Zitholele Consulting (Pty) Ltd
Reg. No. 2000/000392/07

PO Box 6002 Halfway House 1685, South Africa
Building 1, Maxwell Office Park, Magwa Crescent West
c/o Allandale Road & Maxwell Drive, Waterfall City, Midrand
T : 011 207 2060 **F** : 086 674 6121 **E** : mail@zitholele.co.za

FINAL BASIC ASSESSMENT REPORT

for

Development of the Kiwano Solar Photovoltaic Facility and Battery Energy Storage System, including associated substation and 132kV loop-in loop-out powerlines

Report No : 21139-46-Rep-001-Kiwano Solar PV and BESS FBAR-Rev2

Submitted to :

Department of Forestry, Fisheries and Environment
Environment House
473 Steve Biko
Arcadia
Pretoria
0083
South Africa

Submitted on behalf of :

Eskom Holdings SOC Ltd
Northern Cape Operating Unit
Po Box 606
Kimberley
8301

03 February 2023 21139

Additions and amendments undertaken to this document has been underlined in the text for ease of reference

DOCUMENT CONTROL SHEET

Project Title : Development of Kiwano Solar Photovoltaic Facility and Battery Energy Storage System, including associated substation and 132kV loop-in loop-out powerlines

Project No : 21139

Document Ref. No : 21139-46-Rep-001-Kiwano PV BA-Rev1

DOCUMENT APPROVAL

ACTION	DESIGNATION	NAME	DATE	SIGNATURE
Prepared	Report authors / EAP	J. Morwasehla / M. Vosloo / N. Lalie	10.10.2022	
Reviewed	EAP	N. Lalie	14.10.2022	
Reviewed	EAP	A. Esterhuizen	05.12.2022	
Approved	Environmental Lead	M. Vosloo	03.02.2023	

RECORD OF REVISIONS

Date	Revision	Author	Comments
24.10.2022	0	J. Morwasehla / M. Vosloo / N. Lalie	Issue to client for review
11.11.2022	1	J. Morwasehla / M. Vosloo / N. Lalie	Issued/released for public review and comment
03.02.2023	2	J. Morwasehla / M. Vosloo / N. Lalie	Final BAR submitted to the Competent Authority for decision-making

EXECUTIVE SUMMARY

Background

Eskom Holdings SOC Limited ("Eskom") is proposing to develop, construct and operate a 58 Megawatt (MW) Solar Photovoltaic (PV) facility and a Battery Energy Storage System (BESS) with an envisaged capacity of 40 Megawatt (MW) / 200 Megawatt Hour (MWh). The development further include construction of the 132 kilovolt (kV) Kiwano substation with 5 feeder bays and a single Twin-Tern 132 kV overhead powerline on a double circuit support structure connecting Kiwano substation to the Upington substation.

Development Site

The proposed development will be located on Erf 1080 Olyvenhouts Drift Settlement Agricultural Holding approximately 14km southwest of the Upington Central Business District. Erf 1080 is very large in size, measuring in excess of 8000 ha, while a proposed development area, excluding linear services, of approximately 136.9 ha is required for the development of the proposed Kiwano Solar PV and BESS with substation.

Study Area

A development Study Area for each of the two site alternatives were compiled by the addition of a 50m buffer on the Solar PV and BESS site delineation, substation delineation and access road alignment received from Eskom. <u>A 250m buffer on either site of the proposed powerline alignment (500 m powerline development corridor) was implemented to allow minor changes to the alignment of the powerlines during detail design and construction.</u>

Proposed Development Activities

Eskom propose the installation of a solar PV facility with an envisaged capacity of 58 MW. The total site area envisaged for the PV installation measure up to approximately 1 150 000 m^2 (115 hectares). The Solar PV facility will include the following infrastructure:

- 2 x 40 MVA 132/22 kV transformers with associated 22 kV switchgear and control plant
- Build the PV plant with the output rating of 58 MW
- Establish the PV plant POC on the 132 kV between the PV plant and Kiwano 132kV busbar
- Separate statistical metering points to be commissioned for the BESS plant and the PV plant
- The BESS and PV plant are to be positioned and configured in isolation of each other in terms of connections and dependency

The medium voltage (MV) / low voltage (LV) transformation and LV equipment for BESS and PV must be designed by the Engineering, Procurement and Construction (EPC) Contractor according to Eskom specifications.

The envisaged area the solar PV modules, which will convert solar radiation directly into electricity, will cover is expected to total approximately 450 000 m^2. The solar PV modules will be elevated above the ground and will be mounted on either fixed tilt systems or tracking systems (comprised of galvanised steel and aluminium). The Solar PV modules will be placed in rows in such a way that there is allowance for a perimeter road and security fencing along the site boundary, and access roads in between the PV module rows.

A Solar PV Plant generates electrical power by converting solar radiation through a process known as the photovoltaic effect. The Solar PV Plant consists of the following components and configurations that will be further explored at conceptual design and specified in the functional specification:

- PV modules that are connected in series to form strings. These strings are further combined in parallel via combiner boxes to form PV arrays.
- PV ground mounting structures and foundations are used to fix the PV modules to the ground at the appropriate orientation to the sun.
- Inverter and transformer cabins which house the inverters that converts DC electricity from the PV arrays to AC electricity at grid frequency, and transformers to step-up the voltage as determined by the selected point of connection.
- Solar PV plant power collection switchgear, auxiliary transformers, and battery tripping units.
- AC cabling that will connect the Solar PV plant to the selected point of connection.
- Control and instrumentation equipment to monitor and configure plant operations.
- Infrastructure and associated utilities such as roads, storm water infrastructure, security fence, buildings, and meteorological measuring stations.

Eskom propose to install a Battery Energy Storage System (BESS) facility with an envisaged capacity of 40 MW / 200 MWh. The BESS facility will be located in the south-eastern section of the development site and will integrate at the proposed Kiwano substation together with the Solar PV facility. The BESS facility will include the following infrastructure:

- 2 x 40 MVA 132/22 kV transformers with associated 22 kV switchgear and control plant, and connect at Kiwano 132kV busbar
- Establish the BESS POC on the 132 kV between the BESS plant and Kiwano 132 kV busbar
- Build the BESS plant with an output rating of 40 MW / 200 MWh

The use cases for Kiwano BESS are ancillary services support and energy support. The custodian of ancillary services and energy support service is the System Operator. The BESS will have capability to charge from the proposed PV as well as from the grid. The dispatching of the BESS will be under the custodianship of the System Operator.

Eskom proposes to construct a 132 kV substation with 5 feeder bays on the eastern extent of the development site. This substation will be known as the Kiwano 132 kV substation and will include the following infrastructure:

- 132kV Double Bus-Bar
- 132kV Bus-Coupler
- 132kV incomer feeder bay
- Establish 2 x 132 kV feeder bays for the BESS connection
- Establish additional 2 x 132 kV feeder bays for the PV integration
- Spatial provision for a minimum of additional 4 x 132 kV feeder bays for future use

Kiwano Substation will be a dedicated substation to integrate the proposed BESS and PV projects into the network. No known local constraints that would prevent Kiwano BESS and PV from being able to export the 40 MW BESS and 58 MW PV were identified at the Kiwano site.

The solar PV and BESS facility will include the construction of a 132kV single twin-turn overhead powerline on a double circuit support structure connecting the Kiwano substation to the Upington substation in order to evacuate power generated at the facility. Tower structures that will be utilised include S/C Angle Strain Structure at bend points along the powerline alignment, and S/C Suspension Structure for inline structures- between bend points. This line is rated at 408 MVA at 70°C templating.

The development will require the following roads to be constructed to service the solar PV and BESS facility:

- Access road from the nearest existing road to the facility. Where possible, existing roads that provide access to the Kiwano site will be used, upgraded, and extended as necessary. For Site A, an access road, approximately 6 m wide and estimated up to 5 km long, will be required to provide access to the PV site. For Site B, a new access road from the existing D3276 road to the site will be required, approximately 6 m wide and estimated up to 1 km long. The existing D3276 road will require upgrading, approximately 6 m wide and estimated up to 4 km long (from N14 to site access road).
- A perimeter road around the site, approximately 5 m wide and 4.5 km in length.
- Internal roads for access to the Inverter stations, approximately 5 m wide and 18 km total length.
- Internal roads/paths between the Solar PV module rows, approximately 2-3 m wide, to allow access to the Solar PV modules for operations and maintenance activities.

Project Screening

Environmental sensitivities were identified through the DFFE online screening tool as well as a desktop screening independently undertaken by the EAP. Several specialist studies were identified as a result of the screening undertaken for the proposed development and the following studies were commissioned to support the application for Environmental Authorisation:

- Soil and Agricultural Compliance Statement
- Terrestrial Biodiversity Impact Assessment, including Animal and Plant Species Assessment
- Wetlands and Surface Water Impact Assessment
- Avifauna Impact Assessment
- Heritage, Archaeology and Palaeontology Impact Assessment
- Visual Impact Assessment
- Socio-economic Impact Assessment

Summary of site selection considerations

The development site was assessed as part of Eskom's historic proposal to develop a CSP facility on the proposed site. Three alternative sites were considered, and although the specialist studies did not identify any fatal flaws on any of the sites, Erf 1080 Olyvenhouts Drift Settlement Agricultural Holding emerged as the preferred site when economic and technical considerations were considered. The site was subsequently acquired by Eskom for the purposes of development of renewable energy infrastructure.

Since the suitability of the development site was already considered for the historic proposed CSP development, the site would also serve as the preferred alternative for the Kiwano Solar PV and BESS development. Erf 1080 Olyvenhouts Drift Settlement Agricultural Holding were also found suitable when general site selection considerations were considered. Taking the above into consideration, no alternative site, other than the proposed Erf 1080 Olyvenhouts Drift Settlement Agricultural Holding, has been assessed within this BA process for the proposed Kiwano Solar PV and BESS development.

Surrounding Land use and Infrastructure

The project site is located entirely within the Upington REDZ and the Northern Strategic Powerline Corridor (Figure 6 4). Due to the location of the Upington REDZ, the broader area around the development site is characterised by numerous renewable energy installations, including Solar Photovoltaic (PV) and Concentrated Solar Power (CSP) facilities.

Soil and Agricultural Potential

The most sensitive soil forms identified within the assessment area are the Hutton and Dundee soil forms. The land capability sensitivities (DAFF, 2017) indicate land capabilities with “Very low to Low” sensitivities, which correlates with the findings from the baseline assessment.

The assessment area is associated with non-arable lands, due to the type of soils in the area. The available climate limits crop production significantly. The harsh climatic conditions are associated with low annual rainfall and high evapotranspiration potential demands of the area, which consequently result into a very restricted choice of crops due to the heat and moisture stress. The area is not favourable for most cropping practices, which corresponds to the current agriculture (grazing) and renewable energy facilities activities.

The proposed Kiwano BESS and PV project is characterised with “Very Low” to “Low” land capability sensitivities. It is also the specialist’s opinion that the land capability and land potential of the resources in the regulated area is characterised by “Very Low” to “Low” sensitivities (TBC, 2022d).

It was therefore concluded that the impact of the proposed development on soil, land capability and agricultural potential was INSIGNIFICANT. No Impact Assessment was resultantly undertaken for impacts on soil, land capability and agricultural potential in Chapter 8 of this Basic Assessment Report.

Hydrology and Surface Water

Various non-wetland drainage features and two non-wetland depressions (pans) were identified within the 500 m regulated area. None of these systems are characterised by hydromorphic signs of wetness, and therefore do not constitute wetland habitat. The drainage features are not characterised by riparian vegetation and grasses, these systems represent bare surfaces with evidence of surface run-off. A large number of small drainage features were identified within the assessment area. None of these systems are characterised by wetland features as only alluvial soils and no hydrophytic vegetation is present (TBC, 2022b).

A number of impact points with delineated watercourse features were identified for Site A (Figure 6 17) and Site B (Figure 6 18). For Site A, the roads, pipeline and power line will have multiple crossings over the delineated drainage line and will thus have the highest impacts on the watercourses. For Site B there are two drainage features running through the proposed PV facility area and the roads, pipeline and power line will have multiple crossings over the delineated drainage line and will thus have the highest impacts on the watercourses

Furthermore, the development site does not fall within a South African Inventory of Inland Aquatic Ecosystem (SAIIAE), Strategic Water Source Areas (SWSA), or National Freshwater Ecosystem Priority Areas (NFEPA).

Terrestrial Biodiversity (Flora and Fauna)

The proposed development overlaps with two vegetation types, the Kalahari Karroid Shrubland and the Bushmanland Arid Grassland (TBC, 2022a). Both these vegetation types are listed as Least Threatened in terms of the National Biodiversity Assessment, 2018 database.

Site Layout Alternative A proposes an access road to be constructed from the N14 national road to the western boundary of the development site. The proposed access road will traverse through a CBA area for a distance of approximately 2.8km and will have a direct impact on the CBA resulting in the permanent clearing of vegetation. For Site Layout Alternative B neither the access road, Solar PV or BESS development footprint nor powerline will travel through a CBA.

295 Species of indigenous plants are expected to occur within the development area and surrounding landscape. During the field assessment a total of 52 species, representing 22 families of flora species were recorded within the assessment area. None of the expected threatened flora species were recorded within the assessment area during the survey period. However, four (4) of the recorded flora species are protected by legislation. No amphibian species were recorded during the survey period, accounting for 0% of the expected species, whereas two reptile species were recorded within the assessment area during the survey periods.

Avifauna

Based on the South African Bird Atlas Project, Version 2 (SABAP2) database, 132 bird species have the potential to occur in the vicinity of the assessment area. Of the potential bird species, nine (9) species are listed as Species of Conservation Concern (SCC), either on a regional or global scale. These include Kori Bustard (*Ardeotis kori*), Abdim's Stork (*Ciconia abdimii*), Pallid Harrier (*Circus macrourus*), Karoo Korhaan (*Eupodotis vigorsii*), Lanner Falcon (*Falco biarmicus*), White-backed Vulture (*Gyps africanus*), Ludwig's Bustard (*Neotis ludwigii*), Martial Eagle (*Polemaetus bellicosus*), and Secretarybird (*Sagittarius serpentarius*).

Five SCCs were observed during the wet and dry season assessments. The SCCs confirmed were Lanner Falcon, Red-footed Falcon, Abdim’s Stork, Secretarybird and Kori Bustard. Based on the nesting behaviour and the habitat type in the assessment area, it can be said that two of the five SCCs are permanent residents in the assessment area (TBC, 2022c).

Heritage, Archaeology and Palaeontology

Isolated Stone Age artefacts were recorded within the alternative development sites as well as a possible grave that is located outside of the development footprint (Beyond Heritage, 2022). The heritage significance of the Stone Age artefacts is of Low Significance, while the possible grave site is of High Social significance.

The palaeontological study concluded that it is extremely unlikely that any fossils would be preserved in the aeolian sands of the Gordonia Formation, Kalahari Group (Quaternary). There is a very small chance that fossils may have been trapped in features such as palaeo-pans or palaeo-springs, and buried by the aeolian sands, but no such feature is visible in the satellite imagery. Nonetheless, a Fossil Chance Find Protocol should be added to the EMPr (Bamford 2022). No palaeontological sensitive areas were identified within the study area.

Although no further mitigation measures were required due to the low heritage, archaeological and palaeontological sensitivity of within the development footprint, the implementation of a chance find procedure was recommended, nonetheless.

Visual

Whilst the landscape in the region of the proposed sites is potentially sensitive to visual impacts due to lack of visual contrast in the landscape and the lack of significant enclosure or relief, the specific sites chosen for the alternative sites (Site A and Site B), the limited number of visual receptors and sensitive views in the area and the low height and flat, linear nature of the development mean that there will be limited impact on the visual and aesthetic environment. This is primarily due to the very subtle ridge of high lying ground located between the proposed sites and the N14 that screens the majority of receptors from any visual impacts (Geonest, 2022).

Important also is the fact that such a development, once constructed, involves very little movement or noise in its operation. It will thus not intrude on the sense of quiet solitude in the area. There are also a number of existing renewable energy facilities in the area which have asserted a change on the visual character of the area. The proposed development is in keeping with this character and whilst further PV infrastructural development may be considered adding to the cumulative impact, the development is also consistent with local, regional and national planning policy (Geonest, 2022).

Socio-economic environment

The Applicant owns the directly affected farm portion, Olyvenhouts Drift Settlement Agricultural Holding 1080 Portion 0. Existing electrical infrastructure on the site includes the Eskom Upington Main Transmission Substation (MTS) and related transmission lines.

The area towards the north and west of the proposed project site is undeveloped and used predominantly for livestock grazing. While Eskom is the landowner for Erf 1080, there is a 5-year grazing agreement with the previous landowner. To the south-east, along the N14 and down towards the banks of the Orange River, livestock grazing, cultivation of grapes and other crops are the predominant land use (Solarys, 2022).

Settlement patterns in this area are characterised by a number of farmsteads, farm employee accommodation and farming related infrastructure. Inhabitants of this area are therefore likely to rely primarily on agriculture to support their livelihoods. The closest human settlement to the proposed project site is the rural agricultural settlement of Kalksloot which is located approximately 3.5 km from the Site A alternative. Oranjevallei is the next closest settlement located approximately 4.7 km from Site A. Other settlements within close proximity of the proposed project site include Louisvale (8.4 km); Dysons Klip (8.3 km); Raaswater (9.5 km); and Bloemsmond (12 km) (Solarys, 2022).

The findings of the SIA indicate that social impacts associated with each of the two project site alternatives are similar. Both alternatives are located on the farm Olyvenhouts Drift Settlement Agricultural Holding 1080 Portion 0, which is owned by the Applicant. Separate assessments have therefore not been undertaken and the significance ratings indicated in this section apply to each of the two site alternatives (Solarys, 2022).

Summary of specialist findings

A summary of the specialist assessments was compiled in Chapter 8, 9 and 10 of this BAR. It was concluded that not fatal flaws were identified on either of the site layout alternatives proposed or either of the BESS technologies proposed. Impact significance after mitigation ranged between LOW and MODERATE, while no impact significance of HIGH or VERY HIGH were reported.

All specialists concluded that the development of both site layout alternatives was feasible, although Site A were slightly favoured in all of the assessments. However, the development footprint does infringe on pockets of sensitive features, which include a small non-wetland pan, sections of non-perennial drainage lines and habitat for avifauna species of conservation concern. The placement of infrastructure within these features constitutes an acceptable loss, based on the development footprint assessed within this BAR and the avoidance of the larger and more significant drainage features.

EAP's reasoned opinion

Based on the findings of independent specialist studies and the suitability of the implementation of the development footprint assessed as part of this BAR, it is the EAP's recommendation that the Site Layout Alternative B be authorised as the preferred development footprint of the proposed Kiwano Solar PV and BESS development.

Furthermore, although the BESS Technology Alternative 1 (Solid State Batteries) has emerged as the preferred BESS technology alternative, it must be noted that both BESS technology alternatives (Solid State Batteries and Flow Batteries) are feasible technology alternatives. Final BESS technology selection will however only occur during the design and implementation phase once the EPC contractor has been appointed.

All impacts identified can be mitigated to acceptable levels or enhanced through the implementation of the recommended mitigation or enhancement measures. Through the assessment of the development of the proposed Kiwano Solar PV and BESS within the broader study area, and the implementation of the preferred layout map, it can be concluded that the development of the solar PV and BESS facility is environmentally acceptable, however subject to the implementation of the recommended mitigation measures.

Considering the findings of the independent specialist studies, the impacts identified, the preferred development footprint proposed by the proponent, the avoidance of the high sensitive environmental features within the development area, as well as, the potential to further minimise the impacts to acceptable levels through mitigation, **it is the reasoned opinion of the EAP that the development of the proposed Kiwano Solar PV and BESS facility is acceptable within the landscape and can reasonably be authorised for Site Layout Alternative B.**

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

LIST OF ABBREVIATIONS

AC	alternating current
AEL	Atmospheric Emission License
BA	Basic Assessment
BAR	Basic Assessment Report
BESS	Battery Energy Storage System
BPEO	Best Practicable Environmental Option
BARESG	Birds and Renewable Energy Specialist Group
CBD	Central Business District
CRR	Comments and Response Report
CA	Competent Authority
CSP	Concentrated Solar Power
CSP	Concentrating Solar Plant
COP	Conference of the Party
CARA	Conservation of Agricultural Resources Act, No 43 of 1983
CAR	Coordinated Avifaunal Roadcount
CWAC	Coordinated Waterbird Count
CBA	Critical Biodiversity Area
CR	Critically Endangered
DKLM	Dawid Kruiper Local Municipality
DoE	Department of Energy
DFFE	Department of Fisheries, Forestry and the Environment
DoH	Department of Health
DoL	Department of Labour
DMRE	Department of Mineral Resources and Energy
DWS	Department of Water and Sanitation
DoD	depth of discharge
DEM	Digital Elevation Model
DC	direct current
DM	District Municipality
DBAR	Draft Basic Assessment Report
ESA	Ecological Support Area
EPL	Ecosystem Protection Level
ETS	Ecosystem Threat Status
ERA	Electricity Regulation Act, No 4 of 2006
e-WULAAS	electronic Water Use Licence Application and Authorisation System
EN	Endangered
EWT	Endangered Wildlife Trust
ESSs	energy storage systems
EPC	Engineering, Procurement and Construction
ECA	Environment Conservation Act, No 73 of 1989
ESMS	Environmental and Social Management System
EAP	Environmental Assessment Practitioner
EAPASA	Environmental Assessment Practitioners Association of South Africa
EA	Environmental Authorisation
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EPs	Equator Principles
FEPA	Freshwater Ecosystem Priority Areas
GHI	Global Horizontal Irradiance
GIIP	Good International Industry Practice

GHG	Greenhouse Gases
GVA	Gross Value Added
HSA	Hazardous Substances Act, No 15 of 1973
IBA	Important Bird Areas
IPP	Independent Power Producer
IEP	Integrated Energy Plan
IEMIS	Integrated Environmental Management Information Series
IRP	Integrated Resource Plan
I&APs	Interested and Affected Parties
IAIAsa	International Association for Impact Assessment South Africa
IFC	International Finance Corporation
IAP	Invasive Alien Plants
FeCr	Iron-Chromium
JET	Just Energy Transition
kV	kilovolt
LCUs	landscape character units
LCO	Lithium cobalt oxide
LFP	Lithium iron phosphate
LMO	Lithium manganese oxide
NMC	Lithium nickel cobalt manganese
LM	Local Municipality
LV	low voltage
MTS	Main Transmission Substation
MAP	Mean Annual Precipitation
MV	medium voltage
MW	Megawatt
MWh	Megawatt Hour
MASL	Metres Above Sea Level
MPRDA	Minerals and Petroleum Resources Development Act, No. 28 of 2002
NCCRP	National Climate Change Response Policy
NDP	National Development Plan
NDCR	National Dust Control Regulations
NEA	National Energy Act, No. 34 of 2008
NERSA	National Energy Regulator
NEMA	National Environmental Management Act, No. 107 of 1998
NEMAQA	National Environmental Management: Air Quality Act, No 39 of 2004
NEMBA	National Environmental Management: Biodiversity Act, No. 10 of 2004
NEMWA	National Environmental Management: Waste Act, No. 59 of 2008
NFA	National Forests Act, No. 84 of 1998
NFEPA	National Freshwater Ecosystem Priority Areas
NHRA	National Heritage Resources Act, No 25 of 1999
NIP 2050	National Infrastructure Plan 2050
NPC	National Planning Commission
NPAES	National Protected Area Expansion Strategy
NVFFA	National Veld and Forest Fire Act, No 101 of 1998
NWA	National Water Act, No 36 of 1998
NT	Near Threatened
NBKB	Ngwao-Boswa Ya Kapa Bokone
NiCd	Nickel Cadmium
NCCCRS	Northern Cape Climate Change Response Strategy
NCDENC	Northern Cape Department of Environment and Nature Conservation
NCOU	Northern Cape Operating Unit
NCPGDP	Northern Cape Provincial Growth and Development Plan

MTSF POA	Northern Cape Provincial Medium Term Strategic Framework Programme of Action
NCPSDF	Northern Cape Provincial Spatial Development Framework
OHSA	Occupational Health and safety Act, No. 85 of 1993
AIS	on Alien and Invasive Species
PSs	Performance Standards
PV	Photovoltaic
POC	Points of Connection
PSB	Polysulfide Bromide
PCC	Presidential Climate Commission
PICC	Presidential Infrastructure Coordinating Commission
Pr. Sci. Nat.	Professional Natural Scientist
PAOI	Project Area of Influence
PA	Protected Area
PPP	Public Participation Process
RAAA	Radio Astronomy Advantage Area
RFI	Radio Frequency Interference
RFB	redox flow battery
RI&APs	registered interested and affected parties
RE	Renewable Energy
REDZ	Renewable Energy Development Zone
REEA	Renewable Energy EIA Application
REP	Renewable Energy Park
REIPPP	Renewable Independent Power Producer Programme
RTE	round trip efficiency
SIA	Social Impact Assessment
SIA	Socio-Economic Impact Assessment
NaNiCl	Sodium Nickel Chloride
NaS	Sodium Sulphur
PV	Solar Photovoltaic
NCCRP	South Africa’s National Climate Change Response Policy
SABAP	South African Bird Atlas Project
SACAD	South African Conservation Area Database
SACNASP	South African Council for Natural Scientific Professions
SAHRA	South African Heritage Resources Agency
SAIIAE	South African Inventory of Inland Aquatic Ecosystem
SANRAL	South African National Roads Agency
SAPAD	South African Protected Area Database
SAROA	South African Radio Astronomy Observatory
SDF	Spatial Development Framework
SEZ	Special Economic Zone
SCC	Species of Conservation Concern
SEMA	Specific Environmental Management Acts
SOEs	state-owned enterprises
SEA	Strategic Environmental Assessment
SIP	Strategic Infrastructure Project
SIPs	Strategic Integrated Projects
SWSA	Strategic Water Source Areas
SDG	Sustainable Development Goals
NaAlCl4	tetrachloroaluminate
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
VRFB	Vanadium Redox Flow Batteries
VU	vulnerable

WMA	Water Management Area
WULA	Water Use License Application
ZBr	Zinc Bromine
ZnFe	Zinc-Iron

GLOSSARY OF TERMS

Term	Description
Alien species	A species that is not indigenous to the area or out of its natural distribution range.
Alternatives	Alternatives are different means of meeting the general purpose and need of a proposed activity. Alternatives may include location or site alternatives, activity alternatives, process or technology alternatives, temporal alternatives or the 'do nothing' alternative.
Assessment	The process of collecting, organising, analysing, interpreting and communicating information which is relevant.
Basic Assessment Process	As defined by NEMA.
Biological diversity	The variables among living organisms from all sources including, terrestrial, marine and other aquatic ecosystems and the ecological complexes they belong to.
Commence	The start of any physical activity, including site preparation and any other activity on site furtherance of a listed activity or specified activity, but does not include any activity required for the purposes of an investigation or feasibility study as long as such investigation or feasibility study does not constitute a listed activity or specified activity.
Construction	Construction means the building, erection or establishment of a facility, structure or infrastructure that is necessary for the undertaking of a listed or specified activity as per Regulations GNR 544, 545 and 546 of June 2010. Construction begins with any activity which requires Environmental Authorisation.
Cumulative impacts	The impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.
Decommissioning	To take out of active service permanently or dismantle partly or wholly, or closure of a facility to the extent that it cannot be readily re-commissioned. This usually occurs at the end of the life of a facility.
Direct impacts	Impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity (e.g. noise generated by blasting operations on the site of the activity). These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.
'Do nothing' alternative	The 'do nothing' alternative is the option of not undertaking the proposed activity or any of its alternatives. The 'do nothing' alternative also provides the baseline against which the impacts of other alternatives should be compared.
Drainage	A drainage line is a lower category or order of watercourse that does not have a clearly defined bed or bank. It carries water only during or immediately after periods of heavy rainfall i.e. non-perennial, and riparian vegetation may or may not be present.
Ecosystem	A dynamic system of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit.
Endangered species	Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating. Included here are taxa whose numbers of individuals have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction.
Endemic	An "endemic" is a species that grows in a particular area (is endemic to that region) and has a restricted distribution. It is only found in a particular place. Whether something is endemic or not depends on the geographical boundaries of the area in question and the area can be defined at different scales.
Environment	the surroundings within which humans exist and that are made up of: The land, water and atmosphere of the earth; Micro-organisms, plant and animal life; Any part or combination of (i) and (ii) and the interrelationships among and between them; and

Term	Description
	The physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.
Environmental assessment practitioner:	An individual responsible for the planning, management and coordinating of environmental management plan or any other appropriate environmental instruments introduced by legislation.
Environmental impact	An action or series of actions that have an effect on the environment.
Environmental management	Ensuring that environmental concerns are included in all stages of development, so that development is sustainable and does not exceed the carrying capacity of the environment.
Environmental management programme	An operational plan that organises and co-ordinates mitigation, rehabilitation and monitoring measures in order to guide the implementation of a proposal and its on-going maintenance after implementation.
Habitat	The place in which a species or ecological community occurs naturally.
Heritage	That which is inherited and forms part of the National Estate (Historical places, objects, fossils as defined by the National Heritage Resources Act of 2000).
Hazardous waste	Any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment.
Indigenous	All biological organisms that occurred naturally within the study area prior to 1800
Indirect impacts	Indirect or induced changes that may occur as a result of the activity (e.g. the reduction of water in a stream that supply water to a reservoir that supply water to the activity). These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken, or which occur at a different place as a result of the activity.
Interested and affected party	Individuals or groups concerned with or affected by an activity and its consequences. These include the authorities, local communities, investors, work force, consumers, environmental interest groups and the general public.
Pollution	A change in the environment caused by substances (radio-active or other waves, noise, odours, dust or heat emitted from any activity, including the storage or treatment or waste or substances.
Rare species	Taxa with small world populations that are not at present Endangered or Vulnerable but are at risk as some unexpected threat could easily cause a critical decline. These taxa are usually localised within restricted geographical areas or habitats or are thinly scattered over a more extensive range. This category was termed Critically Rare by Hall and Veldhuis (1985) to distinguish it from the more generally used word "rare".
Red data species	Species listed in terms of the International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species, and/or in terms of the South African Red Data list. In terms of the South African Red Data list, species are classified as being extinct, endangered, vulnerable, rare, indeterminate, insufficiently known or not threatened (see other definitions within this glossary).
Riparian	The area of land adjacent to a stream or river that is influenced by stream-induced or related processes. Riparian areas which are saturated or flooded for prolonged periods would be considered wetlands and could be described as riparian wetlands. However, some riparian areas are not wetlands (e.g. an area where alluvium is periodically deposited by a stream during floods, but which is well drained).
Significant impact	An impact that by its magnitude, duration, intensity, or probability of occurrence may have a notable effect on one or more aspects of the environment.
Waste	Any substance, material or object, that is unwanted, rejected, abandoned, discarded or disposed of, or that is intended or required to be discarded or disposed of, by the holder of that substance, material or object, whether or not such substance, material or object can be re-used, recycled or recovered and includes all wastes as defined in Schedule 3 to the Waste Amendment Act (as amended on June 2014); or any other substance, material or object that is not included in Schedule 3 that may be defined as a waste by the Minister.
Watercourse	As per the National Water Act means -

Term	Description
	(a) a river or spring; (b) a natural channel in which water flows regularly or intermittently; (c) a wetland, lake or dam into which, or from which, water flows; and (d) any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.
Wetlands	land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which under normal circumstances supports or would support vegetation typically adapted to life in saturated soil (Water Act 36 of 1998); land where an excess of water is the dominant factor determining the nature of the soil development and the types of plants and animals living at the soil surface (Cowardin et al., 1979).

DOCUMENT ROADMAP

This Basic Assessment Report (BAR) aims to conform to the requirements stipulated in Appendix 1 of the National Environmental Management Act 107 of 1998 (NEMA) Environmental Impact Assessment Regulations, 2014 (as amended). The table below presents the document's structure, in terms of conformance with the aforementioned regulatory requirements. Based on the contents of this table, it is evident that the BAR conforms to the regulatory requirements and provides sufficient information to facilitate the Competent Authority (CA) i.e. Department of Forestry, Fisheries and the Environment (DFFE) to reach an informed decision with regards to granting or refusal of the Environmental Authorisation (EA).

Document Roadmap in terms of Appendix 1 NEMA EIA Regulations, 2014

Regulatory Requirement		Description	Document Section
3(a)		Details of - (i) the EAP who prepared the report; and (ii) the expertise of the EAP, including a curriculum vita;	Section 1.4
3(b)		Details of the location of the activity, including: (i) the 21-digit Surveyor General code of each cadastral land parcel; (ii) where available, the physical address and farm name; and (iii) where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;	Section 2.2
3(c)		A plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale, or, if it is - (i) a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; (ii) on land where the property has not been defined, the coordinates within which the activity is to be undertaken;	Appendix A-3 and F
3(d)		(d) a description of the scope of the proposed activity, including- (i) all listed and specified activities triggered and being applied for; (ii) a description of the associated structures and infrastructure related to the development;	Sections 2.3, 2.4 and 5.2
3(e)		a description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context.	Chapter 5
3(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.	Chapter 4
3(g)		a motivation for the preferred development footprint within the approved site.	Chapter 10, Section 10.3
3(h)		A full description of the process followed to reach the proposed development footprint within the approved site, including	
	(i)	details of the development footprint alternatives considered;	Section 3.1

Regulatory Requirement		Description	Document Section
	(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;	Appendix J-12
	(iv)	the environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Chapter 6
	(v)	the impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts – (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated;	Chapter 8
	(vi)	the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks	Section 8.1
	(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;	Chapter 8
	(viii)	the possible mitigation measures that could be applied and level of residual risk;	Chapter 8
	(ix)	if no alternative development locations for the activity were investigated, the motivation for not considering such; and	Chapter 3
	(x)	a concluding statement indicating the preferred alternative development location within the approved site	Section 10.3
3(i)		a full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred location through the life of the activity, including - (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	Chapter 8
3(j)		an assessment of each identified potentially significant impact and risk, including- (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 mitigated;	Chapter 8

Regulatory Requirement	Description	Document Section
3(k)	where applicable, a summary of the findings and recommendations of any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report;	Chapter 6
3(l)	an environmental impact statement which contains – (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;	Chapters 8, 9, 10 and 11
3(m)	based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation	Appendix H and Chapters 8, 9, 10 and 11
3(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	Chapter 11
3(o)	a description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed	Section 1.9
3(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;	Section 11.3
3(q)	where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded, and the post construction monitoring requirements finalised	N/A
3(r)	an undertaking under oath or affirmation by the EAP in relation to: (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 or affected parties	Section 1.6
3(s)	where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;	N/A
3(t)	any specific information that may be required by the competent authority; and	N/A
3(u)	any other matters required in terms of section 24(4)(a) and (b) of the Act.	N/A

1 INTRODUCTION

1.1 Project Background

Eskom Holdings SOC Limited ("Eskom") is proposing to develop, construct and operate a 58 Megawatt (MW) Solar Photovoltaic (PV) facility and a Battery Energy Storage System (BESS) with an envisaged capacity of 40 Megawatt (MW) / 200 Megawatt Hour (MWh). The development further include construction of the 132 kilovolt (kV) Kiwano substation with 5 feeder bays and a single Twin-Tern 132 kV overhead powerline on a double circuit support structure connecting the Kiwano Substation to the Upington Substation.

Zitholele Consulting (Pty) Ltd ("Zitholele") has been appointed by Eskom as the independent Environmental Assessment Practitioner (EAP) to undertake a Basic Assessment (BA) process, including Specialist Studies, and apply for the necessary Environmental Authorisation (EA) for the proposed project.

1.2 Purpose of this Report

In accordance with the National Environmental Management Act, No. 107 of 1998 (NEMA), as amended, and the NEMA EIA Regulations of 4 December 2014 (GN R.982), as amended, the issuing of an EA requires the undertaking of a BA process, with associated Public Participation Process (PPP) and the required Specialist Studies. This will enable the Competent Authority to decide whether or not, to issue an EA for the proposed development.

The EIA Regulations of 2014 (as amended) allows for a BA process to be undertaken for activities with limited environmental impact as listed in Listing Notice 1 (GN R.983) and Listing Notice 3 (GN R.985), as well as for the undertaking of a more rigorous two-tiered Scoping and Environmental Impact Assessment (EIA) process for activities with potentially greater environmental impact. Activities that may trigger the need to undertake a Scoping and EIA process are listed in Listing Notice 2, as stipulated in GN R.984.

In terms of the EIA Regulations of 2014 (as amended), activities associated with the proposed development project are listed under Listing Notice 1, Listing Notice 2 and Listing Notice 3, which requires a Scoping and Environmental Impact Reporting (S&EIR) process to be undertaken due to the fact that activities from Listing Notice 2 is also triggered.

However, in terms of Section 3 of GN 114 of 2018, solar projects that falls within a Renewable Energy Development Zone (REDZ) are exempted from following a full S&EIR process and may follow a Basic Assessment (BA) Process. The proposed solar development falls entirely within the demarcated REDZ, as published by the Department of Fisheries, Forestry and the Environment (DFFE). As such, a BA Process will be followed.

1.3 Report Structure

This Basic Assessment Report (BAR) aims to conform to the requirements stipulated in Appendix 1 of the National Environmental Management Act 107 of 1998 (NEMA) Environmental Impact Assessment Regulations, 2014 (as amended).

This report documents the process and findings of the BA process, and associated PPP for the proposed facility and associated infrastructure. This report is subject to a public comment period from 24 October to 23 November 2022. The BAR will thereafter be finalised (inclusive of consideration of the comments received from the public and a Comments and Responses Report) and will be submitted to the Competent Authority (CA) for review and decision-making.

The BA Report is structured according to the following chapters:

- **Chapter 1: Introduction** - provides background to proposed Kiwano Solar PV, BESS and associated infrastructure (herein referred to as the proposed development) project, the Applicant, EAP and Specialist Team and limitations to the BA process.
- **Chapter 2: Project Description** - provides a detailed description of the activities and infrastructure associated with the proposed development.
- **Chapter 3: Consideration of Alternatives** - provides site selection information and an overview of the identified project alternatives.
- **Chapter 4: Project Need and Desirability** - describes the need and desirability of proposed development within the surrounding Upington area.
- **Chapter 5: Policy and Legislative Context** - outlines the strategic regulatory and legal context for energy planning in South Africa, and specifically relating to proposed development.
- **Chapter 6: Description of the Affected Environment** - describes the existing biophysical and socio-economic environment within, and surrounding the broader study and the development area.
- **Chapter 7: Basic Assessment and Public Participation Process –** provides a summary of the general steps and approach to undertaking the BA process.
- **Chapter 8: Impact Identification and Assessment** - provides an assessment of the potential and anticipated impacts associated with construction, operation and decommissioning of the proposed development, and presents recommendations for the mitigation of significant impacts.
- **Chapter 9: Assessment of Cumulative Impacts** - provides an assessment of the potential cumulative impacts associated with construction, operation and decommissioning of the proposed development, and presents recommendations for the mitigation of significant impacts.
- **Chapter 10: Summary of Key Environmental Findings** – presents the impact summary of all key and significant environmental findings and recommendations
- **Chapter 11: Conclusion and Recommendation** - presents the conclusions and recommendations of the study, including the EAP’s reasoned opinion based on the findings of the BA Report.

- **Chapter 12: References** - provides references used in the compilation of the BA Report.

1.4 Details of Environmental Assessment Practitioner

Zitholele is an empowerment company formed to provide specialist consulting services primarily to the public sector in the fields of Water Engineering, Integrated Water Resource Management, Environmental and Waste Services, Communication (public participation and awareness creation) and Livelihoods and Economic Development.

Zitholele has no vested interest in the proposed project and hereby declares its independence as required in terms of the EIA Regulations. Table 1-1 provides the Environmental Assessment Practitioner (EAP) details. CVs of the EAPs that undertook the assessment and compiled the report is included in Appendix M.

Table 1-1: Details of the Environmental Assessment Practitioner

Name and Surname	**Ms. Natasha Lalie (EAP and Technical Reviewer)**
Highest Qualification	MSc (Environment and Society), University of Pretoria
Professional Registration	Registered EAP: Environmental Assessment Practitioners Association of South Africa (EAPASA), Registration No. 2021/3611.
Company Represented	Zitholele Consulting (Pty) Ltd
Physical Address	Building 1, Maxwell Office Park, Magwa Crescent West, Waterfall City, Midrand
Postal Address	P.O. Box 6002, Halfway House, 1685
Contact Number	011 207 2060
Facsimile	086 674 6121
E-mail	natashal@zitholele.co.za
Name and Surname	**Dr. Mathys Vosloo (Project Manager, Project Consultant)**
Highest Qualification	PhD (Zoology)
Professional Registration	Registered *Pr.Sci.Nat.* (Registration no. 400136/12) with South African Council for Natural Scientific Professions (SACNASP).
Company Represented	Zitholele Consulting (Pty) Ltd
Physical Address	Building 1, Maxwell Office Park, Magwa Crescent West, Waterfall City, Midrand
Postal Address	P O Box 6002, Halfway House, 1685
Contact Number	011 207 2079
Facsimile	086 674 6121
E-mail	mathysv@zitholele.co.za
Name and Surname	**Ms. Jessica Morwasehla (Project Consultant)**
Highest Qualification	BSc (Environmental and Resource Studies)
Professional Registration	SACNASP Candidate (121840)
Company Represented	Zitholele Consulting (Pty) Ltd.
Physical Address	Building 1, Maxwell Office Park, Magwa Crescent West, Waterfall City, Midrand
Postal Address	P O Box 6002, Halfway House, 1685
Contact Number	011 207 2060
Facsimile	086 674 6121
E-mail	jessicam@zitholele.co.za

1.5 Expertise of the Environmental Assessment Practitioner

Ms. Natasha Lalie has obtained an MSc. Environment and Society degree from the University of Pretoria and has been an Environmental Assessment Practitioner (EAP) for almost nineteen years. She has undertaken numerous Scoping Reports, Environmental Management Programmes (EMPr's), Environmental Screening and Feasibility Studies and Environmental Permitting and Licencing projects, as required by NEMA and the EIA Regulations (as amended). She has been involved in a wide range of projects, which include waste management, industrial, township establishments, mixed-use development, road upgrades, infrastructure developments, change of land use, lodge developments, proposed bulk water pipelines, proposed transmission power lines, proposed filling stations, shopping centre developments and so on. Natasha Lalie is a registered EAP with the Environmental Assessment Practitioners Association of South Africa (EAPASA) since September 2021.

Dr Mathys Vosloo graduated from the Nelson Mandela Metropolitan University with a PhD in Zoology in 2012, after successfully completing a MSc in Zoology and BSc (Hons) in Zoology. Dr Vosloo is a member of the International Association for Impact Assessments (IAIA) and is a registered Professional Natural Scientist (*Pr. Sci. Nat*.) in the field of Ecological Science with the South African Council for Natural Scientific Professionals (SACNASP) since 2012. He has been involved in electricity generation, transmission and distribution projects and their potential impacts on the environment for a large part of his career. Mathys has gained extensive experience in managing integrated environmental authorisation processes and has successfully managed large projects through the phases of EIA in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) and National Environmental Management Waste Act, 2008 (Act No. 59 of 2008). Mathys has also been involved in Water Use Licensing as a component of integrated authorisation processes.

Dr Vosloo has been involved in electricity generation, transmission and distribution projects and their potential impacts on the environment for a large part of his career. Mathys has gained extensive experience in managing integrated environmental authorisation processes and has successfully managed large projects through the phases of EIA in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) and National Environmental Management Waste Act, 2008 (Act No. 59 of 2008). Mathys has also been involved in Water Use Licensing as a component of integrated authorisation processes. Mathys has a comprehensive understanding of the relevant environmental legislation and works intimately with specialist consultants to ensure that potential impacts are accurately identified, assessed and mitigated.

Ms Jessica Morwasehla is a Junior Environmental Assessment Practitioner, holds a BSc Degree (Environmental and Resource Studies) from the University of Limpopo (Turfloop Campus) and National Certificate in Environmental (Learnership program) from Green Skills Academy. She has 4 year working experience in the environmental field. Her competencies lie in ArcGIS, Basic Assessment, Environmental Screening, Environmental Control Services, and Water Use License Application through eWULAAs and Public Participation for small- and large-scale projects. She is a member of the International Association for Impact Assessment

South Africa (IAIAsa) and is a registered candidate with the South African Council for Natural Scientific professionals (SACNASP) since 2019.

1.6 Statement of Zitholele's Independence and EAP Affirmation

Neither Zitholele, nor any of the authors of this Report have any material interest in the outcome of this Report, nor do they have any pecuniary or other interest that could be reasonably regarded as being capable of affecting their independence or that of Zitholele. Zitholele has no beneficial interest in the outcome of the assessment which is capable of affecting its independence.

<u>EAP AFFIRMATION:</u>

Section 16 (1) (b) (iv), Appendix 1 Section 3 (1) (r), Appendix 2 Sections 2 (I) and (j) and Appendix 3 Section 3 (s) of the Environmental Impact Assessment (EIA) Regulations, 2014 (promulgated in terms of the NEMA), require an undertaking under oath or affirmation by the EAP in relation to:

- The correctness of the information provided in the report;
- The inclusion of comments and inputs from stakeholders and interested and affected parties;
- 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.

Zitholele and the EAPs managing this project hereby affirm that:

- To the best of our knowledge, the information provided in the report is correct, and no attempt has been made to manipulate information to achieve a particular outcome. Some information, especially pertaining to the project description, was provided by the applicant and/or their sub-contractors.
- To the best of our knowledge all comments and inputs from stakeholders and interested and affected parties have been captured in the report and no attempt has been made to manipulate such comment or input to achieve a particular outcome. Written submissions are appended to the report while other comments are recorded within the report. For the sake of brevity, not all comments are recorded verbatim and are mostly captured as issues, and in instances where many stakeholders have similar issues, they are grouped together, with a clear listing of who raised which issue(s).

Information and responses provided by the EAP to interested and affected parties are clearly presented in the report. Where responses are provided by the applicant (not the EAP), these are clearly indicated.

