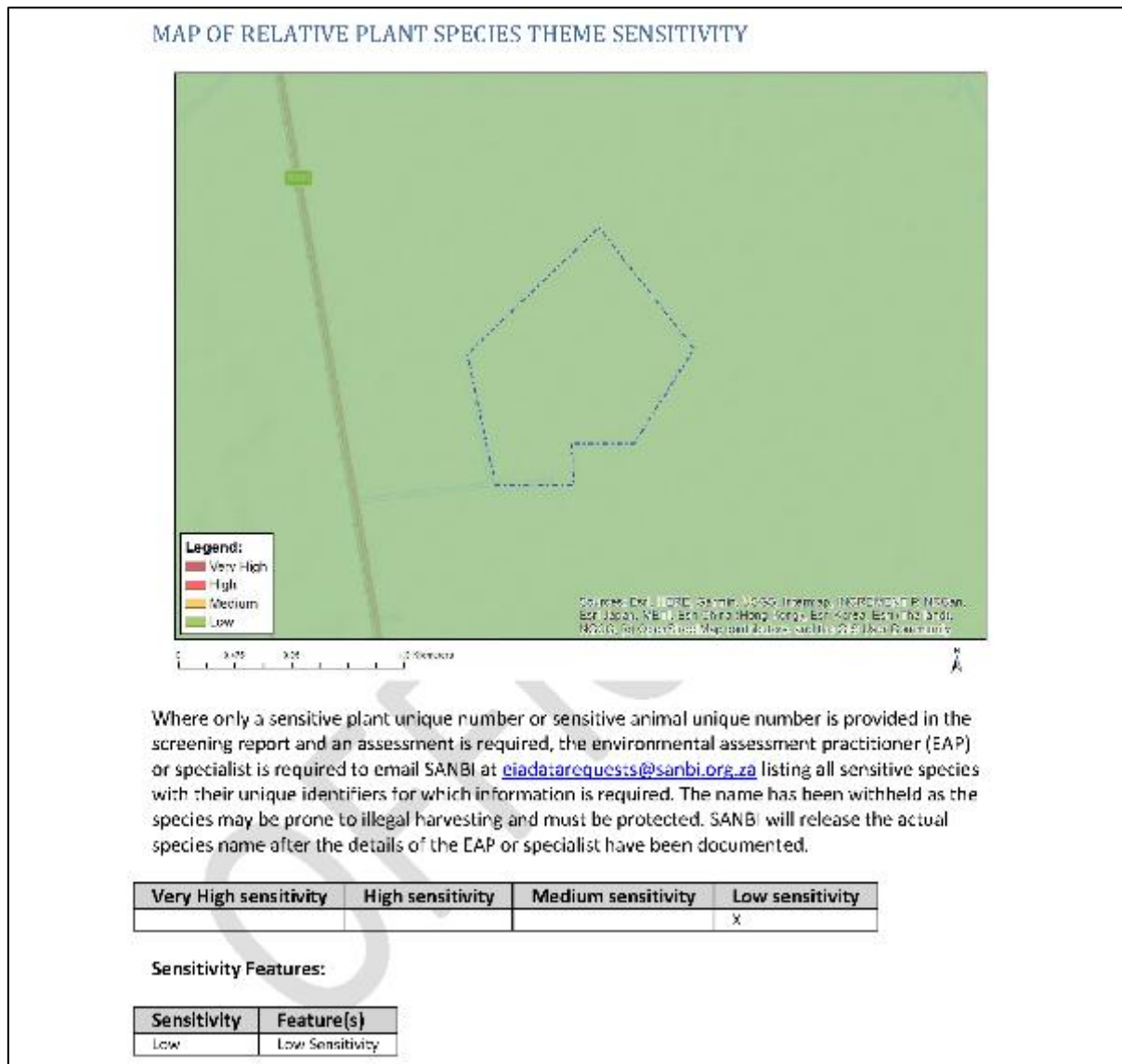


Figure 12: Plant species sensitivity as per the DFFE Screening Tool.

Based on the DFFE Screening Tool and the Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in Terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for EA the site falls within a Low Plant species sensitivity. From the site visit it can be confirmed that the sensitivity of the site is medium.



Based on the DFFE Screening Tool and the Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in Terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation the site falls within a low Terrestrial Biodiversity Sensitivity.

The distribution is within the northern cape province which spans the plains from Kathu and Dibeng in the south, through Hotazel, vicinity of Frylinckspan to the Botswana border roughly between Van Zylsrus and McCarthyrsus. Altitude 960–1 300 m. (Mucina & Rutherford, 2006).

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Vegetation in the proposed site consists of a tree layer, comprised mainly of *Acacia haematoxylon*, *Acacia mellifera*, *Acacia erioloba* and *Grewia flava*, with a grassy understorey consisting mainly of perennial grass species such as *Schmidtia pappophoroides*, *Aristida meridionalis*, *Eragrostis lehmanniana* and *Stipagrostis uniplumis*. There are some occasional shrubs present, such as *Gnidia polycephala*, *Hermannia tomentosa* and *Melolobium macrocalyx*. Other large woody species that occurred at the site as scattered individuals or localized clumps include *Searsia lancea*, *Acacia hebeclada*, *Lycium hirsutum* and *Tarchonanthus camphoratus*.

The proposed site area composed of little variation in the vegetation composition. In some areas, such as the density of trees was somewhat higher, and the grass layer grazed out. However, there were no significant differences visible that warranted recognition as different plant communities within the site. It is possible that the dry conditions at the time of sampling as well as the burnt condition of a large proportion of the site may have hindered the recognition of the different communities within the site.

However, this seems unlikely as the substrate was very homogenous and there was little significant variation in the woody layer.

No individual plant species of the endemic or biogeographically importance were observed during the survey, although it may have previously been found in the larger area.

No red data species potentially occur in the Quarter Degree Square (**QDS**) of the study area according to the Plants of South Africa (**POSA**) database. No other red data species were found in the area.

None of these threatened species were identified during the site inspection.

In terms of protected trees, the National Forest Act (Act no.84 of 1998: National Forest Act, 1998) provides a list of tree species that are considered important in a South African perspective as a result of scarcity, high utilization, common value, etc. In terms of the National Forest Act of 1998, these tree species may not be cut, disturbed, damaged destroyed and their products may not be possessed, collected, removed, transported, exported, donated, purchased, or sold – except under license granted by the Department of Water and Sanitation (**DWS**) (or a delegated authority). Obtaining relevant permits are therefore required prior to any impact on these individuals. Taking cognizance of the data obtained from the field surveys.

Boscia albitrunca, *Acacia haematoxylon*, and *Acacia erioloba* are located within the study area and need to be tagged as these are species of concern and protected under the National Forestry Act, 1998.

No *Boscia albitrunca* was found on site.

From the site visit it can be confirmed that the onsite sensitivity of the site is Medium (grasslands remain, however were impacted upon). The site still has a functional role to play for ecological connectivity.

6.8 Socio-Economic Context

Joe Morolong Local Municipality formerly known as Moshaweng Local Municipality is an average small area spreading over about 20 000 km². It is located in Northern Cape Province of South Africa within John Taolo Gaetsewe District Municipality. The area is mostly rural with about 60% of it comprising virgin land surface. The total population of the area is roughly than 89 000 with only 58% of it being economically active.

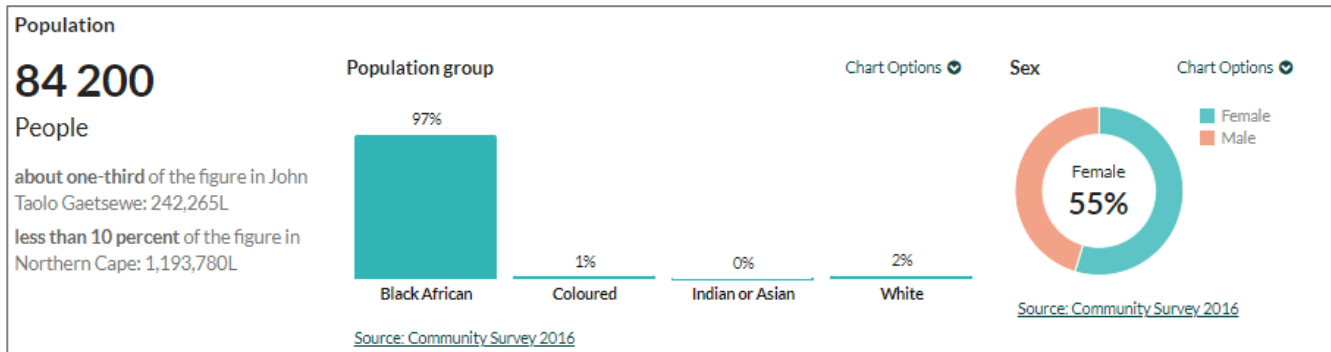


Figure 14: Population breakdown (Community Survey, 2016).

The area has an extremely low employment rate of 16% which are actively largely in the formal sector.

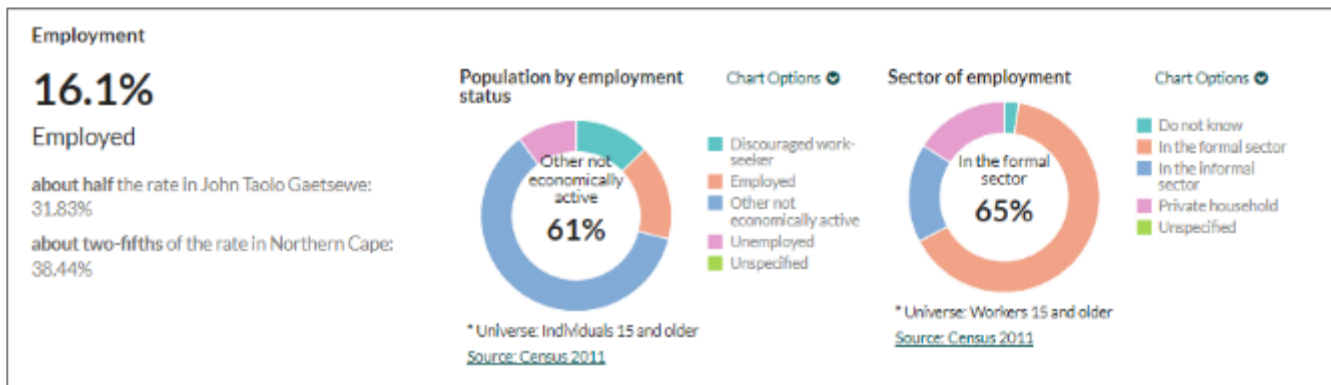


Figure 15: Employment breakdown (Census, 2011).

The annual average income is R30 000 which is on par with the average annual income of the Northern Cape province.

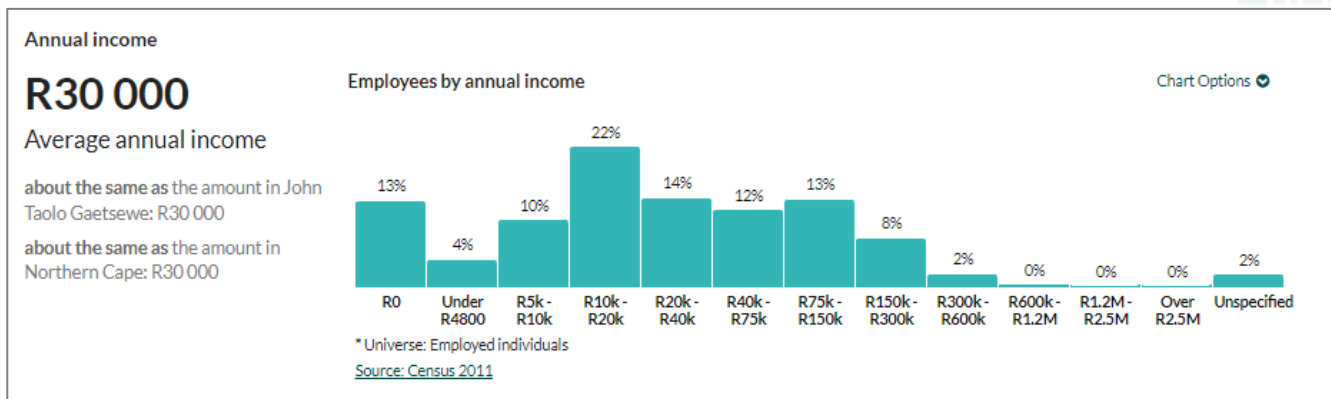


Figure 16: Breakdown of income (*Census, 2011*).

6.9 Visual

The proposed Adams BESS and associated infrastructure will be located directly adjacent to the existing Adams PV Facility.

The proposed BESS will be no greater than 4ha in comparison to the 189ha Adams PV Facility. The proposed BESS facility accounts for 2% of the size of the existing PV facility.

Only the R380 road running past the site is considered sensitive as regular commuters on the road is most likely to be directly exposed to the development, however the impact associated with regular commuters on the R380 road is considered minimal due to the existing facility and the thickets of bush located between the road and proposed site.

In addition, the Adams BESS and associated infrastructure will be located directly adjacent to the already authorised Adams Substation, within the Adams PV Energy Facility.

A visual impact assessment was conducted for the much larger Adams PV Facility where the outcome indicated that a **low** visual impact was determined.

The much larger facility was anticipated to be minimally visible along the R380 road, because of the resulting visual absorption capacity of the bushland native to the area. Because of the fact that viewer frequencies are very limited as well as somewhat obscured by existing power infrastructure, the expected visual impact is considered minimal.