The EAP Declaration of Interest is included in Appendix N.

1.7 DFFE Screening Tool Assessments

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 DFFE's national web based environmental screening tool (https://screening.environment.gov.za) is compulsory for the submission of applications, in terms of Regulation 19 and 21 of the 2014 EIA Regulations (as amended).

The Screening Tool Assessments were undertaken for the two proposed alternative site layouts independently, and the results of the environmental sensitivities as per the Screening Tool Assessments are presented in Table 1-2 below. Table 1-3 provides a cross-reference to the Appendices where the Specialist Assessment identified in terms of the DFFE Screening Tool Assessment has been included in the BAR. In instances where a Specialist Study is not included, a motivation by the EAP is included in Table 1-3.

Table 1-2: Development Site Environmental Sensitivities assigned by the DFFE Screening Tool Assessment

Theme	Development Site Environmental Sensitivities	
	Site Alternative A	Site Alternative B
Agriculture	Low	Low
Animal Species	Medium	High
Aquatic Biodiversity	Low	Low
Archaeological and Cultural Heritage	High	Low
Avian	High	High
Civil Aviation (Solar PV)	Low	Low
Defence	Medium	Medium
Landscape (Solar)	Very High	Very High
Palaeontology	Medium	Medium
Plant Species	Low	Low
Radio Frequency Interference (RFI)	Medium	Medium
Terrestrial Biodiversity	Very High	Very High

Table 1-3: Specialist assessments identified in terms of the DFFE Screening Tool Assessment

Specialist Assessment	Site Alternative A	Site Alternative B
Agricultural Impact Assessment	An Agricultural Compliance Statement was compiled for the development site and is included in **Appendix H-7**	An Agricultural Compliance Statement was compiled for the development site and is included in **Appendix H-7**
Visual Impact Assessment	A Visual Impact Assessment has been undertaken and is included as **Appendix H-5**	A Visual Impact Assessment has been undertaken and is included as **Appendix H-5**
Archaeological and Cultural Heritage	An Archaeological and Cultural Heritage Assessment was undertaken	An Archaeological and Cultural Heritage Assessment was undertaken

Specialist Assessment	Site Alternative A	Site Alternative B
	for the development site and is included in **Appendix H-4**	for the development site and is included in **Appendix H-4**
Palaeontology Impact Assessment	The Archaeological and Cultural Heritage Assessment included a Palaeontological Assessment of the development site and is included in **Appendix H-4**	The Archaeological and Cultural Heritage Assessment included a Palaeontological Assessment of the development site and is included in **Appendix H-4**
Terrestrial Biodiversity Impact Assessment	A Terrestrial Biodiversity Impact Assessment and Avifaunal Impact Assessment has been undertaken and included as **Appendix H-1** and **Appendix A-2**, respectively	A Terrestrial Biodiversity Impact Assessment and Avifaunal Impact Assessment has been undertaken and included as **Appendix H-1** and **Appendix A-2**, respectively
Aquatic Biodiversity Impact Assessment	An Aquatic Impact Assessment / Wetland Baseline and Impact Assessment has been undertaken and is included as **Appendix H-3**	An Aquatic Impact Assessment / Wetland Baseline and Impact Assessment has been undertaken and is included as **Appendix H-3**
Civil Aviation Assessment	The site assessment confirmed that the site is surrounded with existing and proposed PV and CSP plants. No major or other types of civil aviation aerodromes were identified within 5km of the development site. The Civil Aviation Authority (CAA) was furthermore consulted to determine specific requirements. A Civil Aviation Assessment was therefore not undertaken.	The site assessment confirmed that the site is surrounded with existing and proposed PV and CSP plants. No major or other types of civil aviation aerodromes were identified within 5km of the development site. The Civil Aviation Authority (CAA) was furthermore consulted to determine specific requirements. A Civil Aviation Assessment was therefore not undertaken.
Defence Assessment	The site inspection confirmed that the site is surrounded with existing and proposed PV and CSP plants. 8 South African Infantry Battalion Army Base is located approximately 17km from the nearest site alternative, while Lohatla Combat Training Centre is located approximately 200km from Site Alternative A. Key stakeholders associated with 8 SAI Battalion, Lohatla and SA Army Foundation were notified of the proposed development.	The site inspection confirmed that the site is surrounded with existing and proposed PV and CSP plants. 8 South African Infantry Battalion Army Base is located approximately 15km from the nearest site alternative, while Lohatla Combat Training Centre is located approximately 200km from Site Alternative A. Key stakeholders associated with 8 SAI Battalion, Lohatla and SA Army Foundation were notified of the proposed development.
Radio Frequency Interference (RFI) Assessment	The development site falls between 14 km and 32 km outside the Karoo Core Astronomy Advantage Area and the Karoo Central Astronomy Advantage Areas. Key stakeholders from South African Radio Astronomy Observatory (SAROA) were notified of the development, and requested to quantify if any significant RFI will result from the development.	The development site falls between 14 km and 32 km outside the Karoo Core Astronomy Advantage Area and the Karoo Central Astronomy Advantage Areas. Key stakeholders from South African Radio Astronomy Observatory (SAROA) were notified of the development, and requested to quantify if any significant RFI will result from the development.
Geotechnical Assessment	A Geotechnical Assessment is undertaken during the engineering design phase to inform the infrastructure design and placement.	A Geotechnical Assessment is undertaken during the engineering design phase to inform the infrastructure design and placement.

Specialist Assessment	Site Alternative A	Site Alternative B
Socio Economic Assessment	A Socio-Economic Impact Assessment has been undertaken and included as **Appendix H-6.**	A Socio-Economic Impact Assessment has been undertaken and included as **Appendix H-6.**
Plant Species Assessment	The plant species assessment was included with the Terrestrial Biodiversity Impact Assessment that has been undertaken and included as **Appendix H-1** .	The plant species assessment was included with the Terrestrial Biodiversity Impact Assessment that has been undertaken and included as **Appendix H-1** .
Animal Species Assessment	The animal species assessment was included with the Terrestrial Biodiversity Impact Assessment and Avifauna Impact Assessment has been undertaken and included as **Appendix H-1** and **Appendix A-2**, respectively.	The animal species assessment was included with the Terrestrial Biodiversity Impact Assessment and Avifauna Impact Assessment has been undertaken and included as **Appendix H-1** and **Appendix A-2**, respectively.

The DFFE Screening Tool Assessments are presented in Appendix G.

1.8 Specialist Team

Specialist input in the fields of Terrestrial Ecology, Avifauna, Wetlands, Visual, Socio-economics and Agriculture were identified to support the application for the Kiwano Solar PV and BESS project. Relevant specialists were appointed by Zitholele to undertake the necessary assessments to identify, assess impacts and propose appropriate mitigation and management measures for the identified impacts in their respective fields. The specialists commissioned for the project, including qualifications and professional registrations are provided in Table 1-4

Table 1-4: Specialist team commissioned for the Kiwano Solar PV and BESS project

Specialist Field	Company	Specialist	Qualifications and Professional Registration
Terrestrial Ecology	The Biodiversity Company	Ms. Leigh-Ann de Wet	MSc (Botany), Rhodes University SACNASP: *Pr. Nat. Sci.,* Registration No. 400233/12: Ecological Science.
		Mr. Andrew Husted	SACNASP: *Pr. Nat. Sci.,* Registration No. 400213/11: Aquatic Science, Ecological Science, Environmental Science.
Avifauna	The Biodiversity Company	Ms. Leigh-Ann de Wet	MSc (Botany), Rhodes University SACNASP: *Pr. Nat. Sci.,* Registration No. 400233/12: Ecological Science.
		Mr. Andrew Husted	SACNASP: *Pr. Nat. Sci.,* Registration No. 400213/11: Aquatic Science, Ecological Science, Environmental Science.
Wetlands	The Biodiversity Company	Mr. Ivan Baker	SACNASP: *Pr. Nat. Sci.,* Registration No. 119315: Environmental Science, Geological Science (Candidate Natural Scientist)
		Mr. Andrew Husted	SACNASP: *Pr. Nat. Sci.,* Registration No. 400213/11: Aquatic Science, Ecological Science, Environmental Science.
Heritage and Archaeology	Beyond Heritage	Mr. Jaco van der Walt	MA Archaeology, Wits (2012) Association of Southern African Professional Archaeologists (ASAPA) #159

Specialist Field	Company	Specialist	Qualifications and Professional Registration
			APHP #114
Palaeontology		Prof. Marion Bamford	PhD Paleo Botany
Visual	Geonest	Mr. Leo Quayle	MPhil (Environmental Management), BSc (Hons) (Geography, GIS), SACNASP: *Pr. Nat. Sci.,* Registration No. 400165/15: Ecological Science, Water Resource Science
Socio-Economic	Solarys	Ms. Ursula Papé	Master of Laws (LLM), University of Pretoria (2021) Environmental Law Association, South Africa International Association for Public Participation
Agricultural Compliance Statement	The Biodiversity Company	Ms. Maletsatsi Mohapi	MSc in Agriculture, University of Free State (2021)
		Mr. Andrew Husted	SACNASP: *Pr. Nat. Sci.,* Registration No. 400213/11: Aquatic Science, Ecological Science, Environmental Science.

The specialist CVs and Declaration of Interests are provided in Appendix O.

A Site Sensitivity Verification Report was compiled at the time of the site assessment and included in Appendix D of the FBAR.

1.9 Gaps, Assumptions and Limitations

The following assumptions and limitations were applicable to the compilation of this impact assessment report:

1.9.1 Basic Assessment Process:

- All information provided by the applicant and I&APs to the environmental team was assumed to be accurate, correct and valid at the time it was provided.

1.9.2 Terrestrial Biodiversity

- The Global Positioning System (GPS) used for the assessment is accurate to 5 metres and therefore any spatial features may be offset by this distance;
- The buffer areas defined by the client were designated as the Project Area of Influence (PAOI);
- No avifaunal results are presented herein, a final avifaunal report will be completed separately, considering the findings from two field surveys; and
- The fieldwork component of the assessment comprised of one wet-season survey. The survey was conducted over two days (the 22 and 23 March 2022). It is possible that plants emerging in other seasons (particularly geophytes) may have been missed.

- Wetland and Surface Water Assessment

- Areas characterised by external wetland indicators have been the focus for this assessment. Areas lacking these characteristics have not been focussed on;
- High concentrations of drainage features and small pan-like features are located throughout the 500 m regulated area. Only those considered to be larger in extent and those with recent water accumulation have been delineated and considered to be more sensitive;
- It has been assumed that the extent of the project area provided to the specialist is accurate; and
- The GPS used for water resource delineations is accurate to within five meters. Therefore, the wetland delineation plotted digitally may be offset by a maximum of five meters to either side.

1.9.3 Wetlands and Surface Water Assessment

- Areas characterised by external wetland indicators have been the focus for this assessment. Areas lacking these characteristics have not been focussed on;
- High concentrations of drainage features and small pan-like features are located throughout the 500 m regulated area. Only those considered to be larger in extent and those with recent water accumulation have been delineated and considered to be more sensitive;
- It has been assumed that the extent of the project area provided to the specialist is accurate; and
- The GPS used for water resource delineations is accurate to within five meters. Therefore, the wetland delineation plotted digitally may be offset by a maximum of five meters to either side.

1.9.4 Avifauna Impact Assessment

- Information relating to project activities, spatial data and infrastructure locations for the proposed development was obtained from information provided by the client. The potential impacts and recommendations described in this report apply specifically to the provided information.
- Although considerable time has been spent to ensure that information utilised in this report is verified. It is assumed that all third-party information utilised in the compilation of this report is correct at the time of compilation (e.g., spatial data, online databases, and species lists).
- The GPS used for the assessment is accurate to 5 metres and therefore any spatial features may be offset by this distance.
- The project area defined by the client were designated as the Project Area of Influence (PAOI).
- The fieldwork component of the assessment comprised of a summer (wet season) survey conducted from the 15th to the 18th of March 2022 and a winter (dry season) survey conducted from 15th to the 18th of August 2022.

1.9.5 Visual Impact Assessment

- The layout, drawings, height regulations etc. for the various layouts and sites are provided by the developer and are assumed to represent the proposed development's specifications accurately.
- Where different options are listed but the final construction specifications are not yet finalised, the most visually intrusive option has been selected for modelling (worst case scenario)
- The viewshed models produced in this report are generated using the best available topographic information to identify the areas from which the proposed development would be visible. The topographic information used is a close approximation of the earth's surface but is not a perfect representation and as such may not include minor topographic variations.
- The viewshed models do not take into account man-made structures and vegetation which may obscure the development from view.
- The nature of a visual impact assessment is mostly descriptive and qualitative not quantitative, being based on subjective attributes. Attempts have been made to limit subjectivity by using non-emotive metrics.
- This document is a visual impact assessment and therefore confines itself to assessing visual impact issues.

1.9.6 Heritage, Archaeology and Palaeontology

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

1.9.7 Agricultural Compliance Statement

- The handheld GPS used potentially could have inaccuracies up to 5 m. Any and all delineations therefore could be inaccurate within 5 m; and
- No heavy metals have been assessed nor fertility been analysed for the relevant classified soils.

1.9.8 Socio-economic Impact Assessment

- The socio-economic baseline section is based on a desktop review of available information sourced from the various sources outlined in section 6.1 of the Socio-Economic Impact Assessment (SIA). While some data outlined in these sources might not contain the latest statistical data, sufficient information was secured to establish a baseline that is reasonably accurate, allowing for the establishment of trends.
- A desktop assessment of sensitive receptors was undertaken by examining information available on Google Earth; findings of site visits undertaken by the Visual; Heritage; Terrestrial Biodiversity; and Wetland specialists; and reviewing the record of consultations with key stakeholders regarding land use arrangements and impact identification referred to in Section 6.2 of the SIA.
- Comments received during the Basic Assessment Public Participation Process provided information regarding concerns of I&APs.

2 PROJECT DESCRIPTION

This chapter provides an overview of the proposed project and details the project scope which includes details relating to the planning/design, construction, operation, and decommissioning activities.

2.1 Regional Setting

The project location is situated approximately 27 km southwest of the town of Upington in the Northern Cape Province. The project will be located within Ward 11 of the Dawid Kruiper Local Municipality (LM) and within the jurisdiction of the Z F Mgcawu District Municipality (DM) (Table 2-1). Refer to Figure 2-1.

Table 2-1: Details relating to project location

Local Municipality	Dawid Kruiper Local Municipality
District Municipality	Z F Mgcawu District Municipality
Ward Number	Ward 11
Access to the site	The project site can be accessed off the N14, southwest of Upington.
Nearest Towns	Site Alternative A: ~18.1km from Upington Site Alternative B: ~19.3km from Upington

2.2 Project Site Description

There are two site alternatives that have been assessed as part of the BA process i.e. Site A and Site B. Refer to Figure 2-2 for the location of the site alternatives. The proposed development (site alternative A and B) will be located on Erf 1080 Olyvenhouts Drift Settlement Agricultural Holding approximately 14km southwest of the Upington Central Business District (CBD). Details relating to Erf 1080 and property ownership is provided in Table 2-2.

Table 2-2: Development property details

Property No. (Erf No.)	1080
Portion of Property	0
Property Type	Agricultural Holding
Holding Area	Olyvenhouts Drift Settlement Agricultural Holding
Registration Division	Gordonia RD
Surveyor-General Cadastral Code	C02800130000108000000
Zoning	Agriculture
Property Area Size (ha)	8385.57
Development Area Size (ha), excl. linear infrastructure.	~140
Property Owner	Eskom Holdings SOC Limited
Title Deed Number	T3236/2010
Registration Date	15/12/2010

Erf 1080 borders the N14 National Road at its southern boundary. Regional road R3276 turns off the N14, in a north-westward direction and bisects Erf 1080 through its interior.

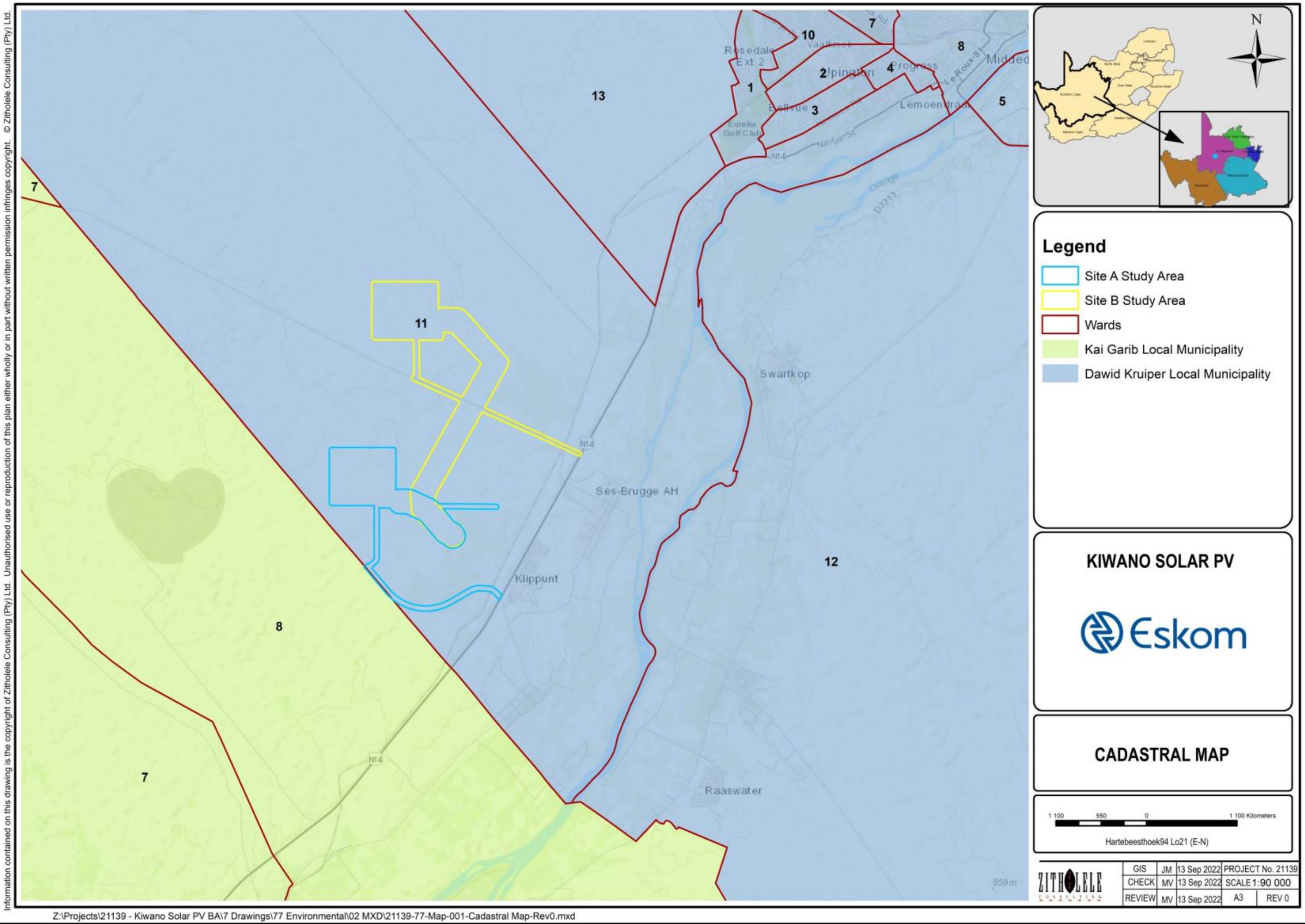

Figure 2-1: Local and District Municipal setting

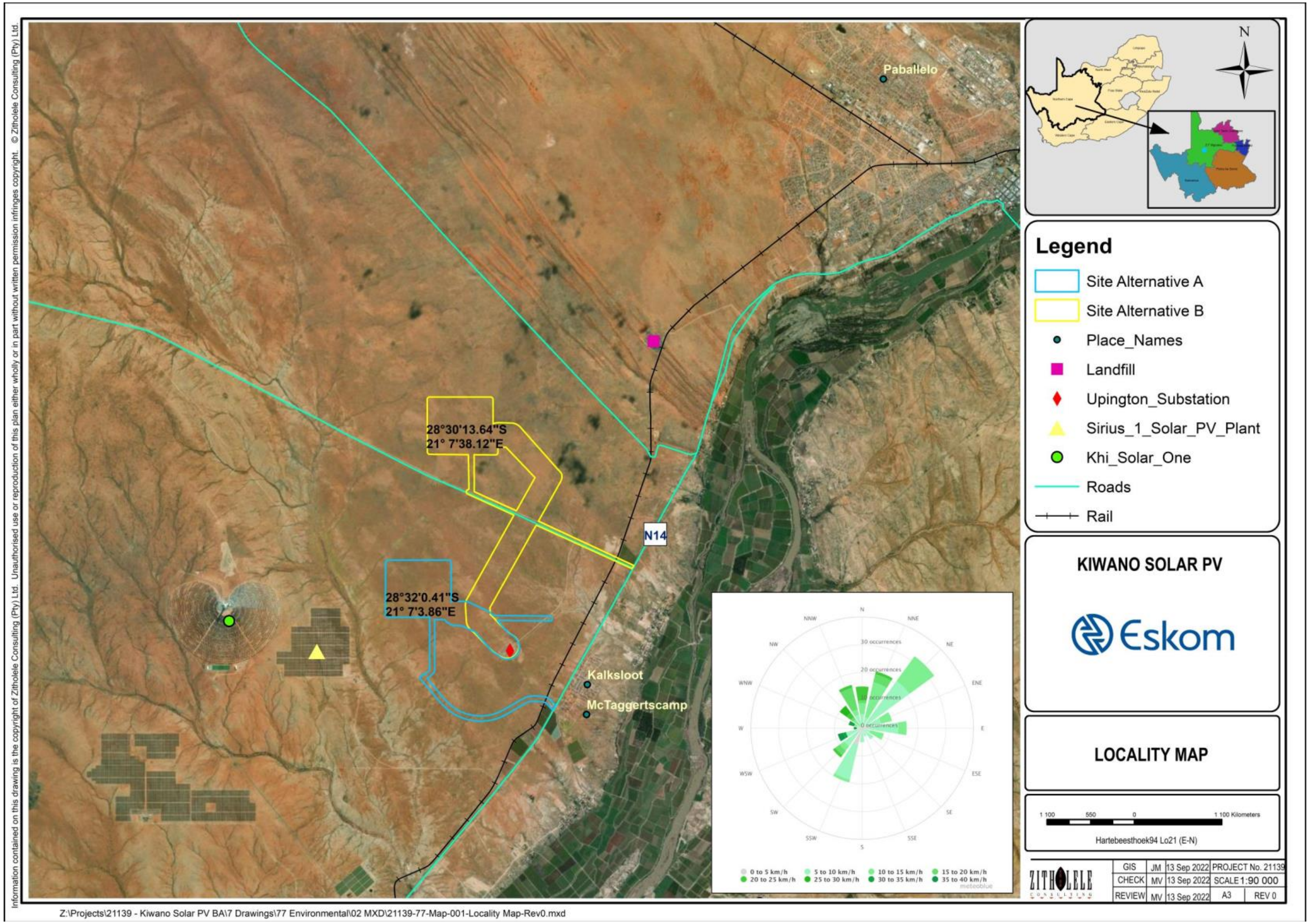

Figure 2-2: Locality map

2.3 Description of the Planned Activities

Eskom proposes to construct and install a solar PV plant, grid-scale battery storage, substation, powerline, pipeline and an access road on Olyvenhouts Drift Settlement Agricultural Holding 1080 Portion 0 in Upington, Northern Cape. The proposed development will also include the following infrastructure:

2.3.1 Feeder Bay at Upington MTS

The proposed Solar PV and BESS development will utilise the existing 132kV feeder bay at Upington MTS for the Upington/Kiwano 132kV line connection. No new infrastructure will therefore be required at the Upington MTS.

2.3.2 Solar PV installation

Eskom propose the installation of a solar PV facility with an envisaged capacity of 58 MW. The total site area envisaged for the PV installation will measure up to approximately 1 150 000 m^2 (115 hectares). The Solar PV facility will include the following infrastructure:

- Two (2) x 40 MVA 132/22 kV transformers with associated 22 kV switchgear and control plant
- Solar PV plant with the output rating of 58 MW
- Establishment of the PV plant POC on the 132 kV between the PV plant and Kiwano 132kV busbar
- Separate statistical metering points to be commissioned for the BESS plant and the PV plant
- The BESS and solar PV plant are to be positioned and configured in isolation of each other, in terms of connections and dependency

The medium voltage (MV) / low voltage (LV) transformation and LV equipment for BESS and PV must be designed by the Engineering, Procurement and Construction (EPC) Contractor, according to Eskom specifications.

The envisaged area for the solar PV modules, which will convert solar radiation directly into electricity, is expected to cover an area of approximately 450 000 m^2. The solar PV modules will be elevated above the ground, and will be mounted on either fixed tilt systems, or tracking systems (comprised of galvanised steel and aluminium). The Solar PV modules will be placed in rows in such a way that there is allowance for a perimeter road and security fencing along the site boundary, and access roads in between the PV module rows.

<u>**Solar PV technology**</u>

In layman's terms, the PV solar panels make use of the sun's light instead of the sun's energy as is the case with CSP. In other words, photovoltaics is the direct conversion of light into electricity. Solar PV cells absorb light, which will then knock electrons loose. Then once the loose electrons flow, a current is created, and this current is then captured and transferred into wires, thus generating a direct electric current (DC). After the direct electric current is generated, it is then converted into Alternating Current (AC), usually using inverters, so that it will be distributed on the power network[1].

Solar PV components

A Solar PV Plant generates electrical power by converting solar radiation through a process known as the photovoltaic effect. The Solar PV Plant consists of the following components and configurations that will be further explored at conceptual design and specified in the functional specification:

- PV modules that are connected in series to form strings. These strings are further combined in parallel via combiner boxes to form PV arrays.
- PV ground mounting structures and foundations are used to fix the PV modules to the ground at the appropriate orientation to the sun.
- Inverter and transformer cabins which house the inverters that converts DC electricity from the PV arrays to AC electricity at grid frequency, and transformers to step-up the voltage as determined by the selected point of connection.
- Solar PV plant power collection switchgear, auxiliary transformers, and battery tripping units.
- AC cabling that will connect the Solar PV plant to the selected point of connection.
- Control and instrumentation equipment to monitor and configure plant operations.
- Infrastructure and associated utilities such as roads, storm water infrastructure, security fence, buildings, and meteorological measuring stations.

The three main components that form the backbone of a PV plant are PV modules, PV ground mounting structures, and inverters. These are further described in the following sections.

PV Modules

PV modules are made up of PV cells that generate electricity on exposure to solar radiation. PV technologies can be divided into different types depending upon the materials used in the modules. Generally, two different concepts for generating energy by means of PV technology are commercially available on the market: (1) crystalline silicon based and (2) thin film-based PV technology. Both use direct and diffuse components of solar irradiation.

- **Crystalline silicon (c-Si) based Solar PV modules** can be divided into two main categories: mono and poly crystalline silicon. Monocrystalline silicon PV modules are based on monocrystalline silicon PV cells manufactured from pure silicon.

[1] solarfeeds.com/mag/csp-and-pv-differences-comparison/

Polycrystalline silicon PV modules are based on polycrystalline PV cells made from many fragments of silicon crystal melted together. Polycrystalline silicon PV modules are the mainstream technology since they are cheaper and manufacturing processes have improved significantly. Monocrystalline modules have generally higher efficiency, tend to last longer but are more expensive than polycrystalline modules.
Within crystalline PV modules the latest trend is to use is bifacial PV modules which allow for the production of energy from both sides of the PV module. Similar to the monofacial PV module, the front side is covered by protective glass. However, with the bifacial module the backside may be glass or clear backsheet allowing for additional absorption of reflected solar radiation off the ground. Conventional estimates show the power increase between 20-40%, although this may vary per project and is subject to the design configuration and albedo from the soil. In terms of the arrangement of the PV cells within a PV module, the so-called half-cell modules are typically used in large scale PV projects, in which PV cells are cut in half, which improves modules performance as a result of a lower current per cell.

- **Thin film-based PV modules** are made of layers of semiconducting materials, such as amorphous silicon, Copper Indium Selenide (CIS), Cadmium Telluride (CdTe) and Copper Indium/Gallium/Selenite (CIGS). Thin film module technology is generally cheaper than silicon crystalline but offer lower efficiency and power ratings. Some of the latest thin-film technologies can reach efficiencies comparable with poly crystalline silicon technology. Aside from the cost advantage, thin film technology has two further benefits to be considered: the more effective use of diffuse light, as well as mostly more favourable temperature related performance compared to crystalline modules.

Known advantages of the preferred PV module types are summarised in Table 2-3.

Table 2-3: Advantages of preferred PV module types

Crystalline PV modules	Thin-film modules	Bi-facial crystalline PV modules
• High efficiency (>20%) • High power rating (>400Wp) • Medium to high losses in hot weather • Extensive track record • Low to medium cost per Wp • High market share • Extensive suppliers	• Medium to high efficiency (15-20%) • Low to medium losses in hot weather • Limited track record (depending on technology) • Low cost per Wp • Small market share • Limited suppliers	• High efficiency (>21%) • High power rating (>600Wp) • Medium to high losses in hot weather • Limited track record • Low to medium cost per Wp • Small but increasing market share • Extensive suppliers

Ground Mounting Structures and Foundations

PV mounting options include fixed tilted mounting systems and tracking systems. Tracking systems can be single axis or dual axis systems. Figure 2-3 illustrates these different types of mounting systems.

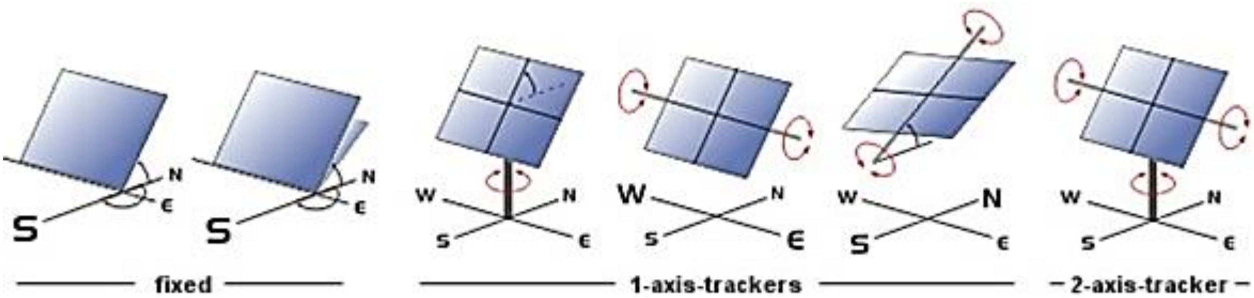

Figure 2-3: Types of Mounting Systems

The simplest installation for large scale free field mounted PV systems is fixed mounted systems, where groups of PV modules, i.e., PV arrays, are mounted on a structure with fixed slope or inclination and fixed azimuth, generally due north in the southern hemisphere. These structures are usually metallic. Figure 2-4 illustrates examples of fixed mounting structures.

Figure 2-4: Examples of Fixed Mounting Structures

For maximum annual energy production, the optimum inclination with respect to horizontal plane and the module plane is generally determined in accordance with the respective latitude of the site. For PV plants located in South Africa, the optimal inclination angle or tilt is generally between 20° and 30°, depending on the exact location.

Fixed mounted structures are considered as very robust and mostly maintenance free solutions. The use of these systems usually allows the plant layout to be easily adaptable to the terrain.

Single-axis tracking systems have become widely implemented in utility-scale applications due to their decreasing costs, and the ability to maximize energy production from PV facilities, thereby maximizing profits. Tracking systems make financial sense when the energy generation yield gain over fixed-tilt applications outweighs the capital and operational expense of the system. Single-axis trackers generally rotate PV modules from East to West throughout the day, about a North-South fixed axis which is parallel to the ground (other variations do exist). This allows the PV modules to approximately follow the sun's movement from the morning to evening across the sky and can result in increased energy yield.

Figure 2-5: Example of a PV tracking system

Detailed geotechnical investigations will be undertaken during the design phase to determine the geotechnical parameters and to inform the foundation design of the mounting structures, i.e. fixed-tilt or tracking systems.

Inverters

The inverter is a key component of the plant when it comes to reliability and efficiency. The three most common inverter-module configurations in PV systems are central inverter, string inverter and module integrated inverter (micro inverter), as shown in Figure 2-6.

Module integrated inverters (micro inverters) use a single inverter for each PV module. This configuration minimizes shading losses and module mismatch losses in a string; however, this solution is relatively expensive for large scale grid tied power plants, due to the number of module inverters required and its use as mainly for rooftop installations.

String inverters use a single string or group of strings as input to the inverter and generally generate up to 150 kW. The string inverter concept is most suitable on complex sites, where different shadings or orientation of the strings occur. The use of string inverters is becoming more popular in large scale PV projects due to its benefits in terms of offering potential to lower Balance of Plant cost, increase modularity and ease of operation and maintenance. Typically string inverters are just replaced and not repaired on site when they fail, limiting the impact in performance. String inverters tend to have higher cost than central inverters and will also have higher AC cable loss than a plant with central inverters.

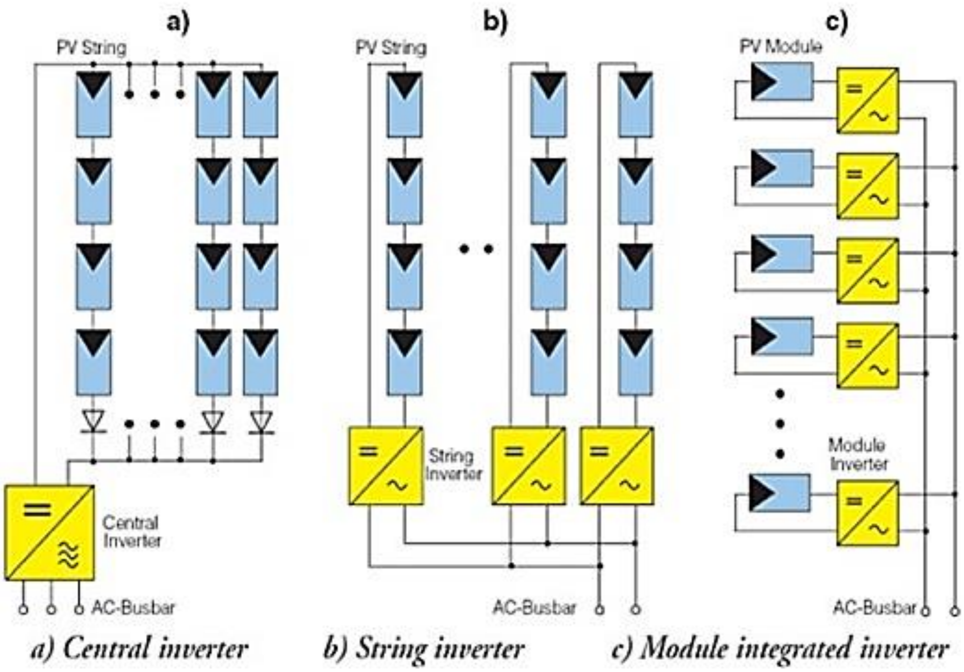

Figure 2-6: Inverter Configuration Types

Central inverters aggregate a large number of strings through DC combiner boxes and can generated up to 1-2 MW per single central inverter (sometimes 2-3 inverters are combined in a single power station to achieve higher power outputs). Central inverters are generally characterized by a lower cost per kW and are the most common inverter type used in utility scale applications.

2.3.3 BESS installation

Eskom propose to install a Battery Energy Storage System (BESS) facility with an envisaged capacity of 40 MW / 200 MWh. The BESS facility will be located in the south-eastern section of the development site and will integrate at the proposed Kiwano substation together with the Solar PV facility. The BESS facility will include the following infrastructure:

- 2 x 40 MVA 132/22 kV transformers with associated 22 kV switchgear and control plant, and connect at Kiwano 132kV busbar
- Establish the BESS POC on the 132 kV between the BESS plant and Kiwano 132 kV busbar
- Build the BESS plant with an output rating of 40 MW / 200 MWh

The use cases for Kiwano BESS are ancillary services support and energy support. The custodian of ancillary services and energy support service is the System Operator. The BESS will have capability to charge from the proposed PV as well as from the grid. The dispatching of the BESS will be under the custodianship of the System Operator.

Generally, the BESS will be expected to charge during the low load period at night (23h00 to 04h59) and be available to provide ancillary and energy services during the day (05h00 to

22h59). The BESS is required to have flexibility for the System Operator to dispatch it for ancillary services and energy as and when required, for the good of the grid. The charging power will be limited by the capacity of the 2 x 40 MVA 132/22 kV transformation at Kiwano Substation. Thus the maximum charging rate of 80MW may not be exceeded (Eskom, 2020). It must be noted that the BESS must also be capable of charging outside the stated period when required by the System Operator.

To cater for the BESS round trip efficiency (RTE), the storage will be allowed to charge for durations longer than 5 hours to ensure that the required and contracted power and energy output of 40 MW / 200 MWh is available at the Points of Connection (POC). From the network capacity perspective, the assessments will be done such that the BESS is capable of discharging at any given time of the day via the Distribution network when dispatched to do so. The required BESS discharge capacity is 40 MW / 200 MWh for the Kiwano BESS.

In terms of the size requirements for the BESS facility, 63 m^2 containers are used to store BESS infrastructure within the plant. After the BESS densities per 63 m^2 container for a number of manufacturers were considered, the minimum BESS density per 63 m^2 container was found to be 2 MWh. Assuming the worst-case density of 2 MWh per 63m^2 container and 2 m spacing between containers, the required space for the 40 MW / 200 MWh BESS plant is 10 620 m^2.

2.3.4 Kiwano 132 kV substation

Eskom proposes to construct a 132 kV substation with 5 feeder bays on the eastern extent of the development site. This substation will be known as the Kiwano 132 kV substation and will include the following infrastructure:

- 132kV Double Bus-Bar
- 132kV Bus-Coupler
- 132kV incomer feeder bay
- Establish 2 x 132 kV feeder bays for the BESS connection
- Establish additional 2 x 132 kV feeder bays for the PV integration
- Spatial provision for a minimum of additional 4 x 132 kV feeder bays for future use

Kiwano Substation will be a dedicated substation to integrate the proposed BESS and PV projects into the network. No known local constraints that would prevent Kiwano BESS and PV from being able to export the 40 MW BESS and 58 MW PV were identified at the Kiwano site (Eskom, 2020).

It is further proposed that adequate space be allowed at Kiwano substation to accommodate additional 132kV line bays for future developments, should a need arise. It is envisioned that a total energy storage capacity of 340 MW / 1 360 MWh can be deployed at the proposed Kiwano substation without any additional network capacity upgrade on the Distribution network through future upgrades as capacity requirements increase with future renewable energy developments.

For the substation site requirements, the dimensions of the neighbouring Upington MTS site were assumed for Kiwano substation. Upington MTS is a 300 m x 300 m substation, therefore the Kiwano substation site is proposed to be 90 000 m^2 (9 ha).

2.3.5 Single Twin-Tern 132 kV overhead line

The solar PV and BESS facility will include the construction of a 132kV single twin-turn overhead powerline on a double circuit support structure connecting the Kiwano substation to the Upington substation in order to evacuate power generated at the facility. Tower structures that will be utilised include S/C Angle Strain Structure at bend points along the powerline alignment, and S/C Suspension Structure for inline structures- between bend points. This line is rated at 408 MVA at 70°C templating.

The proposed line will be utilised in future to facilitate additional generation connections in the area from future and currently approved renewable projects and the Kiwano substation will be a collector substation. This will assist in avoiding having many lines running to and accessing Upington MTS which could lead to physical space constraints in future. Moreover, Upington/Kiwano 132kV line will accommodate future Kiwano BESS expansions. As such, a 132kV double circuit structure design with the provision of stringing only one circuit for the commissioning of Kiwano BESS and PV is proposed. The 2nd circuit is to be strung in future when the demand for more capacity at Kiwano materialises.

The powerline alignment has been proposed to follow existing infrastructure as closely as possible and to cover the shortest distance between the Kiwano and Upington substation as is technically feasible.

Technical drawings of the proposed tower structures (pylons) are included in Appendix C.

2.3.6 Access, perimeter and internal roads

The development will require the following roads to be constructed to service the solar PV and BESS facility:

- Access road from the nearest existing road to the facility. Where possible, existing roads that provide access to the Kiwano site will be used, upgraded, and extended as necessary. For Site A, an access road, approximately 6 m wide and estimated up to 5 km long, will be required to provide access to the PV site. For Site B, a new access road from the existing D3276 road to the site will be required, approximately 6 m wide and estimated up to 1 km long. The existing D3276 road will require upgrading, approximately 6 m wide and estimated up to 4 km long (from N14 to site access road).
- A perimeter road around the site, approximately 5 m wide and 4.5 km in length.

- Internal roads for access to the Inverter stations, approximately 5 m wide and 18 km total length.
- Internal roads/paths between the Solar PV module rows, approximately 2-3 m wide, to allow access to the Solar PV modules for operations and maintenance activities.

2.3.7 Infrastructure associated with the solar PV and BESS facility

Supporting infrastructure is required to ensure effective operation of the solar PV and BESS facility. The associated infrastructure required include:

- Inverter stations: Each inverter station will occupy a footprint of up to approximately 30 m^2, with up to 60 Inverter stations proposed to be installed on the site. Each Inverter station will contain an inverter, step-up transformer, and switchgear. The Inverter stations will be distributed on the site, located alongside its associated Solar PV module arrays. The Inverter station will perform conversion of direct current (DC) to alternating current (AC), and step-up the LV voltage of the inverter to 22 kV, to allow the electricity to be fed into the Kiwano substation. Inverter stations will connect several arrays of Solar PV modules and will be placed along the internal roads for easy accessibility and maintenance.
- Below ground electrical cables: Below ground electrical cables will be required to connect PV arrays, Inverter stations, Operational and Maintenance buildings, and 132kV Kiwano substation. Trenching will be required to excavate the trenches which will house the below ground electrical cables, before being closed and rehabilitated.
- Foundations and mounting structures: Adequately designed foundations and mounting structures will be required to support the Solar PV modules and Inverter stations.
- Operational and maintenance infrastructure: Infrastructure required for the operation and maintenance of the Kiwano Solar PV Plant will include:
  - Meteorological Station
  - Operation and Maintenance (O&M) Building, which will comprise a control room, server room, security equipment room, offices, boardroom, kitchen, and ablution facilities (including sewage infrastructure such as a septic tank).
  - Spares Warehouse and Workshop
  - Hazardous Chemical Store
  - Security Building
  - Parking areas

2.3.8 Laydown area during construction

A temporary laydown area occupying a footprint up to 100 000 m^2 (10 hectares) will be demarcated to the south of the Solar PV facility and west of the proposed BESS facility (Figure 3-1). The laydown area will be used during construction for the storage and handling of construction equipment and material. The laydown area will also accommodate water storage tanks or lined ponds, which is estimated to store- water for construction purposes measuring approximately 815 kl/month for the first 3 months and 408 kl/month for the remaining 21 months, until construction is completed. The temporary laydown area will be rehabilitated once construction has been completed.

A temporary concrete batching plant will also be required and will occupy a footprint up to 10 000 m^2 (1 hectare). The concrete batching plant area will be used during construction and rehabilitated thereafter.

A temporary site construction office area, occupying a footprint up to 10 000 m^2 (1 hectare), will be constructed within the temporary laydown area footprint. This area will accommodate the offices for construction contractors during construction and rehabilitated thereafter.

2.3.9 Fencing

It is recommended that the BESS area receive maximum physical protection in light of the fact that the site will be a target as a result of the batteries that will be stored on site. The following standards and standard drawings shall apply to the construction of the substation site perimeter and BESS perimeter barriers:

- All wire mesh fences shall be constructed in compliance with the Standard for High Security Mesh Fences (240-76368574).
- Energized fence to comply with the Standard for Non-lethal energized perimeter detection system (NLEPDS) for protection of Eskom installations and its subsidiaries (240-78980848)

The Substation perimeter barriers (3-tier) shall be constructed as follows:

- Outer perimeter:
    - The outer perimeter shall be constructed of a Category 2 High Security mesh Fence,
    - Fence height at 2.4m with double-V overhang with BTC installed at 600mm in diameter,
    - Access gate to match fence construction,
    - Anti-burrowing plinth as per standard (100mm wide by 600mm deep),
    - Galvanized coating as per standard,
    - Connected to station earth mat,
    - Pedestrian access gate to be provided with high security, all weather padlocks installed in protective sleeve (Sleeve required to prevent lock tampering).
- Energized fence:
    - Free standing 24 strand energized fence,
    - Fence height at 2.4m above ground level,
    - Gate to match fence construction and be energized with suitable contactor(s),
    - Minimum energy output at end-of –line to match 5 Joule,
    - Zones to be setup on the four sides, i.e. eastern side – Zone 1, southern side – Zone 2, western side – Zone 3, northern side – Zone 4,

- Remote arming/disarming and alarming of the fence system with GUI for control room operator,
- T-plinth installed under fence at 600mm wide by 100 high top slab with 100mm wide by 600mm deep anti burrowing plinth as per specification,
- System integration with site PSIM.
- Pedestrian access gate to be provided with high security, all weather padlock installed in protective sleeve (Sleeve required to prevent lock tampering),
- Connected to station earth mat,
- Energizer(s) to be installed in lockable enclosure within control room

- Inner perimeter:
  - Fence height at 2.4m above ground level with V overhang with BTC installed at 600mm in diameter,
  - Pedestrian access gate to be provided with high security, all weather padlock installed in protective sleeve (Sleeve required to prevent lock tampering),
  - Foundation of concrete wall to cater for integrated sleeve for network infrastructure with appropriately positioned draw boxes and draw wires installed,
  - Connected to station earth mat,
- Additional single-tier Category 1 High Security Fences will be constructed within the site to separate the BESS area and Solar PV area from the normal Substation. The fences shall be constructed as follows:
  - Category 1 High Security Mesh Fence,
  - Fence height at 2.4m
  - Vehicle Access Gates to match fence construction,
  - Galvanized coating as per standard,
  - Connected to station earth mat,
- Gate access points
  - All gate access points to have required sleeves installed for electrical and communications services with construction to match security device positions.

2.4 Bulk Services

2.4.1 Potable and Construction Water

<u>Water requirements during the Construction Phase</u>

Eskom has estimated the water consumption requirements on site during construction based on the following assumptions:

- The construction period will be 24 months.
- 250 workers on site during construction, each consuming 50 litres per day. It is assumed that portable chemical toilets will be used at the construction site.
- 150 litres per m^3 will be required for compaction and dust suppression during construction, for approximately 32 000 m^3 of construction material.

- Additional 200 kilolitres of water are used for other general uses such as concrete curing, road maintenance, etc.

The total estimated water required during the construction phase is estimated as 11 000 kilolitres (total for construction period). It is assumed more water will be required in the beginning of the construction period – 815 kilolitres per month for the first three months of construction, and 408 kilolitres per month for remaining construction period. The Contractor shall be responsible for securing electricity, water, and any other services during construction.

A small diameter (what size) water supply pipeline of approximately 5 km long will connect with the existing municipality pipeline infrastructure located along the N14 National Road.

Water requirements during the Operational Phase

Eskom has estimated water consumption during operation based on the following assumptions:

- Three litres of water are required to clean 1 m^3 of PV modules during a cleaning event.
- Four cleaning events will be required per year (this is taken as the worst case).
- Twenty full time operational staff will be based on site, each consuming 50 litres of water per day

The total estimated water required per year during the operational phase is 5 240 kilolitres of water per year for the design life of the plant. This translates into a total design life of plant water requirement of 131 000 kilolitres of water, over the 25-year design life of the facility.

Confirmation of availability of potable water supply has been included in Appendix L.

2.4.2 Sewerage

All sewerage and refuse material generated during the establishment of the proposed site will be collected by a Contractor to be disposed of at a licensed waste disposal site. Detailed stormwater management interventions will be developed during the design phase of the proposed development once the EPC contractor has been appointed. A Stormwater Management Plan has, however, been developed, to guide interventions aimed at stormwater management in and around the development footprint.

2.4.3 Stormwater

Stormwater channels and drainage infrastructure will be installed, e.g. under access or internal roads that cross a drainage line, during the construction phase. A Stormwater Management Plan has, however, been developed, to guide interventions aimed at stormwater management in and around the development footprint.

2.4.4 General Waste Management

In terms of the waste management hierarchy, the first priority of waste management is avoidance, followed by reduction in the quantities of waste, re-use and recycling, treatment of waste and lastly disposal of waste to landfill.

General waste associated with the proposed development may include construction waste (rubble, metal offcuts), packaging waste, foodstuffs, metal and plastic containers, etc.

Eskom has a systematic and hierarchical approach to integrated waste management, with the goal of zero waste. A proactive prevention approach is followed to ensure cleaner production, effective and sensible reuse, and recycling, as well as responsible treatment and disposal of waste generated. To give effect to this approach, Eskom have developed the Eskom Waste Management Standard, listed below, to provide the minimum management requirements of waste streams and to ensure legal compliance.

- Eskom, 2021a. Eskom Waste Management Standard, Document Identifier: 32-245, Johannesburg: Eskom Holdings SOC Limited, December 2021

All general waste handling, storage and management will therefore occur within the specifications of the abovementioned Eskom standard, and provisions of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEM:WA) and the associated Norms and Standards. These requirements are included in the EMPr and will become binding, if an Environmental Authorisation is granted by the DFFE.

2.4.5 Handling, Management and Disposal of Hazardous Substances

Eskom uses batteries at their sites for the provision of standby power for the control and protection of power plant at these sites. Batteries are classified as hazardous substances and therefore must be handled in a safe manner to minimize risk and ensure the safety of staff, the public and the environment.

Eskom has developed a number of procedures and standards to deal with waste management and the handling of hazardous substances, specifically relating to safe handling, transportation and disposal of cells, batteries and electrolyte for renewable energy facilities developed by the power utility. Relevant standards include:

- Eskom, 2017b. The safe handling, transportation and disposal of cells, batteries and electrolyte, Unique Identifier: 240-89797258, Johannesburg: Eskom Holdings SOC Limited, September 2017.

- Eskom, 2022. Transportation, Storage and Disposal of Hazardous Substances and Dangerous Goods in GEMMA Cluster: Distribution, Document Identifier: GCEMS020, Johannesburg: Eskom Holdings SOC Limited, June 2022.

These standards specify the minimum requirements for the safe handling, transportation and disposal of cells, batteries and the associated electrolyte. It does not replace material data sheets that are shipped with hazardous substances, but gives an indication of the risks involved and the procedure to follow when handling identified hazardous substances. As far as transportation of dangerous goods is concerned, the standards indicate the requirements when loads below the exempt quantities are being transported as the applicable SANS documents detail the requirements where the loads exceed exempt quantities.

All hazardous waste and material generated during the establishment and operation of the proposed Kiwano Solar PV and BESS facility will be collected by a Contractor to be disposed of at a licensed waste disposal site. Contractually all the battery suppliers that have an active contract with Eskom are obligated to accept and recycle, or if recycling is not possible, to dispose of redundant cells/batteries and associated hazardous waste returned to them.

2.4.6 Transportation of Hazardous substances

It is frequently required of Eskom field staff to commission batteries required for renewable energy and BESS installations either at the workshop, or at site, which will involve the transportation of the batteries or battery components and electrolyte on public roads. As stated in section 2.4.5, Eskom has developed procedures and standards to deal with waste management and the handling of hazardous substances, specifically relating to safe handling, transportation and disposal of cells, batteries and electrolyte for renewable energy facilities developed by the power utility.

SANS 10231:2010 stipulates that hazardous substance and goods loads below the exempt quantity as stated in the standard is not required to comply with the requirements of SANS 10231: 2010 (Edition 3.1, Transportation of dangerous goods). However, in cases where the exempt quantities are exceeded it may be necessary to transport the load with more than one vehicle or contract the services of an authorised dangerous goods operator. In cases such as these the regulations apply and the SANS, and relevant Eskom standards, must be adhered to.

The Eskom standards listed in Section 2.4.5 further provide specific transport, packaging and container use management measures to ensure adverse impacts from the transportation of batteries and battery components are effectively managed. Eskom, as the proponent, and the appointed EPC contractor and sub-contractors will adhere and comply to these standards and procedures at all times during the construction, operation and decommissioning of the solar PV and BESS facility to ensure no adverse impact result from the transport, loading and offloading of hazardous substances associated with the battery technology used.

Requirements applicable to transport vehicles are furthermore stipulated in Eskom standard 240-62946386, i.e. Vehicle and Driver Safety Management Procedure. Load Constraints are further managed through adherence to SANS 10231: 2010, Edition 3.1, Transportation of dangerous goods – Operational requirements for road vehicles.

A summary of components associated with the proposed development are shown in Table 2-4 below.

Table 2-4: Components of Proposed activities

Components	Description		Comment
Electricity - generated power capacity from PV	58 MW		-
Extent of the proposed PV development footprint	Up to 1 150 000 m² (115 hectares)		-
Site access	**Site A:** A new access road to the site will be required from the N14 (approximately 5 km long). Construction access road from the neighbouring IPP access road to be negotiated.	**Site B:** The main access to the site will be from the D3276 road, off the N14 (approximately 4 km along the D3276 road)). An access road from the D3276 road to the PV site will be required (approximately 1 km long)	-
Proposed technology and height of installed panels from ground level	Fixed-tilt or static PV – fixed mounted PV up to 3.5 m above ground level. Tracking – single or double axis tracking up to 6 m above ground level.		EPC Contractor will perform the detail design and final selection of equipment and structures.
PV modules	200 000 – 235 000 solar PV modules, with a total PV module area up to 450 000 m² (45 ha), and total installed power capacity of 58 MW.		EPC Contractor will perform the detail design and final selection of components.
PV module dimensions	Length = 1.954 m Width = 0.982 m Area = 1.92 m²		EPC Contractor will perform the detail design and final selection of the PV modules, which may be of a different size.
Panel orientation	Fixed-tilt or static PV with 25º - 30º north facing slope. PV module rows will track the sun path from east to west daily.		-
Number of inverters	58 inverters		EPC Contractor will perform the detail design and final selection of equipment.
Associated buildings sizes	Meteorological station – 20 m² O&M building – 600 m² Spares warehouse and workshop – 1000 m² Hazardous chemical store – 24 m² Security building – 150 m²		EPC Contractor will perform the detail design – final buildings and sizes may different.
Roads	The site access road from N14 for Site A or from D3276 road for Site B will be approx. 6 m wide. The site perimeter road will be approx. 5 m wide and 4.5 km total length and will be tarred. Internal roads for access to the Inverter stations will be approx. 5 m wide and 18 km total length. Internal roads/paths between the Solar PV module rows will be approx. 2 to 3 m wide.		-

Components	Description	Comment
Below ground Electrical Interconnection Line(s)	Trenched electrical interconnection line(s) will be installed for evacuation of power from the Solar PV facility to the 132 kV Kiwano substation.	-
Below ground water supply pipeline	Small diameter (50-100NB, or approximately 57.15mm to 114.3mm internal diameter) water supply pipeline of approximately 5 km long will connect to the existing municipality pipeline.	The construction of the small diameter pipe does not trigger Listed Activity 9 of Listing Notice 1: The development of infrastructure exceeding 1 000 metres in length for the bulk transportation of water or storm water— (i) with an internal diameter of 0,36 metres or more; or (ii) with a peak throughput of 120 litres per second or more;
Services required	All sewerage and refuse material generated during the establishment of the proposed site will be collected by a Contractor to be disposed of at a licensed waste disposal site. Water will be supplied by the municipality and stored in water tanks.	-

2.5 Study Area

A development study area for each of the two site alternatives were compiled with the addition of a 50m buffer on the Solar PV and BESS site boundary, substation boundary, access road and pipeline alignment received from Eskom. A 250m buffer on either site of the centreline of the proposed powerline alignment (500 m powerline development corridor) was implemented, to allow minor changes to the alignment of the powerlines during detail design and construction.

The study area for Site Alternative A is depicted by the purple polygon outline in Figure 2-2, while the study area for Site Alternative B is depicted by the green polygon outline in the same figure.

The straight-line distance between the approximate centre points of Site Alternative A and B is approximately 4km and 4.3km northwest of the N14 National Road, respectively. As is evident from the map, the study areas wholly include all the proposed infrastructure for the Kiwano Solar PV and BESS development.

All assessments undertaken by the specialists commissioned for this study, assessed the footprint area as represented by the study areas for each of the alternative sites.

2.6 Strategic Infrastructure Project Status

The Kiwano Solar PV and BESS project currently fall under Just Energy Transition (JET) projects. However, Eskom is in the process to register the proposed project as a Strategic Infrastructure Project (SIP). Once the project is gazetted, its SIP status will be confirmed.

2.7 Description of development / lifecycle phases

2.7.1 Pre-Construction and Construction Process for proposed development

It is estimated that approximately 150-250 construction workers will be required on the site. Most of the unskilled labour will be sourced from the local towns nearby the site and will be transported daily to site during construction. The pre-construction and construction of the proposed development will be undertaken in the following steps:

- Undertaking and completion of proposed development concept. Eskom will execute the project utilising an EPC Contractor. The final detailed designs, layout, and construction of the PV and BESS facility will be performed by the selected EPC Contractor.
- Obtain the relevant permits and siting approval (Undertake the EIA Process, WULA/GA, obtain permits from local authorities, landowners, fire department, etc.);
- Pre-construction site work, such as geotechnical investigations;
- Undertaking of, and compliance with pre-construction activities and conditions in terms of the Environmental Authorisation;
- Site preparation: Vegetation and topsoil will be cleared for the footprint of the infrastructure, as well as for the access roads to the solar PV site, internal roads and the laydown yard, etc. The topsoil removed will be stored for rehabilitation purposes of the site.
- Transportation of equipment: All equipment will be transported to site by means of national, provincial and district roads. This includes but is not limited to transformers, solar PV modules, inverters, excavators, towers, graders, trucks, compacting equipment, construction material, amongst others.
- Site Establishment Works: The site will have temporal laydown areas and offices for the construction contractors. This will include the contractor's chosen electricity supply infrastructure, e.g. use of generators and fuel storage, that will be required to conform to acceptable measures to ensure no harm to the environment. The laydown area will also be used for assembling of solar PV modules and structures. A concrete batching plant may also be required as part of the site establishment works.
- Construction of the Solar PV Facility and BESS: Trenches would need to be excavated for underground cabling to connect Solar PV arrays and Inverter stations. Foundations for the solar PV array mounting structures and Inverter stations will need to be excavated, with the final extent depending on the Geotechnical studies that will be conducted. The Geotechnical studies will determine the type of foundations that can be utilised at the PV site. Construction of access, perimeter, and internal gravel roads may require material to be imported from licenced material sources or a permitted quarry.

- Construction and/or installation of water supply and storm water management infrastructure.
- Construction and installation of underground electrical interconnection cables, connecting the Solar PV facility to the 132 kV Kiwano substation.
- Site Rehabilitation: Once all the construction activities are completed the site will be rehabilitated where possible and practical. All temporal structures and facilities will be removed from site and the area rehabilitated.
- Testing and commissioning.

The construction phase for the proposed project will take approximately 2 years.

2.7.2 Operational and Maintenance Activities

After the installation and commissioning, the responsibility for safe operation and asset management will be transferred to the operation team. The solar PV plant has a minimum design life of 25 years. Operational and maintenance activities associated with the Solar PV and BESS facility include:

- Normal maintenance of all electrical and mechanical components of the plant will occur during the life of the Solar PV facility.
- Periodic cleaning and washing of the solar PV modules will be required. This PV module cleaning will be performed when required, and it is estimated to occur 2-4 times a year, or when the reference cells show a difference greater than 50 W/m^2 between the clean and soiled cells.

A plan for systematic maintenance and function testing should be kept on location showing in detail how components and systems should be tested and what should be observed during testing. Visual periodical and mandatory services should be kept in place. Maintenance may be performed manually or automated. In case of manual maintenance, a higher level of safety precautions needs to be undertaken.

2.7.3 Decommissioning and Recycling Activities

The Solar PV plant has a minimum design life of 25 years. The extension of the life of the plant will be considered when assessing the plant's economic viability to remain operational after its end of life. The decommissioning of the plant will have similar activities to those that are performed during construction. The decommissioning activities anticipated once the facility reaches its end of life are as follows:

- Disassembling of the components of the facility, including but not limited to Solar PV modules, structures, foundations, inverters, cabling, etc.
- Site preparation, removal of all equipment for disposal and re-use.
- Site rehabilitation to acceptable level as per Environmental Management Plan (EMP) guidelines.

3 CONSIDERATION OF ALTERNATIVES

In terms of the EIA Regulations, reasonable and feasible alternatives are required to be considered within the EIA process. All identified, feasible alternatives are required to be assessed in terms of social, biophysical, economic and technical factors.

Different types of alternatives must be considered in an impact assessment and may include alternatives to:

- the property on which, or location where, it is proposed to undertake the activity;
- the type of activity to be undertaken;
- the design or layout of the activity;
- the technology to be used in the activity; and
- the operational aspects of the activity.

This chapter discusses the alternatives that will be considered as part of the impact assessment process. NEMA requires that alternatives to a proposed activity must be considered, where “Alternatives” are considered different means of meeting the general purpose and need of a proposed activity. The alternatives considered in the Basic Assessment process can be categorised as follows.

- Location **/** Site alternatives
- Activity Type alternatives
- Design and Layout alternatives
- Technology alternatives
- Timing or Phasing alternatives
- No-Go alternative

These alternatives are discussed below.

3.1 Location / Site alternatives

The initial selection of the development site was informed by a number of factors, which is discussed in the following sections.

3.1.1 Site selection process for historic proposed CSP Plant

In the early 2000’s, Eskom proposed the development and construction of a Concentrating Solar Plant (CSP) plant and additional infrastructure in the Northern Cape Province. The scoping process evaluated three alternative sites for the CSP Plant. A number of studies were undertaken during the scoping phase to inform the site selection process. These studies covered the physical, biological and social aspects of the environment and included groundwater, surface water, soil and agricultural potential, avifauna, terrestrial ecology, visual, tourism, heritage, noise, and socio-economic aspects. Technical criteria were also considered, including existing roads and their condition, existing transmission lines and electrical infrastructure, future planned transmission lines, technical support infrastructure close by, proximity of an airport, boarding and lodging close by, and water supply from municipality.

Three sites were assessed, namely Erf 1080 Olyvenhouts Drift, Farm Bok Poort 390, and Farm Tampansrus. The Specialist Studies found no fatal flaws at any of the three alternative sites that would eliminate one site. Based on the consideration of environmental, social, technical and economic criteria through a weighted rating matrix approach Erf 1080 Olyvenhouts Drift Agricultural Holdings Settlement scored the highest in the comparative rating matrix and was confirmed as the preferred development site.

Subsequent to confirmation of Erf 1080 Olyvenhouts Drift, Eskom purchased the property for the purposes of development of renewable energy infrastructure and associated grid conveyance and connection infrastructure. The property was registered with Eskom as the property owner on 12 December 2010.

An Environmental Impact Assessment (EIA) process was undertaken and submitted to the Competent Authority, the erstwhile, Department of Environmental Affairs (DEA), after which an EA was issued for the application. Subsequent to granting of the EA, however, the CSP project was cancelled. In a separate application, Eskom proposed the development of 400kV and 132kV powerlines and the development and construction of the proposed Upington MTS on Erf 1080. After an EA was granted, Eskom constructed the Upington MTS on Erf 1080.

3.1.2 Other site selection considerations of the proposed site

<u>Property size</u>

Availability of level land of sufficient extent can be a restraining factor for the development of renewable infrastructure. Erf 1080 is very large in size, measuring in excess of 8 000 ha, while a proposed development area, excluding linear services, of approximately 136.9 ha is required for the development of the proposed Kiwano Solar PV and BESS with a substation. The large property size therefore allows for the consideration of layout alternatives within the same property. Sensitive environmental features can furthermore be avoided more easily as when a development property is small in size limiting available space within the property.

<u>Topography</u>

The property can be described as a flat plateau with an average slope less than 1% (ranging between 0.6% to 0.9%) The maximum slope range between 2% to 3.2%. The property terrain conditions are therefore optimal for a development of this nature, with the area being of a suitable gradient.

Site access

Access to the broader study area is considered as an important characteristic as appropriate access is required for the transportation of project-related infrastructure and heavy machinery during construction. The property borders the N14 National Road, and access to the interior of the property can be gained via the R3276 regional untarred road. Considering the readily available site access to the broader study area and the development area, the location of the proposed Kiwano Solar PV and BESS site is considered to be suitable and appropriate.

Land use considerations

The current land use of a site is an important consideration in the site selection process in terms of limiting disruption to existing and possible future land use practices. No cultivated agricultural land that can be impacted upon by the proposed solar PV development occurs within the considered property. This is the result of the low agricultural potential of the land.

The identified property is however used for livestock grazing from time to time, while another renewable energy development has been approved in the northern portion of the property. Other renewable energy projects have also been approved on directly adjacent properties.

Proximity to electrical and grid connection infrastructure

Grid connection consideration is a key aspect that influenced the proposed site selection process for the Kiwano Solar PV and BESS facility. Ease of access into the Eskom national electricity grid is vital to the viability of a solar PV facility. The Upington Main Transmission Substation (MTS) is located on Erf 1080 and Eskom has proposed the location of the Kiwano Solar PV and BESS facility within the property in close proximity to the Upington MTS substation.

Property ownership

Erf 1080 is currently owned by Eskom Holdings SOC Limited who purchased the property in 2010 for the planned CSP development at the time. Since the acquisition of the property, the greater Upington area has been designated as a REDZ area and a Strategic Transmission Corridor, which are areas designated by the South African government for the development of large-scale solar PV facilities and grid connection solution infrastructure.

3.1.3 Summary of site selection considerations

The development site was assessed as part of Eskom's historic proposal to develop a CSP facility on the proposed site. Three alternative sites were considered, and although the Specialist Studies did not identify any fatal flaws on any of the sites, Erf 1080 Olyvenhouts Drift Settlement Agricultural Holding emerged as the preferred site when economic and technical considerations were considered. The site was subsequently acquired by Eskom for the purposes of development of renewable energy infrastructure.

Since the suitability of the development site was already considered for the historic proposed CSP development, the site would also serve as the preferred alternative for the Kiwano Solar PV and BESS development. Erf 1080 Olyvenhouts Drift Settlement Agricultural Holding were also found suitable when general site selection considerations were considered, as discussed in Section 3.1.2.

Taking the above into consideration, no alternative sites, other than the proposed Erf 1080 Olyvenhouts Drift Settlement Agricultural Holding, has been assessed within this BA process for the proposed Kiwano Solar PV and BESS development.

3.2 Activity Type alternatives

Activity type alternatives relate to proposing alternative activities for a development site, for example as agricultural or manufacturing activities within the proposed development site. Eskom has not considered other activity type alternatives mainly for the following reasons:

- Eskom's mandate is the generation, distribution and maintenance of electricity to support economic activities and future economic growth in South Africa. The proposed activity type, which is the proposed generation of renewable energy at the development site, is therefore in line with Eskom's mandate.
- The development of a renewable energy facility at the proposed development site as the only proposed activity type is justified given the current electricity supply challenges facing the South Africa and the need for additional electrical capacity, as well as Eskom's lender obligations to roll out renewable energy in the South Africa.
- The broader area surrounding the town of Upington has been strategically earmarked for the development of renewable energy facilities through the establishment of the Upington REDZ. Several other renewable energy facilities have already established within the boundary of the development site and adjacent properties. The development of a renewable facility, as opposed to another activity type, is therefore in line with the gazetted strategic purpose of the broader development area.
- The development site is further central to Eskom's grid strengthening efforts and long-term power generation planning in the area. A main transmission substation has already been established on the development site and Eskom proposed a CSP facility within the development site before the project was shelved.

As such, Eskom has no intention of considering alternative activity types within the development site, therefore no activity type alternatives were considered.

3.3 Design / Layout Alternatives

3.3.1 Micro-siting alternatives within the development site

The proposed installation of the Kiwano Solar PV and BESS facility, substation, powerline, access road, pipeline and the construction of associated infrastructures will take place on the Erf 1080 Olyvenhouts Drift Settlement Agricultural Holding in Upington, which is owned by Eskom Holdings SOC Ltd. The total area required for development of the infrastructure is approximately 140 ha. Given the fact that the total size of Erf 1080 Olyvenhouts Drift Settlement Agricultural Holding is approximately 8 385 ha, Eskom has proposed two layout alternatives i.e. Site A and Site B, within the development property, approximately 2 kms apart. The layout alternatives are presented in Figure 3-1. The placement of the proposed layout alternative sites was informed by the following:

- The findings of previous environmental Specialist Studies undertaken on the development site during the original EIA process for the proposed CSP plant. The studies highlighted existing sensitive areas within the development site that had to be avoided, for example the prominent non-perennial drainage line feature meandering along the western boundary of the development site.
- The location of existing and future proposed power generation and grid connection infrastructure traversing the site, and/or connecting to the existing Upington MTS.
- The proximity of the proposed alternative sites to the Upington MTS after existing and future proposed power generation and grid connection infrastructure had been considered, in order to reduce the distance and associated environmental impact between the site and the Upington MTS.
- Proximity to existing road infrastructure.

The alternative sites are described in more detail in the sections below.

<u>Site A</u>

Site A is located approximately 2.3 km northwest of the existing Upington MTS. The western boundary of Site A is located approximately 3.3 km east of the Khi Solar CSP tower and approximately 1 km east-northeast of the Sirius 1 Solar PV Plant. Site A is further located approximately 15 southwest of the Upington Central Business District (CBD).

The location of the Site A alternative is shown in Figure 3-1. The detailed layout drawing is provided in Appendix C. Dimensions, sizes and co-ordinates of the infrastructure components are provided in Table 3-1. Advantages and disadvantages of the location of Site A within the development site is considered in Table 3-2.

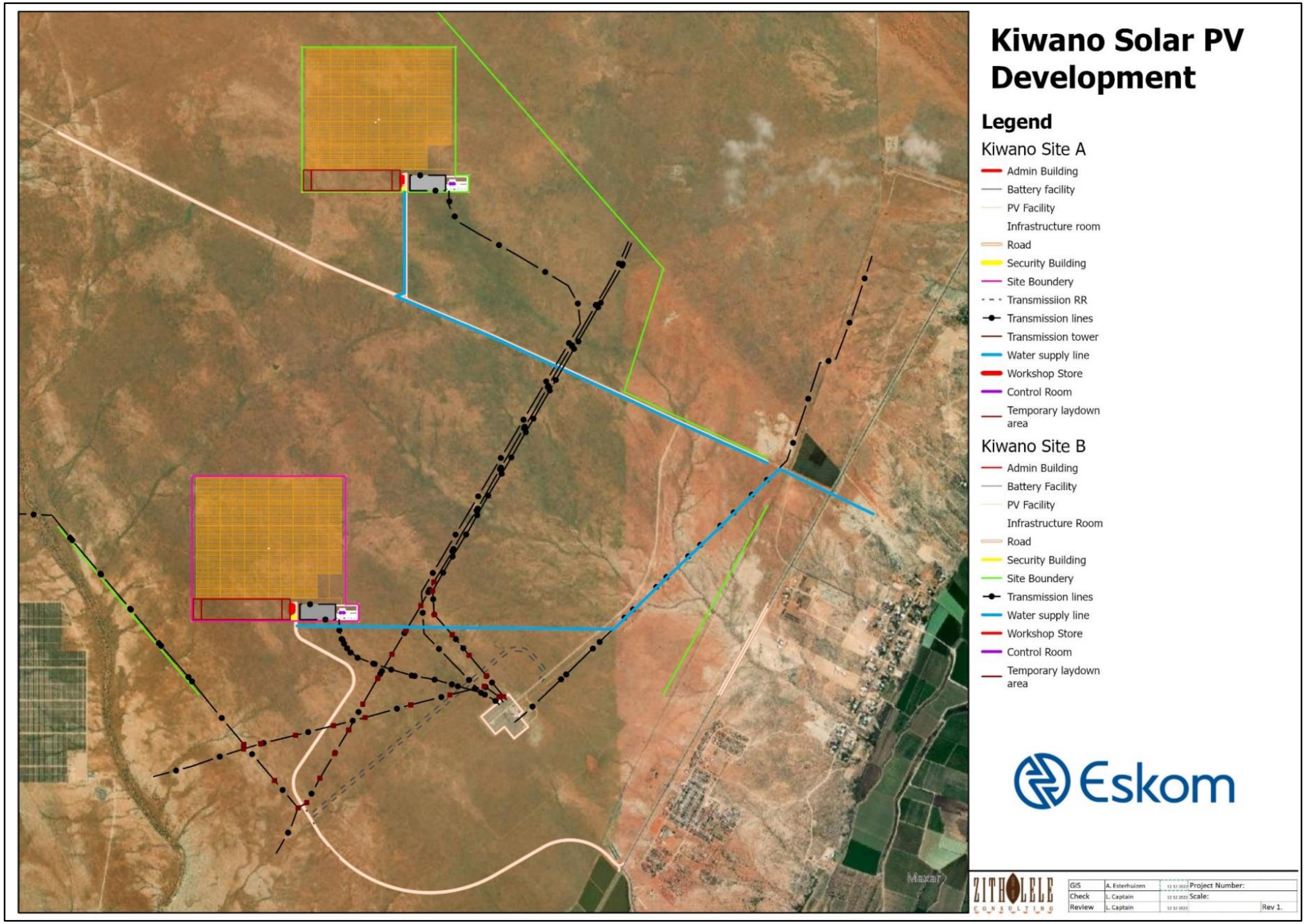

Figure 3-1: Kiwano Site Layout Alternatives

Site B

Site B is located approximately 4.5 km northwest of the existing Upington MTS. The western boundary of Site B is located approximately 5.3 km northeast of the Khi Solar CSP tower and approximately 4 km northeast of the Sirius 1 Solar PV Plant. Site A is further located approximately 12.7 southwest of the Upington Central Business District (CBD).

The location of the Site B alternative is shown in Figure 3-1, while the internal layout of Site B is shown in **Error! Reference source not found.**. The detailed layout drawing is provided in Appendix C. Dimensions, sizes and co-ordinates of the infrastructure components are provided in Table 3-1. Advantages and disadvantages of the location of Site A within the development site is considered in Table 3-2.

A summary of the infrastructure footprint sizes and co-ordinates is provided in Table 3-1.

Table 3-1: Layout alternative footprint sizes and coordinates

Development Footprint	**Site Alternative A**	**Site Alternative B**
Development site (Ha)	~ 136.9	~ 136.9
Solar PV (Ha)	~ 103.5	~ 103.5
Laydown Area (Ha)	~ 12.2	~ 12.2
BESS Area (Ha)	~ 3.4	~ 3.4
Substation (Ha)	~ 2.2	~ 2.2
Powerline (Km)	~ 1.33	~ 5.57
Pipeline (Km)	~ 2.41	~ 4.50
Access Road (Km)	~ 4.5	~ 0.83
Co-ordinates	**Site Alternative A**	**Site Alternative B**
Development Site Corner Co-ordinates (DMS)	28°31'41.935" S, 21°06'44.791" E 28°32'18.641" S, 21°06'44.830" E 28°32'18.599" S, 21°07'32.705" E 28°32'14.392" S, 21°07'32.700" E 28°32'14.396" S, 21°07'28.966" E 28°31'41.897" S, 21°07'28.928" E	28°29'53.087" S, 21°07'16.298" E 28°30'29.793" S, 21°07'16.340" E 28°30'29.751" S, 21°08'04.201" E 28°30'25.545" S, 21°08'04.195" E 28°30'25.545" S, 21°08'00.462" E 28°29'53.049" S, 21°08'00.422" E
Development Site Central Co-ordinates (DMS)	28°32'00.268" S, 21°07'08.747" E	28°30'11.420" S, 21°07'40.248" E
Solar PV Corner Co-ordinates (DMS)	28°31'42.259" S, 21°06'46.001" E 28°32'12.920" S, 21°06'46.033" E 28°32'12.890" S, 21°07'20.795" E 28°32'08.320" S, 21°07'20.790" E 28°32'08.312" S, 21°07'27.740" E 28°31'42.223" S, 21°07'27.719" E	28°29'53.416" S, 21°07'17.626" E 28°30'23.847" S, 21°07'17.661" E 28°30'23.815" S, 21°07'52.182" E 28°30'19.476" S, 21°07'52.176" E 28°30'19.459" S, 21°07'59.126" E 28°29'53.377" S, 21°07'59.094" E
Solar PV Central Co-ordinates (DMS)	28°31'57.572" S, 21°07'06.877" E	28°30'08.612" S, 21°07'38.378" E
Battery Energy Storage System Area Corner Coordinates (DMS)	28°32'14.408" S, 21°07'15.833" E 28°32'18.289" S, 21°07'15.838" E 28°32'18.280" S, 21°07'26.101" E 28°32'14.398" S, 21°07'26.096" E	28°30'25.558" S, 21°07'47.334" E 28°30'29.439" S, 21°07'47.338" E 28°30'29.429" S, 21°07'57.598" E 28°30'25.548" S, 21°07'57.593" E
Battery Energy Storage System Area Central Coordinates (DMS)	28°32'16.344" S, 21°07'20.967" E	28°30'27.493" S, 21°07'52.466" E

Development Footprint	Site Alternative A	Site Alternative B
Substation Corner Co-ordinates (DMS)	28°32'14.398" S, 21°07'26.096" E 28°32'18.280" S, 21°07'26.101" E 28°32'18.336" S, 21°07'32.709" E 28°32'14.392" S, 21°07'32.700" E	28°30'25.548" S, 21°07'57.593" E 28°30'29.429" S, 21°07'57.598" E 28°30'29.436" S, 21°08'04.216" E 28°30'25.545" S, 21°08'04.195" E
Substation Central Co-ordinates (DMS)	28°32'16.352" S, 21°07'29.403" E	28°30'27.492" S, 21°08'00.905" E
Laydown Area Corner Co-ordinates (DMS)	28°32'13.093" S, 21°06'45.192" E 28°32'18.316" S, 21°06'45.198" E 28°32'18.292" S, 21°07'13.004" E 28°32'13.070" S, 21°07'12.998" E	28°30'24.245" S, 21°07'16.701" E 28°30'29.468" S, 21°07'16.707" E 28°30'29.442" S, 21°07'44.505" E 28°30'24.223" S, 21°07'44.499" E
Laydown Area Central Co-ordinates (DMS)	28°32'15.693" S, 21°06'59.098" E	28°30'26.846" S, 21°07'30.603" E
Powerline Co-ordinates: Start, Middle, End Point (DMS)	28°32'17.28" S, 21°07'33.89" E 28°32'27.44" S, 21°07'58.92" E 28°32'39.80" S, 21°08'13.22" E	28°30'18.07" S 21°08'06.42" E 28°31'30.32" S 21°08'16.96" E 28°32'39.18" S 21°08'13.05" E
Access Road Co-ordinates: Start, Middle, End Point (DMS)	28°32'18.61" S, 21°07'16.59" E 28°32'41.72" S, 21°07'16.61" E 28°33'00.76" S, 21°07'10.34" E	28°30'29.60" S, 21°07'46.20" E 28°30'43.11" S, 21°07'46.31" E 28°30'56.93" S, 21°07'46.45" E
Pipeline Co-ordinates: Start, Middle, End Point (DMS)	28°32'19.85" S, 21°07'16.91" E 28°32'20.30" S, 21°07'58.36" E 28°32'20.72" S, 21°08'45.43" E	28°30'29.95" S, 21°07'45.62" E 28°31'12.70" S, 21°08'25.30" E 28°31'45.45" S, 21°09'47.35" E

Table 3-2: Advantages and disadvantages considered for the layout alternatives Site A and Site B

	Site A	Site B
Advantages	• Site located close to the Upington MTS, when compared to Site B • A short powerline of ~1.4 km will be required to tie into the Upington MTS. • The development site is located close to the existing Khi Solar One CSP plant, Sirius 1 Solar PV plant which will confine impacts to a smaller area of influence.	• The development site can be access via the existing D3276 road. The construction of only a short access road of ~800 m will therefore be required to access the site from the D3276. • The development site is located further from the N14 when compared to Site A. this will make the development site less visible from the N14 when compared to Site A. • The development site is located on a plateau with the closest drainage line located more than 2.2 km away from the site. • Most of the proposed powerline route can align with an existing powerline located south of the development site. This will reduce the visual impact of the powerline proposed for the Kiwano Solar PV and BESS development. • The location of the development site will not constrain the routing of new and planned grid connection and powerline infrastructure to the Upington MTS. • The pipeline will be placed within the existing road reserve of the D3276 road.

Disadvantages	• Site located close (~ 660 m) to a major non-perennial drainage line. • Require a new access road of ~4.5 km to be constructed from the N14 national road to the site. • The new access road will traverse a Critical Biodiversity Area (CBA). • The close proximity of the development site to the Upington MTS will result in a constrained area around the Upington MTS where new and planned grid connection infrastructure and powerlines can be aligned to connect to the MTS. This may require internal infrastructure changes to the existing MTS.	• The site is located further away from the Upington MTS, hence a longer powerline will be required when compared to Site A. • The site is further away from the existing Khi Solar One CSP plant and Sirius 1 Solar PV plant, therefore the potential exist to increase the cumulative impact from renewable energy facilities in the area.

3.3.2 Access road alternatives for Site A

Two alternative access road alignments are proposed for Site A.

Access road alternative 1

Access road alternative 1 leaves the proposed new main access road originating from the N14 at the western boundary of Erf 1080 at the coordinates: 28°33'00.85" S, 21°07'10.37" E, and runs in a northeast direction for approximately 1 km before turning northwest toward the development site for another 680 m.

Access road alternative 1 is shown in Figure 3-1. Advantages and disadvantages of the alignment of Access road alternative 1 within the development site is considered in Table 3-3.

Access road alternative 2

Access road alternative 2 leaves the proposed new main access road originating from the N14 at the western boundary of Erf 1080 at the coordinates: 28°33'00.85" S, 21°07'10.37" E, and runs in a northeast direction for approximately 250 m before turning north toward the development site for another 1140 m.

Access road alternative 2 is shown in Figure 3-1. Advantages and disadvantages of the alignment of Access road alternative 2 within the development site is considered in Table 3-3.

Table 3-3: Advantages and disadvantages considered for Access road alternative 1 and 2

	Access road alternative 1	Access road alternative 2
Advantages	• This access road alternative avoids a minor drainage line feature by traversing around the feature.	• Access road alternative 2 is slightly shorted in length (~1400 m) when compared to Access road alternative 1, which is ~1750 m in length. This alternative will therefore result in a

		slightly smaller impact footprint area than Access road alternative 1.
Disadvantages	• This access road alternative is slightly longer in length (~1750 m) when compared to Access road alternative 2, which is ~1400 m in length. This alternative will therefore result in a slightly larger impact footprint area than Access road alternative 2.	• This access road alternative will traverse a minor drainage line feature that seemingly originates in this area.

3.4 Technology Alternatives

3.4.1 Renewable Power Generation Alternatives

Renewable Energy Technologies

The Upington REDZ area has been strategically identified for the development of renewable energy facilities. The Upington REDZ area is, however, not considered suitable for the development of wind energy projects due to the low average wind speeds. Solar energy, on the other hand, is abundant in the area resulting in the development of solar energy renewable facilities being the primary renewable energy development in the area. This is supported by the numerous solar PV and CSP developments within the Upington REDZ.

Solar energy is therefore considered to be the most suitable renewable energy technology for this area, based on the site location, ambient conditions and energy resource availability. **No other renewable energy technologies have therefore been considered further in this assessment.**

Solar Energy Technologies

When solar energy technologies are considered, an alternative to Solar PV is Concentrated Solar Power (CSP). CSP technology convert the sun's energy using various mirror configurations that drive a heat engine and produce electrical power. On the other hand, photovoltaic solar panels, use the sun's light, rather than its energy. Unlike CSP, PV converts light into electricity directly. CSP plant's cooling systems has a very high water demand and the plant infrastructure has a pronounced visual impact. Given the nature of the water-scarce nature of the area, PV technology was identified as being the preferred option for the broader study area and consists of a lower visual profile and limited water requirements when compared to the CSP technology option.

No other solar technology alternatives have therefore been assessed for the proposed Kiwano Solar PV and BESS development as the development of solar PV on the site is considered the best available option for the area considering the ample solar resource available and the potential resource saving in terms of water requirements in an area experiencing extreme drought conditions.

Solar PV Technologies

When solar PV technology are considered, two types of panel housing/mountings could be installed, which include:

- Fixed-tilt or static PV: fixed mounted PV up to 3.5 m above ground level.
- Tracking: single or double axis tracking up to 6 m above ground level.

The primary difference on how these PV technologies will impact on the environment relate to the extent of the facility, as well as the height of the facility (visual impacts). For example, fixed mounted PV systems are able to occupy a smaller extent and have a lower height when compared to tracking PV systems, which require both a larger extent of land, and are taller in height.

The proposed internal PV layout for the fixed tilt PV structures are provided in Figure 3-2, while the proposed internal layout for the single axis tracking PV structures is provided in Figure 3-3. Detailed internal layout drawings for both solar PV technologies are also provided in Appendix C.

Both options, however, are considered to be acceptable for implementation from an environmental perspective. The preference will therefore be determined on the basis of technical considerations and the site conditions. EPC Contractor will perform the detail design and final selection of equipment and structures.

Solar PV Panel Technologies

When Solar PV technology is considered, there are two types of PV Panel technology that may be utilised for the proposed development, i.e. Polycrystalline (c-Si) technology and Thin Film (TF) technology. c-Si Technology is essentially crystalline silicon cells which are connected and compressed between a transparent layer and a backing material. The TF technology is one or more thin layers, or thin film of photovoltaic material on a substrate, such as glass, plastic or metal. Both PV Panel technologies have the same components which consist of the following:

- PV Cell: A basic PV device, which generates electricity when exposed to solar radiation. All PV cells produce Direct Current (DC) electricity.
- PV Module or Panel: The smallest complete assembly of interconnected PV cells. The modules are typically mounted in a lightweight aluminium frame to form a panel.
- PV Array: A group of PV panels connected together is termed as PV Array. An interconnected system of PV modules that function as a single electricity producing unit.

Both options are considered to be acceptable for implementation from an environmental perspective. The preference will therefore be determined on the basis of technical considerations and the site conditions. The EPC Contractor will perform the detail design and final selection of equipment and structures.

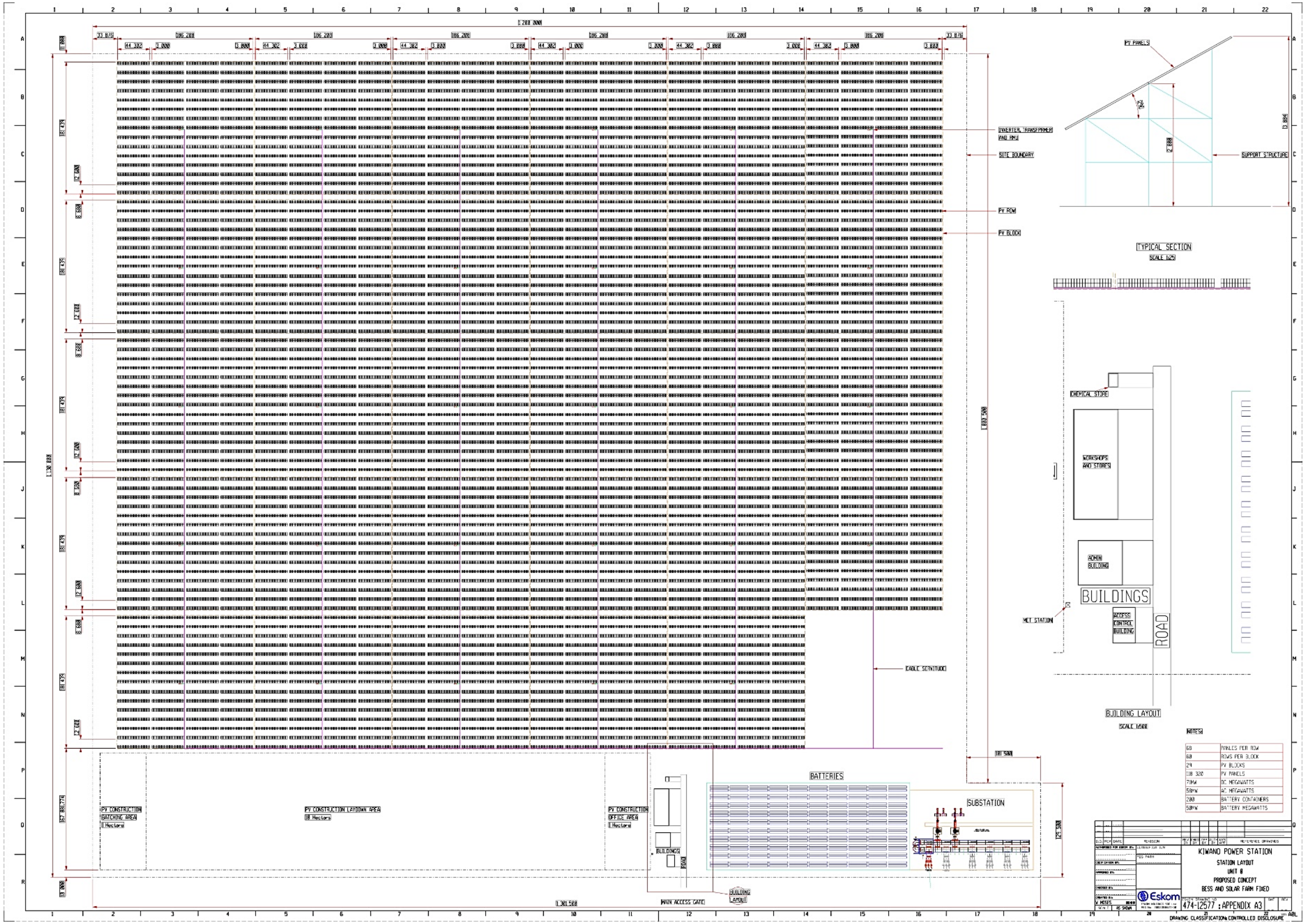

Figure 3-2: Proposed layout alternative for the fixed tilt PV structures

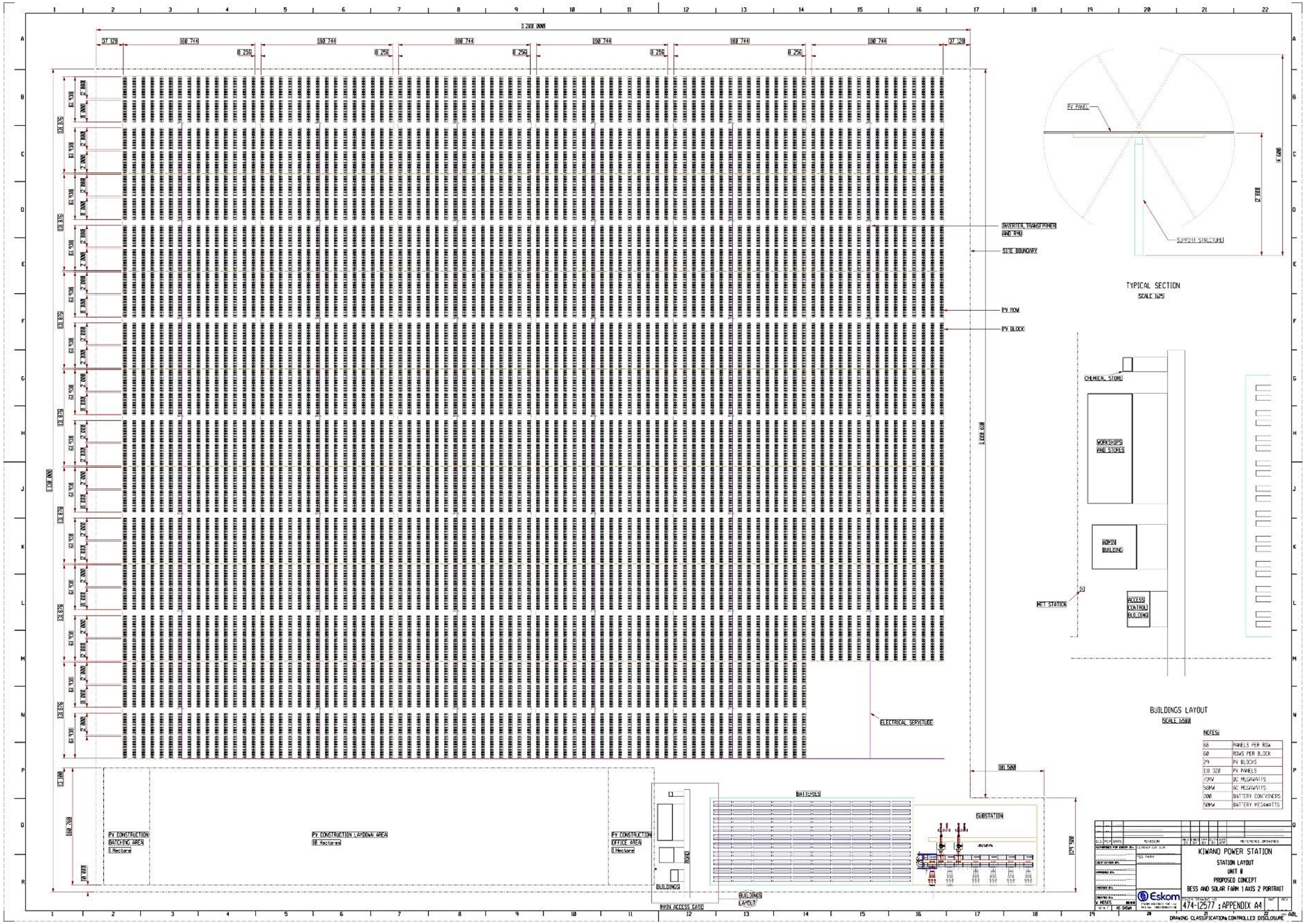

Figure 3-3: Proposed layout alternative for the single axis tracking PV structure

3.4.2 Battery Energy Storage Systems Alternatives

BESS Technology Alternative 1: Solid state batteries (Lithium-ion):

Lithium-ion-based energy storage systems (ESSs) are expected to be the dominant energy storage technology for utility-scale applications with cycle durations up to 4 hours. A lithium-ion (Li-ion) battery is a rechargeable electrochemical battery. Rather than a single electrochemical couple like NiCd, “lithium-ion” refers to a wide array of chemistries in which lithium ions are transferred between the electrodes during the charge and discharge reactions. These chemistries include Lithium cobalt oxide (LCO), Lithium manganese oxide (LMO), Lithium nickel cobalt aluminium oxide (NCA), Lithium iron phosphate (LFP) and Lithium nickel cobalt manganese (NMC)

A Li-ion cell consists of three main components: cathode and anode electrodes and an electrolyte that allows lithium ions to move from the negative electrode to the positive electrode during discharge and back when during charge. When the battery is charging, lithium ions flow from the positive metal oxide electrode to the negative graphite electrode. When the battery is discharging, the ions flow in reverse.