6.10 Agricultural & Soil Potential

Agricultural potential was identified as low in the DFFE Screening Tool Report, this was further conformed through on-site assessment and literature review.

Through the review of the Soil and Agricultural potential study conducted for the Adams 2 PV facility it stated the following:

“Due to the sandy to loamy soils (low water holding capacity) and climatic conditions (low rainfall) of the study area the agricultural potential is considered to be low. The cost associated to prepare the soils for crop production, install irrigation systems as well as taking into consideration the climatic conditions and water constraints would not be practical. The potential loss of grazing land is not considered to be a significant issue as the area is not supportive of high stocking rates. Stocking rates in the region are typically in the order of approximately 22-25 ha/large stock unit (LSU).

There is, however, some mitigation measures that would need to be implemented to prevent and contain erosion associated with soil disruptions during the construction phase. The impact is considered negligible when comparing it, for example, to coal mining on the Highveld which occurs on high agricultural soils and produces similar quantities of electricity)⁶.

⁶ EScience Associates (Pty) Ltd, *Land Use, Soil and Agricultural Potential Assessment*, Proposed Development of a Photo-Voltaic Solar Power Generation Plant on the Farm Adams near Augrabies in the Northern Cape, 2012

7 PUBLIC PARTICIPATION PROCESS

7.1 Description of the Process Undertaken

When undertaking an EIA in terms of NEMA, a formal **public participation process (PPP)** is also undertaken as detailed in Regulations 39-44 of the NEMA EIA Regulations, 2014 (as amended).

As prescribed in the EIA Regulation's in Regulation 40 of Chapter 6, the purpose of public participation in relation to a basic assessment report *must give all potential or registered interested and affected parties, including the competent authority, a period of at least 30 days to submit comments on each of the basic assessment report, EMPr, scoping report and environmental impact assessment report, and where applicable the closure plan, as well as the report contemplated in regulation 32, if such reports or plans are submitted at different times.*

It goes on further to state:

The public participation process contemplated in this regulation must provide access to all information that reasonably has or may have the potential to influence any decision about an application unless access to that information is protected by law and must include consultation with—

- (a) The competent authority.*
- (b) Every State department that administers a law relating to a matter affecting the environment relevant to an application for an environmental authorisation.*
- (c) All organs of state which have jurisdiction in respect of the activity to which the application relates; and*
- (d) All potential, or, where relevant, registered interested and affected parties (I&APs).*

The aim of the public participation process is primarily to ensure that:

- Information containing all relevant facts in respect of the project is made available to potential stakeholders and I&APs.
- Participation by potential I&APs is facilitated in such a manner that all potential stakeholders and I&APs are provided with a reasonable opportunity to comment on the project.
- Comments received from stakeholders and I&APs are recorded and incorporated into the basic assessment report.

Therefore, various stakeholders (Government entities) have been identified and informed, whilst potential I&APs were notified of the project through various platforms, refer to Section 7.3.

All I&APs were provided with the opportunity to register and provide comment on the application and associated documents.

A 30-day registration and commenting period will commence after an application for environmental authorisation has been submitted.

I&APs are afforded the opportunity to register and provide comment throughout the commenting period.

The commenting periods included:

- **Commenting period: 9th November 2022 to 10th December 2022**

Proof of all PPP efforts will be included with this report after the commenting period is completed and a Comments & Response Report (**CCR**) is compiled. The CCR will be included as part of the final submission.

7.2 Identified Interested and Affected Parties (I&APs)

Identification of I&APs was undertaken by NCC through existing contacts and databases, recording responses to site notices and newspaper advertisements, as well as through the process of networking. The key stakeholder groups identified include authorities, the metropolitan municipality, organs of state departments, state-owned companies and non-governmental organisations.

The following I&APs were identified, but not limited to:

Organs of State	
National Government Departments	
•	Department of Forestry, Fisheries, and the Environment (DFFE)
•	Department of Water and Sanitation (DWS)
•	Department of Mineral Resources and Energy (DMRE)
•	Government Bodies and State-Owned Companies
•	South African Heritage Resources Agency (SAHRA)
Provincial Government Departments	
•	Northern Cape Department of Agriculture and Rural Development
•	Northern Cape Department of Economic, Small Business Development, Tourism and Environmental Affairs
•	Department of Environment and Nature Conservation (DENC)
Local Government Departments	
•	Joe Morolong Local Municipality
•	John Taolo Gaetsewe District Municipality
Other Stakeholders	
•	Affected landowners and tenants
•	Ward Councilors
•	Endangered Wildlife Trust
•	Eskom
•	Neighbouring mines
•	National Energy Regulators of South Africa

7.3 Notifications

To accommodate the varying needs of stakeholders and I&APs within the study area, as well as capture their comments regarding the proposed BESS project, various opportunities for stakeholders and I&APs to be involved in the process have been provided, as follows:

- Opportunity to register as an I&AP and review of the draft Basic Assessment Report for a 30-day period. Comments received from I&APs during this period are captured within a Comments and Response Report, which is included within the Final BAR, for submission to the DFFE for final decision.

I&APs will be notified in writing by means of the following:

- Emails
- Bulk SMS
- Advertisement in the Noordkaap Bulletin newspaper
- Site notices (Section 7.3.3) placed up at the site

Notifications to be compiled in accordance with the guidelines provided in the NEMA EIA Regulations.

In addition, a Background Information Document (BID) was provided along with the notification in certain cases. Refer to Appendix J1

7.3.1 Background Information Document (BID) & Notification Letter

A BID and Notification letter will be sent to all pre-identified I&APs highlighting the various avenues to register and provide comment. A copy was supplied to the local Stakeholder Relations Manager (SRM) and/or ward councillors where the residents will be able to review, register, and provide comment.

A copy of the written notice was sent via email to the *relevant organs of state and other potential I&APs*.

Refer to Appendix J4.

7.3.2 Newspaper Advertisement

An advert will be published in **Noordkaap Bulletin** informing the public of the opportunity to register and provide comment for proposed project.

A tear out will be included in the final Draft BAR in Appendix J2

7.3.3 Site Notice

Site notices will be placed at the entrance to the Adams Solar Park facility.

[To be included in Final Draft BAR]

Figure 17: Notice placed at of proposed project.

7.4 Registration & Commenting Period

The draft BAR will be made available for comment to all registered interested and affected parties and relevant organs of state for two periods of 30 days.

Any comments received from I&APs during these periods to be considered and incorporated into the Final BAR through a Comments & Response Report before final submission to the CA (DFFE).

I&APs could obtain the Draft BAR and associated documents from the following:

- www.ncc-group.co.za
- Adams Solar Park Security Office

The registration and comment period will run from 10th November 2022 to 10th December 2022

7.5 Summary of Issues Raised by I&APs

All comments, if received, are responded to in a Comments and Response Report.

A Comments and Response Summary will be attached as Appendix G6 with the submission of the Final Draft BAR.

A summary of all the issues and / or concerns that will be received from I&APs will be presented in a table format.

Copies of the full submissions will be in the final Draft BAR.

8 ENVIRONMENTAL MANAGEMENT PROGRAMME

The EMPr indicates the roles and responsibilities of all parties involved during all phases of the development. This legally binding document will provide recommendations for the implementation of avoidance strategies (where possible) and mitigation and management measures (if required) to ensure that the project retains an acceptable environmental impact and considers all highly sensitive features located within the project site.

As the applicant has the responsibility to avoid or minimise impacts and plan for their management (in terms of the EIA Regulations), the mitigation of significant impacts is required to be recommended. Assessment of impacts with mitigation are made to demonstrate the effectiveness of the proposed mitigation measures.

Refer to **Appendix F** for the complete standalone EMPr.

9 METHODOLOGY AND ASSESSMENT OF ALTERNATIVES

9.1 Methodology to determine the significance ratings of the potential environmental impacts and risks associated with the alternatives.

A standard methodology was used in the environmental impact assessment to determine the significance rating of the potential impacts (direct, indirect and cumulative), as outlined in this section.

9.1.1 Significance

The **significance** of an impact is defined as the combination of the **consequence** of the impact occurring and the **probability** that the impact will occur. The nature and type of impact may be direct or indirect and may also be positive or negative Refer to 10-16 below for the specific definitions.

Table 15: Nature and type of impact.

IMPACT	Nature and Type of Impact		
	Direct	Impacts that are caused directly by the activity and generally occur at the same time and place as the activity	
	Indirect	Indirect or induced changes that may occur because of the activity. These include all impacts that do not manifest immediately when the activity is undertaken, or which occur at a different place as a result of the activity	
	Cumulative	Those impacts associated with the activity which add to, or interact synergistically with existing impacts of past or existing activities, and include direct or indirect impacts which accumulate over time and space	
	Positive	Impacts affect the environment in such a way that natural, cultural and / or social functions and processes will benefit significantly, and includes neutral impacts (those that are not considered to be negative)	+
	Negative	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will be comprised	-

Table 16 Table 16 presents the defined criteria used to determine the **consequence** of the impact occurring which incorporates the extent, duration, and intensity (severity) of the impact.

Table 16: Consequence of the Impact occurring.

CONSEQUENCE	Extent of Impact:	
	Site	Impact is limited to the site and immediate surroundings, within the study site boundary or property (immobile impacts)
	Neighbouring	Impact extends across the site boundary to adjacent properties (mobile impacts)
	Local	Impact occurs within a 5km radius of the site
	Regional	Impact occurs within a provincial boundary
	National	Impact occurs across one or more provincial boundaries
	Duration of Impact:	
	Incidental	The impact will cease almost immediately (within weeks) if the activity is stopped, or may occur during isolated or sporadic incidences
	Short-term	The impact is limited to the construction phase, or the impact will cease within 1 - 2 years if the activity is stopped
	Medium-term	The impact will cease within 5 years if the activity is stopped
	Long-term	The impact will cease after the operational life of the activity, either by natural processes or by human intervention
	Permanent	Where mitigation either by natural process or by human intervention will not occur in such a way or in such a time span that the impact can be considered transient
	Intensity or Severity of Impact:	
	Low	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are not affected
	Low-Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are modified insignificantly
	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are altered
	Medium-High	Impacts affect the environment in such a way that natural, cultural and / or social functions and processes are severely altered
	High	Impacts affect the environment in such a way that natural, cultural and / or social functions and processes will permanently cease

The probability of the impact occurring is the likelihood of the impacts occurring and is determined based on the classification provided in **Table 17**.

Table 17: Probability and confidence of impact prediction.

PROBABILITY	Probability of Potential Impact Occurrence:	
	Improbable	The possibility of the impact materialising is very low either because of design or historic experience
	Possible	The possibility of the impact materialising is low either because of design or historic experience
	Likely	There is a possibility that the impact will occur
	Highly Likely	There is a distinct possibility that the impact will occur
	Definite	The impact will occur regardless of any prevention measures

The **significance** of the impact is determined by considering the consequence and probability without considering any mitigation or management measures and is then ranked according to the ratings listed in Table 18. The level of confidence associated with the impact prediction is also considered as low, medium, or high (Table 19).

Table 18: Significance rating of the impact.

SIGNIFICANCE	Significance Ratings:	
	Low	Neither environmental nor social and cultural receptors will be adversely affected by the impact. Management measures are usually not provided for low impacts
	Low-Medium	Management measures are usually encouraged to ensure that the impacts remain of Low-Medium significance. Management measures may be proposed to ensure that the significance ranking remains low-medium
	Medium	Natural, cultural and/or social functions and processes are altered by the activities, and management measures must be provided to reduce the significance rating
	Medium-High	Natural, cultural and/or social functions and processes are altered significantly by the activities, although management measures may still be feasible
	High	Natural, cultural, and/or social functions and processes are adversely affected by the activities. The precautionary approach will be adopted for all high significant impacts and all possible measures must be taken to reduce the impact

Table 19: Level of confidence of the impact prediction.

CONFIDENCE	Level of Confidence in the Impact Prediction:	
	Low	Less than 40% sure of impact prediction due to gaps in specialist knowledge and/or availability of information
	Medium	Between 40 and 70% sure of impact prediction due to limited specialist knowledge and/or availability of information
	High	Greater than 70% sure of impact prediction due to outcome of specialist knowledge and/or availability of information

Once significance rating has been determined for each impact, management and mitigation measures must be determined for all impacts that have a significance ranking of Medium and higher to attempt to reduce the level of significance that the impact may reflect.

The EIA Regulations, 2014 (as amended) specifically require a description be provided of the degree to which these impacts:

- Can be reversed
- May cause irreplaceable loss of resources
- Can be avoided, managed, or mitigated

Based on the proposed mitigation measures the EAP will determine a mitigation efficiency (**Table 20**) whereby the initial significance is re-evaluated and ranked again to affect a significance that incorporates the mitigation based on its effectiveness. The overall significance is then re-ranked, and a final significance rating is determined.

Table 20: Mitigation efficiency.

MITIGATION EFFICIENCY	Mitigation Efficiency	
	None	Not applicable
	Very Low	Where the significance rating stays the same, but where mitigation will reduce the intensity of the impact. Positive impacts will remain the same
	Low	Where the significance rating reduces by one level, after mitigation
	Medium	Where the significance rating reduces by two levels, after mitigation
	High	Where the significance rating reduces by three levels, after mitigation
	Very High	Where the significance rating reduces by more than three levels, after mitigation

The reversibility is directly proportional to the “*Loss of Resource*” where no loss of resource is experienced, the impact is completely reversible; where a substantial “*Loss of resource*” is experienced there is a medium degree of reversibility; and an irreversible impact relates to a complete loss of resources, i.e. irreplaceable (Table 16).