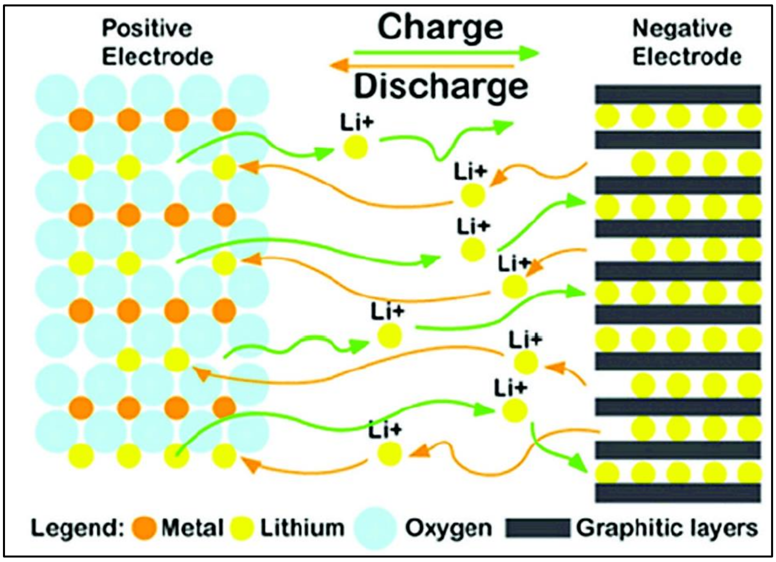

Figure 3-4: Li-ion battery function and components

Li-ion technology has been improved significantly through the evaluation and optimization of various combinations of chemistries, each of which presents slightly different performance characteristics. Cathode materials can generally be grouped into two categories, namely iron phosphate, and mixed metal (combinations of cobalt and manganese oxide). Anode material is generally graphite/carbon or titanate.

a. Performance

Li-ion performance depends on the electrode and electrolyte materials (chemistries); however, the following generalizations apply.

Table 3-4: Typical performance for Li-ion battery technology

Parameter	Range
Power Rating	Fully scalable
Discharge at Rated Power	generally, < 4 hours
Round Trip Efficiency	92% – 96%
Response Time	milliseconds
Self-Discharge per day	0.1 – 0.3% per day
Power Density	200 – 500 kWm
Energy Density	1,500 – 10,000 kWhm
Depth of Discharge	2,000 – 20,000 cycles
Cycle Life	~80 %
System Lifetime	10 – 20 years
Cost, Energy	200 – 3,800 $/kWh
Cost, Power	175 – 4,000 $/kW
Actual cost/performance is highly dependent on chemistry and manufacturer	

One disadvantage of Li-ion batteries is that the expected lifetime is related to the cycling depth of discharge. Although they perform better than lead-acid batteries, which perform better at less than <50 % depth of discharge (DoD), Li-ion batteries' lives are generally limited to <80 % DoD to ensure an adequate life.

b. Applications

Li-ion batteries have been deployed in a wide range of energy-storage applications, ranging from energy-type batteries of a few kilowatt-hours in residential systems with rooftop PV arrays to multimegawatt containerized batteries to provide grid ancillary services. Li-ion batteries can meet all the identified use cases for South Africa.

c. Construction and Installation

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. Containerized BESS can be sited on pads or simple foundations and electrically connected to switchgear. Containerization significantly reduced the costs for local labour and on-site construction.

d. Operation and Maintenance

Small ESS for residential and light industrial or office buildings are essentially maintenance free and require little on-site monitoring. This is particularly true for systems that are monitored remotely, and maintenance staff can be dispatched as needed. The greatest maintenance issue for Li-ion batteries is generally the monitoring and replacement of individual cells/modules later in life as replacement is required.

e. Decommissioning and Disposal

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 nonhazardous waste. The metals in the system can be recycled, but they do not represent a high salvage value.

f. Maturity

Li-ion batteries are a relatively mature commercial technology and are now the dominant electrical storage technology in automotive applications for both electric vehicles and hybrids. Although manufacturers are still experimenting with formulations and fabrication techniques to improve performance, reliability and reduce costs, the overall performance of this technology is reasonably well developed and understood. Most MW and MWh scale utility applications have been operating for less than 5 years of a presumed 10-year lifetime and some of the newer formulations have been operating for significantly less than that. Long-term performance reliability data is therefore still being confirmed. The recent construction of several gigawatt factories in the United States, Japan, and China is indication of confidence in the maturity and bankability of the Li-ion technology.

g. Suitability for South Africa

Li-ion technology is a commercial and proven electrochemical battery technology. It exhibits a high energy density and moderate cost that can be scaled for a wide variety of energy storage applications. A variety of chemistries and formulations yield slightly different performance characteristics. Li-ion is and will likely continue to be the dominant energy storage technology for the next 10 to 15 years and will be the yardstick by which other technologies are compared. Li-ion systems are the basis for many current residential and industrial-commercial BESS being installed and will be increasingly used for grid connected utility-scale applications globally and in South Africa as prices fall. Beyond the prospect for local cell manufacture, these systems will require local resources for final system assembly, installation, operation, and maintenance.

h. Other solid state battery chemistries considered

Other solid state battery chemistries considered include:

- **Lead Acid (Pb) and Advanced Lead Acid / Lead Carbon:** This technology is mature. The electrolyte and active materials consist of diluted Sulphuric Acid, Lead and Lead Dioxide.
- **Nickel Cadmium (NiCd):** This technology is mature. The electrolyte and active materials consist of Potassium Hydroxide, using nickel oxide hydroxide and metallic cadmium as electrodes.
- **Sodium Sulphur (NaS):** This technology is mature. The active materials in a NaS battery are molten sulfur as the positive electrode and molten sodium as the negative. The electrodes are separated by a solid ceramic, sodium alumina, which also serves as the electrolyte.
- Sodium Nickel Chloride (NaNiCl): This technology has been used commercially. Sodium-nickel-chloride batteries contain a molten sodium negative electrode and a nickel chloride salt in sodium tetrachloroaluminate (NaAlCl4) as the positive electrode.

i. Impacts and safety considerations

One of the challenges facing lithium-ion is safety. The energy density of the cells and the combustibility of the organic-based electrolyte make these batteries a fire hazard. Excessive charging, discharging, high current, or imbalances between cells can cause overheating in a cell and result in thermal runaway as neighbouring cells also overheat.

Extreme high temperatures lead to leaks, smoke, gas venting, and/or combustion of the cell pack. Manufacturers of large systems have, however, employed sophisticated battery management systems to monitor cell performance and limit operation to safe and acceptable performance ranges.

Some solid state battery chemistries, such as Vanadium Redox Flow Batteries (VRFB) contain toxic and hazardous substances. Lead Acid (Pb) and Advanced Lead Acid / Lead Carbon contain diluted Sulphuric Acid, Lead and Lead Dioxide. Sulfuric acid is listed in terms of SANS 10234:2008 and is highly corrosive and when overcharged the battery generates hydrogen which presents an explosion risk. Sulphuric acid is also toxic to freshwater fish and invertebrates at certain dosages.

Nickel Cadmium (NiCd) solid state batteries, on the other hand, contain Cadmium and various Cadmium chemical combinations of which several are listed in terms of SANS 10234:2008. Cadmium is a heavy metal, it can cause substantial pollution when discarded in a landfill or incinerated. Cadmium cyanide, Cadmium dicyanide, Cadmium diformate, amongst others, is fatal if swallowed, inhaled, or in some if it comes into direct contact with the skin, and may cause damage to organs.

Chemicals associated with Lithium ion solid state batteries include, amongst others, Lithium Cobalt Oxide, Lithium sulphate, Lithium Nitrate and Lithium hexafluorophosphate. Some of the chemicals may ignite spontaneously due to flammable gases being released when it comes into contact with water, and can cause severe skin burns and eye damage

Due to the toxic substances associated with the electrolyte in many of the solid state batteries, key concerns identified include:

- Short circuit of the battery storage unit, facility or parts could lead to explosions and a fire risk. This, in turn, could lead to the spread of debris and hazardous substances over a large area, emission of toxic gasses, equipment damage, and ultimately the interruption of power supply to communities.
- Extreme high temperatures lead to leaks, smoke, gas venting, and/or combustion of the cell pack. This could lead to leaks and spillages. Spillage of electrolyte / dangerous substances resulting in contamination of the surrounding environment, soil, flora, and indirectly impacting of fauna and avifauna.
- Incorrect or improper handling of the toxic and hazardous electrolytes could lead to spillages. Spillage of electrolyte / dangerous substances resulting in contamination of the surrounding environment, soil, flora, and indirectly impacting of fauna and avifauna.

- Improper decommissioning, storage and disposal of expelled electrolyte substances, contaminates parts and infrastructure could leading to a spillage of the chemicals, causing harm to the environment and the health of the users.
- Spillage of electrolyte / dangerous substances could further cause exposure of employees and the potentially the general public to the toxic and hazardous substances

BESS Technology Alternative 2: Redox Flow Batteries

Many manufacturers have invested significant capital in the development of commercial flow battery designs. Flow batteries require mechanical systems (pumps, pipes, and tanks) and are inherently more complex than a solid-state battery. The most expensive components within the flow battery are generally the reaction stacks. The greatest advantage of the flow battery is the potential to scale up to longer duration discharge cycles more cost efficiently than solid-state batteries. The most successful and prevalent of these batteries use vanadium and zinc-bromine chemistries. Flow battery manufacturers across all chemistries are expected to continue to refine product offerings while reducing the initial costs of their products and demonstrating long-term reliability. Manufacturers that provide reliable products.

Redox Flow Batteries: Redox flow batteries represent one class of electrochemical energy storage devices. The term “redox” refers to chemical reduction and oxidation reactions employed in the redox flow battery (RFB) to store energy in liquid electrolyte solutions that flow through a battery of electrochemical cells during charge and discharge.

A RFB is a rechargeable battery in which the energy is stored in one or more electrolyte species dissolved into liquid electrolytes. The electrolytes are stored externally in tanks and pumped through electrochemical cells that convert chemical energy directly into electrical energy and vice versa, on demand. The power density is defined by the size and design of the electrochemical cell; the energy density or output depends on the size of the electrolyte tanks.

Flow batteries are reaction stacks separated from one or more of the electrolytes held in external storage tanks. Either one or both active materials are always in solution in the electrolyte. Flow batteries have unique characteristics in terms of the power (rate at which energy changes) and energy (volume of energy) they provide. Power (in kW) is a function of the number of cells that are stacked; energy (kWh) is a function of the electrolyte volume, which is circulated by pumps. Flow batteries are generally less affected by overcharge or discharge. This means they can be used without significant degradation of performance. This is even the case when using most of the energy capacity (deep discharge) uncommon for most battery types and a distinct advantage for this type of battery. On the other hand, tanks, piping, and pumps associated with electrolyte storage and flow add costs and maintenance to the plumbing and pipe work ads to the cost, and the electrolyte may be prone to leaks and must be contained.

Until now, membrane materials have been susceptible to premature degradation and contamination and/or are expensive. Flow batteries are often used for storing and discharging long durations of energy supply (typically between 2 and 10 hours). Leading chemistries now include vanadium redox and zinc bromine redox flow batteries.

During discharge, an electron is released via an oxidation reaction from a high chemical potential state on the negative or anode side of the battery. The electron moves through an external circuit to do useful work. Finally, the electron is accepted via a reduction reaction at a lower chemical potential state on the positive or cathode side of the battery. The direction of the current and the chemical reactions are reversed during charging.

The total difference in chemical potential between the chemical states of the active elements on the two sides of the battery determines the electromotive force (emf or voltage) generated in each cell of the battery. The voltage developed by the RFB is specific to the chemical species involved in the reactions and the number of cells that are connected in series. The current generated by the battery is determined by the number of atoms or molecules of the active chemical species that are reacted within the cells as a function of time. The power delivered by the RFB is the product of the total current and total voltage developed in the electrochemical cells. The amount of energy stored in the RFB is determined by the total amount of active chemical species available in the volume of electrolyte solution present in the system.

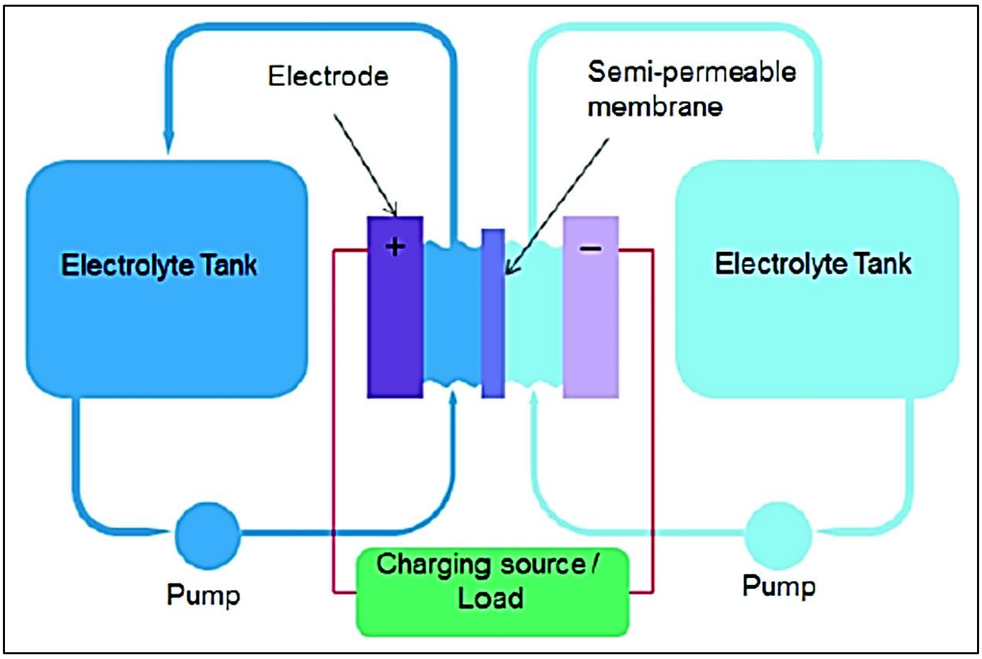

Figure 3-5: Schematic for typical of flow battery

The separation of power and energy also provides design flexibility in the application of RFBs. The power capability (stack size) can be directly tailored to the associated load or generating asset. The storage capability (size of storage tanks) can be independently tailored to the energy storage need of the specific application. In this way, RFBs can economically provide an optimized storage system for each application. In contrast, the ratio of power to energy is fixed for integrated cells at the time of design and manufacture of the cells. Economies of scale in cell production limit the practical number of different cell designs that are available. Hence, storage applications with integrated cells will usually have an excess of power or energy capability. An additional advantage of flow batteries is that flow can easily be stopped during a fault condition. As a result, system vulnerability to uncontrolled energy release in the case of RFBs is limited by system architecture to a few percent of the total energy stored. This feature is in contrast with packaged, integrated cell storage architectures (lead-acid, NaS, Li-ion) in which the full energy of the system is always connected and available for discharge.

One of the primary barriers to the deployment of flow battery systems has been the reluctance of the utilities to allow the interconnection of untried/unproven storage devices on the utility grid. Much of this reluctance is based on the early failures of flow battery systems that were introduced before they were fully ready to perform a successful demonstration. The rush to bring poorly designed and untried flow battery systems to market has contributed heavily to this reluctance. Another barrier to the wide deployment of flow battery systems is the issue of bringing large quantities of potentially dangerous liquid electrolytes to locations that could expose the public to these chemicals in the event of a spill. The public perception of the danger in having bromine chemicals nearby is somewhat widespread. This “not-in-my-backyard” issue has been a major obstacle in the deployment of large flow battery systems.

True vs Hybrid RFBs

RFBs can be divided into two categories. In a true redox flow battery, the active chemical species used to store energy remain dissolved in solution. This allows for the separation of power and energy capacity during battery design as the power is determined by the reaction cell and the energy is determined by the volumes of electrolyte available. Examples of true RFBs include the Vanadium Redox Flow Batteries (VRFB) and Iron-Chromium RFB.

In a hybrid redox flow battery, at least one chemical species is deposited as a solid in the electrochemical cells during charge. This prevents the complete separation of power and energy characteristics. Examples of hybrid RFBs include the zinc-bromine and zinc-chlorine systems.

a) **True RFB: Vanadium Redox Flow Batteries**: The vanadium redox flow battery (VRFB) 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. 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.

$$\text{Positive electrode: } V^{4+} \underset{\text{Charge}}{\overset{\text{Discharge}}{\rightleftharpoons}} V^{5+} + e^{-}$$

$$\text{Negative electrode: } V^{3+} \underset{\text{Charge}}{\overset{\text{Discharge}}{\rightleftharpoons}} V^{2+} + e^{-}$$

Figure 3-6: VRFB cell electrochemistry

As a true RFB, the active chemical species (vanadium) are fully dissolved at all times in electrolyte solutions and the power and energy ratings of a VRFB are independent of each other and each may be optimized separately for a specific application.

Electrolyte: Both electrolytes in the VRFB are composed of vanadium ions in an aqueous sulfuric acid solution at very low pH. The acidity of the sulfuric acid is comparable to that of the electrolyte found in lead-acid batteries, with a pH of between 0.1 and 0.5. The acidity of the electrolyte serves two purposes in the battery: to increase the ionic conductivity of the electrolyte, and to provide hydrogen ions to the reaction at the positive electrode. In 2011, Pacific Northwest National Laboratory (PNNL) patented a new electrolyte formulation that contains a mixture of hydrochloric and sulfuric acid. PNNL discovered that this increased the batteries' energy storage capacity by 70% and allowed the battery to work in both colder and warmer temperatures, between –5° and +50°C, greatly reducing the need for costly cooling systems.

Electrodes: The electrodes used in VRFB are composed of high-surface area carbon materials. These materials operate across a wide range of voltage potentials with minimal hydrogen and oxygen evolution, are chemically stable with respect to the acidic electrolytes at both the anode and cathode of a cell and are available at reasonable costs. Carbon materials have a very wide range of characteristics depending on the methods of manufacturing and preparation.

Membrane: The two half-cells in each cell are separated by a proton exchange membrane (PEM). The membrane physically separates the two vanadium-based electrolyte solutions, preventing self-discharge while allowing for the flow of ions to complete the circuit. Several membranes can be used in vanadium redox batteries.

Cell Stacks: In practice, vanadium redox batteries are constructed by stacking several cells together in series to form a battery stack. Electrodes are placed on either side of a bipolar plate, which separates each cell from the next cell. The bipolar plate acts as the current conducting mechanism between the negative electrode of one cell and the positive electrode of the next. The positive electrode of the most positive cell in the stack and the negative electrode of the cell at the other end of the stack form the positive and negative ends of the battery and are connected to the power conditioning system. The cells in the battery are electrically connected in series, but in most designs the electrolyte flows through the cells in parallel. The number of cells used in the complete battery depends on the desired voltage level of the final battery.

Electrolyte Tanks: The vanadium electrolytes are stored in separate large electrolyte tanks outside the cell stack. The tanks must be composed of materials that are resistant to corrosion in the very low Ph environment. In the past, off-the-shelf plastic or fiberglass tanks, such as those used to store gasoline, have been used to store electrolyte.

Pumps, Piping, And Auxiliary: Pumps, valves, pipes, and other piping components must be corrosion resistant and stable in low pH environments. For this reason, pumps using plastic impellers are used in most installations. Similarly, valves must be rated for low pH environments. For piping, most developers use standard polyvinyl chloride (PVC) piping, which is inexpensive and readily available. Laying out pipe can be a labour-intensive process, however. At least one major developer has made an effort to cut down on the amount of piping used, using prefabricated piping wherever possible and minimizing placement of valves.

Table 3-5: Typical Performance for Vanadium REDOX Battery Technology

Parameter	Range
Power Rating	Fully scalable
Discharge at Rated Power	4 – 12 hours
Round Trip Efficiency	60% – 85%
Response Time	milliseconds
Self-Discharge per day	Small
Power Density	<2 kWm
Energy Density	16 – 35 kWhm
Cycle Life	>20,000 cycles
Depth of Discharge	100%
System Lifetime	10 – 20 years
Cost, power	500 – 1,500 $/kW
Cost, energy	150 – 1,000 $/kWh

Applications: Due to its relative mechanical complexity and economies of scale, the vanadium redox battery is most suited for utility-scale power systems in the 100-kW to 10-MW size range in applications having low power/energy ratios (long discharge durations). Transmission and distribution applications with these characteristics include load shifting (peak shaving), renewables time shifting, fluctuation suppression, forecast hedging, mitigating transmission curtailment, spinning reserve, power quality (especially long duration), voltage support, and frequency excursion suppression.

Construction and Installation: Newer systems being produced are based on standardized design of modular or containerized construction. Both approaches reduce shipping and installations costs.

Operation and Maintenance: The normal operating temperature of a VRB ranges from about 10° to 40°C. Active cooling subsystems are employed if ambient temperatures exceed 40° to 45ºC. For new installations, monthly visual inspections of piping and tanks are required, with detailed inspection at 6-month intervals. Pumps and HVAC systems require inspection every 6 months. Pump bearings and seals may require replacement at 5-year intervals. Electronic parts such as boards, sensors, relays, and fuses, may require replacement as necessary. Without extended field experience, the system maintenance requirements have not been thoroughly established. However, a typical system has only two moving parts — pumps on the operates at atmospheric pressure and the temperature never exceeds 40°C. Primary maintenance items are annual inspections and replacement of pump bearings and impeller seals at intervals of about every 5 years. As necessary, smaller parts, such as electronic boards, sensors, relays, and fuses are replaced.

Decommissioning and Disposal: 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. During decommissioning, users can dispose of the membranes using the same processes used to handle highly corrosive substances. In fact, membranes are somewhat simpler to handle because they are solid and do not require containment. In considering vanadium electrolyte toxicity, it should be noted that the electrolyte does not require change over the lifetime of the battery because it does not degrade or otherwise require replacement. At the end of life for the battery system, the electrolyte will almost certainly be recycled to recover its valuable vanadium content. For these reasons, electrolyte disposal is not likely to be a significant obstacle to the adoption of VRFBs.

Maturity: The VRFB is the most technically mature of the flow-type battery chemistries. The first operational VRFB was successfully demonstrated in the late 1980s, and early commercial systems were deployed by SEI in the early 2000s. Several manufacturers (Vionx, and UniEnergy Technologies [UET]) are employing advanced designs are at an early stage of field deployment for larger scale systems (500 kW to 1 MW with 6 hours of storage).

Suitability for South Africa: VRFB represents a mature and well understood energy storage technology that is well suited for energy intensive energy storage applications. Advanced vanadium flow battery designs with higher energy capacity and wide operating temperature ranges are expected to further improve cost and performance. The relative ease of vanadium electrolyte production and the availability of vanadium in South Africa further enhances the attractiveness of this specific flow technology.

b) **Hybrid RFB: Zinc-Bromine Redox Flow Battery**: Zinc-bromine is a type of RFB that uses zinc and bromine in solution to store energy as charged ions in tanks of electrolytes. The Zn-Br battery is charged and discharged in a reversible process as the electrolytes are pumped through a reactor vessel.

Technology: The Zn-Br flow batteries are the most developed example of hybrid RFBs. A Zn-Br battery consists of a zinc negative electrode and bromide positive electrode. An aqueous solution of zinc bromide is circulated through the two compartments of the cell from two separate reservoirs. During charge, zinc metal is plated as a thick film on the anode side of the electrode. Meanwhile, bromide ions are oxidized to bromine on the other side of the electrode. During discharge, the zinc metal (plated on the anode during charge) releases two electrons and dissolves into the aqueous electrolyte. These two electrons return to the cathode and reduce bromine molecules to bromide ions.

Positive: $$Br_2(aq) + 2e^- \underset{\text{Charge}}{\overset{\text{Discharge}}{\rightleftarrows}} 2Br^-(aq)$$

Negative: $$Zn \underset{\text{Charge}}{\overset{\text{Discharge}}{\rightleftarrows}} Zn^{2+}(aq) + 2e^-$$

Figure 3-7: Zn-Br cell electrochemistry

Electrodes: The cell electrodes are generally composed of carbon plastic and are designed to be bipolar. Thus, a given electrode serves both as the cathode for one cell and the anode for the next cell in series. Carbon plastic must be used because of the highly corrosive nature of bromine. The positive electrode surface is coated with a high-surface-area carbon to increase surface area.

Electrolyte: The two electrolytes (anolyte and catholyte) will have the same zinc and bromine ion concentrations at any given time during the charge/discharge cycle and differ only in the concentration of elemental bromine. Because of the limited solubility of elemental bromine, the catholyte will contain organic amine, which reacts with the bromine to form dense, viscous bromine-adduct oil that tends to settle to the bottom of the catholyte tank. Adequate mixing of the catholyte solution is therefore necessary to enable discharge.

Separator: A membrane provides a porous separator between the electrolyte streams in the cells. This membrane can be either selective or non-selective. A selective membrane allows the passage of zinc and bromine ions while preventing the transfer of elemental bromine. Selective membranes, however, can be more costly and less durable so nonselective membranes are generally used. Nonselective micro-porous membranes allow the passage of elemental bromine however, the flow of the catholyte sweeps the bromine (in the form of polybromine) from the positive electrode quickly, freeing up the surface area for further reaction. It also allows the polybromine to be stored in a separate tank to minimize self-discharge.

Packaging: Zn-Br flow batteries are generally constructed as module ranging from 5 kW to 1,000 kW, with variable energy storage duration from 2 to 6 hours, depending on the service requirements and need.

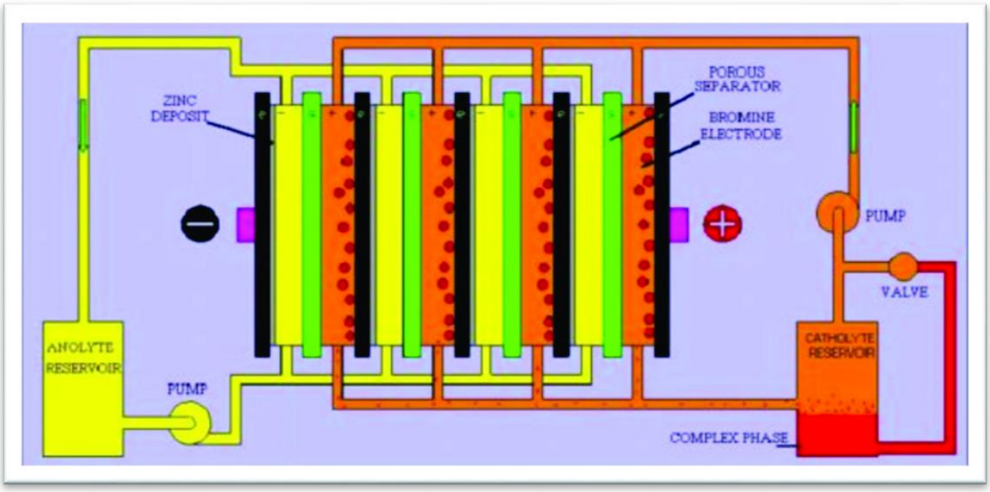

Figure 3-8: Zinc-bromine flow battery cell configuration

Performance: The Zn-Br redox battery offers one of the highest cell voltages and releases two electrons per atom of zinc. These attributes combine to offer the highest energy density among flow batteries. The zinc-bromine cell has a nominal voltage of 1.8 V. Self-discharge arises largely from bromine crossover to the anode side. Testing has shown the effect to be about 1% per hour on a watt-hour basis. Self-discharge can be minimized by stopping electrolyte circulation during stand periods, limiting the degree of crossover to bromine that is in the cell when circulation ceases.

Table 3-6: Typical Performance for Zinc-Bromine Battery Technology

Parameter	Range
Power Rating	Fully scalable
Discharge at Rates Power	4 – 12 hours
Round Trip Efficiency	65% - 80%
Response Time	Milliseconds
Self-Discharge per day	Small
Power Density	<25 kWm^3
Energy Density	30 – 65 kWhm^3
Cycle Life	10,000 – 15,000 cycles
Depth of Discharge	100%
System Lifetime	10 – 20 years
Cost, power	600 – 2,500$/kW
Cost, energy	150 – 1,000$/kWh

Application: Zn-Br flow batteries exhibit the dual advantages of low cost and high energy density and are best suited for applications requiring high energy density (such as load shifting), as opposed to high power density.

Construction and Installation: Integrated Zn/Br ESSs have been tested on transportable trailers (up to 1 MW/3 MWh) for utility-scale applications. Multiple systems of this size could be connected in parallel for use in much larger applications. Smaller Zn-Br systems are also being supplied at the 5-kW/20-kWh community energy storage (CES) scale and are now being tested by utilities, primarily in Australia.

Operation and Maintenance: Zn-Br flow battery operations are typically fully automated. Maintenance is similar to any piece of mechanical/process equipment. Most systems require scheduled conditioning for morphology control and dendrite removal (stripping) about once a week. Annual preventive maintenance, testing, and reconditioning of electrolytes may be required approximately every 5 years.

Decommissioning and Disposal

Bromine is a toxic material and should be recovered in the event of a spill or if the unit is decommissioned. Zinc-bromine is corrosive and should be handled appropriately. Zinc is considered a transition-metal contaminant in some locales and thus should be properly recovered when the unit is decommissioned.

Maturity

Although initially patented in 1885, the zinc-bromine flow battery was not developed as a hybrid flow battery system until the early 1970s. Since 2009, small projects comprising 5-kW/2-hour systems have been deployed in rural Australia as an alternative to installing new power lines. Larger scale Zn-Br flow batteries are generally in an early stage of field deployment and demonstration trails, although several companies (e.g., Redflow, Primus Power and EnSync) are introducing commercial products.

Suitability for South Africa

Zn-Br flow batteries offer an economical, low-vulnerability means for grid scale electrical energy storage. These batteries also offer greater flexibility to independently tailor power rating and energy rating for a given application than other electrochemical means for storing electrical energy. Zn-Br flow batteries are suitable for energy storage applications with power ratings from kilowatts up to multiple megawatts and are most efficient for storage durations of 4 to 12 hours. This technology shows strong potential for energy storage application in South Africa.

c) Other RFB chemistries include:

- **Zinc Bromine (ZBr):** ZBr is a hybrid RFB. The cell electrodes are generally composed of carbon plastic and are designed to be bipolar. The two electrolytes (anolyte and catholyte) will have the same zinc and bromine ion concentrations at any given time during the charge/discharge cycle and differ only in the concentration of elemental bromine.

- **Iron-Chromium (FeCr):** FeCr is a true RFB. Energy is stored by employing the Fe^{2+} - Fe^{3+} and Cr^{2+} - Cr^{3+} redox couples. The active chemical species are fully dissolved in the aqueous electrolyte at all times. Like other true RFBs, the power and energy ratings of the iron-chromium system are independent of each other, and each may be optimized separately for each application. All the other benefits and distinctions of true RFBs compared to other energy storage systems are realized by iron-chromium RFBs. Flow batteries are classed as 'true' when all of their chemical active species are fully dissolved, at all times.
- **Zinc-Iron (ZnFe):** Zinc Iron Redox flow batteries are closed loop batteries, with the battery operating at ambient temperatures. Closed loop refers to the unit in question being devoid of hazardous gases as it is depressurised and there is no potential for waste by products.
- **Polysulfide Bromide (PSB):** The polysulfide bromide battery (PSB) is a type of regenerative fuel cell involving a reversible electrochemical reaction between two salt-solution electrolytes: sodium bromide and sodium polysulfide.

d) Potential impacts associated with Redox Flow Batteries

Some RFB chemistries, such as Vanadium Redox Flow Batteries (VRFB) contain toxic and hazardous substances. VRFBs contain Vanadium pentoxide, Hydrochloric acid and Sulfuric acid. Vanadium pentoxide is listed in SANS 10234:2008 (023-001-00-8), and although Vanadium is a nontoxic chemical, the electrolyte is caustic and poses corrosive and environmental hazards similar to lead-acid batteries. Hydrochloric acid and Sulfuric acid are similarly listed in terms of SANS 10234:2008. Hydrochloric acid may cause respiratory irritation, severe skin burns and eye damage. Sulphuric acid, on the other hand, is highly corrosive and when overcharged the battery generates hydrogen which presents an explosion risk. Sulphuric acid is also toxic to freshwater fish and invertebrates at certain dosages.

Environmental and health concerns related to Zinc-Bromine (Zn-BR) RFBs include potential bromine toxicity. Zn-Br poses environmental and safety concerns relating to the use of bromine and the potential for release or exposure. Bromine creates a harsh and corrosive environment that requires more robust mechanical systems and materials. Bromine is a highly toxic material through inhalation and absorption; as a result, the possibility of a hazardous environmental event or personnel exposure must be addressed through adequate design features and operational practices.

Based on the hazards of bromine, some companies may consider shipping systems without electrolyte and then loading it at a location near, or at, its point of installation. Solutions containing zinc bromide are considered Marine Pollutants and Environmentally Hazardous. Entry into waterways, sewers, basements or confined areas must be prevented at all cost.

Due to the toxic substances associated with the electrolyte in many of the RFBs, key concerns identified include:

- Short circuit of the battery storage unit, facility or parts could lead to explosions and a fire risk. This, in turn, could lead to the spread of debris and hazardous substances over a large area, emission of toxic gasses, equipment damage, and ultimately the interruption of power supply to communities.
- The higher voltage and highly oxidative electrolytes put more chemical stress on the materials used in the cell electrodes, membranes, and fluid handling components and systems. This could lead to leaks and spillages. Spillage of electrolyte / dangerous substances resulting in contamination of the surrounding environment, soil, flora, and indirectly impacting of fauna and avifauna.
- Incorrect or improper handling of the toxic and hazardous electrolytes could lead to spillages. Spillage of electrolyte / dangerous substances resulting in contamination of the surrounding environment, soil, flora, and indirectly impacting of fauna and avifauna.
- Improper decommissioning, storage and disposal of expelled electrolyte substances, contaminates parts and infrastructure could leading to a spillage of the chemicals, causing harm to the environment and the health of the users.
- Spillage of electrolyte / dangerous substances could further cause exposure of employees and the potentially the general public to the toxic and hazardous substances

3.4.3 Powerline

The footprint for 132 kV towers ranges between 0.36 m^2 and 2.35 m^2 depending on the structure that is used. The average span between two towers would be approximately 200 m, but can vary between 250 m and 375 m depending on the ground profile and the terrain to be spanned.

The corridor width for the 132 kV distribution line is approximately 500m (250 m on either side of the centre line of the power line). The minimum vertical clearance to buildings, poles and structures not forming part of the power line must be 3.8 m, while the minimum vertical clearance between the conductors and the ground is 6.7 m.

Tower structures proposed are already considered the most optimum, bird friendly, self-supporting (no stays or guides) tower structures based on Eskom’s internal standards and guidelines. **No alternative tower structures were therefore considered for this project.**

3.5 No-go Alternatives

This alternative considers the option of ‘do nothing’ and maintaining the status quo. Should the proposed development not proceed, the site will remain unchanged. Eskom will no longer be able to provide ancillary support in terms of enhanced frequency control of the network, reactive power support and improved quality of supply performance near existing Distributed Generation Renewable Energy plants. Therefore, the no-go alternative is not considered to be feasible. The No-Go Alternative have, however, been assessed and rated in terms of Zitholele Consulting’s Impact Assessment Methodology.

4 PROJECT NEED AND DESIRABILITY

Appendix 1 of the 2014 EIA Regulations, 2014 (as amended) requires the inclusion of 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.

4.1 Renewable Energy Planning and Projects in the Upington REDZ

The Upington area is renowned for its attraction of renewable energy developments. Solar technology has become prevalent in this area with preferred bidders awarded during the last five Renewable Independent Power Producer Programme (REIPPP) DoE programmes. Figure 4-2 below provides an indication of the committed and interested projects in the area. With the exception of the 2200MW Upington Solar Park, all the interested projects have enquired or applied with the expectation of exportation facilitated through existing integration or new infrastructure into the Upington MTS (Eskom, 2020).

From Table 4-1 it is noted that there are 405 MW of approved projects currently connecting to the Upington MTS. The two 5 MW projects were awarded by the Department of Energy (DoE) in the Small IPP 1-5 MW Bid Window but these projects are not yet in execution due to outstanding licensing and contracting issues.

Further to this, between the DoE's Round 4B submission until 2020, Eskom's Distribution Network Planning has received applications and queries in the order of 4925 MW already. This list is not exhaustive and there are many additional applications and solar projects under investigation and development. Table 4-1 is provides an indication of the renewable interest in the area which accompanied the motivation and development of Upington MTS and the design plan of a station in the order of 5 x 500MVA 400/132kV transformers (Eskom, 2020).

Table 4-1: Approved and Interested Renewable Projects in Upington (Eskom, 2020)

Name	Technology	Size (MW)	Status	Substation
Gordonia Solar PV	PV	10	Connected	Gordonia
Khi Solar	CSP	50	Connected	McTaggerts
Ilanga CSP	CSP	100	Connected	Ilanga
Neusberg Hydro	Hydro	10	Connected	Taaipit
Keren Kakamas	PV	5	Preferred Bidder	Taaipit
Keren Keimoes	PV	5	Preferred Bidder	Oasis
Dyasonsklip 1	PV	75	Connected	Dyasonsklip
Dyasonsklip 2	PV	75	Connected	Dyasonsklip
Sirius PV 1	PV	75	Connected	Sirius
Subtotal		**405**		
Klip Punt Cluster	PV	400	Interested	Klipunt
Bloemsmond Cluster	PV	500	Interested	Bloemsmond
Geelkop Cluster	PV	500	Interested	Geelkop
Ilanga CSP 2	CSP	200	Interested	Ilanga
Upington Solar Park	CSP	2 200	Interested	New MTS
Sirius PV Phase 2	PV	150	Interested	Sirius
Dyasonsklip 3	PV	75	Interested	Dyasonsklip

Name	Technology	Size (MW)	Status	Substation
Eenduin Solar	PV	75	Interested	Oasis
Rooipunt	CSP	150	Interested	McTaggerts
Solis Power Cluster	CSP	300	Interested	McTaggerts
Khunab	CSP	150	Interested	McTaggerts
Kai Garib Solar	CSP	150	Interested	McTaggerts
Blucoso Solar	PV	75	Interested	Oasis
Subtotal (Interested)		**4 925**		
Total Outlook		**5 330**		

The Renewable Energy forecast for Upington MTS as provided by Eskom's Transmission Grid Planning (Eskom, 2020) is shown in Figure 4-1. Given the demand for connectivity to the Upington MTS, Eskom's Transmission Grid Planning have given a high-level strengthening development plan with indicative dates for when upgrades to the Upington MTS may be commissioned (Table 4-2). Eskom's Transmission Grid Planning have, however, indicated that these dates will need to be revised to cater for the IPP forecast presented in Figure 4-1.

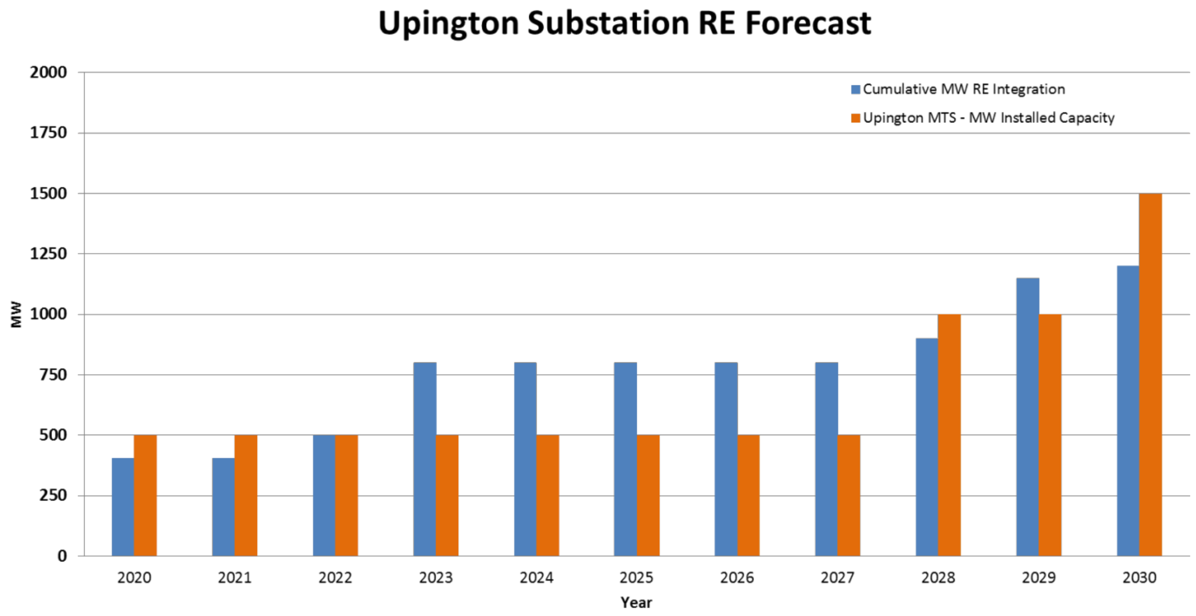

Figure 4-1: Upington MTS Renewable Forecast

Table 4-2: Indicative Upington MTS strengthening development plan

TDP Scheme	Project Name	Required CO Year
Upington Strengthening (IPP)	Ferrum – Upington 1st 400 kV line	2026
	Aries – Upington 1st 400 kV line	2026
	Upington 2nd 500 MVA 400 / 132 kV transformer	2028
	Upington 3rd 500 MVA 400 / 132 kV transformer	2030
	Upington 4th 500 MVA 400 / 132 kV transformer	2033
	Aries – Upington 2nd 400 kV line	2035

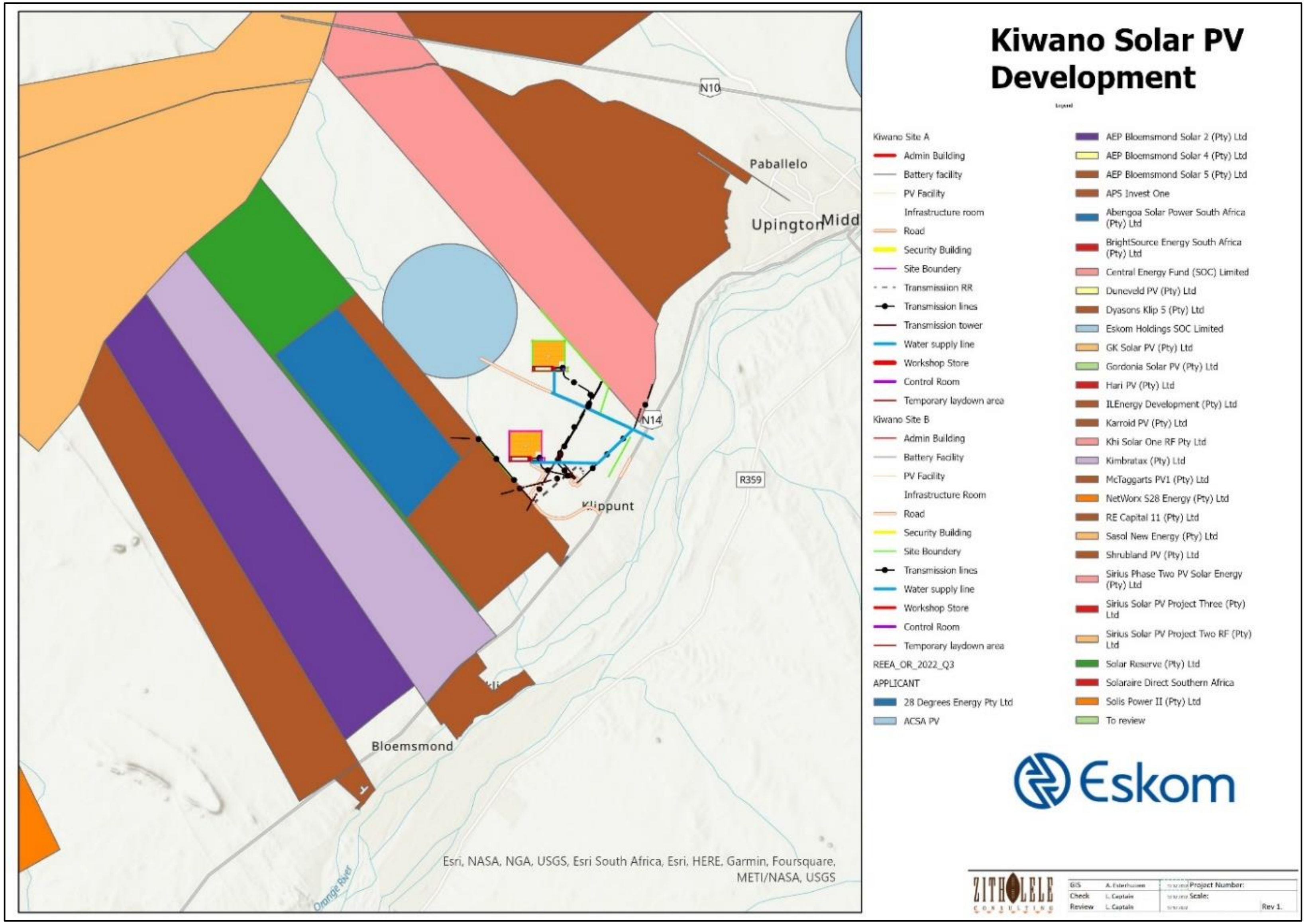

Figure 4-2: Renewable developments around the Kiwano Solar PV and BESS development

The maximum loading due to generation at the Upington 500MVA 400/132kV substation when calculated in August 2020 was 395 MW. This shows that the worst-case spare capacity at Upington MTS is in the order of 105 MW and that is sufficient to accommodate the proposed BESS and PV at Kiwano, noting that their combined output is 98 MW.