Table 21: Degree of reversibility and loss of resources.

DEGREE REVERSABILITY & LOSS OF RESOURCES	Loss of Resources:	
	No Loss	No loss of social, cultural and/or ecological resource(s) are experienced. Positive impacts will not experience resource loss
	Partial	The activity results in an insignificant or partial loss of social, cultural and/or ecological resource(s)
	Substantial	The activity results in a significant loss of social, cultural and/or ecological resource(s)
	Irreplaceable	The activity results in the complete and irreplaceable social, cultural and/or ecological loss of resource(s)
	Reversibility:	
	Irreversible	Impacts on natural, cultural and/or social functions and processes are irreversible to the pre-impacted state in such a way that the application of resources will not cause any degree of reversibility
	Medium Degree	Impacts on natural, cultural and/or social functions and processes are partially reversible to the pre-impacted state if less than 50% resources are applied
	High Degree	Impacts on natural, cultural and/or social functions and processes are partially reversible to the pre-impacted state if more than 50% resources are applied
	Reversible	Impacts on natural, cultural and/or social functions and processes are fully reversible to the pre-impacted state if adequate resources are applied

9.1.2 Cumulative Impacts

It is important to assess the natural environment using a systems approach that will consider the cumulative impact of various actions. Cumulative impact refers to the impact on the environment, which results from the incremental impact of the actions when added to other past, present, and reasonably foreseeable future actions regardless of what agencies or persons undertake such actions. Cumulative impacts can result from individually minor, but collectively significant actions or activities taking place over a period. Cumulative effects can take place frequently and over a period that the effects cannot be assimilated by the environment.

9.2 Mitigation

An EMPr has been developed based on the findings of the impact assessment of the EIA. This will be amended if any significant comments come from the PPP.

The EMPr will be compiled as a site-specific mitigation measure for all medium to high (significant) impacts.

9.3 Impact Assessment

The negative and positive impacts assessed in this section has already occurred and will therefore be assigned two assessment ratings, namely the impact rating assigned to the status (without mitigation) and the impact significance after the management measures have been implemented (with mitigation).

Management measures for the above-described impacts are discussed in the Table 22: Preferred Alternative - Construction. Table 22: Preferred Alternative - Construction.below. A re-evaluation of the impacts has been made after consideration of implementing the management measures.

Table 22: Preferred Alternative - Construction.

PREFERRED ALTERNATIVE - CONSTRUCTION PHASE											
Aspects	IMPACTS				SIGNIFICANCE (WOM)	CONFIDENCE	MANAGEMENT & MITIGATION MEASURES	MITIGATION EFFICIENCY	SIGNIFICANCE (WM)	DEGREE	
	TYPE	DESCRIPTION	CUMULATIVE	NATURE						LOSS RESOURCE	REVERSABILITY
Soil Alteration	Direct	Erosion and topsoil loss	No	Negative	Low	High	<ul style="list-style-type: none"> Minimize the amount of land disturbance and develop and implement stringent erosion and dust control practices. Institute a stormwater management plan including strategies. Install detention or retention facilities with graduated outlet control structures, if necessary. Have both temporary (during construction) and permanent erosion control plans. Limitations on access for heavy machinery and the storage of materials to avoid soil compaction. Permanent erosion control plans should focus on the establishment of stable native vegetation communities. Ensure the amount of bare soil exposed is minimized by staging earthworks in phases and leaving as much ground cover intact as possible during construction. Protect all areas susceptible to erosion and ensure that there is no undue soil erosion resultant from activities within and adjacent to the construction camp and Work Areas. Repair all erosion damage as soon as possible and in any case not later than six months before the termination of the Maintenance Period to allow for sufficient rehabilitation growth. 	Medium	Low	Partial	High Degree
	Indirect	Loss of land capability	No	Negative	Medium-High	High	<ul style="list-style-type: none"> Impact on the land lost capability is expected to be minimal. Monitor disturbed areas for signs of erosion. Store topsoil stockpiles in the most appropriate method possible in consultation with onsite Environmental personnel. 	None	Medium-High	Substantial	Medium Degree
	Direct	Clearing of vegetation	Yes	Negative	Medium-High	Medium	<ul style="list-style-type: none"> The impact on the environment is expected to be medium as the area is in a rural setting. 	High	Low	Partial	High Degree
	Direct	Soil contamination	No	Negative	Low	Medium	<ul style="list-style-type: none"> Measures will be implemented to ensure that no hydrocarbons and/or other pollutant liquids are spilt, and if so, they are contained, and a clean-up protocol followed. No hydrocarbons are to be stored with water course or within proximity. 	High	Low	Partial	High Degree
Resource Consumption	Direct	Water consumption	No	Negative	Low	High	<ul style="list-style-type: none"> Monitor water usage. Ensure not leaking infrastructure, such as pipes, taps, etc. 	Medium	Low	Partial	High Degree
	Indirect	Fuel consumption	No	Negative	Low	High	<ul style="list-style-type: none"> All construction vehicles will be maintained such as to operate efficiently. Idling times of machinery to be minimised. 	Medium	Low	Partial	High Degree
	Indirect	Raw materials consumption	No	Negative	Low	High	<ul style="list-style-type: none"> Raw materials will be used efficiently. Recycled material should be used where possible. 	Low	Low	Partial	High Degree
Effects on Terrestrial Biodiversity	Direct	Direct habitat destruction	Yes	Negative	Medium	High	<ul style="list-style-type: none"> The impact on the loss of habitat will be limited to footprint of the site. Search & Rescue prior to clearing of area is recommended. 	Low	Medium	Substantial	Medium Degree
	Direct	Habitat fragmentation	No	Negative	Medium	Medium	<ul style="list-style-type: none"> Use existing facilities (e.g., access roads, degraded areas) to the extent possible to minimize the amount of new disturbance. Ensure protection of important resources by establishing protective buffers to exclude unintentional disturbance. All possible efforts must be made to ensure as little disturbance as possible to the sensitive habitats on site during construction. During construction, sensitive habitats must be avoided by construction vehicles and equipment, wherever possible, in order to reduce potential impacts. 	Low	Medium	Substantial	Medium Degree
	Direct	Spread and establishment of alien invasives	Yes	Negative	Medium	Medium	<ul style="list-style-type: none"> Institute strict control over materials brought onto site, which should be inspected for potential invasive invertebrate species and steps taken to eradicate these before transport to the site. Rehabilitate disturbed areas as quickly as possible to reduce the area where invasive species would be at a strong advantage and most easily able to establish. Institute a monitoring programme to detect alien invasive species early, before they become established and, in the case of weeds, before the release of seeds. Institute an eradication/control programme for early intervention if invasive species are detected, so that their spread to surrounding natural ecosystems can be prevented. 	Medium	Medium	Substantial	Medium Degree

	Direct	Displacement of faunal community	No	Negative	Medium-High	Medium	<ul style="list-style-type: none"> The removal of the isolated indigenous trees and shrubs should only occur on the footprint area of the development and not over the larger area. No trees may be trimmed or removed without the prior permission of the landowner. Clearly demarcate the entire development footprint prior to initial site clearance and prevent construction personnel from leaving the demarcated area. Monitoring should be implemented during the construction phase to ensure that minimal impact is caused to the fauna of the area. The Environment Officer (EO) should advise the construction team in all relevant matters to ensure minimum destruction and damage to the environment. The EO should enforce any measures that he/she deem necessary. Regular environmental training should be provided to construction workers to ensure the protection of the habitat, fauna and flora and their sensitivity to conservation. Where trenches pose a risk to animal safety, they should be adequately cordoned off to prevent animals falling in and getting trapped and/or injured. This could be prevented by the constant excavating and backfilling of trenches during pipeline construction. Poisons for the control of problem animals should rather be avoided since the wrong use thereof can have disastrous consequences for the raptors occurring in the area. The use of poisons for the control of rats, mice or other vermin should only be used after approval from an ecologist. Furthermore, a maintenance management plan should be developed for the control of termites already within the PV facility and outside in the study area. 	Medium	Medium	Partial	Medium Degree
Incidents, Accidents and Potential Emergency Situations	Direct	Pollution incidents	No	Negative	Medium	Medium	<ul style="list-style-type: none"> Compilation of incident management plan. Conduct toolbox talks. Ensure plant and equipment are in good working order. Store all hazardous materials in an appropriate manner, banded impermeable surface. 	Medium	Low	Substantial	Medium Degree
	Direct	Traffic Incidents	No	Negative	Medium-High	Medium	<ul style="list-style-type: none"> Installation of safety barriers. Installation of warning traffic signs. Traffic management plan as per EMPr ETC. 	Medium	Medium	Partial	High Degree
	Direct	Storage of hydrocarbons	No	Negative	Low	Medium	<ul style="list-style-type: none"> All hazardous materials will be stored in a banded and lockable area. Material Safety Data Sheet (MSDS) sheets will be available for all hazardous products. 	High	Low	Substantial	Medium Degree
	Direct	Fire	No	Negative	Medium-High	Medium	<ul style="list-style-type: none"> Fire and emergency plans will be implemented during construction. Adequate firefighting equipment will be instituted as recommended. 	Medium	Medium	Substantial	Medium Degree
Social	Direct	Visual impact	No	Negative	Low - Medium	Medium	<ul style="list-style-type: none"> Ensure all disturbed areas are rehabilitated accordingly. Vegetation is to be reinstate where possible. 	Low	Low	No Loss	High Degree
	Direct	Traffic Safety	No	Negative	Medium-High	Medium	<ul style="list-style-type: none"> Site security will ensure that the site is secured, and only authorised access allowed. Safety signal erected on approach to the facility. Incorporation traffic safety and rules into induction. Include traffic safety into toolbox talks. 	High	Medium	Partial	High Degree
Economic	Direct	Sustain provision of energy into the national grid	Yes	Positive	High (-ve)	High	<ul style="list-style-type: none"> Construction on site will provide employment and skills to the local community. The local economy will benefit in terms of supply of building materials and services. 	Very High	High (+ve)	No Loss	N/A
	Direct	Temporary Employment	Yes	Positive	Medium - High	Medium	<ul style="list-style-type: none"> Construction on site will provide employment and skills to the local community. Wherever possible labour, materials and services will be sourced locally. 	High	High	No Loss	N/A
Heritage Resources	Direct	Discovery of archaeological deposits and loss of or discovery of heritage resources	No	Negative	Low - Medium	Medium	<ul style="list-style-type: none"> Demarcate find and manage via the Chance Find Procedure. If sub-surface archaeological material is discovered work must stop and a heritage practitioner preferably an archaeologist contacted to assess the find and make recommendations. 	Low	Low	No Loss	High Degree
	Direct	Discovery of graves or burial grounds and loss of or discovery of heritage resources	No	Negative	Low - Medium	Medium	<ul style="list-style-type: none"> Demarcate find and manage via the Chance Find Procedure. If sub-surface graves are discovered work should stop and a professional preferably an archaeologist contacted to assess the age of the grave/graves and to advice on the way forward. 	Low	Low	No Loss	High Degree
Atmospheric Emissions	Direct	Dust Nuisance	No	Negative	Medium	Medium	<ul style="list-style-type: none"> Dust suppression measures will be implemented during the construction phase to minimise dust generated by construction activities. 	High	Low	No Loss	Reversible
	Indirect	Noise Pollution	No	Negative	Medium	Medium	<ul style="list-style-type: none"> All construction vehicles will be maintained such as to operate efficiently. 	High	Low	No Loss	Reversible

							<ul style="list-style-type: none"> Operations shall not occur before or after normal working hours. Standard/Factory fitted noise mufflers should be utilized to reduced noise. Keep an open channel of communication between all stakeholders and keep record of any concerns raised. 				
Effects on Groundwater System	Direct	Contamination	low to moderate	Negative	Medium	Medium	<ul style="list-style-type: none"> Clearly demarcate the construction footprint and restrict all activities to within this area. Appropriately contain any generators, fuel storage tanks, machinery spills (e.g., accidental spills of hydrocarbons oils, diesel etc.) or construction materials on site (e.g., cement) in such a way as to prevent them leaking and entering the soil and groundwater. Adhere to conditions of EA and EMPr. Design of infrastructure by a competent engineer. Develop a method statement for the handling and transportation of the battery components and electrolytes. All cargo must be checked and transported to the site by authorised, appropriately qualified technician(s). 	High	Low	None	N/A
	Direct	Impaired water quality	Yes	Negative	Medium	Medium	<ul style="list-style-type: none"> If flow batteries are used for the BESS, a primary and secondary containment system should be placed around the BESS. This should include a bunded platform which can contain up to 110% of the liquid contents. Training and suitably equipping of staff to deal with emergencies (fires, floods, explosions, etc). Design of an adequate stormwater drainage system and energy dissipation structures (e.g., stone-pitching, grassed earth berms) to re-direct and allow natural rainfall to percolate into surrounding vegetated surfaces and enter the sub-surface soil layer. 	Medium	Low	Partial	Reversible
Waste Generation	Direct	Domestic waste	No	Negative	Low	Medium	<ul style="list-style-type: none"> A waste management system to be formulated and implemented on site. All employees will be subjected to induction to understand the environmental management requirement on site. Domestic waste will be removed from to a landfill facility. Waste disposal certificates will be kept on record. 	Medium	Low	Partial	High Degree
	Direct	Construction waste	No	Negative	Low	Medium	<ul style="list-style-type: none"> All construction waste will be placed in a demarcated area and disposed of accordingly. This area will be bermed to prevent the dispersal of said waste by wind and rain. Waste disposal certificates will be kept on record. 	Medium	Low	Partial	High Degree
	Direct	Hazardous waste	No	Negative	Low	Medium	<ul style="list-style-type: none"> All hazardous waste will be stored in a bunded and lockable area. Hazardous waste will be removed from the site by a certified waste contractor. Waste disposal certificates will be kept on record. 	Medium	Low	Partial	High Degree

Table 23: Preferred Alternative - Operations.

PREFERRED ALTERNATIVE – OPERATIONAL PHASE											
Aspect	IMPACTS				SIGNIFICANCE (WOM)	CONFIDENCE	MANAGEMENT & MITIGATION MEASURES	MITIGATION EFFICIENCY	SIGNIFICANCE (WM)	DEGREE	
	TYPE	DESCRIPTION	CUMULATIVE	NATURE						LOSS RESOURCE	REVERSABILITY
Atmospheric Emissions	Direct	Dust Nuisance	No	Negative	Medium	Medium	<ul style="list-style-type: none"> Dust suppression measures will be implemented during the operational phase to minimise dust generated by activities. 	High	Low	No Loss	Reversible
	Indirect	Noise Pollution	No	Negative	Medium	Medium	<ul style="list-style-type: none"> All construction vehicles will be maintained such as to operate efficiently. Operations shall not occur before or after normal working hours. Noise mufflers should be utilized to reduced noise. Keep an open channel of communication between all stakeholders and keep record of any concerns raised. 	High	Low	No Loss	Reversible
Effects on Terrestrial Biodiversity	Direct	Obstruction of Ecological Corridors	No	Negative	High	Medium	<ul style="list-style-type: none"> Waste should be managed as not to be aesthetically appealing or attract pests or rodents. Control of alien invasive plants is encouraged. Rehabilitation and landscaping with indigenous vegetation within the development should be encouraged and made a condition within the Environmental Authorisation. Mitigation Measure Objectives for biodiversity. 	High	Medium	No Loss	Reversible
	Indirect	Noise Pollution	No	Negative	High	Medium	<ul style="list-style-type: none"> All construction vehicles will be maintained such as to operate efficiently. Operations shall not occur before or after normal working hours. Noise mufflers should be utilized to reduced noise. Keep an open channel of communication between all stakeholders and keep record of any concerns raised. 	High	Medium	No Loss	Reversible
Waste Generation	Direct	Domestic waste	No	Negative	Medium	Medium	<ul style="list-style-type: none"> A waste management system to be formulated and implemented on site. All employees will be subjected to induction to understand the environmental management requirement on site. Domestic waste will be removed from to a landfill facility. Waste disposal certificates will be kept on record. 	Medium	Low	Partial	Reversible
	Direct	Hazardous waste	No	Negative	Medium	Medium	<ul style="list-style-type: none"> All hazardous waste will be stored in a bunded and lockable area. Hazardous waste will be removed from the site by a certified waste contractor. Waste disposal certificates to be kept on record. 	Medium	Low	Partial	High Degree
Resource Consumption	Direct	Water consumption	No	Negative	Low	High	<ul style="list-style-type: none"> Monitor water usage. Ensure not leaking infrastructure, such as pipes, taps, etc. 	Medium	Low	Partial	Reversible
	Indirect	Fuel consumption	No	Negative	Medium	High	<ul style="list-style-type: none"> All vehicles will be maintained such as to operate efficiently. Idling times of machinery to be minimised. 	Medium	Low	Partial	Medium Degree
	Indirect	Raw materials consumption	No	Negative	Medium	High	<ul style="list-style-type: none"> Raw materials will be used efficiently. Recycled material should be used where possible. 	Low	Low	Partial	Medium Degree
Soil Alteration	Direct	Erosion and topsoil loss	No	Negative	Medium	High	<ul style="list-style-type: none"> Minimize the amount of land disturbance and develop and implement stringent erosion and dust control practices. Institute a stormwater management plan including strategies. Install detention or retention facilities with graduated outlet control structures, if necessary. Limitations on access for heavy machinery and the storage of materials to avoid soil compaction. Permanent erosion control plans should focus on the establishment of stable native vegetation communities. Protect all areas susceptible to erosion and ensure that there is no undue soil erosion resultant from activities within the facility. Repair all erosion damage as soon as possible and in any case not later than six months before the termination of the Maintenance Period to allow for sufficient rehabilitation growth. 	Medium	Low	Partial	High Degree
	Direct	Soil contamination	No	Negative	Medium	Medium	<ul style="list-style-type: none"> Measures will be implemented to ensure that no hydrocarbons and/or other pollutant liquids are spilt, and if so, they are contained, and a clean-up protocol followed. No hydrocarbons are to be stored with water course or within proximity. 	High	Low	Partial	High Degree
Incidents, Accidents and Potential	Direct	Pollution incidents	No	Negative	High	Medium	<ul style="list-style-type: none"> Compilation of incident management plan. Conduct toolbox talks. Ensure plant and equipment are in good working order. 	Medium	Medium	Substantial	Medium Degree

Emergency Situations							<ul style="list-style-type: none"> Store all hazardous materials in an appropriate manner, bunded impermeable surface. 				
	Direct	Traffic Incidents	No	Negative	High	Medium	<ul style="list-style-type: none"> Installation of safety barriers. Installation of warning traffic signs. 	Medium	Medium	Substantial	High Degree
	Direct	Storage of hydrocarbons	No	Negative	High	Medium	<ul style="list-style-type: none"> All hazardous materials will be stored in a bunded and lockable area. Material Safety Data Sheet (MSDS) sheets will be available for all hazardous products. 	High	Medium	Substantial	Medium Degree
	Direct	Fire	No	Negative	High	Medium	<ul style="list-style-type: none"> Fire and emergency plans will be implemented during operations. Adequate firefighting equipment will be instituted as recommended. 	Medium	Medium	Substantial	Medium Degree

Table 24: Alternative 1 - Construction.

CONSTRUCTION PHASE											
ASPECT	IMPACTS				SIGNIFICANCE (WOM)	CONFIDENCE	MANAGEMENT & MITIGATION MEASURES	MITIGATION EFFICIENCY	SIGNIFICANCE (WM)	DEGREE	
	TYPE	DESCRIPTION	CUMULATIVE	NATURE						LOSS RESOURCE	REVERSABILITY
Incidents, Accidents and Potential Emergency Situations	Direct	Pollution incidents	No	Negative	Medium	Medium	<ul style="list-style-type: none"> Compilation of incident management plan. Conduct toolbox talks. Ensure plant and equipment are in good working order. Store all hazardous materials in an appropriate manner, bunded impermeable surface. 	Medium	Low	Substantial	Medium Degree
	Direct	Traffic Incidents	No	Negative	Medium-High	Medium	<ul style="list-style-type: none"> Installation of safety barriers. Installation of warning traffic signs. 	Medium	Medium	Partial	High Degree
	Direct	Storage of hydrocarbons	No	Negative	Low	Medium	<ul style="list-style-type: none"> All hazardous materials will be stored in a bunded and lockable area. Material Safety Data Sheet (MSDS) sheets will be available for all hazardous products. 	High	Low	Substantial	Medium Degree
	Direct	Fire	No	Negative	Medium-High	Medium	<ul style="list-style-type: none"> Fire and emergency plans will be implemented during construction. Adequate firefighting equipment will be instituted as recommended. 	Medium	Medium	Substantial	Medium Degree
Social	Direct	Visual impact	No	Negative	Low - Medium	Medium	<ul style="list-style-type: none"> Ensure all disturbed areas are rehabilitated accordingly. Vegetation is to be reinstate where possible. 	Low	Low	No Loss	High Degree
	Direct	Traffic Safety	No	Negative	Medium-High	Medium	<ul style="list-style-type: none"> Site security will ensure that the site is secured, and only authorised access allowed. Safety signal erected on approach to the facility. Incorporation traffic safety and rules into induction. Include traffic safety into toolbox talks. 	High	Medium	Partial	High Degree
Economic	Direct	Sustained provision of energy into the national grid	Yes	Positive	High (-ve)	High	<ul style="list-style-type: none"> Construction on site will provide employment and skills to the local community. The local economy will benefit in terms of supply of building materials and services. 	Very High	High (+ve)	No Loss	N/A
	Direct	Temporary Employment	Yes	Positive	Medium - High	Medium	<ul style="list-style-type: none"> Construction on site will provide employment and skills to the local community. Wherever possible labour, materials and services will be sourced locally. 	High	High	No Loss	N/A
Heritage Resource	Direct	Discovery of archaeological deposits and loss of or discovery of heritage resources	No	Negative	Low - Medium	Medium	<ul style="list-style-type: none"> Demarcate find and manage via the Chance Find Procedure. If sub-surface archaeological material is discovered work must stop and a heritage practitioner preferably an archaeologist contacted to assess the find and make recommendations. 	Low	Low	No Loss	High Degree
	Direct	Discovery of graves or burial grounds and loss of or discovery of heritage resources	No	Negative	Low - Medium	Medium	<ul style="list-style-type: none"> Demarcate find and manage via the Chance Find Procedure. If sub-surface graves are discovered work should stop and a professional preferably an archaeologist contacted to assess the age of the grave/graves and to advice on the way forward. 	Low	Low	No Loss	High Degree
Soil Alteration	Direct	Erosion and topsoil loss	No	Negative	Low	High	<ul style="list-style-type: none"> Minimize the amount of land disturbance and develop and implement stringent erosion and dust control practices. Institute a stormwater management plan including strategies. Install detention or retention facilities with graduated outlet control structures, if necessary. Have both temporary (during construction) and permanent erosion control plans. Limitations on access for heavy machinery and the storage of materials to avoid soil compaction. Permanent erosion control plans should focus on the establishment of stable native vegetation communities. Ensure the amount of bare soil exposed is minimized by staging earthworks in phases and leaving as much ground cover intact as possible during construction. Protect all areas susceptible to erosion and ensure that there is no undue soil erosion resultant from activities within and adjacent to the construction camp and Work Areas. Repair all erosion damage as soon as possible and in any case not later than six months before the termination of the Maintenance Period to allow for sufficient rehabilitation growth. 	Medium	Low	Partial	High Degree
	Indirect	Loss of land capability	No	Negative	Medium-High	High	<ul style="list-style-type: none"> Impact on the land lost capability is expected to be minimal. Monitor disturbed areas for signs of erosion. Store topsoil stockpiles in the most appropriate method possible in consultation with onsite Environmental personnel. 	None	Medium-High	Substantial	Medium Degree
	Direct	Clearing of vegetation	Yes	Negative	Medium-High	Medium	<ul style="list-style-type: none"> The impact on the environment is expected to be medium as the area is in a rural setting. 	High	Low	Partial	High Degree

	Direct	Soil contamination	No	Negative	Low	Medium	<ul style="list-style-type: none"> Measures will be implemented to ensure that no hydrocarbons and/or other pollutant liquids are spilt, and if so, they are contained, and a clean-up protocol followed. No hydrocarbons are to be stored with water course or within proximity. 	High	Low	Partial	High Degree
Resource Consumption	Direct	Water consumption	No	Negative	Low	High	<ul style="list-style-type: none"> Monitor water usage. Ensure not leaking infrastructure, such as pipes, taps, etc. 	Medium	Low	Partial	High Degree
	Indirect	Fuel consumption	No	Negative	Low	High	<ul style="list-style-type: none"> All construction vehicles will be maintained such as to operate efficiently. Idling times of machinery to be minimised. 	Medium	Low	Partial	High Degree
	Indirect	Raw materials consumption	No	Negative	Low	High	<ul style="list-style-type: none"> Raw materials will be used efficiently. Recycled material should be used where possible. 	Low	Low	Partial	High Degree
Effects on Terrestrial Biodiversity	Direct	Direct habitat destruction	Yes	Negative	High	High	<ul style="list-style-type: none"> The impact on the loss of habitat will be limited to the servitude of the interchange development. Search & Rescue prior to clearing of area is recommended. 	Low	Medium	Substantial	Medium Degree
	Direct	Habitat fragmentation	No	Negative	Medium	Medium	<ul style="list-style-type: none"> Use existing facilities (e.g., access roads, degraded areas) to the extent possible to minimize the amount of new disturbance. Ensure protection of important resources by establishing protective buffers to exclude unintentional disturbance. All possible efforts must be made to ensure as little disturbance as possible to the sensitive habitats on site during construction During construction, sensitive habitats must be avoided by construction vehicles and equipment, wherever possible, in order to reduce potential impacts. 	Low	Low	Substantial	Medium Degree
	Direct	Spread and establishment of alien invasives	Yes	Negative	Low	Medium	<ul style="list-style-type: none"> Institute strict control over materials brought on to site, which should be inspected for potential invasive invertebrate species and steps taken to eradicate these before transport to the site. Rehabilitate disturbed areas as quickly as possible to reduce the area where invasive species would be at a strong advantage and most easily able to establish. Institute a monitoring programme to detect alien invasive species early, before they become established and, in the case of weeds, before the release of seeds. Institute an eradication/control programme for early intervention if invasive species are detected, so that their spread to surrounding natural ecosystems can be prevented. 	Medium	Low	Substantial	Medium Degree
Atmospheric Emissions	Direct	Dust Nuisance	No	Negative	Low	Medium	<ul style="list-style-type: none"> Dust suppression measures will be implemented during the construction phase to minimise dust generated by construction activities. 	High	Low	No Loss	Reversible
	Indirect	Noise Pollution	No	Negative	Low	Medium	<ul style="list-style-type: none"> All construction vehicles will be maintained such as to operate efficiently. Operations shall not occur before or after normal working hours. Noise mufflers should be utilized to reduced noise. Keep an open channel of communication between all stakeholders and keep record of any concerns raised. 	High	Low	No Loss	Reversible
Waste Generation	Direct	Domestic waste	No	Negative	Low	Medium	<ul style="list-style-type: none"> A waste management system to be formulated and implemented on site. All employees will be subjected to induction to understand the environmental management requirement on site. Domestic waste will be removed from to a landfill facility. Waste disposal certificates will be kept on record. 	Medium	Low	Partial	High Degree
	Direct	Construction waste	No	Negative	Low	Medium	<ul style="list-style-type: none"> All construction waste will be placed in a demarcated area and disposed of accordingly. This area will be bermed to prevent the dispersal of said waste by wind and rain. Waste disposal certificates will be kept on record. 	Medium	Low	Partial	High Degree
	Direct	Hazardous waste	No	Negative	Low	Medium	<ul style="list-style-type: none"> All hazardous waste will be stored in a bunded and lockable area. Hazardous waste will be removed from the site by a certified waste contractor. Waste disposal certificates will be kept on record. 	Medium	Low	Partial	High Degree

Table 25: Alternative 1 - Operations.