Other renewable energy projects within the direct vicinity of the proposed Kiwano Solar PV and BESS facility are shown in Figure 4-2.

4.2 Need and Desirability in terms of the guideline

Furthermore, the DEA 2017 Guideline on the Need and Desirability (DEA, 2017) were considered in determining and presenting the Need and Desirability of the proposed development. In terms of Section 4 of the guideline, the questions to be engages with when considering the Need and Desirability is addressed in the table below.

4.2.1 Securing ecological sustainable development and use of natural resources

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?:

1.1.1. Threatened Ecosystems

A Terrestrial Biodiversity study was commissioned to determine the any potential impact on threatened ecosystems. The Terrestrial Biodiversity study concluded that the development is located within a Least Concern (LC) ecosystem (TBC, 2022a). Threatened ecosystems were therefore considered and the proposed development was not found to impact on any 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

A Wetland Delineation and Assessment study was commissioned to assess the potential impact on wetland and aquatic ecosystems. The wetland specialist concluded that various non-wetland drainage features and depressions were identified within the 500 m regulated area (TBC, 2022b). None of these systems are characterised by wetland features as only alluvial soils and no hydrophytic vegetation is present. The wetland specialist further observed that there are two non-wetland pans located inside Site Alternative A's PV area and that the roads and powerlines will have 18 crossings with drainage systems. Given the size of the pans and the drainage systems the impacts of the activities will be limited. A low post-mitigation risk level to the identified features were assigned by the wetland specialist (TBC, 2022b). No significant impact on wetland and aquatic features are therefore expected as a result of the development.

1.1.3. Critical Biodiversity Areas ("CBAs") and Ecological Support Areas ("ESAs")

A Terrestrial Biodiversity Study concluded that the proposed development area alternatives largely fall within the category of Other Natural Areas (ONA) in terms of the Northern Cape Critical Biodiversity Area (CBA) Map. A small portion of the proposed access road for site Alternative A was however found to fall within a Critical Biodiversity Area 2 (TBC, 2022a). Destruction, further loss and fragmentation of the vegetation community including a portion of an area classified as an CBA-irreplaceable and ESA as well as an Endangered vegetation type was identified as a potential impact. The specialist concluded that with mitigation the residual impact on the CBA and ESA area would be Low.

1.1.4. Conservation targets

The development site falls within the Kalahari Karroid Shrubland and Bushmanland Arid Grassland vegetation type. Both these vegetation types have a conservation status of Least Concern. A conservation target of 21% has been allocated to the vegetation types (TBC, 2022a). As a result, the conservation targets of the vegetation types are not threatened by the proposed development.

1.1.5. Ecological drivers of the ecosystem

The ecological drivers and processes associated with the terrestrial ecosystem have been considered and described in detail by the terrestrial biodiversity specialist in Sections 3 and 4 the Terrestrial Ecology Specialist Report (TBC, 2022a). The specialist concluded that the potential impact on the ecological drivers of the ecosystem is expected to be low once proposed mitigation measures are implemented.

1.1.6. Environmental Management Framework

An Environmental Management Framework (EMF) is not applicable to the development area. Furthermore, the development area does not overlap any National Protected Area Expansion Strategy (NPAES) areas, Important Bird and Biodiversity Areas, wetlands identified in terms of the South African Inventory of Inland Aquatic Ecosystems, Strategic Water Source Areas, nor any Freshwater Ecosystem Priority Areas.

1.1.7. Spatial Development Framework

The Northern Cape Provincial Development and Resource Management Plan / Provincial Spatial Development Framework (NCPSDF) approved in 2012 is a statutory document intended to direct spatial land-use planning to promote environmental, economic, and social sustainability through sustainable development. It provides a legal basis to direct provincial government programmes and projects. It provides a framework for integrated land-use planning within the province. The NCPSDF highlights the potential of the energy sector to stimulate economic growth; reduce greenhouse emissions through renewable energy sources; and the need for targeted investment in renewable energy infrastructure.

Furthermore, the Dawid Kruiper Local Municipality (DKLM) Spatial Development Framework (SDF) records that the DKLM by Council Resolution endorsed the establishment of a Solar SEZ in 2014. The SDF notes that the Upington SEZ is a business entity of the Northern Cape provincial government, responsible for a combination of industrial activities including renewable and solar energy, mining, agricultural, aeronautical and various other sectors. The SDF Implementation Plan indicates that the area in which the proposed project site is located falls within the Upington Renewable Energy Park (REP). The project site is located within the C.a.2 Agriculture (Ward 11) Spatial Planning Category.

The proposed Kiwano Solar PV and BESS development therefore aligns with the goals and objectives of the NCPSDF and DKLM SDF.

1.1.8. Global and international responsibilities relating to the environment (e.g. RAMSAR sites, Climate Change, etc.).

Several international polices and frameworks were considered in this assessment as is listed in Table 5-1 of this report. These include the United Nations Framework Convention on Climate Change (UNFCCC) and Conference of the Party (COP), The Equator Principles III (June 2013) and International Finance Corporation (IFC) Performance Standards and Environmental and Social Sustainability (January 2012). Of particular relevant is IFC Performance Standards on Environmental and Social Sustainability which were considered throughout this assessment, including the Social Impact Assessment (SIA) undertaken by Solarys (Solarys, 2022). Given the nature of the proposed Kiwano Solar PV and BESS development, it is anticipated based on the project parameters that Performance Standards 1, 2, 3, 4, 6, and 8 may be applicable to the project.

The United Nations Development Programme (UNDP) Sustainable Development Goals (SDG) Impact Standards were also considered in preparing this impact assessment process. The SDGs break down silos between actors and geographies, creating space and opportunities for new ways of working towards solutions, including working collaboratively with a broader range of partners and constituencies to operate more sustainably and contribute positively to sustainable development and the UN Sustainable Development Goals (SDGs). The following SDGs may be applicable to the proposed project:

- SDG 1: End poverty in all its forms everywhere.
- SDG 3: Ensure healthy lives and promote well-being for all at all ages.
- SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.
- SDG 5: Achieve gender equality and empower all women and girls.

- SDG 7: Ensure access to affordable, reliable, sustainable and modern energy for all.
- SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.
- SDG 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.
- SDG 10: Reduce inequality within and among countries.
- SDG 12: Ensure sustainable consumption and production patterns.
- SDG 13: Take urgent action to combat climate change and its impacts.
- SDG 16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.

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?

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?

Questions 1.2 and 1.3 are collectively answered in the following paragraphs.

The proposed development will result in a physical footprint impact within the identified development site and along the proposed access road and powerline alignment. The impacts associated with the development of the plant has been assessed by the terrestrial biodiversity, wetland, avifauna, heritage and archaeology specialists. These assessment reports are included in Appendix H. The proposed development will also result in a visual and socio-economic impact on surrounding communities. These assessment reports are also included in Appendix H.

The development site was assessed as part of Eskom’s historic proposal to develop a CSP facility on the proposed site. Three alternative sites were considered, and although the Specialist Studies did not identify any fatal flaws on any of the sites, Erf 1080 Olyvenhouts Drift Settlement Agricultural Holding emerged as the preferred site when economic and technical considerations were considered. The site was subsequently acquired by Eskom for the purposes of development of renewable energy infrastructure.

Since the suitability of the development site was already considered for the historic proposed CSP development, the site would also serve as the preferred alternative for the Kiwano Solar

PV and BESS development. Erf 1080 Olyvenhouts Drift Settlement Agricultural Holding were also found suitable when general site selection considerations were considered.

Site layout and technology alternatives were furthermore proposed and assessed to identify the least environmental sensitive area where the proposed facility can be developed. Positive impacts were specifically identified in the socio-economic assessment. The proposed development has a high probability of enhancing existing positive impacts such as creating jobs and employment and business opportunities if the mitigation measures proposed in the socio-economic study is implemented successfully.

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?

The proposed development will generate general and hazardous waste during the construction, operation and decommissioning phase. Eskom has developed its own standards in compliance with relevant SANS standards and applicable legislation to ensure waste management is undertaken environmentally responsible and effectively. The relevant Eskom standards, SANS standards, procedures and regulations are summarised in Chapter 5, more specifically sections 5.6 and 5.7 of this report.

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?

No cultural heritage, archaeological sites or palaeontological sites of significance were identified within the development site and study area by the Heritage and Palaeontological specialists. The findings of their assessments are documented in their impact assessment reports included in Appendix H.

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?

The proposed development will not impact on non-renewable natural resources at the proposed development site or study area.

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?

The proposed development is the construction and operation of a solar PV and BESS facility within a strategically identified and gazetted renewable energy development zone. The development will therefore generate electricity from a renewable solar energy source. Since the sun's energy is limitless, the proposed development will not jeopardise the integrity of the resource.

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)

The proposed development will not exacerbate the increased dependency on increased use of resources to maintain economic growth as the majority of impacts on natural resources are within acceptable limits and reversable.

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?

The proposed use of the natural resources constitutes the best use thereof since the proposed solar PV and BESS development will be constructed and operated within a strategically identified and gazetted renewable energy development zone, specifically earmarked for this kind of development.

1.7.3. Do the proposed location, type and scale of development promote a reduced dependency on resources?

Yes, the proposed development will not impact on non-renewable natural resources at the proposed development site or study area. The proposed development is the construction and operation of a solar PV and BESS facility within a strategically identified and gazetted renewable energy development zone. The proposed development will therefore contribute to the renewable energy mix so the dependency on non-renewable energy generation can be reduced.

1.8. How were a risk-averse and cautious approach applied in terms of ecological impacts?

The proposed development will result in a physical footprint impact within the identified development site and along the proposed access road and powerline alignment. The impacts associated with the development of the plant has been assessed by the terrestrial biodiversity, wetland, avifauna, heritage and archaeology specialists. These assessment reports are included in Appendix H. The proposed development will also result in a visual and socio-economic impact on surrounding communities. These assessment reports are also included in Appendix H.

The development site was assessed as part of Eskom's historic proposal to develop a CSP facility on the proposed site. Three alternative sites were considered, and although the Specialist studies did not identify any fatal flaws on any of the sites, Erf 1080 Olyvenhouts Drift Settlement Agricultural Holding emerged as the preferred site when economic and technical considerations were considered. The site was subsequently acquired by Eskom for the purposes of development of renewable energy infrastructure.

1.8.1. What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?

Limitations and gaps in knowledge experienced during the compilation of this assessment is provided in Section 1.9 of this report.

1.8.2. What is the level of risk associated with the limits of current knowledge?

The level of risk is not at an unacceptable level.

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?

The proposed development was assessed in terms of the IFC Performance Standards on Environmental and Social Sustainability. This impact assessment was specifically undertaken to assess the potential impact of the development on the receiving environment. Site layout and technology alternatives were furthermore assessed to identify the least sensitive site in which the proposed development can be constructed.

1.9. How will the ecological impacts resulting from this development impact on people's environmental right in terms following:

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 avoidance is not possible, to minimise, manage and remedy negative impacts?

Ecological impacts identified by the biodiversity specialist include habitat loss, destruction of protected plant species, displacement of faunal community due to habitat loss, direct mortalities and disturbance (noise, dust and vibration), encroachment and displacement of the vegetation community due to alien invasive plant species, and habitat degradation due to littering and alien vegetation encroachment. Impacts were rated either low or moderate after implementation of mitigation measures. The anticipated ecological impacts are therefore expected to have a limited impact on people's environmental rights, especially considering that no people or communities are directly impacted within the development footprint.

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?

The socio-economic impact assessment has found that positive impacts such as job creation and provision of employment and business opportunities can be enhanced if the recommendations made in the report is implemented successfully

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 socioeconomic impacts (e.g. on livelihoods, loss of heritage site, opportunity costs, etc.)?

The karroid grassland ecosystem located within the development site is still natural to largely natural based on the diversity of species recorded, and the habitat physiognomy. The current natural ecosystems provide important ecosystem services including water regulation and pollination. Given the size of the development site and the fact that the entire site will not be cleared of vegetation, no significant socio-economic impacts are anticipated.

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?

The Kalahari Karroid Shrubland and the Bushmanland Arid Grassland vegetation type are classified as Least Concern. The site is also not located within a protected ecosystem in terms of the list of protected ecosystems published by DFFE. No significant ecological impacts are therefore anticipated.

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?

The site layout alternatives are in sites of low environmental sensitivity. No significantly adverse ecological impacts that will significantly impact the ecological integrity of the vegetation types and ecosystems within the development site are therefore anticipated. The placement of the alternative site layouts in low sensitive areas are confirmed by the recommendation from all specialists that either of the two site layout alternatives are developable.

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?

Cumulative impacts are assessed in context of the extent of the proposed project area, other developments in the area, and general habitat loss and transformation resulting from other activities in the area (all activities, as required for assessment of cumulative impacts including surrounding renewable energy facilities, powerlines and associated infrastructure in the region). Localised cumulative impacts include the cumulative effects from operations that are close enough to potentially cause additive effects on the environment or sensitive receivers, dust deposition, noise and vibration, disruption of corridors or habitat, and transport. Specific cumulative impacts identified include less migratory species found in the area, road killings are still a possibility, migratory routes of fauna will change, and fauna and flora species composition will change.

4.3 Promoting justifiable economic and social development

2.1. What is the socio-economic context of the area, based on, amongst other considerations, the following considerations?

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,

This impact assessment and Social Impact Assessment (Solarys, 2022) have assessed the broader socio-economic context of the development area in relation to all the relevant strategic plans, frameworks of policies applicable to the area. These include the National Development Plan (NDP), National Infrastructure Plan (NIP) 2050, Integrated Resource Plan (IRP), Just Transition Framework: Final Report and Recommendations (July 2022), Northern Cape, Office of the Premier, Strategic plan 2020/25, Northern Cape Provincial Spatial Development Framework (NCSDF), ZF Mgcawu District Municipality Integrated Development Plan (ZFMDM IDP), Dawid Kruiper Local Municipality Integrated Development Plan (DKLM IDP), and Dawid Kruiper Local Municipality Spatial Development Framework (DKLM SDF).

The findings of the review indicate that the proposed Kiwano BESS and PV project is supported at a national, provincial and local government level. At a national and provincial level, increasing South Africa's renewable energy generation capacity is supported by the NDP, the IRP, the NIP 2040, the Northern Cape Office of the Premier Strategic Plan 2020/25 which consolidates various provincial strategic planning documents, and the Northern Cape PSDF. Renewable energy, and particular solar PV developments is also supported at a district and local level as outlined in the ZF Mgcawu District IDP and DKLM IDP. The proposed project is also located within the boundaries of the approved Upington REDZ. It is furthermore aligned with spatial planning for DKLM as outlined in the 2018 SDF. The area has therefore been identified as suitable for the establishment of a facility of this nature.

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.),

The proposed Kiwano BESS and PV facility will be located on a portion of the farm Olyvenhouts Drift Settlement Agricultural Holding 1080 Portion 0, Ward 11. The proposed project site is located approximately 13 km south-west of Upington, DKLM, and 23 km east of Keimoes, KGLM, within close proximity (2 km) of the Orange River. The N14 highway runs along the southern edge of the proposed project site.

The project area falls within one of the 11 identified Renewable Energy Development Zone (REDZ). The entire footprint of the proposed project and related project infrastructure is located within the Upington REDZ 7.

Renewable energy, and particular solar PV developments is supported at a district and local level as outlined in the ZF Mgcawu District IDP and DKLM IDP. The proposed project is also located within the boundaries of the approved Upington REDZ. It is furthermore aligned with spatial planning for DKLM as outlined in the 2018 SDF. The area has therefore been identified as suitable for the establishment of a facility of this nature.

2.1.3. Spatial characteristics (e.g. existing land uses, planned land uses, cultural landscapes, etc.)

The Applicant owns the directly affected farm portion, Olyvenhouts Drift Settlement Agricultural Holding 1080 Portion 0. Existing electrical infrastructure on the site includes the Eskom Upington Main Transmission Substation (MTS) and related transmission lines. The area towards the north and west of the proposed project site is undeveloped and used predominantly for livestock grazing. To the south-east, along the N14 and down towards the banks of the Orange River, livestock grazing, cultivation of grapes and other crops are the predominant land use.

Settlement patterns in this area are characterised by a number of farmsteads, farm employee accommodation and farming related infrastructure. Inhabitants of this area are therefore likely to rely primarily on agriculture to support their livelihoods. The closest human settlement to the proposed project site is the rural agricultural settlement of Kalksloot which is located approximately 3.5 km from the Site A alternative. Oranjevallei is the next closest settlement located approximately 4.7 km from Site A. Other settlements within close proximity of the proposed project site include Louisvale (8.4 km); Dysons Klip (8.3 km); Raaswater (9.5 km); and Bloemsmond (12 km).

To the north, east and west of the proposed project site, there are a number of renewable energy facilities, including two solar PV farms and the Khi Solar One solar concentrator plant (CSP) complex located. The proposed Kiwano project is located on the property adjacent to the 258 MW Scatec Solar complex.

2.1.4. Municipal Economic Development Strategy (LED Strategy).

In its Draft Integrated Development Plan for 2022/2027, the DKLM lists the renewable energy sector as one of the key drivers of economic development in the local municipality. The DKLM Draft IDP notes the importance of the Upington Solar Special Economic Zone (SEZ) positioning itself to provide businesses and investors with prime locations for renewable energy developments. The IDP lists a number of ‘main development thrusts’ that include:

- Thrust 2: Manufacturing which focused on value adding of agricultural products, mining products, construction and renewable energy products.
- Thrust 6: Construction which is an integral part of economic activity in the DKLM through production of building materials, renewable energy plant equipment, steel pipe manufacture, manufacture of storage equipment, increased demand for housing in urban areas, construction of shopping malls and industrial space both within and beyond the municipality. DKLM is responsible for nearly half of all construction related activities in the ZF Mgcawu District.
- Thrust 9: Renewable energy and in particular, the Upington REDZ given that the town is ideally situated to exploit an optimal power per unit area of solar radiation for solar energy production.

Further details around the key priority areas and corresponding development priorities identified in the IDP update process that may be applicable to the proposed project can be viewed in the Social Impact Assessment (Solarys, 2022).

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?

2.2.1. Will the development complement the local socio-economic initiatives (such as local economic development (LED) initiatives, or skills development programs)?

The findings of the review of all relevant plans, strategies and policies applicable to the development area indicate that the proposed Kiwano BESS and PV project is supported at a national, provincial and local government level. At a national and provincial level, increasing South Africa’s renewable energy generation capacity is supported by the NDP, the IRP, the NIP 2040, the Northern Cape Office of the Premier Strategic Plan 2020/25 which consolidates various provincial strategic planning documents, and the Northern Cape PSDF. Renewable energy, and particular solar PV developments is also supported at a district and local level as outlined in the ZF Mgcawu District IDP and Draft IDP. The proposed project is also located within the boundaries of the approved Upington REDZ. It is furthermore aligned with spatial planning for DKLM as outlined in the 2018 SDF. The area has therefore been identified as suitable for the establishment of a facility of this nature.

2.3. How will this development address the specific physical, psychological, developmental, cultural and social needs and interests of the relevant communities?

It is anticipated that the construction phase will extend over a period of approximately 24 months. According to estimates provided by the Applicant, approximately 120 temporary employment opportunities will be created during the peak construction. It is further anticipated that approximately 33% (40) of the employment opportunities will be available to unskilled workers (construction labourers, security staff, cleaners, etc.), 25% (30) for semi-skilled workers (drivers, equipment operators etc.); and 17% (20) for skilled personnel (welders, electricians, solar PV installer, etc.). The remaining positions will be filled by professionals (engineers, project managers, etc), senior management and top management. Construction activities will be managed by the Applicant in conjunction with EPC and O&M contractors.

In a recent study undertaken into the effects of renewable energy on communities around Upington, the researcher noted that solar PV has the potential to create employment, at an estimated rate of 0.87 job-years per gigawatt-hour (GWh). A job-year is the equivalent of one full-time job for one person for one year. This potential benefit can however only be realised to the extent that appropriate skills are available within the local communities. In this regard, the researcher noted that an estimated 3500 CSP and 2000 solar PV construction jobs were created as part of the Independent Power Producer (IPP) rollout in Upington. Most of the construction workers who benefitted from these short-term employment opportunities are doorstep community members from Upington and the surrounding settlements. It can therefore be assumed that there is a local skilled workforce who can be recruited to undertake construction phase activities associated with the proposed project.

Given the high levels of unemployment in DKLM and KGLM the proposed project presents a localised socio-economic benefit with the potential to improve the quality of life for residents of DKLM and the adjacent KGLM. With the implementation of the recommended enhancements as set out in the Social Impact Assessment report (Solarys, 2022), the significance of this positive impact is likely to be Moderate (+), as there is increased probability that local people will be employed during the construction phase.

Local and regional businesses should furthermore be granted opportunities to tender for contracts associated with the provision of goods and services associated with the construction phase. The hospitality sector in DKLM and KGLM is also likely to benefit from provision of accommodation and meals for professionals and other personnel who will be involved in construction phase activities. Other services such transport, retail stores, housing and aviation could also stand to benefit from a short-term increase in economic activity associated with the construction phase.

The project will add new generation capacity (58 MW) and augment existing Eskom generation and transmission infrastructure in the Northern Cape. The proposed development will furthermore provide ancillary support in terms of enhanced frequency control of the network, reactive power support and improved quality of supply performance near existing Distributed Generation Renewable Energy plants. The Battery Storage technology may enable the immediate levels of constraint to be addressed and provide continued access to potential customers to these networks. The battery storage technology will also improve the quality of supply and mitigate voltage related concerns on the networks. The proposed development, once approved and operational, will support efforts to increase and stabilise electricity supply, thereby helping to reduce instances of electricity disruptions and associated negative socio-economic impacts.

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?

Impacts assessed by the Social, Visual and Cultural Heritage Impact Assessments can generally be mitigated to within acceptable limits within the short, medium and long term. The impacts are therefore considered to be socially and economically sustainable in the short- and long-term?

2.5. In terms of location, describe how the placement of the proposed development will:

2.5.1. result in the creation of residential and employment opportunities in close proximity to or integrated with each other,

A detailed description of how the placement of the proposed development will result in the creation of local employment and business opportunities have been provided in question 2.3 above. The answer provided for question 2.3 is therefore applicable to this question also.

2.5.2. reduce the need for transport of people and goods

This aspect is not relevant to the proposed development.

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),

This aspect is not relevant to the proposed development.

2.5.4. compliment other uses in the area, and 2.5.5. be in line with the planning for the area,

The Applicant owns the directly affected farm portion, Olyvenhouts Drift Settlement Agricultural Holding 1080 Portion 0. Existing electrical infrastructure on the site includes the Eskom Upington Main Transmission Substation (MTS) and related transmission lines. The area towards the north and west of the proposed project site is undeveloped and used predominantly for livestock grazing. To the south-east, along the N14 and down towards the banks of the Orange River, livestock grazing, cultivation of grapes and other crops are the predominant land use.

To the north, east and west of the proposed project site, there are a number of renewable energy facilities, including two solar PV farms and the Khi Solar One solar concentrator plant (CSP) complex located. The proposed Kiwano project is located on the property adjacent to the 258 MW Scatec Solar complex.

The proposed Kiwano BESS and PV project is supported at a national, provincial and local government level. At a national and provincial level, increasing South Africa's renewable energy generation capacity is supported by the NDP, the IRP, the NIP 2040, the Northern Cape Office of the Premier Strategic Plan 2020/25 which consolidates various provincial strategic planning documents, and the Northern Cape PSDF. Renewable energy, and particular solar PV developments is also supported at a district and local level as outlined in the ZF Mgcawu District IDP and Draft IDP. The proposed project is also located within the boundaries of the approved Upington REDZ. It is furthermore aligned with spatial planning for DKLM as outlined in the 2018 SDF. The area has therefore been identified as suitable for the establishment of a facility of this nature.

2.5.6. for urban related development, make use of underutilised land available with the urban edge,

This aspect is not relevant to the proposed development.

2.5.7. optimise the use of existing resources and infrastructure,

The development site has strategically been proposed close to the existing Upington MTS in order to facilitate the tie into the MTS over a short distance. The site was furthermore informed by the presence of existing roads and existing powerlines where new powerlines can be aligned in parallel to reduce the potential environmental and visual impact of additional powerlines. The location of the development site has therefore been optimised to align with the existing electricity and transport infrastructure in the area.

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),

This aspect is not relevant to the proposed development as the development is strongly aligned with the priority area for renewable development as outlined by the Upington REDZ boundary and Strategic Powerline Corridor boundaries.

2.5.9. discourage 'urban sprawl' and contribute to compaction/densification,

This aspect is not relevant to the proposed development as the development is a renewable energy development.

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,

This aspect is not relevant to the proposed development as the development is a renewable energy development.

With regards to the optimum use of existing infrastructure, the development site has strategically been proposed close to the existing Upington MTS in order to facilitate the tie into the MTS over a short distance. The site was furthermore informed by the presence of existing roads and existing powerlines where new powerlines can be aligned in parallel to reduce the potential environmental and visual impact of additional powerlines. The location of the development site has therefore been optimised to align with the existing electricity and transport infrastructure in the area.

2.5.11. encourage environmentally sustainable land development practices and processes,

The proposed site alternative for the development was placed in areas of low environmental sensitivities. The prominent non-perennial drainage lines located to the east of site alternative A was specifically avoided. The placement of the alternative site layouts in low sensitive areas are confirmed by the recommendation from all specialists that either of the two site layout alternatives are developable.

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 Applicant owns the directly affected farm portion, Olyvenhouts Drift Settlement Agricultural Holding 1080 Portion 0. Existing electrical infrastructure on the site includes the Eskom Upington Main Transmission Substation (MTS) and related transmission lines. The area towards the north and west of the proposed project site is undeveloped and used predominantly for livestock grazing. To the south-east, along the N14 and down towards the banks of the Orange River, livestock grazing, cultivation of grapes and other crops are the predominant land use.

To the north, east and west of the proposed project site, there are a number of renewable energy facilities, including two solar PV farms and the Khi Solar One solar concentrator plant (CSP) complex located. The proposed Kiwano project is located on the property adjacent to the 258 MW Scatec Solar complex.

The proposed Kiwano BESS and PV project is supported at a national, provincial and local government level. At a national and provincial level, increasing South Africa's renewable energy generation capacity is supported by the NDP, the IRP, the NIP 2040, the Northern Cape Office of the Premier Strategic Plan 2020/25 which consolidates various provincial strategic planning documents, and the Northern Cape PSDF. Renewable energy, and particular solar PV developments is also supported at a district and local level as outlined in the ZF Mgcawu District IDP and Draft IDP. The proposed project is also located within the boundaries of the approved Upington REDZ. It is furthermore aligned with spatial planning for DKLM as outlined in the 2018 SDF. The area has therefore been identified as suitable for the establishment of a facility of this nature.

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),

A detailed description of how the placement of the proposed development will result socio-economic returns have been provided in question 2.3 above. The answer provided for question 2.3 is therefore applicable to this question also.

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, and

According to the Heritage, Archaeological and Palaeontological Impact Assessment undertaken for the proposed development (Beyond Heritage, 2022), the proposed development area is marked by a mantle of Aeolean sand on top of a calcrete substrata and finds are mostly found where the calcrete protrudes through the sand cover. Few formal tools were noted but artefacts are mostly dating to the MSA with facetted striking platforms.

According to the SAHRA Paleontological sensitivity map the study area is of moderate paleontological significance. The palaeontological study concluded that it is extremely unlikely that any fossils would be preserved in the aeolian sands of the Gordonia Formation, Kalahari Group (Quaternary). There is a very small chance that fossils may have been trapped in features such as palaeo-pans or palaeo-springs, and buried by the aeolian sands, but no such feature is visible in the satellite imagery.

The specialists concluded that no adverse impact on heritage resources is expected as a result of the proposed project and it is recommended that the project can commence on the condition that the recommendations prescribed in the specialist reports are implemented as part of the EMPr and based on approval from SAHRA.

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 to the proposed development as the development is a renewable energy development.

2.6. How were 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)?

From a socio-economic perspective the following limitations were noted in the Social Impact Assessment Report:

- The socio-economic baseline section is based on a desktop review of available information sourced from the various sources outlined in section 6.1 of the Social Impact Assessment Report. While some data outlined in these sources might not contain the latest statistical data, sufficient information was secured to establish a baseline that is reasonably accurate, allowing for the establishment of trends.
- A desktop assessment of sensitive receptors was undertaken by examining information available on Google Earth; findings of site visits undertaken by the Visual; Heritage; Terrestrial Biodiversity; and Wetland specialists; and reviewing the record of consultations with key stakeholders regarding land use arrangements and impact identification referred to in section 6.2 of the Social Impact Assessment Report.

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?'

Given the assessment of social impacts undertaken by the social specialist and documented in the Social Impact Assessment Report, the level of risk to local communities associated with the limits of the current knowledge is considered low.

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?

The proposed development was assessed in terms of the IFC Performance Standards on Environmental and Social Sustainability. Potential socio-economic impacts of the proposed project were then identified based on the project description provided by the Applicant; an analysis of the baseline data obtained for the development site and surrounding areas; and a review of several similar studies and projects undertaken in the area over the last decade. Significance of the proposed impacts was assessed and was also benchmarked against previous studies assessments and conclusions. Measures to mitigate and reduce the significance of negative impacts and enhance positive impacts were then identified.

2.7. How will the socio-economic impacts resulting from this development impact on people's environmental right 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? And

2.7.2. Positive impacts. What measures were taken to enhance positive impacts?

The proposed development was assessed in terms of the IFC Performance Standards on Environmental and Social Sustainability. Potential socio-economic impacts of the proposed project were then identified based on the project description provided by the Applicant; an analysis of the baseline data obtained for the development site and surrounding areas; and a review of several similar studies and projects undertaken in the area over the last decade. Significance of the proposed impacts was assessed and was also benchmarked against previous studies assessments and conclusions. Measures to mitigate and reduce the significance of negative impacts and enhance positive impacts were then identified.

Negative impacts are furthermore reduced or avoided by recommending that the applicant implement the following enhancements, which will be bound to the authorisation of the proposed development:

- To the extent possible, the Applicant and any contractors appointed to undertake construction related activities should prioritise employment of local people from DKLM and KGLM, particularly for semi and unskilled job categories.
- Employment of Coloured and Black African people; women; and youth should be prioritised.
- Before the construction phase commences, the Applicant and its contractors should meet with officials from the ZF Mgcawu District as well as DKLM and KGLM to enquire about the possibility and process of hiring people who are registered on district or local skills databases.
- Where feasible, training and on-the-job skills development programmes for temporary employees should be implemented during the construction phase.
- Where feasible, efforts should be made to employ local contactors that are compliant with Broad Based Black Economic Empowerment (BBBEE) criteria.
- Recruitment and employment practises must be aligned with prevailing labour legislation in South Africa.
- Vacancies should be advertised in the local media when they become available.
- The Applicant as well as any contractors that are appointed to undertake the construction phase activities should develop and agree a code of conduct which sets standards for acceptable behaviour and outlines behaviour and activities which could

constitute grounds for dismissal. Any employee or contractor appointed by the Applicant to undertake construction phase activities that is found to be in breach of the code of conduct should be dismissed after following due process in accordance with prevailing labour legislation. Criminal activities should be reported to SAPS immediately for investigation and further action.

- The Applicant and contractor should agree and implement an HIV/AIDS/TB awareness programme.
- The Applicant should develop and implement an appropriate method of communication with the local community. A community liaison officer should be appointed during the construction phase to engage with local community members regarding any issues, complaints or grievances that they may have.
- In consultation with the DKLM and KGLM, investigate the option of establishing a Monitoring Forum to monitor and identify potential influx related problems associated with the proposed project. The Monitoring Forum should include other renewable energy operators in the area.
- Employment for 'walk-in' temporary / casual labourers at the proposed construction site should not be permitted.

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 development area is characterised as grazing agricultural land. The proposed development permanently transform most of the footprint of development site. Eskom is furthermore the owner of the property and is leasing part of the property to a landowner in the area to utilise as grazing land. The development site does not have any other linkages to the local communities, apart from leasing the property for grazing.

Considering the broader area, the proposed development could contribute to the housing of temporary employees in the low and semi-skilled income range to become problematic if they are brought in from other areas during the construction phase. Without mitigation, an additional contingent of temporary construction workers in the area could increase the burden on the local municipalities given that it will increase the demand for services (accommodation, water, sanitation, electricity, etc). The development's socio-economic impacts are unlikely to result in ecological impacts at the development site.

2.9. What measures were taken to pursue the selection of the 'best practicable environmental option' in terms of socio-economic considerations?

The Best Practicable Environmental Option (BPEO) from a socio-economic perspective would be a scenario where adverse impacts on directly affected communities are limited or completely avoided, while the positive impacts resulting from the proposed development is enhanced to provide tangible benefits to affected and surrounding communities.

The selection of the development site was guided by a number of factors as discussed in section 3.1 of this Basic Assessment report. The recommended preferred development site, Olyvenhouts Drift Settlement Agricultural Holding 1080 Portion 0, does not have any directly affected communities or households within the proposed development footprint. There are therefore no directly affected communities impacted by the proposed development.

On the other hand, the SIA has identified several positive impacts that will be enhanced by the proposed development, without resulting in a corresponding negative impact on the ecological environment. These impacts include the creation of employment opportunities, the creation of procurement and business opportunities, and the strengthening of energy supply in the region that will benefit all communities in the area.

The BPEO for the proposed development from a socio-economic perspective does therefore avoid direct socio-economic and ecological impacts, while optimising on the positive impacts and benefits from the proposed development.

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?

Measures that were taken to pursue environmental justice and avoid discrimination against particularly vulnerable and disadvantaged persons include undertaking the environmental impact assessment process as set out in the EIA Regulations of 2014. This includes providing a reasonable and fair opportunity all stakeholders and Interested and Affected Parties (I&Aps) during the Public Participation Process (PPP) to communicate their concerns relating to how the proposed development may adversely impact them. All concerns and comments were duly considered in the Basic Assessment process, addressed and responded to as is evident from the Comments and Responses Report (CRR) included with the Basic Assessment Report.

Furthermore, the SIA has identified several positive impacts that will be enhanced by the proposed development, without resulting in a corresponding negative impact on the ecological environment. These impacts include the creation of employment opportunities, the creation of procurement and business opportunities, and the strengthening of energy supply in the region that will benefit all communities in the area.

To that end, the EAP believe that the alternatives identified and assessed did allow for the BPEO to be selected.

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?

A reasonable and fair opportunity for all stakeholders and Interested and Affected Parties (I&APs) during the Public Participation Process (PPP) to communicate their concerns relating to how the proposed development may adversely impact them. All concerns and comments arising from public review of the Draft BAR will be duly considered in the Basic Assessment process, and will be addressed and responded to as will be evidenced from the Comments and Responses Report (CRR) that will be included with the Final Basic Assessment Report.

A SIA was furthermore commissioned and undertaken to identify particularly vulnerable and disadvantaged communities and persons, and to identify measures to reduce direct socio-economic impacts on these communities while enhancing the socio-economic benefits that could be provided to these communities. The social specialist has identified several measures to enhance the socio-economic benefits to these communities. These measures are listed in the answer to question 2.7.2 above. The proposed measures will be included in the Environmental Management Programme (EMPr) developed for the proposed development and the proponent will be bound by the Environmental Authorisation to implement such measures if authorisation for the proposed development is approved.

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?

Adverse impacts of the proposed development on human health have been assessed in this environmental impact assessment through providing measures to reduce or total avoid any potential adverse impacts, such as the spillage of hazardous substances into the environment or contact of employees and persons to hazardous substances and materials, on employees and persons during all phases of the proposed development. The management of potential impacts on human health and safety is furthermore addressed in the EMPr, which stipulate procedures and measures to follow to effectively storage, handle and manage any substances or activities that could result in adverse impacts on human health. The EMPr also stipulate responsible persons and parties that will be responsible for managing the identified impacts.

2.13. What measures were taken to:

2.13.1. Ensure the participation of all interested and affected parties,

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 wellbeing and empowerment through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means,

2.13.5. ensure openness and transparency, and access to information in terms of the process,

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, and

2.13.7. ensure that the vital role of women and youth in environmental management and development were recognised and their full participation therein were be promoted?

All questions under 2.13 are collectively answered in the following paragraphs.

The Basic Assessment report was drafted in a manner to facilitate a reasonable understanding of the proposed development activities, status quo of the surrounding environment, identified impacts and proposed mitigation and management measures. All stakeholders were provided with an opportunity to review the application documentation and to attend a public meeting during the public review period where any questions regarding the proposed development could be asked and clarifications obtained from the proponent's technical team and EAP. Full details regarding the PPP are available in the Public Participation Report and are included in Appendix J. The comments raised by the I&APs and the EAP's responses thereto, will be included in the JCRR that will form part of the updated Public Participation Report that will be included in the Final BAR that will be submitted to the DFFE for review and decision-making.

A reasonable and fair opportunity for all stakeholders and Interested and Affected Parties (I&APs) during the Public Participation Process (PPP) to communicate their concerns relating to how the proposed development may adversely impact them. The opportunity to register as an I&AP was further communicated through site notices around the development site, newspaper advertisements in local newspapers, and the placement of Background Information Documents (BIDs). Local councillors were further notified of the proposed development, who could in turn notify their constituents. A further option to register as an I&AP was specifically included to cater for previously disadvantaged communities when any community member could register as an I&AP by SMSing a keyword to a shortcode, in the event that some community members does not have smart phones. The public meeting was also held as close as possible to the development site to provide local communities surrounding the development site the opportunity to attend the public meetings and voice their concerns and comments.

All concerns and comments will be duly considered in the Basic Assessment process, addressed and responded to, as will be evidenced from the Comments and Responses Report (CRR) that will be included with the Final Basic Assessment Report.

A SIA was furthermore commissioned and undertaken to identify particularly vulnerable and disadvantaged communities and persons, and to identify measures to reduce direct socio-economic impacts on these communities while enhancing the socio-economic benefits that could be provided to these communities. The Social Specialist has identified several measures to enhance the socio-economic benefits to these communities. These measures are listed in the answer to question 2.7.2 above. The proposed measures will be included in the Environmental Management Programme (EMPr) developed for the proposed development and the proponent will be bound by the environmental authorisation to implement such measures if authorisation for the proposed development is approved.

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)?

In the Dawid Kruiper Local Municipality Draft Integrated Development Plan for 2022/2027, the DKLM lists the renewable energy sector as one of the key drivers of economic development in the local municipality. The DKLM Draft IDP notes the importance of the Upington Solar Special Economic Zone (SEZ) positioning itself to provide businesses and investors with prime locations for renewable energy developments.

It is anticipated that the construction phase will extend over a period of approximately 24 months. According to estimates provided by the Applicant, approximately 120 temporary employment opportunities will be created during the peak construction. It is further anticipated that approximately 33% (40) of the employment opportunities will be available to unskilled workers (construction labourers, security staff, cleaners, etc.), 25% (30) for semi-skilled workers (drivers, equipment operators etc.); and 17% (20) for skilled personnel (welders, electricians, solar PV installer, etc.). The remaining positions will be filled by professionals (engineers, project managers, etc), senior management and top management. Construction activities will be managed by the Applicant in conjunction with EPC and O&M contractors.

2.15. What measures have been taken to ensure that current and/or future workers will be informed of work that potentially might be harmful to human health or the environment or of dangers associated with the work, and what measures have been taken to ensure that the right of workers to refuse such work will be respected and protected?

During the construction phase, most of the workforce will be employed by an Engineering, Procurement and Construction (EPC) contractor. It is expected that the EPC workforce will consist primarily of unskilled, semi-skilled and skilled employees who are likely to be sourced from either DKLM or KGLM. Procurement of a local EPC contractor from DKLM, KGLM or the ZF Mgcawu District will be prioritised to the extent possible. As such, employment and procurement opportunities for people already residing within DKLM, KGLM or the broader ZF Mgcawu District will be prioritised where practicable.

As a contractor to Eskom, the EPC contractor must adhere to Eskom's procurement policies, Health, Safety and Environmental policies and procedures to ensure the safety of its workforce and the general public at large at all times. As part if its commitment to its health and safety standards, Eskom enforces its policies strictly on all its employees, service providers and contractors.

Apart from adherence to Eskom Health and Safety protocols, during the various project phase, all relevant local legislation and regulations pertaining to occupational health and safety will be adhered to. In instances where the local legislation is silent, and where specific occupational health and safety risks have been identified as part of a detailed risk assessment, internationally recognised best practice risk management methods will be implemented to safeguard the work environment and protect employees and contractors working at the proposed project site.

2.16. Describe how the development will impact on job creation in terms of, amongst other aspects:

2.16.1. The number of temporary versus permanent jobs that will be created,

2.16.2. Whether the labour available in the area will be able to take up the job opportunities (i.e. do the required skills match the skills available in the area),

2.16.3. The distance from where labourers will have to travel,

2.16.4. The location of jobs opportunities versus the location of impacts (i.e. equitable distribution of costs and benefits), and

2.16.5. The opportunity costs in terms of job creation (e.g. a mine might create 100 jobs, but impact on 1000 agricultural jobs, etc.).

All questions under 2.16 are collectively answered in the following paragraphs.

It is anticipated that the construction phase will extend over a period of approximately 24 months. According to estimates provided by the Applicant, approximately 120 temporary employment opportunities will be created during the peak construction. During the operational phase, the solar PV and BESS facility will operate for 24-hours per day, 7 days a week, 365 days per year. Routine maintenance activities during the operational phase will be undertaken by Eskom employees. The anticipated manpower requirements during the operational phase will be approximately 18 full time employees.

It is anticipated that approximately 33% (40) of the construction employment opportunities will be available to unskilled workers (construction labourers, security staff, cleaners, etc.), 25% (30) for semi-skilled workers (drivers, equipment operators etc.); and 17% (20) for skilled personnel (welders, electricians, solar PV installer, etc.). The remaining positions will be filled by professionals (engineers, project managers, etc), senior management and top management. Construction activities will be managed by the Applicant in conjunction with EPC and O&M contractors.

In a recent study undertaken into the effects of renewable energy on communities around Upington, the researcher noted that solar PV has the potential to create employment, at an estimated rate of 0.87 job-years per gigawatt-hour (GWh). [2] A job-year is the equivalent of one full-time job for one person for one year. This potential benefit can however only be realised to the extent that appropriate skills are available within the local communities. In this regard, the researcher noted that an estimated 3500 CSP and 2000 solar PV construction jobs were created as part of the Independent Power Producer (IPP) rollout in Upington.[3] Most of the construction workers who benefitted from these short-term employment opportunities are doorstep community members from Upington and the surrounding settlements.[4] It can therefore be assumed that there is a local skilled workforce who can be recruited to undertake construction phase activities associated with the proposed project.

It is anticipated that most of the unskilled and semi-skilled labour would be sources from the local communities in the DKLM, Kai !Garib Local Municipality (KGLM) and ZF Mgcawu District Municipality. Travelling distances would therefore be limited to local travel.