ALTERNATIVE 1 – OPERATIONAL PHASE											
Aspect	IMPACTS				SIGNIFICANCE (WOM)	CONFIDENCE	MANAGEMENT & MITIGATION MEASURES	MITIGATION EFFICIENCY	SIGNIFICANCE (WM)	DEGREE	
	TYPE	DESCRIPTION	CUMULATIVE	NATURE						LOSS RESOURCE	REVERSABILITY
Atmospheric Emissions	Direct	Dust Nuisance	No	Negative	Medium	Medium	<ul style="list-style-type: none"> Dust suppression measures will be implemented during the operational phase to minimise dust generated by activities. 	High	Low	No Loss	Reversible
	Indirect	Noise Pollution	No	Negative	Medium	Medium	<ul style="list-style-type: none"> All vehicles will be maintained such as to operate efficiently. Operations shall not occur before or after normal working hours. Noise mufflers should be utilized to reduced noise. Keep an open channel of communication between all stakeholders and keep record of any concerns raised. 	High	Low	No Loss	Reversible
Effects on Terrestrial Biodiversity	Direct	Obstruction of Ecological Corridors	No	Negative	High	Medium	<ul style="list-style-type: none"> Waste should be managed as not to be aesthetically appealing or attract pests or rodents. Control of alien invasive plants is encouraged. Rehabilitation and landscaping with indigenous vegetation within the development should be encouraged and made a condition within the Environmental Authorisation. Mitigation Measure Objectives for biodiversity. 	High	Medium	No Loss	Reversible
	Indirect	Noise Pollution	No	Negative	High	Medium	<ul style="list-style-type: none"> All construction vehicles will be maintained such as to operate efficiently. Operations shall not occur before or after normal working hours. Noise mufflers should be utilized to reduced noise. Keep an open channel of communication between all stakeholders and keep record of any concerns raised. 	High	Medium	No Loss	Reversible
Waste Generation	Direct	Domestic waste	No	Negative	Medium	Medium	<ul style="list-style-type: none"> A waste management system to be formulated and implemented on site. All employees will be subjected to induction to understand the environmental management requirement on site. Domestic waste will be removed from to a landfill facility. Waste disposal certificates will be kept on record. 	Medium	Low	Partial	Reversible
	Direct	Hazardous waste	No	Negative	Medium	Medium	<ul style="list-style-type: none"> All hazardous waste will be stored in a bunded and lockable area. Hazardous waste will be removed from the site by a certified waste contractor. Waste disposal certificates will be kept on record. 	Medium	Low	Partial	High Degree
Resource Consumption	Direct	Water consumption	No	Negative	Low	High	<ul style="list-style-type: none"> Monitor water usage. Ensure not leaking infrastructure, such as pipes, taps, etc 	Medium	Low	Partial	Reversible
	Indirect	Fuel consumption	No	Negative	Medium	High	<ul style="list-style-type: none"> All vehicles will be maintained such as to operate efficiently. Idling times of machinery to be minimised. 	Medium	Low	Partial	Medium Degree
	Indirect	Raw materials consumption	No	Negative	Medium	High	<ul style="list-style-type: none"> Raw materials will be used efficiently. Recycled material should be used where possible 	Low	Low	Partial	Medium Degree
Soil Alteration	Direct	Erosion and topsoil loss	No	Negative	Medium	High	<ul style="list-style-type: none"> Minimise the amount of land disturbance and develop and implement stringent erosion and dust control practices. Institute a stormwater management plan including strategies. Install detention or retention facilities with graduated outlet control structures, if necessary. Limitations on access for heavy machinery and the storage of materials to avoid soil compaction. Permanent erosion control plans should focus on the establishment of stable native vegetation communities. Protect all areas susceptible to erosion and ensure that there is no undue soil erosion resultant from activities within the facility. Repair all erosion damage as soon as possible and in any case not later than six months before the termination of the Maintenance Period to allow for sufficient rehabilitation growth. 	Medium	Low	Partial	High Degree
	Direct	Soil contamination	No	Negative	Medium	Medium	<ul style="list-style-type: none"> Measures must be implemented to ensure that no hydrocarbons and/or other pollutant liquids are spilt, and if so, they are contained, and a clean-up protocol followed. No hydrocarbons are to be stored directly on the ground surface or within any watercourse or water body. Drip trays and bunded, impermeable platforms for storage of hydrocarbons and other chemicals must be used. 	High	Low	Partial	High Degree
Incidents, Accidents and Potential Emergency Situations	Direct	Pollution incidents	No	Negative	High	Medium	<ul style="list-style-type: none"> Compilation of incident management plan. Conduct toolbox talks. Ensure plant and equipment are in good working order. Store all hazardous materials in an appropriate manner, bunded impermeable surface. 	Medium	Medium	Substantial	Medium Degree
	Direct	Traffic Incidents	No	Negative	High	Medium	<ul style="list-style-type: none"> Installation of safety barriers. Installation of warning traffic signs. 	Medium	Medium	Substantial	High Degree

	Direct	Storage of hydrocarbons	No	Negative	High	Medium	<ul style="list-style-type: none"> All hazardous materials will be stored in a bunded and lockable area. Material Safety Data Sheet (MSDS) sheets will be available for all hazardous products. 	High	Medium	Substantial	Medium Degree
	Direct	Fire	No	Negative	High	Medium	<ul style="list-style-type: none"> Fire and emergency plans will be implemented during operations. Adequate firefighting equipment will be instituted as recommended. 	Medium	Medium	Substantial	Medium Degree

9.4 Cumulative Impacts

The scale at which the cumulative impacts are assessed is important. The significance of the cumulative impact on the regional or national economy will be influenced by energy developments with BESS infrastructure throughout South Africa, while the significance of the cumulative impact on loss of land within a concentrated area may only be influenced by developments that are in closer proximity to each other. A scale of 30km was selected for the cumulative impact evaluation.

There are **no existing** BESS developments located within a 30km radius of the proposed Adams BESS. Only the authorised and existing Adams PV facility, which includes associated infrastructure i.e., an overhead power line and substation, is located within the broader area (30km radius). The BESS would be located immediately adjacent to the existing PV facility where an area of approximately **4ha** will be cleared and developed. This is significantly smaller in comparison to the **~190ha** cleared for the authorised PV facility as it represents **~2.1%** of the size of the authorised PV facility and **~0.24%** of the entire property (Adams 328) which has an area of **~1667ha**.

The development of the BESS and associated infrastructure would not introduce a new type of infrastructure or land-use to the area but would essentially be adding to the already developed landscape. Considering the limited extent of the proposed BESS and associated infrastructure, the addition will be limited with the BESS not conflicting with the future planned land use in the area.

Cumulative Impacts on Ecological Processes

The following are the cumulative impacts assessed as being a likely consequence of the development of the Adams BESS. This is assessed in context of the extent of the proposed development area, other developments in the area, as well as general habitat loss and transformation resulting from agriculture and other activities in the area.

Nature:		
Impact on terrestrial biodiversity and broad-scale ecological processes		
The development of the Adams BESS will contribute to cumulative habitat loss and other broad-scale cumulative impacts on ecological processes in the wider area.		
	Overall impact of the proposed project considered in isolation	Cumulative impact of the project and other projects in the broader area
Extent	Local	Local
Duration	Long-term	Long-term
Magnitude	Low	Moderate
Probability	Improbable	Improbable
Significance	Low	Low
Status	Negative	Negative
Reversibility	High	Moderate
Irreplaceable loss of resources	No	No

Can impacts be mitigated	To some degree, but the majority of the ecological impacts are existing which result from the presence of the various already approved and existing PV plants which cannot be well mitigated in terms of biodiversity.
Mitigation:	
<ul style="list-style-type: none"> Where applicable, undertake a search, rescue and relocation of any sensitive flora and fauna within the BESS development footprint. Obtain vegetation removal permit, where applicable, and adhere to conditions thereto. Ensure that the fencing around the BESS facility is wildlife friendly and does not impede fauna from moving through the area or result in electrocutions. Ensure that an alien invasive management plan and stormwater/erosion management plan is compiled and implemented for the BESS project to prevent impacts to remaining habitats outside the BESS footprint. 	

Nature:	Reduced ability to meet conservation obligations and targets	
The loss of unprotected vegetation types on a cumulative basis from the broader area impacts the country’s ability to meet its conservation targets.		
	Overall impact of the proposed project considered in isolation	Cumulative impact of the project and other projects in the broader area
Extent	Local	Local
Duration	Long Term	Long-Term
Magnitude	Low	Low
Probability	Improbable	Improbable
Significance	Low	Low
Status	Slightly Negative	Slightly Negative
Reversibility	Low	Low
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes, to a large extent	
Mitigation:		
<ul style="list-style-type: none">The development footprint should be kept to a minimum and natural vegetation should be encouraged to return to disturbed areas.Reduce the footprint of the facility within sensitive habitat types as much as possible.		

Nature:	Impact on Avifauna	
The cumulative impact of the BESS facility on priority avifauna around the proposed development is assessed to be low, mainly due to the small size of the proposed BESS development with no additional renewable energy projects within a 30km radius. Previous mortality and displacement of avifauna due to the construction of the existing PV facility and associated infrastructure has already occurred.		
	Overall impact of the proposed project considered in isolation	Cumulative impact of the project and other projects in the broader area
Extent	Local	Local
Duration	Long term	Long term
Magnitude	Moderate	Moderate
Probability	Highly probable	Highly probable
Significance	Moderate	Moderate
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated	Yes, to a large extent	
Mitigation:		

- Construction activity should be restricted to the immediate footprint of the infrastructure.
- Access to the remainder of the site should be strictly controlled to prevent unnecessary degradation of habitat.
- Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum.
- It is recommended that a single perimeter fence is used.
- A bird-friendly pole design must be implemented (e.g. use of bird guards and diverters on any 'live' infrastructure) to prevent electrocutions.

Nature:	Impact on freshwater biodiversity and freshwater ecosystems	
The dry nature of the landscape, the low aquatic sensitivity of the site (field-verified) and the nature, type and extent of the proposed development, the potential for cumulative impacts on freshwater ecosystems is expected to be low / insignificant. No natural freshwater features occur within either of the proposed BESS alternative sites or within close proximity to these sites. There are no fish support areas, fish sanctuaries (for critically endangered or threatened fish species), fish translocation areas, fish migration corridors, fish rehabilitation areas, NFEPA wetlands, high water yield areas or free-flowing rivers. A number of NFEPA wetland clusters are situated >10-15km away from the alternatives sites which will not be impacted upon if either BESS alternative is authorised and subsequently developed.		
	Overall impact of the proposed project considered in isolation	Cumulative impact of the project and other projects in the broader area
Extent	Local	Local
Duration	Long term	Long term
Magnitude	Low	Low
Probability	Improbable	Improbable
Significance	Low	Low
Status	Neutral	Neutral/Low-negative
Reversibility	High	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	
Mitigation:		
<ul style="list-style-type: none">• No project-specific mitigation measures required for freshwater biodiversity.• Although beyond the scope of this report, the basis for mitigation measures for cumulative impacts on freshwater biodiversity from other projects in the area, combined and within a 30km radius, could entail not supporting such infrastructure developments within areas with a confirmed (i.e. field-verified) high sensitivity for freshwater biodiversity, if applicable.• To prevent potential soil and groundwater pollution and/or contamination from spills and leaks during the construction and operational phases, spills must be appropriately managed as provided for in the EMPr.• Stormwater run-off from the BESS to be managed using appropriate mitigation measures to prevent soil erosion.		