An equitable distribution of costs and benefits for the project is expected as most ecological and socio-economic impacts, whether adverse of beneficial, will be experienced within the development area where the majority of the workforce and job opportunities will be available. Furthermore, the opportunity costs in terms of job creation will be low as no direct impact on local communities will result from the proposed development and the loss of other job opportunities are not expected as a result of the proposed development, as is evident from the SIA (Solarys, 2022) undertaken for the proposed development.

2.17. What measures were taken to ensure:

2.17.1. That there were intergovernmental coordination and harmonisation of policies, legislation and actions relating to the environment, and

2.17.2. That actual or potential conflicts of interest between organs of state were resolved through conflict resolution procedures?

[2] Mabele, MB The effects of renewable energy on communities: the case of Upington in the Northern Cape, South Africa (MDS thesis University of the Free State 2021).
[3] Mabele (note 2 above) 49.
[4] As above.

Numerous policies, plans and legislation has been drafted in support of the development if renewable energy development as part of South Africa's commitment to diversity its energy mix. Some of these policies, plans and procedures are summarised in Chapter 5 of this report. Intergovernmental coordination and harmonisation of policies, legislation and actions relating to the environment has therefore been undertaken and optimised to facilitate renewable energy development in South Africa.

2.18. What measures were taken to ensure that the environment will be held in public trust for the people, that the beneficial use of environmental resources will serve the public interest, and that the environment will be protected as the people's common heritage?

The development or renewable energy in South Africa has firstly been guided by several policies, plans and legislation as set out in Chapter 5 of this report. A Strategic Environmental Assessment (SEA) was furthermore undertaken to assess the broader impacts on the natural and socio-economic environment in order to focus renewable energy development is sectors of the country that are less sensitive to this kind of development. The result from this SEA is the establishment and gazetting of 11 REDZ, which include the Upington REDZ in which the proposed development falls in its entirety. Additional assessment of potential impacts of the development on the natural and socio-economic environment is further required through the Basic Assessment process and the need to obtain an EA. The impact assessment process is guided by the implementation of the impact mitigation hierarchy where impacts must first be avoided, or otherwise reduced and remediated to acceptable levels of impact. If approval is granted, the development will be further bound to the implementation of the Environmental Management Programme and regular compliance monitoring and audits to ensure 7impacts are managed as directed in the BAR and EMPr. Given these numerous levels of control, it is with high confidence that the environment will be protected for future generations.

2.19. Are the mitigation measures proposed realistic and what long-term environmental legacy and managed burden will be left?

Biodiversity, water, visual and heritage impacts related to the proposed project are considered and assessed under the various specialist disciplines and more broadly in the BA report. Mitigation measures proposed in these studies are considered to be realistic, reducing the likelihood of a long-term burden for current or future generations to manage.

2.20. What measures were taken to ensure that the costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects will be paid for by those responsible for harming the environment?

The answer provided for question 2.18 is directly applicable to this question. Furthermore, the licence holder is held liable in terms of the EA granted for the proposed development through the compulsory ongoing compliance monitoring and legal compliance auditing required in terms of the EA. Various provisions in the NEMA and SEMAs are also applicable that holds the licence holder accountable for any degradation and unmitigated adverse environmental impacts judged to be unacceptable by the Competent Authority (CA).

2.21. Considering the need to secure ecological integrity and a healthy bio-physical 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 socio-economic considerations?

The answer provided for question 2.9 is directly applicable to this question.

2.22. Describe the positive and negative cumulative socio-economic impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and other planned developments in the area?

It is anticipated that the proposed development will contribute positively to employment, skills development and creation of economic opportunities for people residing in DKLM and KGLM and the broader ZF Mgcawu District. The establishment of the Upington REDZ and other similar proposed solar PV and CSP developments in the region could cumulatively, with the proposed Kiwano BESS and PV project, result in Moderate (+) socio-economic benefits for local communities as it relates to short-term employment, skills development and procurement of goods and services. However, these cumulative benefits will depend on the extent to which employment and procurement of local resources is prioritised by the various developers.

In the event that similar developments to the proposed Kiwano BESS and PV project initiate construction or operational activities within a similar timeframe, potential negative cumulative impacts may occur related to an influx of jobseekers. This potential cumulative impact may be significant, particularly if developers do not prioritise employment of and procurement of services from local people. In particular, if local employment of people in the unskilled and semi-skilled job categories is not prioritised, the cumulative pressure on available low-cost accommodation and municipal services is likely to materialise. Other cumulative impacts associated with an influx of people into the area include strain on road infrastructure due to higher traffic volumes with associated road safety risks; a higher demand for English medium schools; and a sharp increase in the price of property rental and purchase prices. Given that the Applicant is not able to influence the hiring and procurement strategies of other developers, this cumulative impact is assessed as Low (-).

While the local municipality is in a reasonably good position to deal with a potential increase in communicable diseases, the presence of a largely external workforce employed by various developers could place strain on local health resources. Furthermore, an increase in accidents related to industrial events could place strain on the existing local health infrastructure.

Given that the Applicant has no control over measures to mitigate health and safety risks related to transmission of communicable diseases and industrial accidents that may arise from other developments, this potential cumulative impact is assessed at Low (-).

5 POLICY AND LEGISLATIVE CONTEXT

This chapter provides an overview of the legal context of the proposed project, including the applicable legislation, guidelines and information that will inform the BA process.

5.1 International Polices and Frameworks

A brief review of the relevant international frameworks and policies that is applicable to the proposed Kiwano Solar PV and BESS development is summarised in Table 5-1 below.

Table 5-1: Relevant international frameworks and policies applicable to the development

Relevant framework / policy	Relevance to the proposed development
United Nations Framework Convention on Climate Change (UNFCCC) and Conference of the Party (COP)	The Conference of the Parties (COP), established by Article 7 of the UNFCCC, is the supreme body and highest decision-making organ of the Convention. It reviews the implementation of the Convention and any related legal instruments and takes decisions to promote the effective implementation of the Convention. COP 21 was held in Paris in 2015 and from this conference an agreement to address global warming was reached between 195 countries. South Africa signed the Agreement in April 2016 and subsequently ratified on 01 November 2016 and assented to by the National Council of Provinces on 27 October 2016, and the National Assembly on 1 November 2016. The Agreement was promulgated on 04 November 2016. Following COP21, countries met in Katowice, Poland in 2018 for COP24. Countries agreed on various elements from COP21 held in Paris in 2015, which pertained to how governments will measure, report and verify their emission-cutting efforts, which was a key element as it ensured all countries are held to proper standards and will find it difficult to renege from the signed agreements. South Africa's National Climate Change Response Policy (NCCRP) establishes South Africa's approach to addressing climate change, including adaptation and mitigation responses. The NCCRP formalises Government's vision for a transition to a low carbon economy, through the adoption of the 'Peak, Plateau and Decline' (PPD) Greenhouse Gases (GHG) emissions trajectory whereby South Africa's emissions should peak between 2020 and 2025, plateau for approximately a decade, and then decline in absolute terms thereafter, and based on this the country has pledged to reduce emissions by 34% and 42% below Business As Usual (BAU) emissions in 2020 and 2025, respectively. The policy therefore provides support for the development of renewable energy infrastructure such as the proposed Kiwano Solar PV and BESS which will contribute to managing climate change impacts, supporting the emergency response capacity, as well as assist in reducing GHG emissions in a sustainable manner.
The Equator Principles III (June 2013)	The Equator Principles (EPs) III constitute a financial industry benchmark used for determining, assessing, and managing project's environmental and social risks. The EPs are primarily intended to provide a minimum standard for due diligence to support responsible risk decision-making. The

Relevant framework / policy	Relevance to the proposed development
	EPs are applicable to large infrastructure projects such as the proposed Kiwano Solar PV and BESS development and apply globally to all industry sectors. In terms of the EPs, an assessment undertaken in terms of the EPs should propose measures to minimise, mitigate, and offset adverse impacts in a manner relevant and appropriate to the nature and scale of a large-scale development such as the Kiwano Solar PV and BESS development. However, in terms of the EPs, South Africa is a non-designated country, and as such the assessment process for projects located in South Africa evaluates compliance with the applicable IFC Performance Standards on Environmental and Social Sustainability, and Environmental Health and Safety (EHS) Guidelines. The proposed Kiwano Solar PV and BESS development is being assessed in accordance with the requirements of the 2014 EIA Regulations (GN R982), as amended, published in terms of Section 24(5) of the National Environmental Management Act, No. 107 of 1998 (NEMA), which is South Africa's national legislation providing for the authorisation of certain controlled activities. Through this assessment, all potential social and environmental risks are identified and assessed, and appropriate mitigation measures proposed.
International Finance Corporation (IFC) Performance Standards and Environmental and Social Sustainability (January 2012)	The International Finance Corporation's (IFC) Performance Standards (PSs) on- Environmental and Social Sustainability were developed by the IFC and last updated on 1 January 2012. Performance Standard 1 requires that a process of environmental and social assessment be conducted, and an Environmental and Social Management System (ESMS) appropriate to the nature and scale of the project, and commensurate with the level of its environmental and social risks and impacts, be established and maintained. The abovementioned standard is the overarching standard to which all the other standards relate. Performance Standard 2 to 8 establish specific requirements to avoid, reduce, mitigate or compensate for impacts on people and the environment, and to improve conditions where appropriate. More specifically standards 2 and 8 describe potential social and environmental impacts that require particular attention specifically within emerging markets. Where social or environmental impacts are anticipated, the developer is required to manage them through its ESMS consistent with Performance Standard 1. Given the nature of the proposed Kiwano Solar PV and BESS development, it is anticipated based on the project parameters that Performance Standards 1, 2, 3, 4, 6, and 8 may be applicable to the project.
United Nations Sustainable Development Goals	The United Nations Development Programme (UNDP) Sustainable Development Goals (SDG) Impact Standards were also considered in preparing this impact assessment process. The 2030 Agenda for Sustainable Development and its 17 SDGs are the world's roadmap for a better and more sustainable future for everybody. They target poverty, inequality, climate change, environmental degradation, peace and justice. All 193 UN Member States committed to the SDGs, which rely on both state and the private sector to solve sustainable development concerns. The SDGs break down silos between actors and geographies, creating space and opportunities for new ways of working towards solutions, including

Relevant framework / policy	Relevance to the proposed development
	working collaboratively with a broader range of partners and constituencies to operate more sustainably and contribute positively to sustainable development and the UN Sustainable Development Goals (SDGs). The following SDGs may be applicable to the proposed project: • SDG 1: End poverty in all its forms everywhere. • SDG 3: Ensure healthy lives and promote well-being for all at all ages. • SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. • SDG 5: Achieve gender equality and empower all women and girls. • SDG 7: Ensure access to affordable, reliable, sustainable and modern energy for all. • SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all. • SDG 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation. • SDG 10: Reduce inequality within and among countries. • SDG 12: Ensure sustainable consumption and production patterns. • SDG 13: Take urgent action to combat climate change and its impacts. • SDG 16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.

5.2 Applicable Legislative Permitting Requirements

5.2.1 National Environmental Management Act, No. 107 of 1998 (NEMA)

This piece of legislation is South Africa's principle piece of environmental legislation and gives effect to Section 24 of the Constitution. NEMA sets the framework for environmental management in South Africa. The national environmental management principles state that the social, economic and environmental impacts of activities, including disadvantages and benefits, must be considered, assessed and evaluated, and decisions must be appropriate in the light of such consideration and assessment.

In terms of Sections 24 and 24D of NEMA, as read with Government Notices R983, as amended, a Basic Assessment process is required for the proposed development. The table below contains the listed activities in terms of the EIA Regulations of December 2014, as amended, which apply to the proposed development, and for which an application for EA has been applied. Table 5-2 includes a description of the project activities which relate to the applicable listed activities.

Due to the fact that the Kiwano Solar PV and BESS development is a power generation project and therefore relates to the IRP 2010 – 2030, the National Department of Forestry, Fisheries and the Environment (DFFE) has been determined as the Competent Authority in terms of GN R779 of 01 July 2016. The Northern Cape Department of Agriculture, Environmental Affairs, Rural Development and Land Reform (DAERL) will be the Commenting Authority on the project.

Table 5-2: Listed activities triggered by the proposed project

Activity No(s):	Basic Assessment activities as set out in Listing Notice 1 (GN R983) of the EIA Regulations, 2014, as amended	Applicability of listed activities to the proposed development
11	The development of facilities or infrastructure for the transmission and distribution of electricity— (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts. excluding the development of bypass infrastructure for the transmission and distribution of electricity where such bypass infrastructure is— (a) temporarily required to allow for maintenance of existing infrastructure; (b) 2 kilometres or shorter in length; (c) within an existing transmission line servitude; and (d) will be removed within 18 months of the commencement of development.	Eskom proposes the construction and operation of a new on-site 132 kV substation with 5 feeder bays substation to facilitate the connection of the facility to the national grid. The development area is located outside of an urban area. Eskom further propose to develop 132kV loop-in loop-out powerlines from the Solar PV and BESS facility substation to the existing Upington substation. The powerline associated with Site Alternative A will be approximately 1 330m in length, while the powerline associated with Site Alternative B will be approximately 5 568m in length. The infrastructure for the distribution of electricity that will be included in the proposed development is NOT considered bypass infrastructure that is temporarily required for maintenance, within an existing transmission line servitude, nor will it be removed within 18 months of the commencement of the development. The exclusion applicable to Regulation 11 of Listing Notice 1 is therefore NOT APPLICABLE to this proposed development.
12	The development of (ii) infrastructure or structures with a physical footprint of 100 square meters or more; where such development occurs (a) within a watercourse or (c) within 32 meters of a watercourse, measured from the edge of a watercourse; - excluding— (aa) the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour; (bb) where such development activities are related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies; (cc) activities listed in activity 14 in Listing Notice 2 of 2014 or activity 14 in Listing Notice 3 of 2014, in which case that activity applies; (dd) where such development occurs within an urban area;	The development of the Solar PV and BESS facility will require the establishment of solar PV panels and other associated infrastructure within natural drainage lines and within 32m of natural drainage lines identified within the study area. The solar PV panel area will be approximately 103.5 ha in extent, situated within the proposed development site of 136.9 ha. The natural drainage features, although not strictly defined as a wetland or pan, is classified as a watercourse since it does channel water along its alignment during some periods of the year. Considering the exclusions included with Regulation 12 of Listing Notice 1, the development of infrastructure of 100 m^2 or more within a watercourse or within 32m of a watercourse: • Will not occur within a harbour • Is not associated with the development of a new harbour • Does not trigger activity 14 in Listing Notice 2 or 3 • The activity does not occur within the urban boundary of the town of Upington • The activity does not occur within existing roads, road reserves or railway line reserves, nor

	(ee) where such development occurs within existing roads, road reserves or railway line reserves; or (ff) the development of temporary infrastructure or structures where such infrastructure or structures will be removed within 6 weeks of the commencement of development and where indigenous vegetation will not be cleared.	• Will the infrastructure be removed within 6 weeks of the commencement of development and indigenous vegetation will be cleared. The exclusion applicable to Regulation 12 of Listing Notice 1 is therefore NOT APPLICABLE to this proposed development.
14	The development and related operations 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 m3.	The development of the BESS plant will include the installation of batteries that will contain substances and materials classified as dangerous goods. This listed activity was included due to the fact that one of the BESS alternatives propose the use of Solid State batteries. Some solid state batteries mentioned in the FBAR contain Sulfuric acid and Nickel Cadmium (NiCd). Sulfuric acid is listed in terms of SANS 10234:2008 and is highly corrosive and when overcharged the battery generates hydrogen which presents an explosion risk. Sulphuric acid is also toxic to freshwater fish and invertebrates at certain dosages. Nickel Cadmium (NiCd) solid state batteries, on the other hand, contain Cadmium and various Cadmium chemical combinations of which several are listed in terms of SANS 10234:2008. Vanadium Redox Flow Batteries contain Vanadium pentoxide, Hydrochloric acid and Sulfuric acid. Vanadium pentoxide is listed in SANS 10234:2008 (023-001-00-8), and although Vanadium is a nontoxic chemical, the electrolyte is caustic and poses corrosive and environmental hazards similar to lead-acid batteries. Although the EPC contractor that is still to be appointed to develop and construct the BESS facility will confirm construction methods relating to the installation of the chosen battery technology, it is accepted that in some instances the shipping and storage of large quantities of electrolyte, especially for flow battery technologies, will occur on site prior to filling as described on page 62 of the FBAR. Components of the battery storage units for Solid State batteries will be pre-assembled prior to delivery on site, however in the case of flow battery technologies assembly of the battery units will occur on site. The development further includes the construction and use of a Hazardous chemical store with a $24m^2$ footprint size where chemicals will be stored. The chemical store will include oils and lubricants which will be required for the operation and maintenance of plant and machinery, and other industrial applications during the construction and operation phase of the proposed development. Collectively, the combined capacity of all the battery units and content of the chemical store will be more than $80m^3$.

19	The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse. but excluding where such infilling, depositing, dredging, excavation, removal or moving— (a) will occur behind a development setback; (b) is for maintenance purposes undertaken in accordance with a maintenance management plan; (c) falls within the ambit of activity 21 in this Notice, in which case that activity applies; (d) occurs within existing ports or harbours that will not increase the development footprint of the port or harbour; or (e) where such development is related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies.	The construction of the access road to Site Alternative A and B, as well as trenching associated with the construction of the potable water pipeline, will require dredging and construction across non-perennial drainage lines located within the development property. These non-perennial drainage lines are classified as watercourses by the Department of Water and Sanitation (DWS). The construction and installation of the Solar PV panels and BESS facility will result in a cumulative volume of infilling or dredging of more than 10 m^3 within the non-perennial drainage lines located across the development site. Considering the exclusions included with Regulation 19 of Listing Notice 1, the proposed infilling, depositing, dredging, excavation, removal or moving: • Will not occur behind a development setback • Is not associated with maintenance undertaken in accordance with a maintenance management plan, • Does not fall within the ambit of activity 21 of Listing Notice 1, • Does not occur within existing ports or harbours, • Nor is related to the development of a new port or harbour. The exclusion applicable to Regulation 19 of Listing Notice 1 is therefore NOT APPLICABLE to this proposed development.
28	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: (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare, excluding where such land has already been developed for residential, mixed, retail, commercial, industrial or institutional purposes; excluding where such land has already been developed for residential, mixed, retail, commercial, industrial or institutional purposes.	The proposed development is considered an industrial use and is proposed on land that was previously used for agricultural purposes, occurs outside of an urban area and will cover an area of more than 20 ha on land zoned for agriculture. Considering the exclusions included with Regulation 28 of Listing Notice 1, the proposed development site was used for agricultural purposes and has NOT been developed for residential, mixed, retail, commercial, industrial or institutional purposes and any point. The exclusion applicable to Regulation 28 of Listing Notice 1 is therefore NOT APPLICABLE to this proposed development.
Activity No(s):	**Basic Assessment activities as set out in Listing Notice 3 (GN R985) of the EIA Regulations, 2014, as amended.**	**Applicability of listed activities to the proposed development**
4	The development of a road wider than 4 metres with a reserve less than 13,5 metres. **g. Northern Cape:**	The proposed development of Site Alternative A will require construction of an access road from the National Road (N14) to the boundary of the development property. This access road, which goes through a Critical

	ii. Outside urban areas: (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;	Biodiversity Area (CBA) as identified in the Northern Cape Critical Biodiversity Areas of 2016, will be tarred and will be greater than 4m in width.
12	The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan. **g. Northern Cape** i. Within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004; ii. Within critical biodiversity areas identified in bioregional plans;	The proposed development of Site Alternative A will require construction of an access road from the National Road (N14) to the boundary of the development property. This access road alignment goes through a Critical Biodiversity Area (CBA) as identified in the Northern Cape Critical Biodiversity Areas of 2016 and will result in the clearance of more than 300m^2 of indigenous vegetation. The construction of the potable water pipeline (<u>max. 114.3 internal diameter</u>), for Site Alternative A and B will require trenching that will result in the clearance of more than 300m^2 of indigenous vegetation. The proposed Project is located outside an urban area and will not occur on existing infrastructure but on vacant land. <u>Considering the exclusion included with Regulation 12 of Listing Notice 3, the clearance of indigenous vegetation is NOT required for maintenance purposes undertaken in accordance with a maintenance management plan. The exclusion applicable to Regulation 12 of Listing Notice 3 is therefore NOT APPLICABLE to this proposed development.</u>
Activity No(s):	**Scoping and EIR activities as set out in Listing Notice 2 (GN R984) of the EIA Regulations, 2014, as amended.**	**Applicability of listed activities to the proposed development**
1	The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more, excluding where such development of facilities or infrastructure is for photovoltaic installations and occurs — (a) within an urban area; or (b) on existing infrastructure.	Eskom is proposing to develop a 58 MW Solar PV facility as well as a 40 MW / 200 MWh BESS facility. In terms of section 3 of GN 114 of 2018, Solar projects that falls within a REDZ are exempted from following a full EIA process and may follow a Basic Assessment Process. <u>Considering the exclusion included with Regulation 1 of Listing Notice 2, the development of facilities or infrastructure for the generation of electricity from a renewable resource will not occur within an urban area, nor on existing infrastructure. The development will occur outside the urban edge of the town of Upington. The exclusion applicable to Regulation 1 of Listing Notice 2 is therefore NOT APPLICABLE to this proposed development.</u>
15	The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for— (i) the undertaking of a linear activity; or	The proposed Solar PV development areas for Site Alternative A and B are approximately 103.5 ha, while the BESS development site is approximately 3.4 ha in extent. Although not all areas with the development footprint will be cleared, cumulatively the combined clearance of more than 20 ha of indigenous vegetation will occur during the development of the facility.

	(ii) maintenance purposes undertaken in accordance with a maintenance management plan.	The proposed Project is located outside an urban area and will not occur on existing infrastructure but on vacant land. Considering the exclusion included with Regulation 15 of Listing Notice 2, the clearance of indigenous vegetation is NOT required for the undertaking of a linear activity, nor for maintenance purposes undertaken in accordance with a maintenance management plan. The exclusion applicable to Regulation 15 of Listing Notice 2 is therefore NOT APPLICABLE to this proposed development.

Listed Activities are activities identified in terms of Section 24 of the NEMA which are likely to have a detrimental effect on the environment, and which may not commence without an EA from the competent authority subject to the completion of an environmental assessment process, either a Basic Assessment (BA) or full Scoping and EIA.

The proposed development is located within Zone 7 of the Renewable Energy Development Zones (REDZ), which is known as the Upington REDZ and is one of the eight (8) designated REDZ areas within the borders of South Africa. As such, the impact assessment process that must be followed for the Kiwano Solar PV and BESS development will be as per GN R114, which was formally gazetted on 16 February 2018. Therefore, although Listing Notice No. 2 activities are triggered, GN R 114 makes provision for a Basic Assessment process, and not a full EIA process, to be undertaken for projects occurring within the REDZ. This notice further specifies a shortened decision-making timeframe of 57 calendar days for the processing of an application for environmental authorisation for projects of this nature falling within any of the gazetted REDZ.

The BA process being conducted for the proposed development is undertaken in accordance with Section 24(5) of the NEMA, which defines the procedure to be followed in applying for Environmental Authorisation, and requires that the potential consequences for, or impacts of, listed or specified activities on the environment be considered, investigated, assessed, and reported on to the Competent Authority.

5.2.2 National Water Act, No 36 of 1998 (NWA)

The National Water Act, 1998 (Act No. 36 of 1998) (NWA) governs any impact on water resources that may trigger water uses as set out in Section 21 of the NWA. Water uses as defined under Section 21 of the NWA must be licensed, unless such water uses falls into one of the categories listed in Section 22 of the Act or falls under a general authorisation published in terms of the act, in which case registration of the water use is required. Consumptive water uses include the taking of water from a water resource and storage of such water (Sections 21a and b). Non-consumptive water uses include, amongst others, impeding or diverting of flow in a water course (Section 21c), and altering of bed, banks or characteristics of a watercourse (Section 21i).

All Water Use License Application (WULA) processes are be undertaken in terms of the Regulations Regarding the Procedural Requirements for Water Use License Applications and Appeals (GN R. 267 of 24 March 2017) promulgated in terms of the NWA. In terms of these regulations, all WULAs must be undertaken and submitted through the Department of Water and Sanitation (DWS)'s online submission portal called electronic Water Use License Application and Authorisation System (e-WULAAS). In terms of this online submission system, a WULA is submitted in three distinct phases.

Water uses that will be triggered by the Solar PV and BESS development are summarised in Table 5-3.

Table 5-3: Water uses that may be triggered by the proposed development

Notice & Activity No.:	Water Use Activity Description	Applicability of listed activities to the proposed development
NWA Section 21(c)	Impeding or diverting the flow of water in a watercourse	The proposed Solar PV and BESS development areas will be located across areas where non-perennial drainage lines have been identified. Although not classified as wetlands, the non-perennial drainage lines are watercourses. Activities pertaining to the establishment and operation of the solar PV and BESS facility will encroach on watercourses which may lead to an impediment and diversion of the flow of water in the non-perennial drainage line watercourses.
NWA: Section 21(i)	Altering the bed, banks, course, or characteristic of a watercourse.	The proposed Solar PV and BESS development areas will be located across areas where non-perennial drainage lines have been identified. Although not classified as wetlands, the non-perennial drainage lines are watercourses. Activities pertaining to the establishment and operation of the solar PV and BESS facility will encroach on watercourses which may lead to the altering of the characteristics of the non-perennial drainage line watercourses.

5.2.3 National Heritage Resources Act, No. 25 of 1999 (NHRA)

The National Heritage Resources Act, No. 25 of 1999 (NHRA) provides an integrated system which allows for the management of national heritage resources and to empower civil society to conserve heritage resources for future generations. Section 38 of NHRA provides a list of activities which potentially require the undertaking of a Heritage Impact Assessment. Section 38 of the NHRA provides regulations for Heritage Resource Management and states the following:

1) *Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorised as –*
   a. *the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;*
   b. *the construction of a bridge or similar structure exceeding 50m in length;*
   c. *any development or other activity which will change the character of a site –*
      i) *exceeding 5 000m² in extent; or*

ii) involving three or more existing erven or subdivisions thereof; or

iii) involving three or more erven or divisions thereof which have been consolidated within the past five years; or

iv) the costs of which will exceed a sum set in terms of regulations by South African Heritage Resources Agency (SAHRA) or a provincial heritage resources authority;

Must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.

In terms of Section 38(8), approval from the heritage authority is not required if an evaluation of the impact of such development on heritage resources is required in terms of any other legislation (such as NEMA), provided that the consenting authority ensures that the evaluation of impacts fulfils the requirements of the relevant heritage resources authority in terms of Section 38(3) and any comments and recommendations of the relevant resources authority with regard to such development have been taken into account prior to the granting of the consent.

However, should heritage resources of significance be affected by a proposed development, a permit must be obtained prior to disturbing or destroying such resources as per the requirements of Section 48 of the NHRA, and the SAHRA Permit Regulations (GN R668).

5.3 Relevant National Policy, Legislation, and Standards

A brief review of the most relevant national policies is provided in the sections below. The development of the proposed Kiwano Solar PV and BESS development is considered to align with the aims of these policies. Several other acts, regulations, standards and guidelines have also informed the project process and the scope of issues assessed in this report. A listing of relevant legislation is provided in Table 5-4.

Table 5-4: Relevant national policies and legislation applicable to the proposed development

Legislation	Applicable Requirements	*Relevant Authority* / Compliance Requirements	Applicability to the Development
Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996)	Chapter 2, Section 24 (Bill of Rights) of the Constitution pertains specifically to the environment. It states that: *Everyone has the right (a) to an environment that is not harmful to their health or well-being, and (b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that, (i) prevent pollution and ecological degradation, (ii) promote conservation, and (iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.* The Constitution further outlines the need to promote social and economic development. Section 24 of the Constitution therefore requires a development be conducted in a manner that does not infringe on an individual's environmental rights, health, or well-being. This is especially significant for previously disadvantaged individuals who are often most at risk to environmental impacts.		The construction and operation of the proposed Kiwano Solar PV and BESS development must always adhere to the principles as set out in Section 24.
National Environmental Management Act, No. 107 of 1998 (NEMA)	NEMA is South Africa's principle piece of environmental legislation, is gives effect to Section 24 of the Constitution, and it sets the framework for environmental management in South Africa. The environmental management principles set out in NEMA state that the social, economic and environmental impacts of activities, including disadvantages and benefits, must be considered, assessed and evaluated, and decisions must be appropriate in the light of such consideration and assessment. Besides the requirements to obtain Environmental Authorisations for specified activities set out in Section 24 (and summarised for this application in Table 5-2), NEMA further bestows certain obligations on developers through other provisions of the act, such as adherence to the Environmental Management Principles in Chapter 1, exercising Duty of Care (Section 28), controlling of incidents (Section 30) and giving effect to Specific Environmental Management Acts (SEMA) in Part 2 of NEMA.	*DFFE – Competent Authority* *DAERL – Commenting Authority* The proposed development must obtain EA for listed activities that may be triggered by the construction and operational activities.	The proposed development must not only obtain an EA an for listed activities, but must adhere to the stipulated environmental management principles, exercise due diligence through Duty of Care and must prevent and management incidents and emergency incidents as they arise.
White Paper on the Energy Policy of the Republic of South Africa (1998)	The White Paper on Energy Policy places emphasis on the expansion of energy supply options to enhance South Africa's energy security. This can be achieved through increased use of Renewable Energy (RE) and encouraging new entries into the generation market. The policy states that the advantages of RE include, minimal environmental impacts during operation in comparison with traditional supply	-	Eskom proposes to develop a Solar PV and BESS renewable energy facility, which relates directly to the while paper on Energy Policy.

Legislation	Applicable Requirements	*Relevant Authority* / Compliance Requirements	Applicability to the Development
	technologies, generally lower running costs, and high labour intensities. Disadvantages include higher capital costs in some cases, lower energy densities, and lower levels of availability, depending on specific conditions, especially with sun and wind-based systems. Nonetheless, renewable resources generally operate from an unlimited resource base and, as such, can increasingly contribute towards a long-term sustainable energy future.		
White Paper on the Renewable Energy Policy of the Republic of South Africa (2003)	The White Paper on Renewable Energy Policy supplements Government's predominant policy on energy as set out in the White Paper on the Energy Policy of the Republic of South Africa (DME, 1998). The policy recognises the potential of Renewable Energy (RE) and aims to create the necessary conditions for the development and commercial implementation of RE technologies. The White Paper on RE sets out Government's vision, policy principles, strategic goals and objectives for promoting and implementing RE in South Africa. The country relies heavily on coal to meet its energy needs due to its abundant, and fairly accessible and affordable coal resources. However, massive RE resources that can be sustainable alternatives to fossil fuels, have so far remained largely untapped. The White Paper on Renewable Energy of 2003 set a target of 10 000GWh to be generated from RE by 2013, to be produced mainly from biomass, wind, solar and small-scale hydro. The target was subsequently reviewed during the RE summit of 2009. The policy supports the investment in RE facilities as they contribute towards ensuring energy security through the diversification of energy supply, reducing GHG emissions and the promotion of RE sources.	-	Eskom proposed to develop a Solar PV and BESS renewable energy facility, which relates directly to the while paper on Energy Policy.
National Energy Act, No. 34 of 2008 (NEA)	The purpose of the National Energy Act, No. 34 of 2008 (NEA) is to ensure that diverse energy resources are available, in sustainable quantities and at affordable prices, to the South African economy in support of economic growth and poverty alleviation, while taking environmental management requirements into account. In addition, the Act also provides for energy planning, and increased generation and consumption of Renewable Energies (REs).	*Department of Energy*	Eskom proposed to develop a Solar PV and BESS renewable energy facility, which relates directly to the while paper on Energy Policy.

Legislation	Applicable Requirements	*Relevant Authority / Compliance Requirements*	Applicability to the Development
	The Act further provides the legal framework which supports the development of RE facilities for the greater environmental and social good and provides the backdrop against which South Africa's strategic planning regarding future electricity provision and supply takes place. It also provides the legal framework which supports the development of RE facilities for the greater environmental and social good.		
The Electricity Regulation Act, No. 4 of 2006 (ERA)	The Electricity Regulation Act, No. 4 of 2006 (ERA) replaced the Electricity Act (No. 41 of 1987), as amended, with the exception of Section 5B, which provides funds for the energy regulator for the purpose of regulating the electricity industry. The Act establishes a national regulatory framework for the electricity supply industry and introduces the National Energy Regulator (NERSA) as the custodian and enforcer of the National Electricity Regulatory Framework. The Act also provides for licenses and registration as the manner in which the generation, transmission, distribution, trading, and import and export of electricity are regulated.	*Department of Energy.*	Eskom proposed to develop a Solar PV and BESS renewable energy facility, which relates directly to the while paper on Energy Policy.
Environment Conservation Act, No 73 of 1989 (ECA)	The Environment Conservation Act, No. 73 of 1989 (ECA) was South Africa's first environmental management legislation aimed at protecting the environment and reducing adverse impacts resulting from development. Although most of the Act has been repealed some sections, more specifically section 25 dealing with The Noise Control Regulations in terms of Section 25, which deals with regulations regarding noise, vibration and shock is still in effect. ECA contain regulations applicable for the control of noise in the Provinces of Limpopo, North West, Mpumalanga, Northern Cape, Eastern Cape, and KwaZulu-Natal Provinces. National Noise Control Regulations (GN R154 dated 10 January 1992) cover the powers of a local authority, general prohibitions, prohibitions of disturbing noise, prohibitions of noise nuisance, use of measuring instruments, exemptions, attachments, and penalties. In terms of the Noise Control Regulations, no person shall make, produce or cause a disturbing noise, or allow it to be made, produced or caused by any person, machine, device or apparatus or any combination thereof.	*DFFE*	Noise impacts may result from specific activities carried out during the construction phase of the project and could present an intrusion impact to the local community. However, considering the location of the proposed project in relation to residential areas and provided that appropriate mitigation measures are implemented, construction noise is unlikely to present a significant intrusion to the local community. There is therefore no requirement for a noise permit in terms of the legislation.
National Environmental Management: Air	Sections 18, 19 and 20 of the National Environmental Management: Air Quality Act, No 39 of 2004 (NEMAQA) allow certain areas to be declared and managed as "priority	*DFFE*	Dust fallout monitoring may be prescribed by the licensing authority should the need be identified. The

Legislation	Applicable Requirements	*Relevant Authority* / Compliance Requirements	Applicability to the Development
Quality Act, No 39 of 2004 (NEMAQA)	areas" in terms of air quality. Declaration of controlled emitters (Part 3 of Act) and controlled fuels (Part 4 of Act) with relevant emission standards. Section 32 of the Act makes provision for measures in respect of dust control. National Dust Control Regulations (NDCR)s have however, been promulgated and compliance to these regulations are generally prescribed in most Atmospheric Emission License (AEL)s that are issued. The requirement to undertake dust fallout monitoring may, however, be prescribed if in the opinion of the Air Quality Officer dust fallout monitoring is required for a development. Section 34 makes provision for the Minister to prescribe essential national noise standards – (a) for the control of noise, either in general or by specified machinery or activities or in specified places or areas; or (b) for determining – (i) a definition of noise (ii) the maximum levels of noise (2) When controlling noise, the provincial and local spheres of government are bound by any prescribed national standards.	No permitting or licensing requirements will be applicable in terms of the Act for the proposed development as the facilities will not generate emissions that will require regulation and management.	section of the Act regarding noise control is in force, but no standards have yet been promulgated. Draft regulations have however, been promulgated for adoption by Local Authorities.
National Environmental Management: Waste Act, No. 59 of 2008 (NEMWA)	National Environmental Management: Waste Act, No. 59 of 2008 (NEMWA) regulates the production, storage, management, handling and transportation of all waste as defined in the Act. The Minister published a list of waste management activities (GN 921) in terms of the Act that have, or are likely to have, a detrimental effect on the environment. In terms of this Notice a Basic Assessment must be undertaken if waste activities listed in terms of Category A is triggered, while an Environmental Impact Assessment must be undertaken if waste activities listed in terms of Category B is triggered. GN 921 further lists waste activities in Category C that may be undertaken without the need to obtain a Waste Management License (WML) if the Norms and Standards promulgated for that specific waste activity are adhered to and implemented, and a	*DFFE – Hazardous Waste* *DAERL – General Waste* No permitting or licensing requirements will be applicable in terms of the Act for the proposed development as the facilities is not a waste management	General and hazardous waste handling, storage and disposal will be required during construction and operational phase pf the proposed development. The need to register for the storage of waste in terms of the National Norms and Standards for the Storage of Waste may therefore be required and must be considered for this application.

Legislation	Applicable Requirements	*Relevant Authority /* Compliance Requirements	Applicability to the Development
	registration in terms of the applicable Norms and Standards are submitted to regulator. Apart from the list of waste activities published in terms of the Act, the Act itself places an obligation on developers to adhere to the stipulations of the NEMWA such as Section 16 (General duty in respect of waste management), Section 21 (General requirements for the storage of waste), Section 24 (Collection of waste), Section 25 (Duties of persons transporting waste), and Section 27 (Littering).	facility that will trigger listed waste activities in terms of GN 921 and require regulation and management.	
National Heritage Resources Act, No 25 of 1999 (NHRA)	Section 38 of the National Heritage Resources Act, No 25 of 1999 (NHRA) states that Heritage Impact Assessments (HIAs) are required for certain kinds of development including: • the construction of a road, power line, pipeline, canal or other similar linear development or barrier exceeding 300 m in length. • any development or other activity which will change the character of a site exceeding 5 000 m^2 in extent. The relevant Heritage Resources Authority must be notified of developments such as linear developments (such as roads and power lines), bridges exceeding 50 m, or any development or other activity which will change the character of a site exceeding 5 000 m^2; or the re-zoning of a site exceeding 10 000 m^2 in extent. This notification must be provided in the early stages of initiating that development, and details regarding the location, nature and extent of the proposed development must be provided. Standalone HIAs are not required where an EIA is carried out as long as the EIA contains an adequate HIA component that fulfils the provisions of Section 38. In such cases only those components not addressed by the EIA should be covered by the heritage component. Furthermore, Section 7 of the NHRA stipulates assessment criteria and categories of heritage resources according to their significance. Section 35 of the NHRA provides for the protection of all archaeological and palaeontological sites, and meteorites, while Section 36 of the NHRA provides for the conservation and care of cemeteries and graves by SAHRA where this is not the responsibility of any other authority.	*South African Heritage Resources Agency (SAHRA); and* *Ngwao-Boswa Ya Kapa Bokone (NBKB)*	A permit may be required should cultural, heritage, archaeological or palaeontological sites identified within the development footprint be required to be disturbed or destroyed as a result of the proposed development.

Legislation	Applicable Requirements	*Relevant Authority / Compliance Requirements*	Applicability to the Development
National Environmental Management: Biodiversity Act, No 10 of 2004 (NEMBA)	National Environmental Management: Biodiversity Act, No. 10 of 2004 (NEMBA) provides for the MEC/Minister to identify any process or activity in such a listed ecosystem as a threatening process (S53). A list of threatened and protected species has been published in terms of S 56(1) - Government Gazette 29657. Three government notices have been published, i.e. GN R 150 (Commencement of Threatened and Protected Species Regulations, 2007), GN R 151 (Lists of critically endangered, vulnerable and protected species) and GN R152 (Threatened or Protected Species Regulations). NEMBA further provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. The first national list of threatened terrestrial ecosystems has been gazetted, together with supporting information on the listing process including the purpose and rationale for listing ecosystems, the criteria used to identify listed ecosystems, the implications of listing ecosystems, and summary statistics and national maps of listed ecosystems (National Environmental Management: Biodiversity Act: National list of ecosystems that are threatened and in need of protection, (G 34809, GN 1002), 9 December 2011). DFFE published Regulations on Alien and Invasive Species (AIS) in terms of the National Environmental Management: Biodiversity Act, on 25 September 2020 (GN R1020), which has repealed the August 2014 regulations. A total of 568 alien species are now listed as invasive, in four different categories.	*DFFE* *DAERL*	Under this Act, a permit would be required for any activity which is of a nature that may negatively impact on the survival of a listed Protected species. A Terrestrial Biodiversity Impact Assessment has been undertaken as part of the Basic Assessment Process. As such the potential occurrence of critically endangered, endangered vulnerable, and protected species and the potential for them to be affected has been considered.
Minerals and Petroleum Resources Development Act, No. 28 of 2002 (MPRDA)	In terms of the Minerals and Petroleum Resources Development Act, No. 28 of 2002 (MPRDA) a mining permit is required in accordance with Section 27(6) of the Act where a mineral in question is to be mined, including where such mining occurs for purposes of mining materials from a borrow pit. Section 53 of the MPRDA further states that any person who intends to use the surface of any land in any way which may be contrary to any object of the Act, or which is likely to impede any such object must apply to the Minister for approval in the prescribed manner.	*Department of Mineral Resources and Energy (DMRE)*	No borrow pits are expected to be required for the construction of the proposed development. No mining permit or EA is therefore required to be obtained from the DMRE. Consultation with the Minister of Mineral Resources and Energy *is however required to ensure that the proposed development does not

Legislation	Applicable Requirements	*Relevant Authority* / Compliance Requirements	Applicability to the Development
			sterilise a mineral resource that might occur within or below the development site.
Conservation of Agricultural Resources Act, No 43 of 1983 (CARA)	Regulation 15 of the Conservation of Agricultural Resources Act, No 43 of 1983 (CARA), GNR1048, provides for the declaration of weeds and invader plants, and these are set out in Table 3 of GNR1048. Declared Weeds and Invaders in South Africa are categorized according to one of the following categories: • Category 1 plants: are prohibited and must be controlled. • Category 2 plants: (commercially used plants) may be grown in demarcated areas providing that there is a permit and that steps are taken to prevent their spread. Category 3 plants: (ornamentally used plants) may no longer be planted; existing plants may remain, as long as all reasonable steps are taken to prevent the spreading thereof, except within the floodline of watercourses and wetlands. • These regulations provide that Category 1, 2 and 3 plants must not occur on land and that such plants must be controlled by the methods set out in Regulation 15E.	*DFFE*	While no permitting or licensing requirements arise from this legislation, the provisions of the Act will remain applicable throughout the life cycle of the project. Of particular interest is soil erosion prevention, while soil conservation strategies must be developed and implemented. In addition, a weed control and management plan must be implemented.
National Forests Act, No. 84 of 1998 (NFA)	In terms of the National Forests Act, No. 84 of 1998 (NFA), the Minister may declare a tree, group of trees, woodland or a species of trees as protected. The prohibitions provide that "no person may cut, damage, disturb, destroy or remove any protected tree, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a license granted by the Minister". The Act further prohibits the destruction of indigenous trees in any natural forest without a license.	*DFFE*	A Terrestrial Biodiversity Impact Assessment was undertaken as part of the BA process. No forest areas occur on site, therefore no permits are applicable.
National Veld and Forest Fire Act, No 101 of 1998 (NVFFA)	In terms of Section 12 of the National Veld and Forest Fire Act, No 101 of 1998 (NVFFA) the owners of a property are obligated by the NVFFA to prepare and maintain firebreaks on their properties. The firebreak must be wide and long enough to have a reasonable chance of preventing a fire from spreading, not causing erosion, and is reasonably free of inflammable material. In terms of Section 17, the applicant must have such equipment, protective clothing, and trained personnel for extinguishing fires.	*DFFE*	While no permitting or licensing requirements arise from this legislation, provisions of this Act pertaining to the maintenance of firebreaks and combatting fires will remain applicable during the operational phase of the project. Due to the fire prone nature of the area, it must be ensured that the

Legislation	Applicable Requirements	*Relevant Authority / Compliance Requirements*	Applicability to the Development
			landowner and developer proactively manage risks associated with veld fires and provide cooperation to the local Fire Protection Agency.
Hazardous Substances Act, No 15 of 1973 (HSA)	The Hazardous Substances Act, No 15 of 1973 (HSA) regulates the control of substances that may cause injury, or ill health, or death by reason of their toxic, corrosive, irritant, strongly sensitizing or inflammable nature or the generation of pressure thereby in certain instances and for the control of certain electronic products. To provide for the rating of such substances or products in relation to the degree of danger; to provide for the prohibition and control of the importation, manufacture, sale, use, operation, modification, disposal or dumping of such substances and products. Four groups of products are listed in terms of the Act, and include: • Group I and II: Any substance or mixture of a substance that might by reason of its toxic, corrosive etc., nature or because it generates pressure through decomposition, heat or other means, cause extreme risk of injury etc., can be declared to be Group I or Group II hazardous substance; • Group IV: any electronic product; • Group V: any radioactive material. The use, conveyance or storage of any hazardous substance (such as distillate fuel) is prohibited without an appropriate license being in force.	*Department of Health (DoH)*	It is necessary to identify and list all the Group I, II, III and IV hazardous substances that may be on the site and in what operational context they are used, stored or handled. If applicable, a license is required to be obtained from the Department of Health.
Occupational Health and safety Act, No. 85 of 1993 (OHSA)	Relevant sections of the Occupational Health and safety Act, No. 85 of 1993 (OHSA) include Section 8. General duties of employers to their employees and Section 9. General duties of employers and self-employed persons to person other than their employees.	*Department of Labour (DoL)*	A permit or a license is not required, however the applicant must take note and implement Section 8 and 9 of the Occupational Health and Safety Act.
NEM:WA: National Waste Management Strategy, 2020 (GN 56 of 26 January 2021)	The NWMS provides a coherent framework and strategy for the implementation of the Waste Act and outlines government's policy and strategic approach to waste management within the South African government's context and agenda of socio-economic development that is "equitable, inclusive, sustainable and environmentally sound ".		It is therefore necessary to consider the reuse and recycling of all waste products by Eskom.