Cumulative Impacts on Heritage (including archaeology, palaeontology, and cultural landscape)

The proposed BESS development will form part of the infrastructure required for the Adams PV plant with the footprint located immediately adjacent to the substation and operations and maintenance facilities associated with the existing plant. In terms of impacts to heritage resources, it is preferred that this kind of infrastructure development is concentrated in one location as proposed and not sprawled across an otherwise culturally significant landscape. The construction of the proposed BESS is unlikely to result in any unacceptable risk or loss nor would it result in a complete change to the sense of place of the area or an unacceptable increase in negative impacts on heritage resources.

Conclusion regarding Cumulative Impacts

Cumulative impacts and benefits on various environmental and social receptors will occur to varying degrees with the development of several renewable energy facilities in South Africa.

The alignment of renewable energy developments (and the associated BESS such as that proposed) with the IRP and the global drive to move away from the use of non-renewable energy resources and to reduce Green House Gases (GHG) emissions is undoubtedly positive. The assessment of the cumulative impacts associated with the Adams BESS was undertaken through the consideration of the impacts in isolation and compared to the cumulative impacts of the BESS and other energy related facilities in the area. Cumulative impacts are expected to occur throughout all phases of the project life cycle and within all areas of study described in this report. The main aim for the assessment of cumulative impacts is determine whether the development will be acceptable within the landscape proposed for the development, and whether the loss, from an environmental and social perspective, will be acceptable without whole-scale change. The proposed Adams BESS will contribute to other types of (existing and future) renewable energy infrastructure developments proposed in the area thus having a positive cumulative impact on the renewable energy industry in the country in terms of less reliance on energy from fossil fuels and the associated and negative GHG emission impacts. From a cumulative impact perspective there is no reason why the project should not be authorised.

Based on the specialist recommendations and cumulative impact assessment, the development of the BESS and associated infrastructure for the Adams PV facility will result in some cumulative negative impacts which have low significance and which can be managed with appropriate implementation of mitigation measures. There are no impacts or risks identified to be of a high significance or considered as unacceptable with the development of the BESS and associated infrastructure. In addition, no impacts that would result in whole-scale change are expected to occur.

10 FINDINGS, IMPACT MANAGEMENT AND MITIGATION MEASURES

10.1 Summary of the findings.

Terrestrial Biodiversity

In the case of this proposed site, the grasslands have been altered through anthropogenic activities.

Two (2) site/locations were initially considered, one located to the North of existing PV Facility, and the other located to the South (Preferred). Specialists explored both sites however due to the landowner not agreeing with the Northern site it was considered a no-go and not included as an alternative option.

Only the southern site (Preferred Alternative) was therefore considered.

Anthropogenic impacts identified within the study site included alien vegetation encroachment, gravel road construction, natural vegetation removal, hardening of surfaces to establish the Adams Solar Facility, fencing, grazing and power line construction.

The proposed BESS was identified within an **Other Natural Area (ONA)** which still fulfils an ecological function.

The study site still has a functional role to play in regional ecological functioning and biological functions at the site even though it has been influenced by human-related impacts.

Ecological connectivity between the grasslands, thickets, woodland, and drainage located towards the north-west cannot be excluded in the overall study area.

Within the site, there was little apparent variation in the vegetation composition. In some areas, such as near the watering points, the density of trees was somewhat higher, and the grass layer grazed out. However, there were no significant differences visible that warranted recognition as different plant communities within the site. It is possible that the dry conditions at the time of sampling as well as the burnt condition of a large proportion of the site may have hindered the recognition of the different communities within the site. However, this seems unlikely as the substrate was very homogenous and there was little significant variation in the woody layer. In addition, no drainage lines or other edaphic features occur within the site that might lead to differentiation of the vegetation.

Within the site, the vegetation consists of a tree layer, comprised mainly of *Acacia haematoxylon*, *Acacia mellifera*, *Acacia erioloba* and *Grewia flava*, with a grassy understorey consisting mainly of perennial grass species such as *Schmidtia pappophoroides*, *Aristida meridionalis*, *Eragrostis lehmanniana* and *Stipagrostis uniplumis*. There are some occasional shrubs present, such as *Gnidia polycephala*, *Hermannia tomentosa* and *Melolobium macrocalyx*. Other large woody species that occurred at the site as scattered individuals

or localized clumps include *Searsia lancea*, *Acacia hebeclada*, *Lycium hirsutum* and *Tarchonanthus camphoratus*.

The study area has few protected species such as *Boophone disticha*, likely still present under the dense grass layer.

The Preferred Alternative has bush encroacher species present (*Senegalia mellifera*) which thus visible signs of disturbance present.

Concluded from the results presented in this document, the construction activities will impact on the medium sensitive terrestrial biota. Mitigation measures should be implemented to mitigate to satisfactory standards if all mitigatory actions are implemented with due care. Alien eradication and rehabilitation must be encouraged through the development of an alien and invasive species plan.

Freshwater Biodiversity

The proposed development area is situated in the Sishen/Kathu National Strategic Water Source Area (SWSA) for groundwater and as per the DFFE screening tool, in an area considered to have a very high sensitivity for the aquatic biodiversity theme.



Figure 18: Very high relative aquatic biodiversity theme sensitivity of the area in which the site is situated.
(Source: DFFE Screening Tool report <https://screening.environment.gov.za>)

According to geospatial data sources no natural freshwater features occur within the footprint of the property or within close proximity to the property. Figures 20, 21 and 22 represent the same area mapped at different scales showing that no freshwater resources (wetlands or watercourses) occur within either 100m or 500m from the proposed BESS sites (Alternatives 1 and 2).

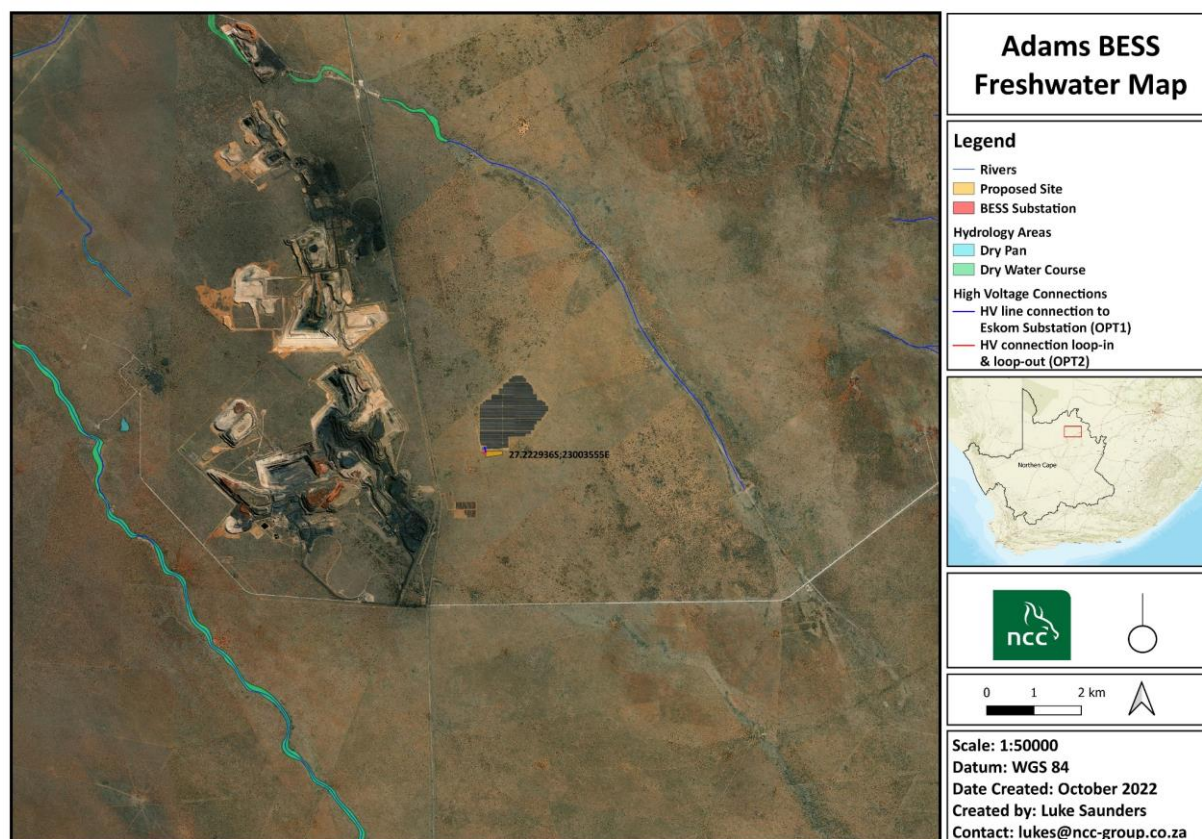


Figure 19: Wetland map indicating no NFEPA or NWM5 wetland occurrence within the regulated area (500m) from BESS Alternative 1. The non-perennial Witteleege River is located >3.5km to the north and north-east from the site and several small artificial and natural wetlands occur to the west >5km from the site.

The Witteleege River, a tributary of the Kuruman River, is located >3.5km to the north and north-east from the site and several small artificial and natural wetlands occur to the west >5km from the site (Figure 20). It is a non-perennial first order river with episodic flows and for that reason has not had a PES category assigned owing to that reason (DWS, 2012). At a desktop level SQ reach D41K-02181, which is in catchment D41K, has been assessed to have a Low mean Ecological Importance (EI) and a D default EC (DWS, 2012).

There were no clear areas of natural drainage on either site and no hydro-geomorphological landscape features indicating the presence of a watercourse i.e. streams, rivers or wetlands. No hydrophytic, wetland or riparian vegetation or riparian habitats were present or observed. The vegetation is terrestrial in nature consisting of a mosaic of trees comprising species such as *Acacia mellifera*, (blackthorn) and *Grewia flava* (raisin tree) with a perennial grass understorey and scattered shrubs.

Based on the results of the combined desktop review and site sensitivity verification in the field, the sensitivity of aquatic biodiversity at the proposed Adams BESS site is regarded to be Low at both alternative sites and it is concluded with a high degree of confidence that no sensitive freshwater features occur on either of the alternative site footprints. The development will not impact on any freshwater biodiversity and no specific impact management interventions for freshwater biodiversity features are considered to be necessary in the context of this development. A freshwater biodiversity compliance statement has been prepared in this regard to be referred to in conjunction with this BAR.

10.2 List of impact management measures that were identified by all Specialists

10.2.1 Terrestrial Ecology

Design and Construction

The following mitigation and management measures should be implemented during the construction phase to minimise potential environmental impacts:

- A search-and-rescue plan needs to be developed for any medicinal plants on-site.
- Prior to construction of the BESS, any identified protected trees need to be tagged and a permit obtained from DAFF to either relocate or cut down these trees.
- To preserve protected trees until a permit is issued, they need to be demarcated and avoided.
- Construction activities should be limited to between 07:00 and 17:00 or in conjunction with the ECO. There will be nightworks during the construction period. In such cases, nearby landowners will be informed prior and appropriate lighting will be used.
- A complaints register should be available onsite whereby the public or community in close connection of the proposed development can issue their concerns, if need be.
- Adopt responsible construction practices aimed at containing the construction activities to specifically demarcated areas.
- Any soil must be exposed for the minimum time possible once cleared of vegetation to avoid prolonged exposure to wind and water erosion and to minimise dust generation.
- Use existing ablutions or provide to a max of 15 per ablution.
- Induction awareness training should be undertaken.
- Onsite waste management and removal, waste not to sit longer than 7 days. Bins to have lids.
- Separation of waste should be encouraged.
- Erosion control measures should be in place.
- Any buffers identified should be maintained by the contractor.

- As far as possible, the proposed development should be restricted to areas that have already been disturbed, and limited further loss of secondary vegetation, wetland areas, drainage lines should be permitted.
- It is recommended that areas to be developed be specifically demarcated so that during the construction phase, only the demarcated areas be impacted upon and preventing movement of workers into sensitive surrounding environments.
- Where possible, existing access routes and walking paths must be made use of, and new routes limited.
- All laydown, storage areas etc should be restricted to within the project area, not beyond the sensitive areas.
- All building materials should be mixed off site and no mixing should take place in sensitive areas
- Prefabricated material must be used (or prioritised) to limit the fabrication and mixing on site
- Areas that are denuded during construction need to be re-vegetated with indigenous vegetation to prevent erosion during flood events. This will also reduce the likelihood of encroachment by alien invasive plant species.
- No trapping, killing, or poisoning of any wildlife is to be allowed on site, including snakes, birds, lizards, frogs, insects, or mammals.
- All building materials should be mixed off site and no mixing should take place near the sensitive areas.
- Have action plans onsite, and training for contactors and employees in the event of spills, leaks, and other impacts to the surrounding environment.
- Erosion prevention and sediment control measures are imperative and need to be implemented throughout the entire project footprint area, access roads and temporary laydown / storage sites. Temporary and permanent erosion control methods may include silt fences, interceptor ditches, seeding and sodding, riprap of exposed embankments, erosion mats, and mulching.
- Further, unstable, and exposed soil embankments should be protected from erosion with a combination of retainer wall bricks / blocks and vegetation.
- The contractors used for the construction should have spill kits available prior to construction to ensure that any fuel, oil, or hazardous substance spills are cleaned-up and discarded correctly
- It is preferable that construction takes place during the dry season (as much as possible) to reduce the erosion potential of the exposed surfaces.
- During construction activities, all rubble generated must be removed from the site and not dumped in the instream, within the wetland habitat towards the northwest of the site.
- An alien invasive species plan must be developed for the BESS site, together with a termite management plan (maintenance management plan).