Legislation	Applicable Requirements	*Relevant Authority /* Compliance Requirements	Applicability to the Development
	Th NWMS 2020, which revises and updates the 2011 strategy, achieves the following: • Assimilates our strategic approach to waste management with the commitments and directives of the Sustainable Development Goals (SDG) 2030 and South Africa's National Development Plan (NDP): Vision 2030. • Unequivocally locates waste management as one of the key underpinnings of South Africa's economy and social fabric; and • Integrates and provides and enabling environment for the DEFF's 2017 Chemicals and Waste Economy Phakisa and government's 2019 Good Green Deeds Programme. The NWMS 2020 provides an enabling environment for the projects identified in the 2017 Operation Phakisa Chemicals and Waste Economy (CWE). The CWE as part of a cross sector national planning process intended to identify and support the implementation of projects in each sector of the economy that will contribute to national goals for sustainable economic growth, job creation and social transformation.		
National Road Traffic Act (Act No 93 of 1996)	The technical recommendations for highways (TRH 11): “Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads” outline the rules and conditions which apply to the transport of abnormal loads and vehicles on public roads and the detailed procedures to be followed in applying for exemption permits are described and discussed. Legal axle load limits and the restrictions imposed on abnormally heavy loads are discussed in relation to the damaging effect on road pavements, bridges, and culverts. The general conditions, limitations, and escort requirements for abnormally dimensioned loads and vehicles are also discussed and reference is made to speed restrictions, power/mass ratio, mass distribution, and general operating conditions for abnormal loads and vehicles. Provision is also made for the granting of permits for all other exemptions from the requirements of the National Road Traffic Act and the relevant Regulations.	South African National Roads Agency (SANRAL), for transport on national roads Northern Cape Department of Transport, Safety and Liaison	An abnormal load/vehicle permit may be required to transport the various components required for the proposed development to site during the construction phase. These include route clearances and permits for vehicles carrying abnormally heavy or abnormally dimensioned loads, as well as transport vehicles exceeding the dimensional limitations (length) of 22 m. Depending on the trailer configuration and height when loaded, some of the on-site

Legislation	Applicable Requirements	*Relevant Authority /* Compliance Requirements	Applicability to the Development
			substation components may not meet specified dimensional limitations in height and width.
Integrated Energy Plan (IEP), 2015	The Integrated Energy Plan (IEP), which was developed under the National Energy Act, No. 34 of 2008, recognises that energy is essential to human activities, and is critical to the social and economic development of a country. The purpose of the IEP is essentially to ensure the availability of energy resources, and access to energy services in an affordable and sustainable manner, while minimising associated adverse environmental impacts. Energy planning therefore needs to balance the need for continued economic growth with social needs, and the need to protect the natural environment.		
Integrated Resource Plan (IRP) for Electricity 2010-2030 (2011)	The Integrated Resource Plan (IRP) for Electricity 2010 – 2030 is a subset of the IEP and constitutes South Africa's National electricity plan. The primary objective of the IRP is to determine the long-term electricity demand and detail how this demand should be met in terms of generating capacity, type, timing and cost. The IRP also serves as input to other planning functions, including amongst others, economic development and funding, and environmental and social policy formulation. Based on the 2019 IRP, 1 474 MW has been installed for solar PV facilities, whereas, 814 MW has already been procured. In addition, 1 000 MW has been allocated for solar PV facilities from 2022 to 2030. This will bring the total installed capacity of solar PV facilities to 8 288 MW by 2030.		
National Development Plan 2030 (2012)	The National Development Plan 2030 (NDP) aims to eliminate poverty and reduce inequality by 2030. As part of this overarching goal, Chapter 5 of the NDP highlights the need for targeted interventions to ensure environmental sustainability and an equitable transition to a low-carbon economy. This includes incorporating at least 20 000 MW of additional renewable energy sources, such as solar PV, in the energy mix. The NDP takes cognisance of the anticipated solar energy development potential in the Northern Cape, noting that this area has 'proven potential to create green jobs'. The proposed project is therefore broadly aligned with the vision of the NDP and could contribute to the goal of transitioning to a low-carbon economy.		
National Infrastructure Plan 2050	As part of the NDP vision of achieving inclusive growth, the National Planning Commission (NPC) recently undertook a review of public sector and state-owned enterprises (SOEs) infrastructure delivery and performance against stated NDP investment-to-GDP targets. It concluded that public sector infrastructure investment is unlikely to meet NDP goals and provided concrete 'course-correction' suggestions. These suggestions are outlined in the National Infrastructure Plan 2050 (NIP 2050) Phase 1 document, published in March 2022. The NIP 2050 identifies key steps for improving public infrastructure delivery, leading to both short and short and long-term impacts. Phase 1 of NIP 2050 focusses on four 'mission critical' infrastructure areas including energy, freight transport, water, and digital infrastructure. The NIP 2050 outlines changes to strengthen and augment government's Strategic Integrated Projects (SIPs) relevant to the four infrastructure areas, as well as applicable action plans. Of relevance is the dominant role that renewables, especially solar and wind, will play in South Africa's 'least-cost energy mix'. The NIP 2050 details key energy specific strategic goals and how the goals will be achieved. The following top-priority energy SIPs listed in the NIP 2050 include: • SIP 8 which includes green energy projects. • SIP 9 which includes the expansion of electricity generation capacity, with attention to a low-carbon energy transition. • SIP 10 which includes the expansion of electricity transmission and distribution networks. • SIP (no 20) includes the following:		

Legislation	Applicable Requirements	*Relevant Authority /* Compliance Requirements	Applicability to the Development
	- Emergency or Risk Mitigation Power Purchase Procurement Programme (2,000 MW) – national. - Embedded Generation Investment Programme (EGIP) (400 MW) – national. To achieve its vision for energy infrastructure, a revision of the Integrated Resources Plan (IRP) will be required. The IRP will need to be extended to 2050 with an update to medium-term targets reflecting a focus on sustainability and least cost.		
Just Transition Framework: Final Report and Recommendations (July 2022)	Under the auspices of the Presidential Climate Commission (PCC), an independent, multistakeholder body established by President Cyril Ramaphosa with the goal of overseeing and facilitating a just and equitable transition towards a low-emissions and climate-resilient economy, the PCC recently released its framework report for a just energy transition in South Africa. The document lists a need for clear political support for, and implementation of an accelerated renewable energy build at a scale that allows for local manufacturing chains to develop, supported by an updated IRP. Key policy areas associated with a just transition include a need to for skills development and capacity building within the renewable energy and battery manufacturing sectors.		
Strategic Integrated Projects (SIPs)	The Presidential Infrastructure Coordinating Commission (PICC) are integrating and phasing investment plans across 18 Strategic Integrated Projects (SIPs) which have 5 core functions, including to unlock opportunity, transform the economic landscape, create new jobs, strengthen the delivery of basic services and support the integration of African economies. SIP 8 supports the development of RE projects by promoting sustainable green energy initiatives on a national scale through a diverse range of clean energy options as envisaged in the Integrated Resource Plan (IRP 2010) and supports bio-fuel production facilities. The proposed Kiwano Solar PV and BESS development is aligned with SIP 8 as it constitutes a green energy initiative that would contribute clean energy in accordance with the IRP 2010 – 2030.		
National Climate Change Response Policy, 2011	South Africa's National Climate Change Response Policy (NCCRP) establishes South Africa's approach to addressing climate change, including adaptation and mitigation responses. The NCCRP formalises Government's vision for a transition to a low carbon economy, through the adoption of the 'Peak, Plateau and Decline' (PPD) GHG emissions trajectory whereby South Africa's emissions should peak between 2020 and 2025, plateau for approximately a decade, and then decline in absolute terms thereafter, and based on this the country has pledged to reduce emissions by 34% and 42% below Business As Usual (BAU) emissions in 2020 and 2025, respectively. The policy provides support for the proposed Kiwano Solar PV and BESS development, which will contribute to managing climate change impacts, supporting the emergency response capacity, as well as assist in reducing GHG emissions in a sustainable manner.		
Climate Change Bill, 2018	The Draft Climate Change Bill was published for comment on 8 June 2018. It's stated objectives are the following: • Provide for the coordinated and integrated response to climate change and its impacts by all spheres of government in accordance with the principles of cooperative governance;		

Legislation	Applicable Requirements	*Relevant Authority /* Compliance Requirements	Applicability to the Development
	• Provide for the effective management of inevitable climate change impacts through enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change, with a view to building social, economic, and environmental resilience and an adequate national adaptation response in the context of the global climate change response; • Make a fair contribution to the global effort to stabilise greenhouse gas concentrations in the atmosphere at a level that avoids dangerous anthropogenic interference with the climate system within a timeframe and in a manner that enables economic, employment, social and environmental development to proceed in a sustainable manner. The Kiwano Solar PV and BESS development is a renewable energy generation facility and would not result in the generation or release of emissions during its operation.		

Table 5-5: Relevant provincial policies and legislation applicable to the proposed development

Legislation	Applicable Requirements	*Relevant Authority /* Compliance Requirements	Applicability to the Development
Northern Cape Nature Conservation Act, No. 9 of 2009	This Act provides for the following: • Sustainable utilisation of wild animals, aquatic biota and plants; • Implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora; • Offences and penalties for contravention of the Act; • The appointment of nature conservators to implement the provisions of the Act; • The issuing of permits and other authorisations. In terms of the Act, the following may apply to the proposed development: • Boundary fences may not be altered in such a way as to prevent wild animals from freely moving onto or off of a property. • Aquatic habitats may not be destroyed or damaged. • The owner of land upon which an invasive species is found (plant or animal) must take the necessary steps to eradicate or destroy such species. The Act also provides lists of protected species for the Province.	NCDENC	A collection/destruction permit must be obtained from Northern Cape Nature Conservation for the removal of any protected plant or animal species found within the development footprint.

Legislation	Applicable Requirements	*Relevant Authority /* Compliance Requirements	Applicability to the Development
Northern Cape, Office of the Premier, Strategic plan 2020/25	To ensure alignment with various national and provincial strategic plans and goals, the Northern Cape Province Office of the Premier published a strategic plan for the 2020-2025 period. The NC OTP Strategic Plan is aligned with, and intended to implement the following provincial strategic plans: • Northern Cape Provincial Growth and Development Plan (NCPGDP). • Northern Cape Provincial Medium Term Strategic Framework Programme of Action (MTSF POA) 2019-2024. • Provincial Government 5-year Implementation Plan (5YIP). The NC OTP Strategy lists finalisation of the Northern Cape Renewable Energy Strategy / Provincial Energy Strategy given the high potential for the solar renewable energy sector to attract investment to the Province.		
Northern Cape Provincial Spatial Development Framework (PSDF) 2012	The Northern Cape Provincial Spatial Development Framework (NCPSDF) approved in 2012 is a statutory document intended to direct spatial land-use planning to promote environmental, economic, and social sustainability through sustainable development. It provides a legal basis to direct provincial government programmes and projects. It provides a framework for integrated land-use planning within the province. The NCPSDF highlights the potential of the energy sector to stimulate economic growth; reduce greenhouse emissions through renewable energy sources; and the need for targeted investment in renewable energy infrastructure. The NCPSDF lists the following key energy objectives that relate specifically to renewable energy: • Advancing the development of renewable energy supply. Large-scale renewable energy supply schemes are crucial for diversifying domestic energy supplies, avoiding energy imports, and mitigating negative environmental impacts. • Develop and implement innovative new technology solutions to expand access to reliable, sustainable, and cost-effective energy services, with the aim of achieving sustainable economic development and growth. The objectives of assuring supply, providing energy services, combating climate change, avoiding air pollution, and achieving sustainable development in the province offer opportunities and synergies that require local, provincial, and private sector collaboration for planning. With a goal of promoting development of renewable energy sources, including solar, the NCPSDF set down the following policy principles: • Appropriate financial mechanisms must be used to encourage the development of sustainable renewable energy developments. • Pricing policies need to take into account all economic, social, and environmental costs and benefits of proposed developments. • Access to basic services should be equitable in order to meet human needs and promote human well-being. Each generation owes it to future generations not to impede their capacity to secure their own well-being. • Government recognizes its shared responsibility for global and regional concerns and acts in accordance with the principles outlined in relevant policies and applicable international and regional agreements. • Within the Constitutional framework of cooperative governance, government will delegate energy policy objectives to the institutions and areas of government most capable of achieving those objectives.		

Legislation	Applicable Requirements	*Relevant Authority* / Compliance Requirements	Applicability to the Development
	• The development, adoption, and ongoing refinement of an efficient legislative system for promoting the use of renewable energy sources is a task that must be completed. • It is imperative that the general public be educated about the merits and potential of renewable sources of energy. • In accordance with the Sustainable Development Initiative, or any other analogous approach, the development of renewable energy systems is to be utilised as a tool for economic development throughout the province. • Prior to being exported, renewable energy produced in the province must first be utilized to meet provincial demands.		
The Northern Cape Climate Change Response Strategy	Northern Cape Climate Change Response Strategy (NCCCRS) propose specific critical sector climate change adaptation and mitigation strategies that include the Water, Agriculture and Human Health sectors as the 3 key Adaptation Sectors, while the Industry, Transport and Energy sectors have been identified as the 3 key mitigation sectors. The Disaster Management, Natural Resources and Human Society, and Livelihoods and Services sectors have been identified as the 3 remaining key sectors to ensure proactive long-term responses to the frequency and intensity of extreme weather events such as flooding and wildfire, with heightened requirements for effective disaster management. The development and promotion of a provincial green economy, including green jobs, and environmental learnership is regarded as an important provincial intervention in addressing climate change. Furthermore, the renewable energy sector, including solar and wind energy is explicitly indicated as an important element of the Provincial Climate Change Response Strategy. The development of the proposed Kiwano Solar PV and BESS development will contribute to achieving the promotion of the provincial green economy of the Northern Cape.		

5.4 Relevant Provincial Policy, Legislation, and Standards

A brief review of the most relevant provincial policies is provided below in Table 5-5. The development of the proposed Kiwano Solar PV and BESS development is considered to align with the aims and objectives of these policies and legislation.

5.5 Local Planning Context

A brief review of the most relevant local policies and plans is provided below in Table 5-6.

Table 5-6: Local policy context applicable to the proposed development

Relevant framework / policy	Relevance to the proposed development
ZF Mgcawu District Municipality Integrated Development Plan	The ZF Mgcawu District Municipality Final Integrated Development Plan 2022/2023 (2022 – 2027) lists facilitation of sustainable regional land use, economic, spatial and environmental planning as a key strategic objective of the municipality. The aim of this broad objective is to support and guide the development of a diversified, resilient and sustainable district economy. To further these goals and objectives, the municipality intents to establish a vehicle to ensure co-operation amongst local businesses such as a District LED Forum. The municipality furthermore intends to both invest in, and take steps to encourage investment in renewable energy developments in order to contribute towards the national goal of transitioning to a lower carbon economy. The development of the proposed Kiwano Solar PV and BESS facility is therefore in line with the objectives of the ZF Mgcawu District Municipality Integrated Development Plan.
Dawid Kruiper Local Municipality Integrated Development Plan	In its Draft Integrated Development Plan for 2022/2027, the Dawid Kruiper Local Municipality (DKLM) lists the renewable energy sector as one of the key drivers of economic development in the local municipality. The DKLM Draft IDP notes the importance of the Upington Solar Special Economic Zone (SEZ) positioning itself to provide businesses and investors with prime locations for renewable energy developments. The IDP lists a number of 'main development thrusts' that include: • **Thrust 2**: Manufacturing which focused on value adding of agricultural products, mining products, construction and renewable energy products. • **Thrust 6**: Construction which is an integral part of economic activity in the DKLM through production of building materials, renewable energy plant equipment, steel pipe manufacture, manufacture of storage equipment, increased demand for housing in urban areas, construction of shopping malls and industrial space both within and beyond the municipality. DKLM is responsible for nearly half of all construction related activities in the ZF Mgcawu District. • **Thrust 9**: Renewable energy and in particular, the Upington REDZ given that the town is ideally situated to exploit an optimal power per unit area of solar radiation for solar energy production. The development of the proposed Kiwano Solar PV and BESS facility is therefore in line with the objectives of the DKLM IDP.
Dawid Kruiper Local Municipality Spatial	The DKLM Spatial Development Framework (SDF) records that the DKLM by Council Resolution endorsed the establishment of a Solar SEZ in 2014. The SDF notes that the Upington SEZ is a business entity of the Northern Cape provincial government, responsible

Relevant framework / policy	Relevance to the proposed development
Development Framework	for a combination of industrial activities including renewable and solar energy, mining, agricultural, aeronautical and various other sectors. The SDF Implementation Plan indicates that the area in which the proposed project site is located falls within the Upington Renewable Energy Park (REP). The project site is located within the C.a.2 Agriculture (Ward 11) Spatial Planning Category.

5.6 Relevant guidelines consulted for the proposed development

The following guideline documents were considered and consulted during the development of this impact assessment report:

Table 5-7: Guideline documents applicable to the proposed development

Guideline Document	Description of Guideline and Relevance
The IFC EHS Guidelines	The IFC EHS Guidelines are technical reference documents with general and industry specific examples of Good International Industry Practice (GIIP). The following IFC EHS Guidelines have relevance to the proposed development: • IFC EHS General Guidelines • IFC EHS Guidelines for Electric Power Transmission and Distribution The General EHS Guidelines are designed to be used together with the relevant Industry Sector EHS Guidelines, however no Industry Sector EHS Guidelines have been developed for PV solar power to date. The application of the General EHS Guidelines should be tailored to the hazards and risks associated with a project and should take into consideration site-specific variables which may be applicable, such as host country context, assimilative capacity of the environment, and other project factors. In instances where host country regulations differ from the standards presented in the EHS Guidelines, whichever is the more stringent of the two in this regard should be applied.
IFC's Project Developer's Guide to Utility-Scale Solar Photovoltaic Power Plants (2015)	While no Industry Sector EHS Guidelines have been developed for PV Solar Power, the IFC has published a Project Developer's Guide to Utility-Scale Solar Photovoltaic Power Plants (IFC, 2015). Chapter 8 of the Project Developer's Guide pertains to Permits, Licensing and Environmental Considerations, and states that in order to deliver a project which will be acceptable to international lending institutions, environmental and social assessments should be carried out in accordance with the requirements of the key international standards and principles, namely the Equator Principles and IFC's Performance Standards. Some of the key environmental considerations for solar PV power plants contained within the Project Developer's Guide include considerations around construction phase impacts, water usage, land matters, landscape and visual impacts, ecology and natural resources, cultural heritage, transport and access, drainage and flooding, consultation and disclosure, and Environmental and Social Management Plan (ESMP)
Best Practice Guidelines Birds & Solar Energy (2017)	The Best Practice Guidelines: Birds & Solar Energy (2017) proposed by the Birds and Renewable Energy Specialist Group (BARESG) (convened by BirdLife South Africa and the Endangered Wildlife Trust) contain guidelines for assessing and monitoring the impact of solar generation facilities on birds in Southern Africa. The guidelines recognise the impact that solar energy may have on birds, through for example the alteration of habitat, the displacement of populations from preferred habitat, and collision and burn mortality

Guideline Document	Description of Guideline and Relevance
	associated with elements of solar hardware and ancillary infrastructure, and the fact that the nature and implications of these effects are poorly understood. The Kiwano Solar PV and BESS study area has been classified as a Regime 2 site, as the area has been defined as a medium sensitive area in terms of the BirdLife South Africa Guidelines. Seasonal monitoring over two monitoring periods have been completed and informed the findings of the Avifauna Impact Assessment.
Guideline on Need and Desirability,	When considering an EA, the competent authority must comply with section 24O of National Environmental Management Act 107 of 1998 (NEMA) and have regard for any guideline published in terms of section 24J of the Act and any minimum information requirements for the application. This includes the Guideline on Need and Desirability which provides information and guidance for Applicants, Authorities and I&APs when considering the need and desirability of a proposed project in terms of NEMA, the EIA Regulations, NEMAQA and NEMWA. The guideline also aims to assist Applicants, Environmental Assessment Practitioners (EAPs) and Competent Authorities to ensure that need and desirability is given due consideration in every EIA application, to help ensure well-informed decision-making is promoted. In preparing this SIA, the requirement to address the various need and desirability questions was given due consideration and formed an integral part of the study approach and methodology. Table 23 in ANNEXURE 3 provides a summary of the respective questions as outlined in the Guideline on Need and Desirability, and the sections of this SIA in which they are addressed.
Public Participation guideline in terms of NEMA EIA Regulations, 2017	NEMA requires that the person conducting a PPP must take into account any relevant guidelines applicable to PP as contemplated in section 24J of the Act. The PPP guideline has been developed in order to assist the proponents or applicants, registered interested and affected parties (RI&APs) and environmental assessment practitioners (EAPs) to understand what is required of them and how to comprehensively undertake a PPP.
EIA Guideline for Renewable Energy Projects	The purpose of this document is primarily to provide guidance on the environmental management legal framework applicable to renewable energy operations and all the role players in the sector. The guideline further seeks to identify activities requiring authorisation prior to commencement of that activity and provide an interface between national EIA regulations and other legislative requirements of various authorities.
Integrated Environmental Management Information Series	The aim of the Integrated Environmental Management Information Series (IEMIS) document series is to provide general information on techniques, tools and processes for environmental assessment and management. The material in this document draws upon experience and knowledge from South African practitioners and authorities, and published literature on international best practice. Applicable guideline documents in the series include: Screening, Scoping, Stakeholder Engagement, Specialist Studies, Impact Significance, Ecological Risk Assessment, Cumulative Effects Assessment, Criteria for determining Alternatives in EIA, Environmental Management Plans, and Review in Environmental Impact Assessment.

5.7 Relevant protocols, standards and procedures consulted for the proposed development

The following protocols and procedure documents were considered and consulted during the development of this impact assessment report by the EAP and commissioned independent specialists:

- Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Avifauna"
- 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, GNR 320 of Government Gazette 43310 (March 2020)
- 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, GNR 1150 of Government Gazette 43855 (October 2020)
- South African National Biodiversity Institute (SANBI). 2020. Species Environmental Assessment Guideline. Guidelines for the implementation of the Terrestrial Fauna and Terrestrial Flora Species Protocols for environmental impact assessments in South Africa. South African National Biodiversity Institute, Pretoria. Version 1.2020.
- Best practice guidelines for avifaunal impact studies at solar developments, compiled by BirdLife South Africa (BLSA) in 2017 (Jenkins et al., 2017)
- Eskom, 2017a. Pro-active Bird Mortality Mitigation in Distribution, Unique Identifier: 240-115756171, Johannesburg: Eskom Holdings SOC Limited, April 2017.
- Eskom, 2017b. The safe handling, transportation and disposal of cells, batteries and electrolyte, Unique Identifier: 240-89797258, Johannesburg: Eskom Holdings SOC Limited, September 2017.
- Eskom, 2018. Contract Specification for Vegetation Management Services on Eskom Networks, Document reference: 240-52456757, Johannesburg: Eskom Holdings SOC Limited.
- Eskom, 2019a. Land and Biodiversity Standard< Document Identifier: 32-815, Johannesburg: Eskom Holdings SOC Limited, September 2019.
- Eskom, 2019b. Vegetation management and maintenance within Eskom land, servitudes and right of way, Unique Identifier: 240-70172585, Johannesburg: Eskom Holdings SOC Limited, June 2019.
- Eskom, 2020. BESS Phase 2 Distribution Planning Proposal: Kiwano Substation, Northern Cape Operating Unit, Johannesburg: Eskom Holdings SOC Ltd, 19 August 2020.
- Eskom, 2020. High Risk Security Mesh Fencing, Unique Identifier: 240-76368574, Johannesburg: Eskom Holdings SOC Limited, July 2020.
- Eskom, 2021a. Eskom Waste Management Standard, Document Identifier: 32-245, Johannesburg: Eskom Holdings SOC Limited, December 2021.
- Eskom, 2021b. Generic Environmental Management Programme for Operation and Maintenance: Distribution Division, Document Identifier: 240-71555378, Johannesburg: Eskom Holdings SOC Limited, October 2021.
- Eskom, 2021c. Draft Standard for non-lethal energised perimeter detection system (NLEPDS), Unique Identifier: 240-78980848, Johannesburg: Eskom Holdings SOC Limited.

- Eskom, 2021d. Technical evaluation criteria for Non-Lethal Energized Perimeter Detection System (NLEPDS), Unique Identifier: 240-134779125, Johannesburg: Eskom Holdings SOC Limited, October 2021.
- Eskom, 2021e. Scope of Work for Non-lethal Energized Perimeter Detection System (NLEPDS), Unique Identified: 240-170000192, Johannesburg: Eskom Holdings SOC Limited, October 2021.
- Eskom, 2021f. Draft Specification for the design and construction of telecoms security fences, Unique Identifier: 240-170000712, Johannesburg: Eskom Holdings SOC Limited.
- Eskom, 2022. Transportation, Storage and Disposal of Hazardous Substances and Dangerous Goods in GEMMA Cluster: Distribution, Document Identifier: GCEMS020, Johannesburg: Eskom Holdings SOC Limited, June 2022.
- SANS 10228:2012, Edition 6, The identification and classification of dangerous goods for transport by road and rail modes
- SANS 10229-1: 2010, Edition 2, Transportation of dangerous goods – Packaging and large packaging for road and rail transport – Part 1: Packaging.
- SANS 10229-2: 2010, Edition 1.1, Transportation of dangerous goods – Packaging and large packaging for road and rail transport – Part 2: Large Packaging.
- SANS 10231: 2014, Edition 4, Transportation of dangerous goods – Operational requirements for road vehicles.
- SANS 10232-1: 2007, Edition 3, Transportation of dangerous goods – Emergency information systems – Part 1: Emergency information system for road transportation.
- SANS 10232-3: 2011, Edition 3.01, Transportation of dangerous goods – Emergency information systems – Part 3: Emergency response guides.
- SANS 10232-4: 2012, Edition 1.02, Transportation of dangerous goods – Emergency information systems – Part 4: Transport emergency card.

6 DESCRIPTION OF THE AFFECTED ENVIRONMENT

This section of the report provides a description of the environment that may be affected by the proposed Project. This information is provided in order to assist the reader in understanding the receiving environment within which the proposed Project is situated. Features of the biophysical, social and economic environment that could directly or indirectly be affected by, or could affect, the proposed development has been described. This information has been sourced from existing information available for the area and aims to provide the context within which this BA is being conducted. A comprehensive description of each aspect of the affected environment is included within the specialist report contained within the Appendices.

6.1 Regional Setting

The Northern Cape is South Africa's largest province (372 889 km^2), but also the most sparsely populated province with a population of 1 303 047 (StatsSA, 2021) resulting in a population density of approximately 3.1/km^2. The capital city of the Northern Cape province is Kimberley, while other important towns are scattered across the province and include Upington, Springbok, Kuruman, De Aar and Sutherland.

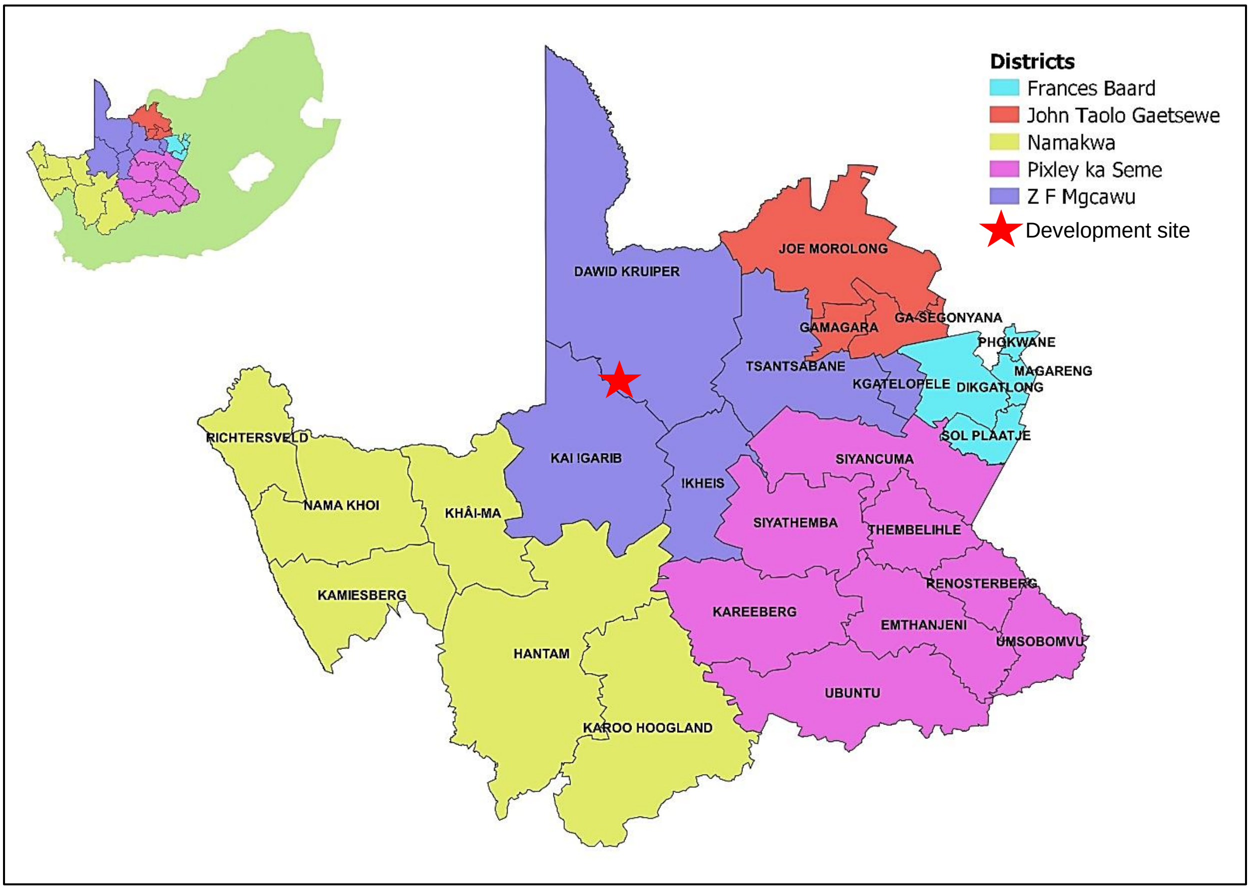

Figure 6-1: District and Local Municipalities of the Northern Cape province

The Northern Cape is made up by 5 district municipalities, namely Francis Baard, John Taolo Gaetsewe, Namakwa, Pixley ka Seme and ZF Mgcawu (Figure 6-1). Kiwano Solar PV will be located on Olyvenhouts Drift Settlement Agricultural Holding 1080 Portion 0, which is owned by Eskom, in Upington. The site is situated within Dawid Kruiper Local Municipality (DKLM) and Z F Mgcawu District Municipality in the Northern Cape Province.

ZF Mgcawu District Municipality extends across an area of 102 504km², almost a third of the Northern Cape Province. Much of this area (65 000km²) comprises the Kalahari Desert, Kgalagadi Transfrontier Park and the former Bushmanland. ZF Mgcawu District shares borders with Botswana to the northeast and Namibia to the north; John Taolo Gaetsewe District Municipality to the north west; Frances Baard District to the west; Pixley ka Seme to the south east; and Namakwa District Municipality to the south west (Figure 6-1).

Municipal government is situated in Upington, the district capital. Agriculture, mining, tourism and manufacturing are the four primary drivers of the ZF Mgcawu District's economy. At 34%, the largest contributor to the district's real Gross Value Added (GVA) in manufacturing is the food, drinks and tobacco subsector.

6.2 Local Setting

The DKLM occupies an area of 44 231km², a vast area comprised of 21 clearly identifiable communities (Table 6-1) in 17 different wards. The proposed development site is located in Ward 11 of the DKLM (Figure 6-2).

Table 6-1: DKLM towns, settlements and communities (Solarys, 2022)

Local towns	Rural settlements/ smaller formalised towns and communities	Communities in the process of formalisation (as at 2018)
Greater Upington area and Rietfontein	Louisvaleweg, Raaswater, Louisvale, Leseding, Ntsikelelo, Karos, Leerkrans, Lambrechtsdrift, Melkstroom, Kalksloot, Askham, Welkom, Groot Mier, Klein Mier, Loubos, Philandersbron and Swartkopdam	Noenieput and Andriesvale

DKLM hosts two Indigenous People groups, i.e. the ǂKhomani San and the Mier Communities. The ǂKhomani Cultural Landscape, a UNESCO World Heritage Site, is located on the border with Botswana and Namibia within the Kgalagadi Transfrontier Park, a distance of approximately 250 km from Upington. The project therefore does not trigger any processes related to the assessment of projects impacts associated with Indigenous People’s rights.

The Kai !Garib Local Municipality (KGLM), directly adjacent to DKLM and the proposed project site, is a Category B municipality situated along the Orange River. It is the second largest of the five municipalities that make up the ZF Mgcawu District, accounting for a quarter of the district’s geographical area. The municipality was established by the amalgamation of the Mier and //Khara Hais Local Municipalities in August 2016. The proposed project site is situated adjacent to KGLM Ward 8 which hosts the settlements of Eksteenskuil Islands, Soverby, McTaggers Camp, Curriescamp, Bloemsmond, Blaauwskop and Kanoneiland.

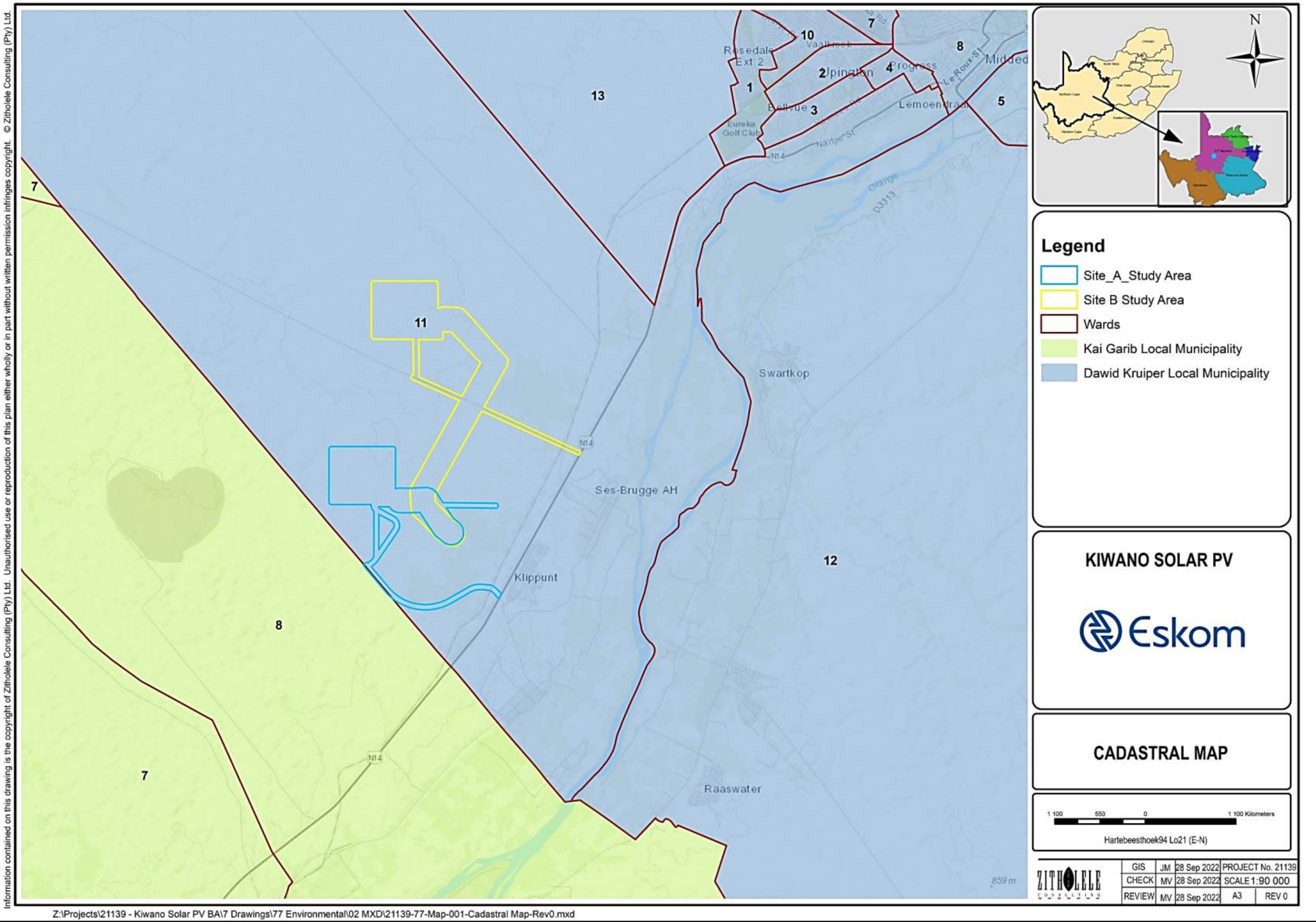

Figure 6-2: Local municipal and ward setting

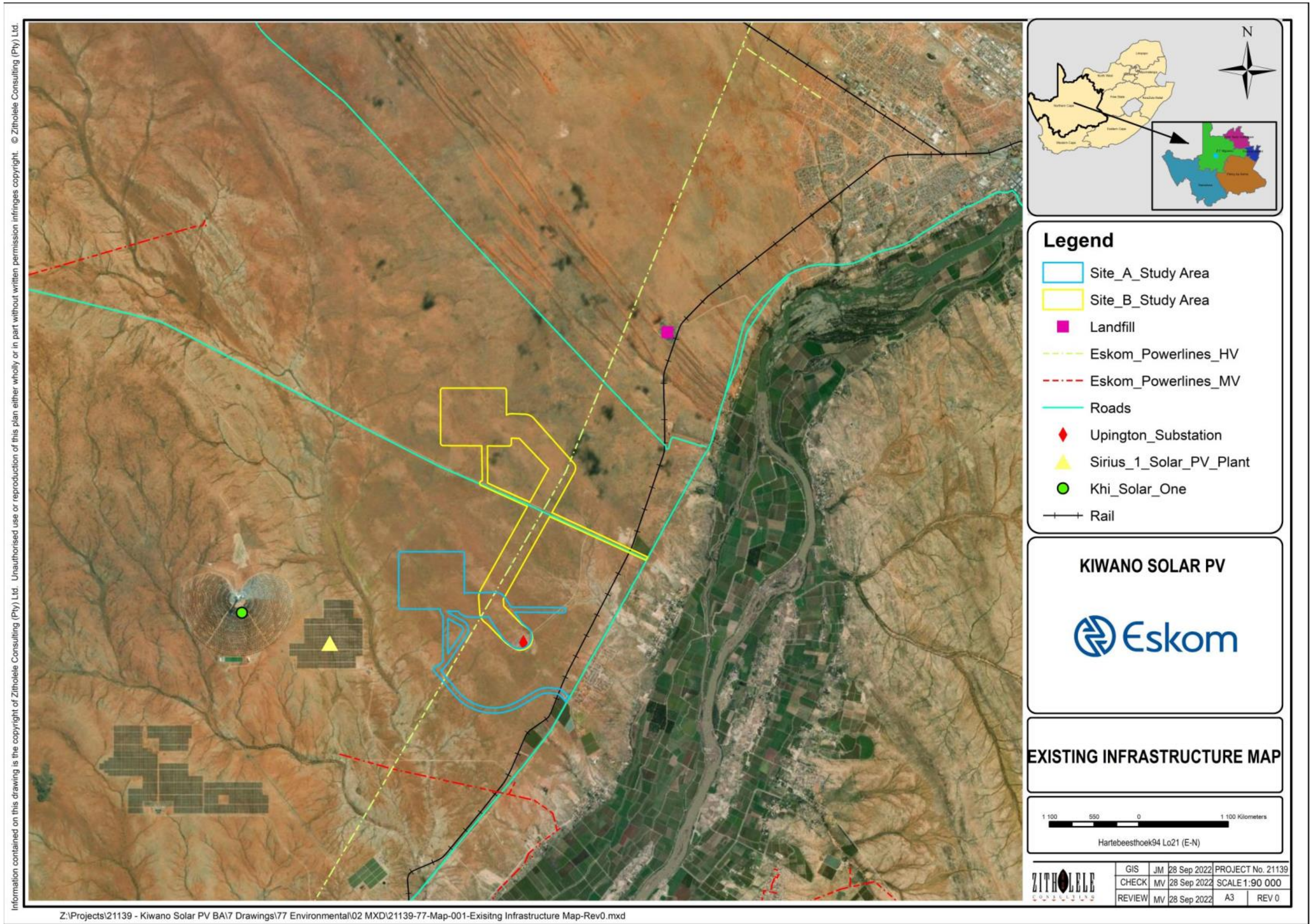

Figure 6-3: Existing infrastructure within and surrounding the proposed development site

6.3 Surrounding Land use and Infrastructure

6.3.1 Existing Infrastructure

Upington MTS

Upington MTS is located within the Northern Cape Operating Unit (NCOU). It is currently equipped with a 1 x 500 MVA 400/132 kV transformer. Upington MTS is currently fed via 400 kV line from Nieuwehoop MTS. The 400 kV powerline servitude in this region is interconnected between Aries, Nieuwehoop and Ferrum 400 kV MTS. The proposal to connect this BESS and PV Plant will be at Upington MTS via a Distribution integration network. This integration will take the form of a 132 kV line connecting to a new 132 kV substation called Kiwano Substation. Kiwano will serve as the connection point for the 40 MW / 200 MWh BESS and 58 MW PV installation.

Grid connection infrastructure

Existing grid connection infrastructure is present in the broader area. These include both power lines and substations:

- Oasis / Oranje Switching Station 1 132kV power line;
- Gordonia / Oranje Switching Station 1 132kV power line;
- Oranje Switching Station;
- Olyfenhout Substation;
- McTaggerts Substation (as part of the Khi Solar One facility); and
- Upington Main Transmission Substation (MTS)

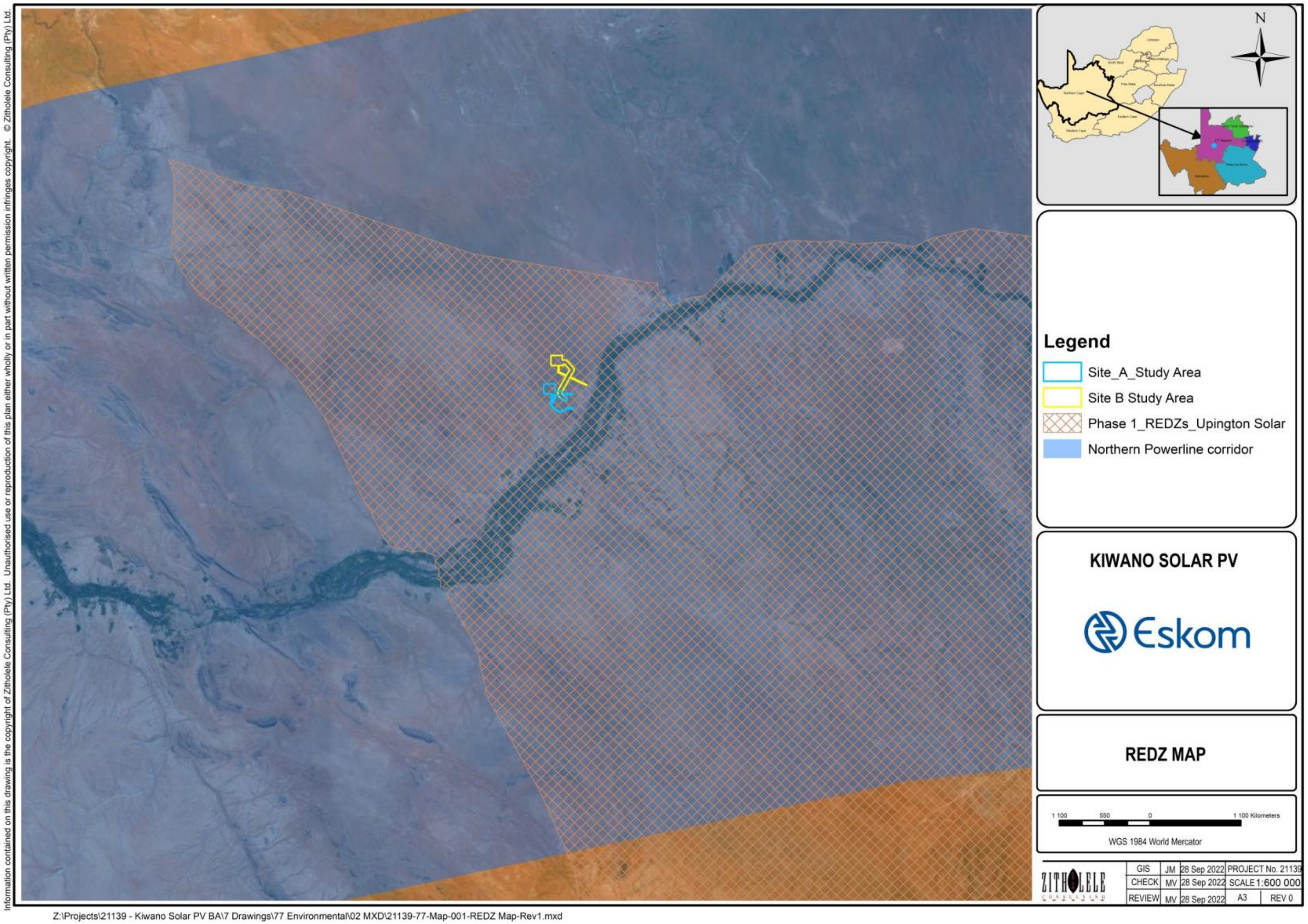

Figure 6-4: Project development site in relation to Upington REDZ

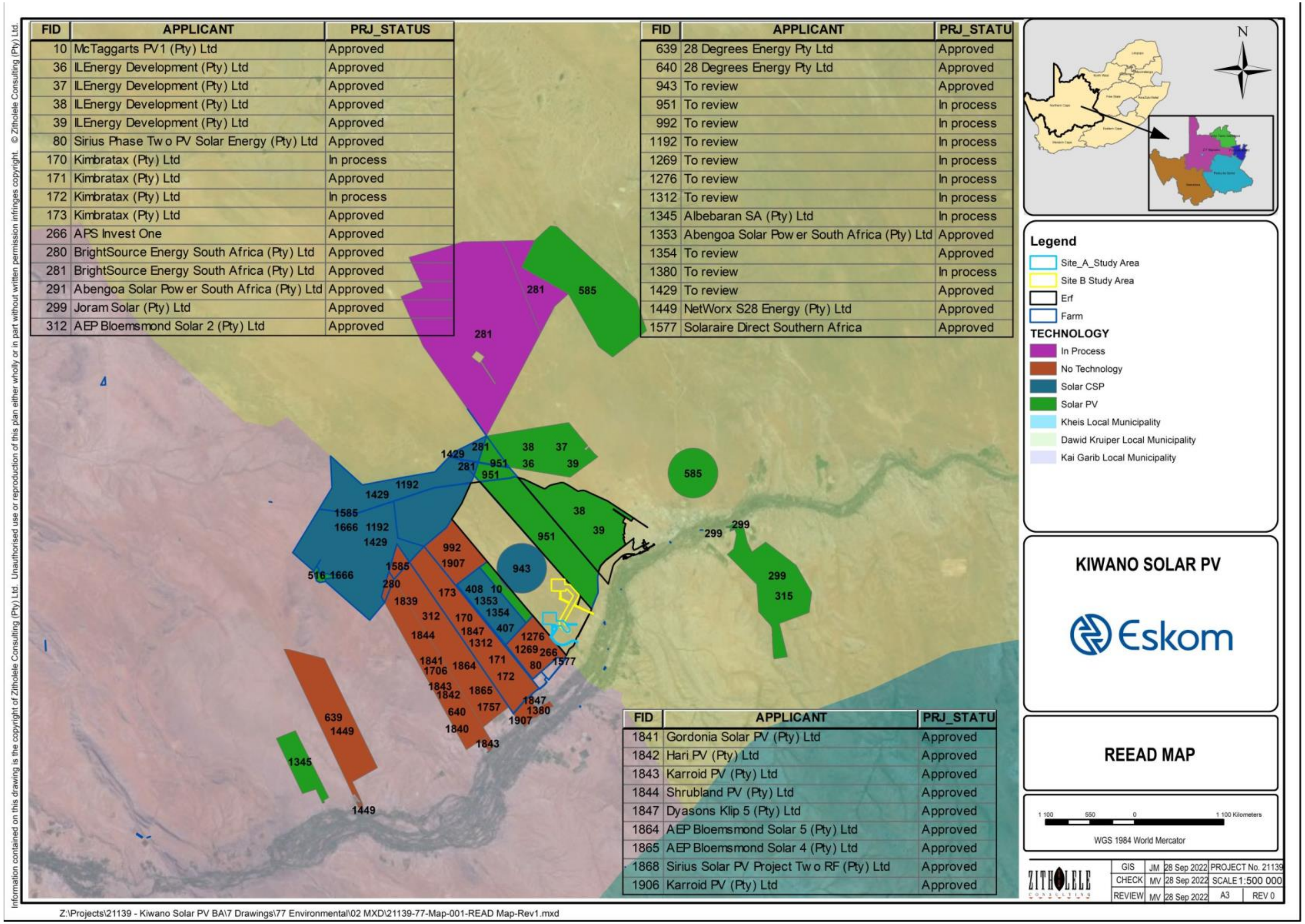

Figure 6-5: Development site in relation to approved and proposed renewable energy developments

6.3.2 Independent Power Producers in terms of the REEA database

The project site is located entirely within the Upington REDZ and the Northern Strategic Powerline Corridor (Figure 6-4). Due to the location of the Upington REDZ, the broader area around the development site is characterised by numerous renewable energy installations, including Solar Photovoltaic (PV) and Concentrated Solar Power (CSP) facilities.