- Monitoring dust at the site should be encouraged.
- Monitor the reinfection of the current Adams PV facility's termites and BESS proposed every 5-years.

Operational Phase

The following mitigation and management measures should be implemented during the operation phase to minimise potential environmental impacts:

- Waste should be managed as not to be aesthetically appealing or attract pests or rodents.
- Control of alien invasive plants is encouraged.
- Rehabilitation and landscaping with indigenous vegetation within the development should be encouraged and made a condition within the Environmental Authorisation.
- Mitigation Measure Objectives for biodiversity impacts on flora and fauna should be encouraged. The EMPr makes further provision for this.

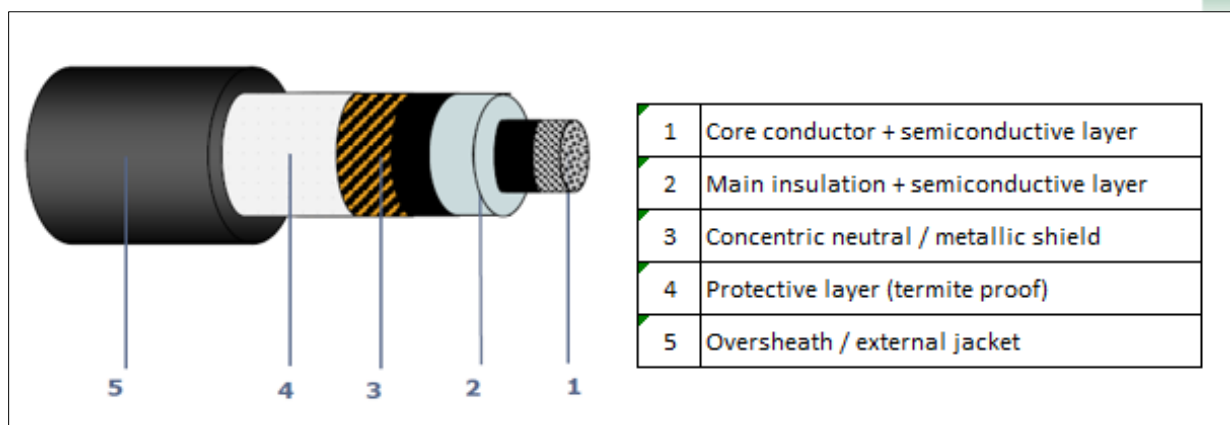
The focus of mitigation measures should be to reduce the significance of potential impacts associated with the proposed water pipeline and thereby to:

- Prevent the destruction of, and fragmentation, of the vegetation community.
- Prevent the loss of the faunal community associated with this vegetation community.

Termite Presence

For the prevention of termite damage to infrastructure such as underground cabling the Applicant should consider preventative measures. The first is to include a physical barrier, while the second is the use of a chemical barrier. The latter option is used successfully on small sites such as homes, but the potential of soil contamination and secondary poisoning on a larger scale may pose a significant risk, when considering the length of the cables within a project on this scale.

Any protection consists of a protective layer installed under the cable oversheath (also said external jacket). If the termite pierces the oversheath, it meets the barrier of this protection.



Prior to considering the second option it is recommended to install monitoring stations within the site, typically the very sandy areas where the termites are found. Using these small bait stations will allow for correct identification of the species present, but also allow for the opportunity to place small sections of the proposed cable inside the monitoring system to see if the termites are causing significant damage to the cable outers. These can be placed throughout the site, to assist if required which portions of the underground cables will require physical barriers.

The second alternative of is the consideration of applying surface spray with suitable and legal termite control spray. A product which is a suspension concentrate residual contact and stomach insecticide for the control of termites and is based on a delayed action which allows the bait to be taken back to the nest by foraging ants so that the entire colony, as well as the queen, is destroyed.

10.2.2 Freshwater Biodiversity

No watercourses were identified in any of the proposed development areas. A list of generic impact management outcomes and monitoring requirements are included in the EMPr to manage alien invasive plants, stormwater around the BESS and to manage spills during construction and operations in order to reduce the risk of potential groundwater pollution.

Objective	Action	Frequency
Manage IAPs	i. Manage invasive alien plants at any disturbed or spoil areas.	With immediate effect
	ii. Manage invasive alien plants around the BESS during operation.	
Manage stormwater run-off from the BESS	iii. Ensure appropriate storm water infrastructure is installed to dissipate flow and direct away from concentrated paths.	During rainfall season
	iv. Ensure drip trays are used under vehicles/machinery and that impervious floor surfaces are constructed to ensure chemicals and waste do not enter the sub-surface.	With immediate effect throughout construction
	v. Where practical, plant appropriate grass species or install energy dissipation structures in stormwater drains around the BESS.	With immediate effect
Manage spills during Construction	vi. Ensure drip trays are used under vehicles/machinery and erosion control measures are implemented.	With immediate effect ECO to check every 2 months
	vii. Ensure a spill contingency plan is put into place	

Manage spills during Operation	<p>viii. Record and report any fuel, oil, hydraulic fluid or electrolyte spills to the Site Manager/Engineer so that appropriate clean-up measures can be implemented.</p> <p>ix. Spills must be completely removed from the site.</p> <p>x. Appropriate fire extinguisher equipment installed within the BESS.</p> <p>xi. Temperature of battery systems monitored continually.</p> <p>xii. Ensure air circulation to prevent the build-up of chemicals.</p> <p>xiii. Implement the storm-water management plan and ensure appropriate water diversion systems are put in place.</p> <p>xiv. Compile (and adhere to) a procedure for the safe handling of battery cells.</p> <p>xv. Compile an emergency response plan and implement should an emergency occur.</p> <p>xvi. Ensure that spill kits (if appropriate) are available on site for clean-up of spills and leaks.</p> <p>xvii. Drip-trays or containment measures must be placed under equipment that poses a risk when not in use.</p> <p>xviii. Immediately clean up spills and dispose of contaminated soil at a licensed waste disposal facility.</p> <p>xix. Dispose of waste appropriately to prevent pollution of soil and groundwater.</p> <p>xx. Completely lined infrastructure (concrete bunded area), with the capacity to contain 120% of the total amount of chemicals stored within the BESS.</p> <p>xxi. Install monitoring systems to detect leaks or emissions.</p>	With immediate effect/Ongoing
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10.2.3 Heritage Resources

No heritage items were identified on site.

There are no visible restrictions or negative impacts in terms of heritage associated with the specific sites.

- The discovery of subsurface archaeological and/or historical material as well as graves must be taken into account in the Environmental Management Programme.

10.3 How the findings and recommendations of the different specialist studies have been integrated.

As indicated in the impact assessment, all the specialist studies as well as other elements were rated before mitigation and after in terms of their significance. This resulted in the proposal of which mitigation measures should be implemented.

Please refer to the EMP with more information of mitigation that the applicant will implement during the different phases of the project development.

11 ENVIRONMENTAL IMPACT STATEMENT

Taking the assessment of potential impacts into account this statement sums up the impact that the preferred alternative and any alternatives may have on the environment after the management and mitigation of impacts have been considered.

11.1 Proposed (Preferred Alternative)

When considering the potential impacts involved with the proposed development, the preferred alternative has a Medium to Low significance; however, these impacts can be mitigated to an acceptable level, based on the following:

- The study site **does not** fall within an identified Critical Biodiversity Area (**CBA**) but falls within an Other Natural Area (**ONA**).
- The study area has been influenced by anthropogenic activities ranging from transformation of grasslands and alien infestation, overgrazing, and hardening of surfaces.
- The state of the vegetation in the study is degraded, with the occurrence of no red data species, probably as a result of this degraded state. The vegetation is classified as having a moderate sensitivity due to the indigenous component still being present.
- No individuals of the endemic or biogeographically important plants were observed during the survey, although it may have previously been found in the larger area.
- No red data species potentially occur in the study area according to the SIBIS database.
- No other red data species was also found in the area, although the potential habitats were surveyed to the extent representative of the area.
- Anthropogenic impacts identified included grazing, infrastructure development (Adams Solar PV Facility), hardening of surfaces, stormwater infrastructure and alien invasive species occurring at the site.
- A distinct feature of is the more 'closed' dense vegetation which is characterised by monospecific stands of the indigenous bush encroacher species *Senegalia mellifera*. This species tends to proliferate in the absence of certain vegetation drivers or site disturbances and/or alterations and as such is viewed as a negative as it forms dense closed masses.
- From a botanical viewpoint due to the larger proportion of mature and protected trees found on site as well as the presence of encroacher species found on Preferred Alternative (suggesting disturbance).
- The site however has protected trees, *Vachellia erioloba* (Camel Thorn) and *Vachellia haematoxylon* (Gray Camel Thorn) present.

- Based on the DFFE Screening tool the site falls within a '**Low**' plant species sensitivity as indicated through the application of the Environmental Screening Tool, however the specialists confirmed that the sensitivity of the site is '**Medium**'.
- No watercourses are present on the site and none will be impacted upon.
- It will not impose on the surrounding area from a visual point of view.
- No heritage items and/or resources were identified on site.

Based on the results and conclusions presented, and the outcomes of the field survey, it is the opinion that the proposed project can be **favourably considered** should all the mitigation measures be implemented and monitored against to ensure compliance and included in the EMP.

Based on the results and conclusions presented in this report, and the outcomes of the field survey, it is the opinion of the EAP and specialists that the proposed BESS project (Preferred Alternative) should be **favourably considered** and authorised contingent on all recommended mitigation measures being implemented and monitored against to ensure compliance.

The development will not impact on any freshwater biodiversity features therefore no specific impact management interventions or monitoring requirements for freshwater biodiversity is considered necessary or provided in this respect.

Even though the site has '**medium**' sensitivity from a terrestrial biodiversity perspective, the mitigation measures provided may reduce the negative risks anticipated with the BESS construction. From an ecological perspective the alternative to the north of the existing PV facility is the '**preferred**' one and is supported. A point of clarity to distinguish between the specialist reports and the reference made to the alternative sites in these reports, the clarifications points are emphasised below:

11.2 No-Go Alternative

The no-go alternative is the option of not constructing the Adams BESS.

Should this alternative be selected, there would be no direct environmental impacts within the designated BESS footprint. The implementation of the no-go alternative will result in the Adams Solar Energy Facility not being able to store additional generated energy or supply sustained electricity to the national grid at times when the PV is not producing optimally or Loadshedding is implemented and will, therefore, result in lost opportunity to dispatch additional electricity from the facility.

To ensure a positive environmental impact, the environmental benefits of the energy storage technology must out-weigh the potential negative impacts.

Based on the outcomes of the specialist studies undertaken (as outlined in this chapter of the report), it can be concluded that limited environmental costs can be anticipated at a local and site-specific level and are considered acceptable provided the mitigation measures as outlined in the BA Report and the EMPr are implemented and adhered to. These environmental costs could include:

- A loss of biodiversity, flora and fauna due to the clearing of land approximately 4-6ha for the construction and utilisation of land for the BESS and associated infrastructure. The ecological assessment predicted the impacts to be low provided that the footprint of the facility is located outside of the identified high sensitivity areas.

These costs are expected at a local level and can be effectively mitigated and managed.

As detailed above, the No-Go alternative will result in a number of lost opportunities and will conserve only a minor (~4ha) portion of degraded vegetation and habitat. The No-Go alternative is therefore not considered to have a significant benefit when compared to the implementation of the proposed BESS, and is therefore not considered as a preferred alternative and not proposed to be implemented for the development of the facility

Environmentally, the no go option assumes the site remains in its current state, i.e. degraded agricultural land. This would mean low negative environmental impacts such as vegetation loss.

Specifics around the exact contribution of the BESS to the energy network have not been quantified, however the BESS would contribute to a reduced usage of fossil fuel plants and will support increased renewable energy generation through the smoothing of renewables. This is in line with the objectives of the 2011 Integrated Resource Plan for Electricity (2010-2030) to reduce carbon emissions and invest in carbon offset technologies.

If the project does not proceed a reduction in carbon emissions in South Africa's power generating infrastructure will potentially not be achieved and we will maintain our reliance on fossil fuel powered peaking plants that are used to managed variability on the power from renewable energy installations, and there will be no capacity to store excess power generated by renewable energy projects when demand is low, but wind (for example, is high) and feeding this back into the grid when demand is high and power generation from renewables is low.

Several benefits and solutions will be lost which is faced by the energy crisis:

- Reduction in carbon emissions in the country's power generation infrastructure
- Unlocking constrained networks (Reduction in loading/ congestion of upstream High Voltage networks)
- Reducing voltage drops and improve quality of supply
- Deferment or replacement of future capital expansion projects
- Supports mini grids in areas with limited access to bulk power; and
- Peak load reduction - up to 8 hours of battery storage will increase the dispatch time thereby extending baseload and offset carbon emissions.

12 DECOMMISSIONING AND SALVAGE

The Adams PV Facility plans to maintain the BESS in the long-term. Replacement of battery components may be required however no decommissioning of the system as a whole is planned in the foreseeable future. Maintenance management measures (e.g., the return to supplier clause) that cover the disposal of certain components such as have been included in the EMPr under the operational phase.

The typical life expectancy for the BESS system is between 15 to 20 years, all depending on the technology used, operations and application of the system and maintenance regimes applied etc. The system is modular which allows premature equipment failures to be counteracted by replacing the specific sections, without major impact on the holistic system.

As with the other equipment, the decommissioning process for BESS involves dismantling and removing the equipment and waste from the site in compliance with applicable laws and regulations governing its safe transport and disposition.

The actual scope of decommissioning shall allow for the energy storage system to be safely de-energised, disassembled, readied for shipment or storage, and removed from the premises.

Once a used battery is removed from service and diverted toward end-of-life management, it will be disposed as per the most relevant measures as identified at the time.

These can include the following.

- Recordkeeping
- Labelling
- Specified storage methods that keep material out of the environment
- Outline approved recycling or disposal pathways and structures

The balance of plant represents a significant quantity of materials, including:

- Concrete pads or foundations
- Steel enclosures or containers
- Cabling
- Array of electronics that are part of the entire energy storage system package (conversion units)

Concrete and steel are readily recyclable, and many enclosures can be reused. Inverters, control systems, and other electronic equipment share many of the challenges of e-waste more broadly, but useful materials often can be recovered.

The cost and environmental implications of BESS end of life decommissioning are considerable. However, especially considering the growth of the battery energy recycling market, these costs and environmental

outcomes will evolve, and these changes will arise from individual companies adopting best practices, industry-wide initiatives to support sustainable market expansion, and changes to policies and regulations at the federal, state and local levels. Improvements in costs and environmental outcomes will apply as the market evolves to cater for these technologies – reuse and safe disposal at a fraction of the cost.

The descriptions of the dismantling activities are indicated in the table below. Their cost is derived by accounting for dismantling of equipment on site, transport to Battery OEM or to the disposal / recycling facility, dedicated recycling cost. There is a possible salvage cost of the batteries since they can be sold as second-hand systems, or the batteries carry some recycle value to be reused.

Key Equipment	Description
Power Conversion Units	Removal and demolishing of Inverter Modules, Inverter Step-Up transformers, Switchgear, Canopies and Enclosures, Rebar of Concrete Foundations
Cable Reticulation System	Removal and Demolish of Cable Trays, Racks, Ladders, Supports, Conduit etc.
Low Voltage Cabling	Removal of DC, LV and Communication Cabling
Medium Voltage Cabling	Partial removal of MV Cabling - above ground and up to a level
Cable Trench Rehabilitation	Opening and Closing of Cable Trenches - Rehabilitating the Route
Batteries and Container	Removal of Batteries and Containers, Rebar of Concrete Foundations
Transport to Recycling Facility	Current batteries to be transported back to manufacturer
Recycling of Lithium Ion Batteries	Depending on recycling plant (cost of recycling and salvaging could be included)
Storm Water Management System	Removal and Demolish of Storm water Pipes, Culverts, Headwalls etc
Fencing	Removal and Demolish of Plant Perimeter Fence
Topsoil Strip	Strip and Store of Topsoil from Formed areas now impacted by Decommissioning
Import and Replace Topsoil	Import Topsoil from Commercial Sources

13 SUMMARY OF THE KEY FINDINGS OF THE EIA

Freshwater Biodiversity

There were no clear areas of natural drainage identified at either alternative site and no hydro-geomorphological landscape features indicating the presence of any watercourses (i.e. streams, rivers or wetlands). No hydrophytic, wetland or riparian vegetation/habitats were present or observed. The vegetation is terrestrial in nature consisting of a mosaic of trees comprising species such as *Senegalia mellifera*, (blackthorn) and *Grewia flava* (raisin tree) with a perennial grass understorey and scattered shrubs. The sensitivity of freshwater biodiversity is low at both alternative sites which the specialist traversed and the development will not impact significantly on any freshwater biodiversity at either alternative site. A freshwater biodiversity compliance statement has been prepared in this regard to be referred to in conjunction with this BAR.

Terrestrial Biodiversity

It was determined that the vegetation has been altered through anthropogenic activities. The grasslands, however, were green and dense.

Anthropogenic impacts identified within the study site included alien vegetation encroachment, gravel road construction, natural vegetation removal, hardening of surfaces to establish the Adams Solar Facility, fencing, grazing and power line construction.

An '**Other Natural Area**' at the proposed BESS was identified and still fulfils an ecological function.

- The study site still has a functional role to play in regional ecological functioning and biological functions at the site even though it has been influenced by human-related impacts.

Ecological connectivity between the grasslands, thickets, woodland, and drainage located towards the northwest cannot be excluded in the overall study area.

Concluded from the results presented in this document, the construction activities will impact on the medium sensitive terrestrial biota. Mitigation measures should be implemented to mitigate to satisfactory standards if all mitigatory actions are implemented with due care. Alien eradication and rehabilitation must be encouraged through the development of an alien and invasive species plan. Monitoring of the termite and prevention of termites should be encouraged at the site. Based on the results and conclusions presented in this report, and the outcomes of the field survey, it is the opinion of the specialists that the proposed project can be favourably considered should all the mitigation measures be implemented and monitored against to ensure compliance and included in the Environmental Management Programme.

Even though the site has medium sensitivity, the mitigation measures provided may reduce the negative risks anticipated with the BESS construction.

From an ecological perspective the Preferred Alternative is supported by the specialist.

Heritage

There are no visible restrictions or negative impacts in terms of heritage associated with the specific sites indicated. In terms of heritage the proposed project may continue. The discovery of subsurface archaeological and/or historical material as well as graves must be taken into account in the EMPr.

14 RECOMMENDATIONS

14.1 RECOMMENDATION OF THE EAP

After assessing the environmental related impact in terms of bio-physical and social the proposed project and **Preferred Alternative** was selected as it has low impact.

From a terrestrial biodiversity perspective the Preferred Alternative had a presence of encroacher species suggesting disturbance, and despite the finding of protected plants on Preferred Alternative, which are very likely to also present in the surrounding areas, it is suggested that the Preferred Alternative should rather be developed due to it being previously disturbed and its close proximity to the existing PV facility.

The Preferred Alternative appears altered which is evidenced by monospecific stands of indigenous encroacher species *Senegalia mellifera* as highlighted above. The Preferred Alternative had a presence of insect and small mammal activity (burrows, ants nest round trees) thus appearing diverse but most likely due to it being a more altered site.

The site area had protected trees, *Vachellia erioloba* (Camel Thorn) and *V. haematoxylon* (Gray Camel Thorn) present.

The Preferred Alternative is the more desired site due to it being altered and the presence of a low number of protected trees.

If the EMPr contained in Appendix H and specialist study recommendations contained under Appendix E, F and G are followed, negative impacts will be significantly reduced.

The heritage study revealed that there were no signs of any heritage resources within the area. If any items of heritage or cultural significance are identified, construction activities must immediately cease and SAHRA notified of the findings.

Mitigation measures mentioned in the EMPr contained in Appendix F, have been developed to assist the contractor during the construction, and post-construction phases of the project to minimise any impacts on the environment.

The EAP's opinion is that the Preferred Alternative (north of the existing PV Facility) will not significantly alter the current status of the environment and surrounds if the recommended mitigation measures are implemented.

After conducting the EIA process and in consultation with specialist studies (Freshwater, Ecological, and Heritage), no environmental fatal flaws are anticipated and those identified can be mitigated against by conditions of the EMPr and specialist studies.

The proposal is therefore the best suited to minimise or have the least impact on the built, natural, and social environments as being the most cost-effective solution and can proceed accordingly.

The following are suggested compulsory recommended conditions for the proposed BESS facility:

- 1) Adhere to the proposed management and mitigation measures during the construction and operation phases as set out in the EMPr
- 2) The EMPr must be implemented and monitored by an independent Environmental Control Officer (ECO) and all monitoring reports must be submitted to the relevant authority for review.
- 3) Conditions as set out by all specialist studies should form part of the General conditions of the EA.

The EAP sees no reason why the proposed BESS development should not be considered favourably by the competent authority (CA) and holds the opinion that the Preferred Alternative should be authorised and developed.

14.2 RECOMMENDATION FROM COMPETENT AUTHORITY (CA)

Recommendations will be included after PPP is complete

15 DECLARATION

15.1 Declaration of the Applicant

I **Manuele Battisti**, ID number ... **YA7235785**.....in my personal capacity or duly authorised thereto hereby declare/affirm that all the information submitted or to be submitted as part of this application form is true and correct, and that:

- I am fully aware of my responsibilities in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (“NEMA”), the Environmental Impact Assessment (“EIA”) Regulations, and any relevant Specific Environmental Management Act and that failure to comply with these requirements may constitute an offence in terms of relevant environmental legislation.
- I am aware of my general duty of care in terms of Section 28 of the NEMA.
- I am aware that it is an offence in terms of Section 24F of the NEMA should I commence with a listed activity prior to obtaining an Environmental Authorisation.
- I appointed the Environmental Assessment Practitioner (“EAP”) (if not exempted from this requirement) which:
 - meets all the requirements in terms of Regulation 13 of the NEMA EIA Regulations; or
 - meets all the requirements other than the requirement to be independent in terms of Regulation 13 of the NEMA EIA Regulations, but a review EAP has been appointed who does meet all the requirements of Regulation 13 of the NEMA EIA Regulations.
- I will provide the EAP and any specialist, where applicable, and the Competent Authority with access to all information at my disposal that is relevant to the application.
- I will be responsible for the costs incurred in complying with the NEMA EIA Regulations and other environmental legislation including but not limited to –
 - costs incurred for the appointment of the EAP or any legitimately person contracted by the EAP.
 - costs in respect of any fee prescribed by the Minister or MEC in respect of the NEMA EIA Regulations.
 - Legitimate costs in respect of specialist(s) reviews; and
 - the provision of security to ensure compliance with applicable management and mitigation measures.
- I am responsible for complying with conditions that may be attached to any decision(s) issued by the Competent Authority, hereby indemnify, the government of the Republic, the Competent

Authority and all its officers, agents, and employees, from any liability arising out of the content of any report, any procedure, or any action for which I or the EAP is responsible in terms of the NEMA EIA Regulations and any Specific Environmental Management Act.

Signature of the Applicant

Enel Green Power (Proprietary) Limited

Name of Organisation

Date

15.2 Declaration of the EAP

I**Nicholas Anthony Gates**....., EAPASA Registration number**NA**..... as the appointed EAP hereby declare/affirm the correctness of the:

- Information provided in this BAR and any other documents/reports submitted in support of this BAR;
- The inclusion of comments and inputs from stakeholders and I&APs.
- The inclusion of inputs and recommendations from the specialist reports where relevant; and
- Any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested and affected parties, and that:
- In terms of the general requirement to be independent:
 - other than fair remuneration for work performed in terms of this application, have no business, financial, personal, or other interest in the activity or application and that there are no circumstances that may compromise my objectivity; or
 - am not independent, but another EAP that meets the general requirements set out in Regulation 13 of NEMA EIA Regulations has been appointed to review my work (Note: a declaration by the review EAP must be submitted);
- In terms of the remainder of the general requirements for an EAP, am fully aware of and meet all of the requirements and that failure to comply with any the requirements may result in disqualification.
- I have disclosed, to the Applicant, the specialist (if any), the Competent Authority and registered interested and affected parties, all material information that have or may have the potential to influence the decision of the Competent Authority or the objectivity of any report, plan or document prepared or to be prepared as part of this application.
- I have ensured that information containing all relevant facts in respect of the application was distributed or was made available to registered interested and affected parties and that participation will be facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments.
- I have ensured that the comments of all interested and affected parties were considered, recorded, responded to and submitted to the Competent Authority in respect of this application.
- I have ensured the inclusion of inputs and recommendations from the specialist reports in respect of the application, where relevant.

- I have kept a register of all interested and affected parties that participated in the public participation process; and
 - I am aware that a false declaration is an offence in terms of Regulation 48 of the NEMA EIA Regulations.
-

Signature of the EAP

NCC Environmental Services (Pty) Ltd

Name of Organisation

April 2021

Date

15.3 Declaration of the Reviewer EAP

I **Ronaldo Retief**....., EAPASA Registration number **2019/181**.....as the appointed Review EAP hereby declare/affirm that:

- I have reviewed all the work produced by the EAP.
- I have reviewed the correctness of the information provided as part of this Report.
- I meet all of the general requirements of EAPs as set out in Regulation 13 of the NEMA EIA Regulations.
- I have disclosed to the applicant, the EAP, the specialist (if any), the review specialist (if any), the Department and I&APs, all material information that has or may have the potential to influence the decision of the Department or the objectivity of any Report, plan or document prepared as part of the application; and
- I am aware that a false declaration is an offence in terms of Regulation 48 of the NEMA EIA Regulations.

Signature of the Reviewer EAP

Date: 10 November 2022

Name of company (if applicable): **NCC Environmental Services (Pty) Ltd**

APPENDIX A – MAPS

APPENDIX B – SITE PLANS

APPENDIX C – PHOTOGRAPHS

APPENDIX D – BIODIVERSITY OVERLAY MAP

APPENDIX E - FRESHWATER REPORT

APPENDIX F - ECOLOGICAL REPORT

APPENDIX G - HERITAGE REPORT

APPENDIX H – ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

APPENDIX I – GENERIC ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

APPENDIX J – PUBLIC PARTICIPATION INFORMATION

Appendix J1 – Background Information Document

Appendix J2 – Advertisement

Appendix J3 – Site Notices

Appendix J4 – Written Letter

Appendix J5 – Stakeholder List

Appendix J6 – Comments & Response Report

Appendix J7 – Stakeholder Engagement

APPENDIX K – ENVIRONMENTAL SCREENING TOOL

APPENDIX I – PROPERTY DETAILS

APPENDIX M – EAP CVs