The Renewable Energy EIA Application (REEA) Database, which provides an up-to-date account of the approved and proposed renewable energy facilities, is maintained by the DFFE and provides the location of the facilities positioned around the proposed development site (Figure 6-5).

The most notable of the renewable energy facilities located near the proposed Kiwano Solar PV and BESS development site is the Khi Solar One CSP facility located on the adjacent property to the west of the development site (Figure 6-6).

Figure 6-6: Khi Solar One located on adjacent to the development site

Other facilities include the following:

- McTaggarts PV1 development located to the northwest of the Khi Solar One facility on the eastern border of the proposed development site, approximately 5 km northwest of the development site,
- The proposed
- Sirius Two (PV) located approximately 3 km southwest of the development site, and
- Dyasons Klip 1, 2 and 5 (PV) facilities located to the west of the development site.

6.3.3 Square Kilometre Array

The project location is furthermore located between 14km and 32km north of the Radio Astronomy Advantage Area (RAAA) and within 5 km of a Sentech High Power Terrestrial Broadcasting Facility.

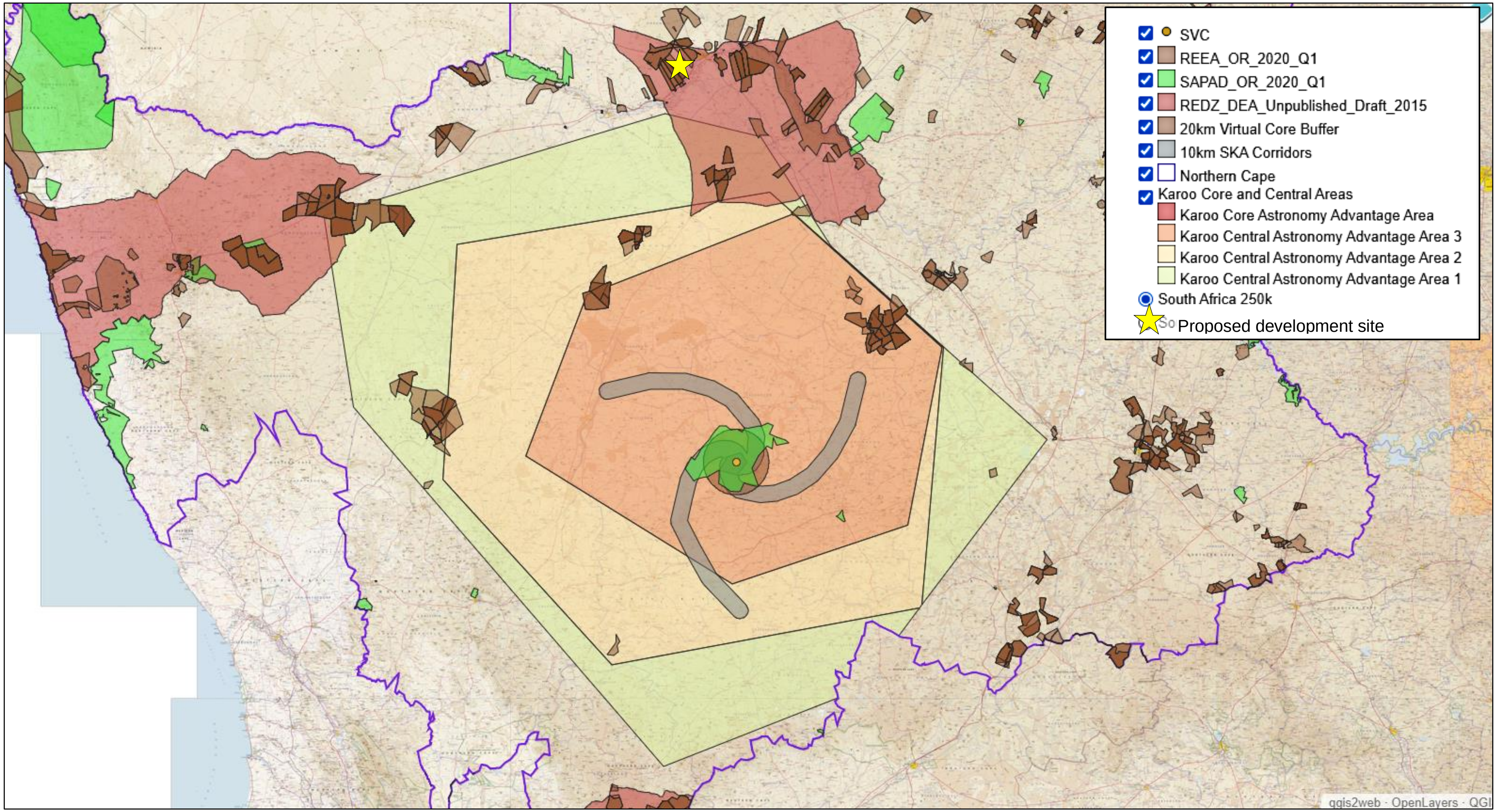

Figure 6-7: Square Kilometre Array's Karoo Core and Central Astronomy Advantage Areas (http://bigrat.jb.man.ac.uk/~sjm/Spectrum/Karoo-WebExport/qgis2web_2020_08_03-11_25_02_774525/)

6.4 Climate

The project area experiences hot summers; the winters are short, cool, and windy; and it is dry and mostly clear year-round. Over the course of the year, the temperature typically varies from 4°C to 36°C and is rarely below 0°C or above 40°C. Rainfall periods peak between February and April with a minor peak in November. March is generally the wettest month in Northern Cape, while the warmest month in Northern Cape is January with an average maximum temperature of 35°C. The Northern Cape province has dry periods between May and December. December is the sunniest month. The mean annual precipitation ranges from 70 to 110 mm.

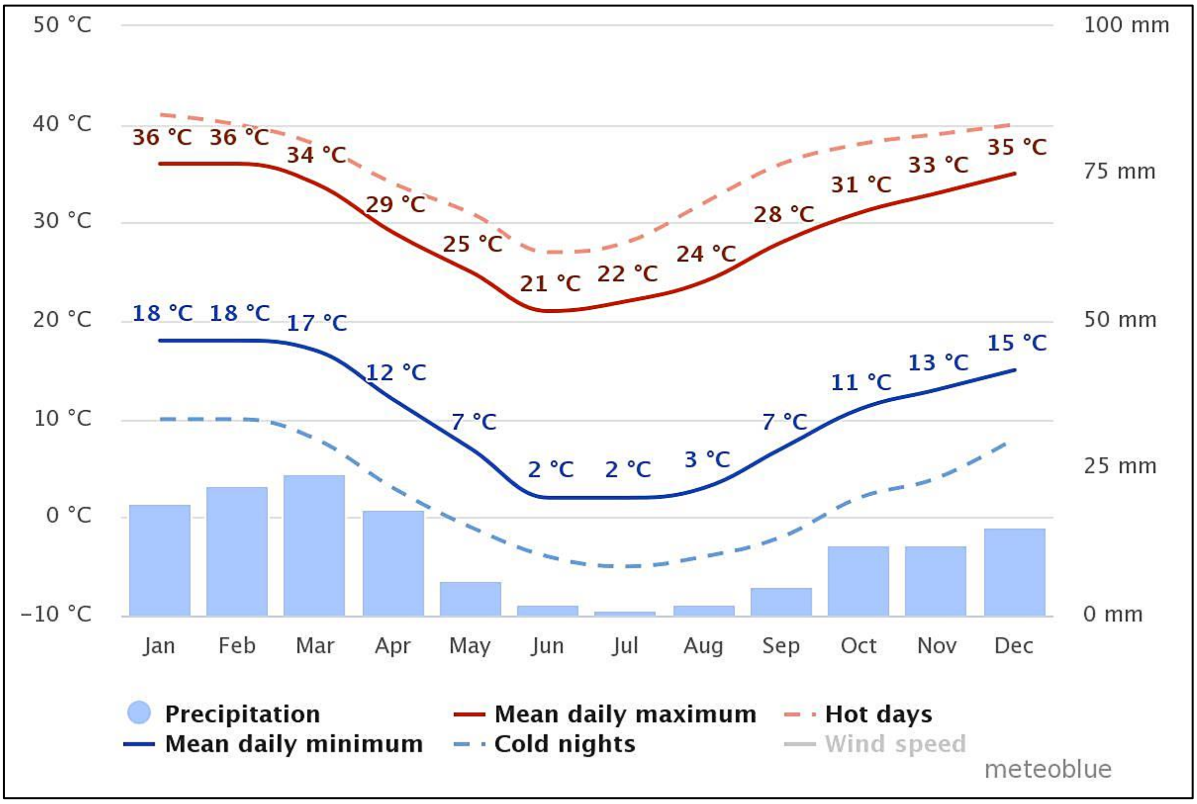

Figure 6-8: Precipitation, mean daily maximum and minimum temperatures for Upington (Meteoblue, 2022)

The mean daily maximum and minimum temperatures, including average monthly precipitation, for the Upington area is provided in Figure 6-8. The "mean daily maximum" (solid red line) shows the maximum temperature of an average day for every month for Upington. Likewise, "mean daily minimum" (solid blue line) shows the average minimum temperature. Hot days and cold nights (dashed red and blue lines) show the average of the hottest day and coldest night of each month of the last 30 years (Meteoblue, 2022).

The mean daily minimum temperatures range between 2 °C and 18 °C in the winter months, while the mean daily maximum temperatures range between 21 °C and 36 °C (Figure 6-8) in the summer months (Meteoblue, 2022).

The wind rose for Upington (Figure 6-9) shows how many hours per year the wind blows from the indicated direction (Meteoblue, 2022). The dominant wind directions in Upington are between north to northeast, and south to southwest, as is evident in Figure 6-9.

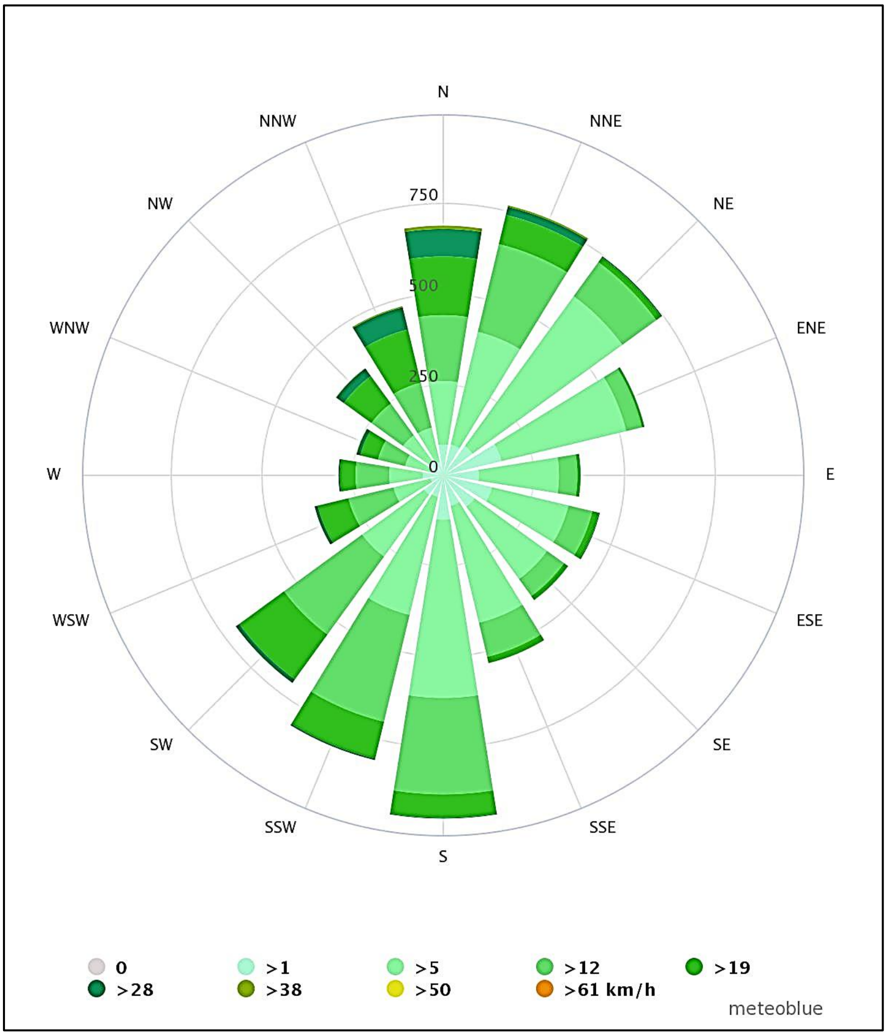

Figure 6-9: Wind rose for Upington (Meteoblue, 2022)

6.5 Solar Irradiance

Global Horizontal Irradiance (GHI) is the total amount of shortwave radiation received from above by a horizontal surface. The GHI for the area derived from the World Bank Group's Global Solar Atlas is approximately 2264 kWh/m^2/annum, equivalent to the highest GHI values in South Africa (Figure 6-10). It is therefore clear from the GHI that the proposed development site is situated in the most optimal area to maximise energy generation from solar PV technology.

The Photovoltaic Power Potential solar resource map provides a summary of estimated solar photovoltaic (PV) power generation potential. It represents the average daily / yearly totals of electricity production from a 1lW-peak grid-connected solar PV plant, calculated for a period of 25 recent years (1994 – 2018). The Photovoltaic Power Potential in the Upington area range between 1899 to 2045 kWh / kWp annually (Figure 6-10).

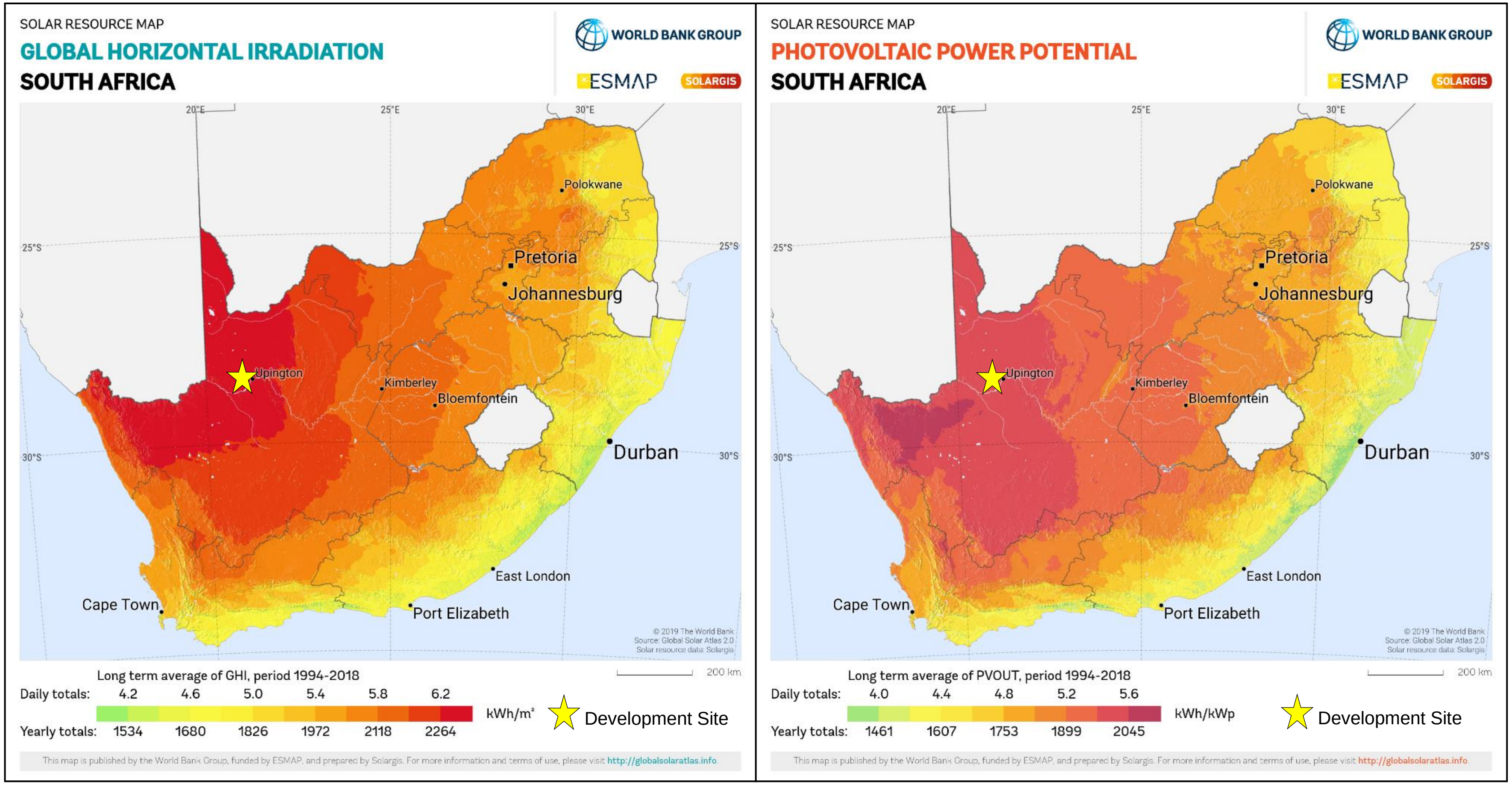

Figure 6-10: Global Horizontal Irradiation and Photovoltaic Power Potential in the Northern Cape (Solargis, 2022)

6.6 Slope and Terrain

The slope percentage of the project area has been calculated and is shown in Figure 6-11. Most of the regulated area is characterised by a slope percentage between 0 to 4% with some irregularities in areas with slopes reaching 7% (TBC, 2022d). This indicates a non-uniform topography with occurrence of some steep sloping areas being present.

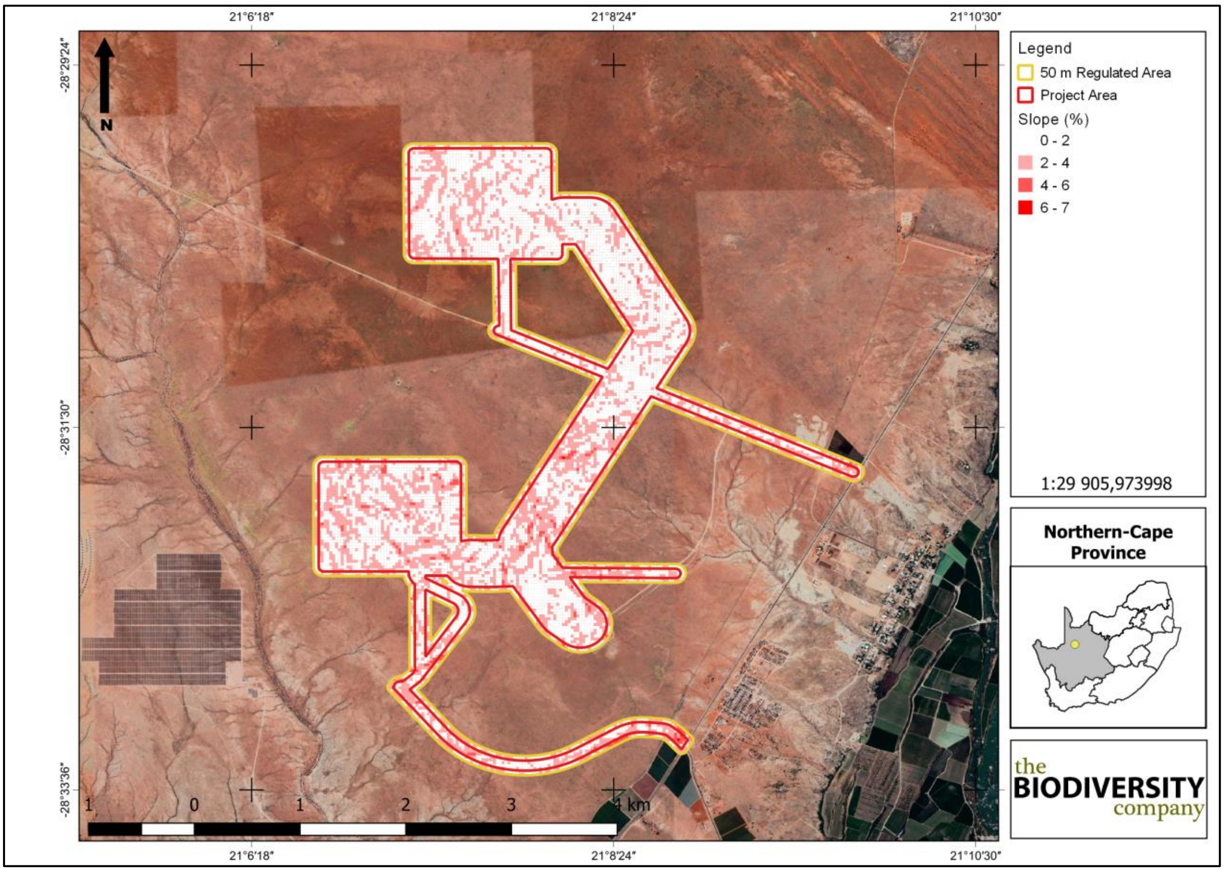

Figure 6-11: Slope within the study area

The Digital Elevation Model (DEM) of the project area indicates an elevation of 813 to 859 Metres Above Sea Level (MASL) (TBC, 2022d).

6.7 Geology, Soil and Agricultural Potential

6.7.1 Geology

A description of the geology of the area was provided in Bamford (2022), and referenced cited therein. The geology of the region is characterised by quaternary sediments (calcrete and sand) with some contribution of the Kalahari Group's pre-Pleistocene sediments.

The Kiwano project lies in the Namaqua-Natal Province in the Namaqua section (Figure 6-12, Table 6-2). The Namaqua-Natal Province is a tectono-stratigraphic province and forms the southern and western boundary of the ancient Kaapvaal Craton and extends below the Karoo Basin sediments to the south (Cornell et al., 2006, as cited in Bamford, 2022). It comprises rocks that were formed during the Namaqua Orogeny (mountain-building) some 1200 – 1000 million years ago. It has been divided by geologists into a number of terranes (similar lithology and bounded by shear zones).

Table 6-2: Explanation of symbols for the geological map (Cornell et al.. 2006, Partridge et al., 2006)

Symbol	Group / Formation	Lithology	Approximate Age
Qg	Gordonia Formation (FM), Kalahari Group	Red-brown wind-blown sand and sand dunes	Quaternary, ca 2.5 Ma to present
T	Tertiary	Calcrete	Neogene, last 25 Ma
Ml	Louisvale Granite, Keimos Suite, Kakamas Terrane, Namaqua-Natal Province	Light grey granite	1200 - 1000 Ma
Mkl	Klipkraal Granite, Keimos Suite, Kakamas Terrane, Namaqua-Natal Province	Unfoliated, granophyric granite porphyry	1200 - 1000 Ma
Mbe	Bethesda Fm, Areachap Group, Kakamas Terrane, Namaqua-Natal Province	Migmatitic, biotite-rich and aluminous gneisses	1200 - 1000 Ma

6.7.2 Soil

A Soil and Agricultural Assessment Report was compiled by The Biodiversity Company (refer to Appendix H-1). The findings of this study are provided below. The surface typically is covered by red sands deeper than 300 mm which is likely to form dunes. According to the land type database (Land Type Survey Staff, 1972 - 2006) the assessment corridor to be focused on falls within the Ae 10 and Ag 1 land types. The Ae 10 and Ag 1 land types are mostly predominated by Hutton and Mispah soil forms with also the occurrence of bare rocks and other soils occurring throughout the terrains, following the South African soil classification working group (1990) (TBC, 2022d).

The Ae land type is characterised by shallow profiles and occurrence of rocky areas. Furthermore, they consist of the freely drained red to yellow-brown apedal soils. The soils have a high base status with profiles deeper than 300 mm without any occurrence of dunes. The Ag land type is characterised by freely drained red or yellow-brown apedal soils, with red apedal soils being dominant. These soils have a high base status and are likely to be less than 300 mm deep. The geology of Ae 10 land type includes migmatite, gneiss and ultrametamorphic rocks of the Namaqualand Metamorphic Complex. Moreover, the geology of Ag 1 land type includes granite, migmatite and gneiss of the Namaqualand Metamorphic Complex (TBC, 2022d).

The most sensitive soil forms identified within the assessment area are Hutton and Dundee soil forms, with other associated soils also occurring. The Hutton soil form consists of an orthic topsoil on top of a thick red apedal subsoil horizon. Dundee soil form consists of an orthic topsoil on top of a thick alluvial subsoil horizon (TBC, 2022d).

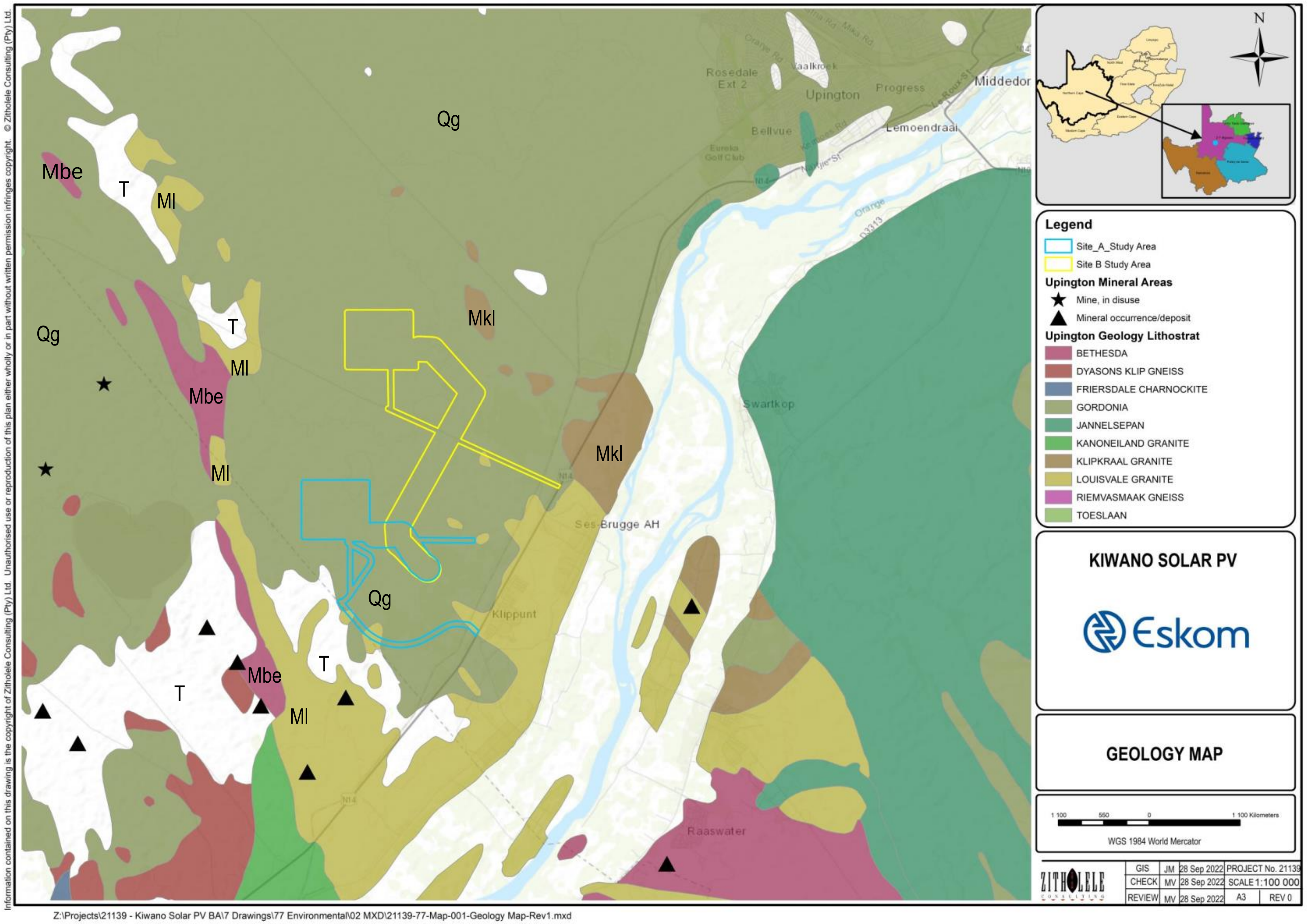

Figure 6-12: Geology of the study area

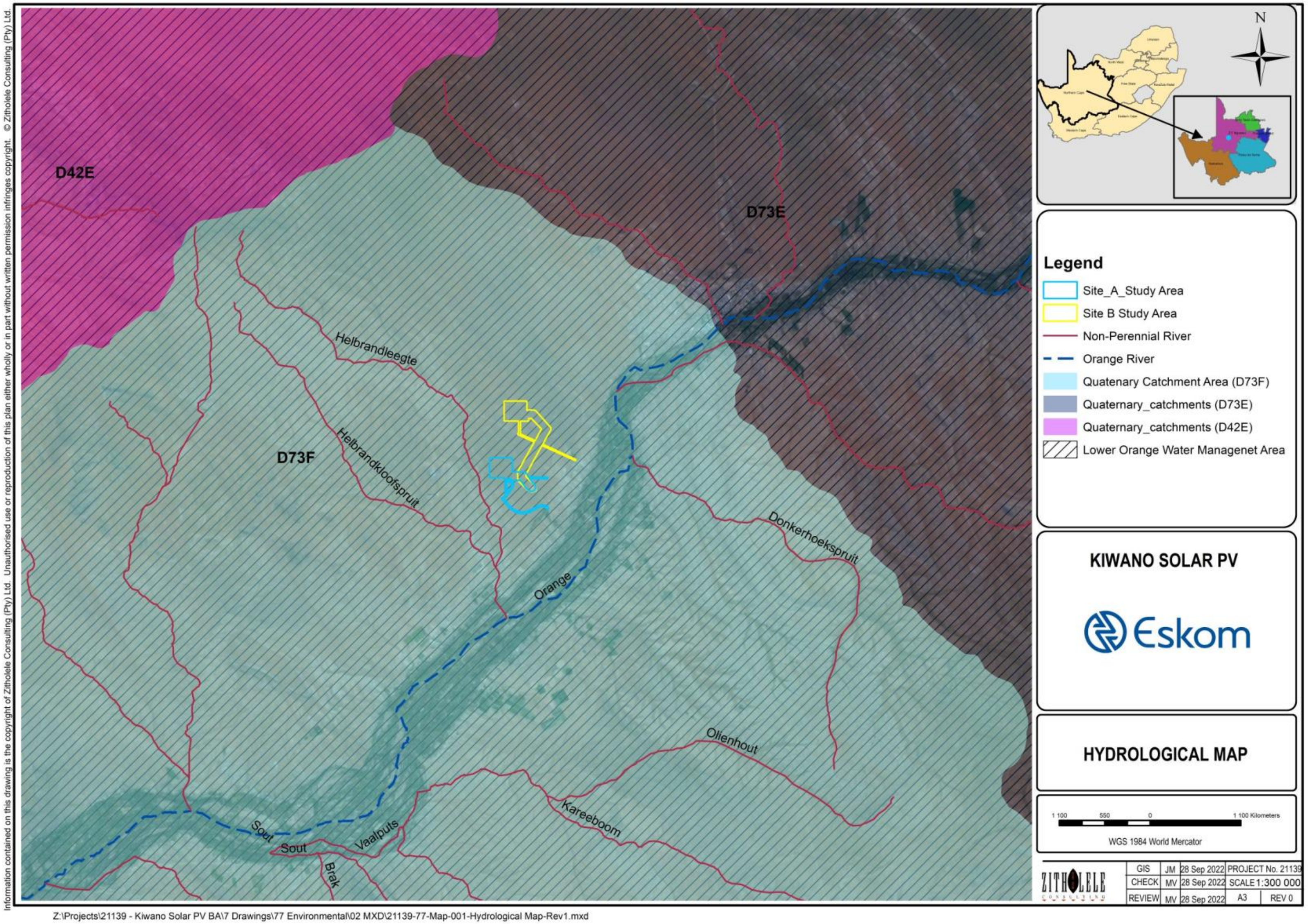

Figure 6-13: Hydrology of the study area

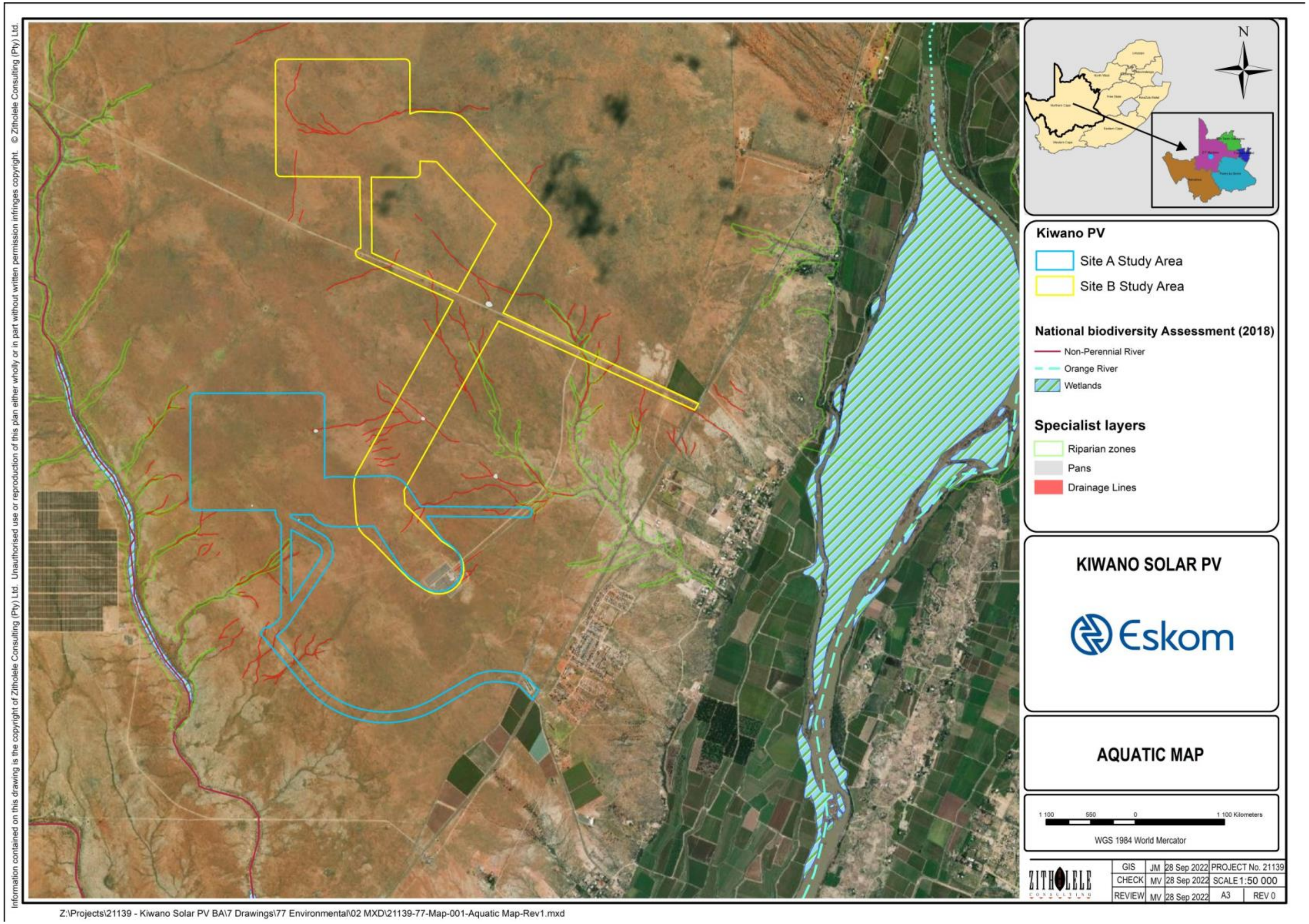

Figure 6-14: Surface water and wetland features in relation to the proposed development site

6.7.3 Agricultural Potential

The land capability of the above-mentioned soil forms has been determined to have land capacity classes of “IV” and “VI” with a climate capacity level 8 given the Low Mean Annual Precipitation (MAP) and the high Mean Annual Potential Evapotranspiration (MAPE) rates. The combination between the determined land capabilities and climate capabilities results in land potentials “L6” and “L7”. The “L6” land potential level is characterised by a very restricted potential. Regular and/or severe limitations that occurs due to soil, slope, temperatures or rainfall. The “L7” land potential level is characterised by low potential. Severe limitations due to soil, slope, temperature or rainfall. These areas are non-arable. The “L6” and “L7” land potentials are characterised with a “Low to Moderate” sensitivity (TBC, 2022d).

6.7.4 Significance of impacts on soils, land capability and agricultural potential

The baseline findings and the sensitivities as per the Department of Agriculture, Forestry and Fisheries (DAFF, 2017) national raster file concur with one another. The proposed Kiwano BESS and PV project is characterised with “Very Low” to “Low” land capability sensitivities. It is also the specialist’s opinion that the land capability and land potential of the resources in the regulated area is characterised by “Very Low” to “Low” sensitivities (TBC, 2022d).

It was therefore concluded that the impact of the proposed development on soil, land capability and agricultural potential was INSIGNIFICANT. No Impact Assessment was resultantly undertaken for impacts on soil, land capability and agricultural potential in Chapter 8 of this Basic Assessment Report.

6.8 Hydrology and Surface Water

A Wetland Baseline and Risk Assessment was undertaken by The Biodiversity Company (TBC) (refer to Appendix H-3). The findings of this study are provided below. The proposed development area is located within the Lower Orange Water Management Area (WMA), as is evident from Figure 6-13. Major rivers systems within the Lower Orange WMA include the Ongers, Hartebeest and Orange Rivers.

The Orange River is South Africa’s largest river and is a significant feature of the Northern Cape province and is also the main source of water in the Province. The Orange River meanders in an east-west direction just south of the town of Upington, and subsequently also the development site (Figure 6-14). The Orange River also forms the international border between South Africa and Namibia where it reaches the southern extent of Namibia.

The extent of the Orange River located within the WMA includes the section of Orange River between the Orange – Vaal confluence and Alexander Bay. Other tributaries include the Ongers and the Hartebeest Rivers from the south and the Molopo and Fish River in Namibia from the north.

The development area is further located within quaternary catchment D73F (Figure 6-13). The Helbrandleegte and Helbrandkloofspruit non-perennial drainage features flows in a southeastwardly direction towards the Orange River. The confluence of the two non-perennial drainage features is located a short distance south of the study area, from where the drainage feature flows into the Orange River (Figure 6-13).

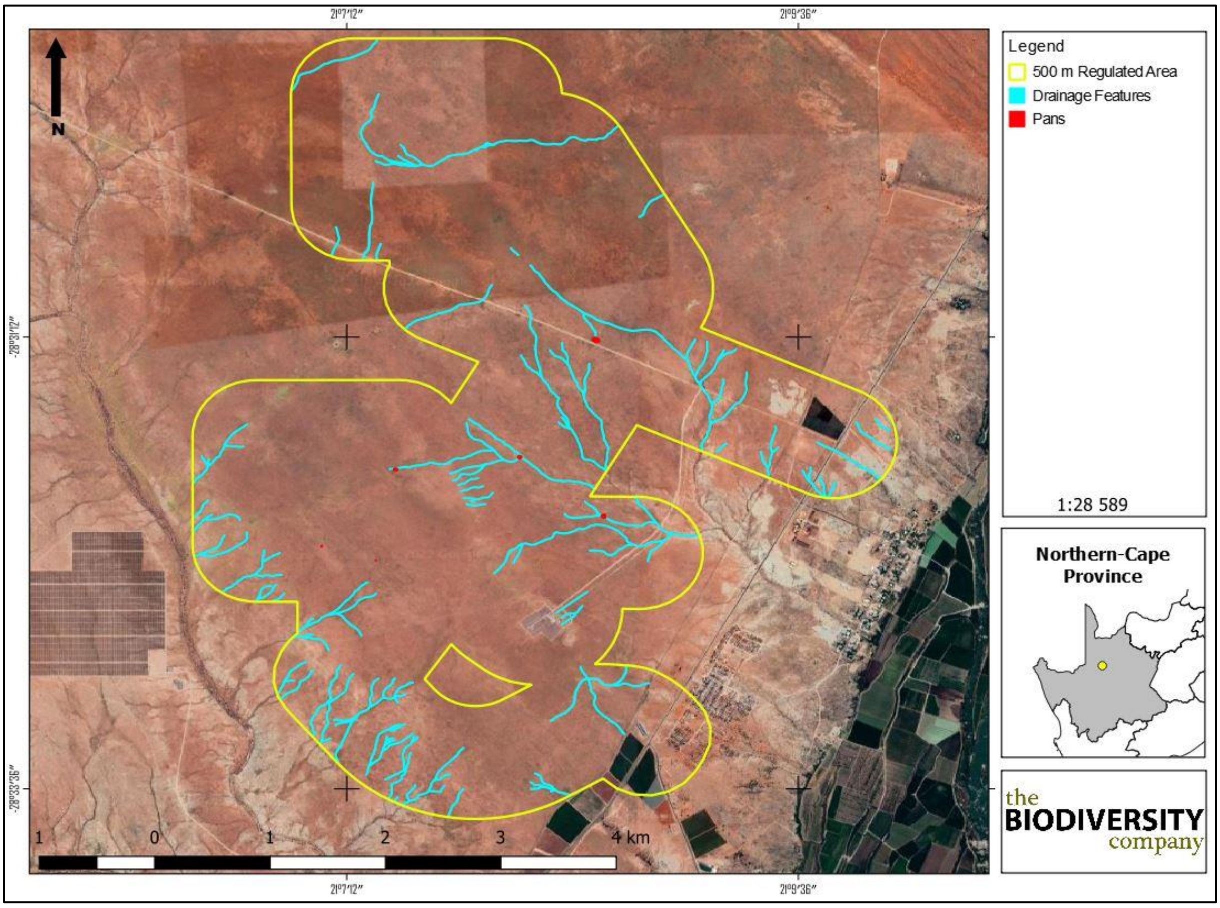

Figure 6-15: Non-perennial drainage features and non-wetland pans identified within the study area and 500m regulated area (TBC, 2022b)

A surface water and wetland delineation assessment were undertaken by a recognised and suitably qualified wetland specialist. Various non-wetland drainage features and two non-wetland depressions (pans) were identified within the 500m regulated area. None of these systems are characterised by hydromorphic signs of wetness, and therefore do not constitute wetland habitat. The drainage features are not characterised by riparian vegetation and grasses, these systems represent bare surfaces with evidence of surface run-off. A large number of small drainage features were identified within the assessment area. None of these systems are characterised by wetland features as only alluvial soils and no hydrophytic vegetation is present (TBC, 2022b). Some of these drainage features and non-wetland depressions as captured by the wetland specialist are shown in Figure 6-16.

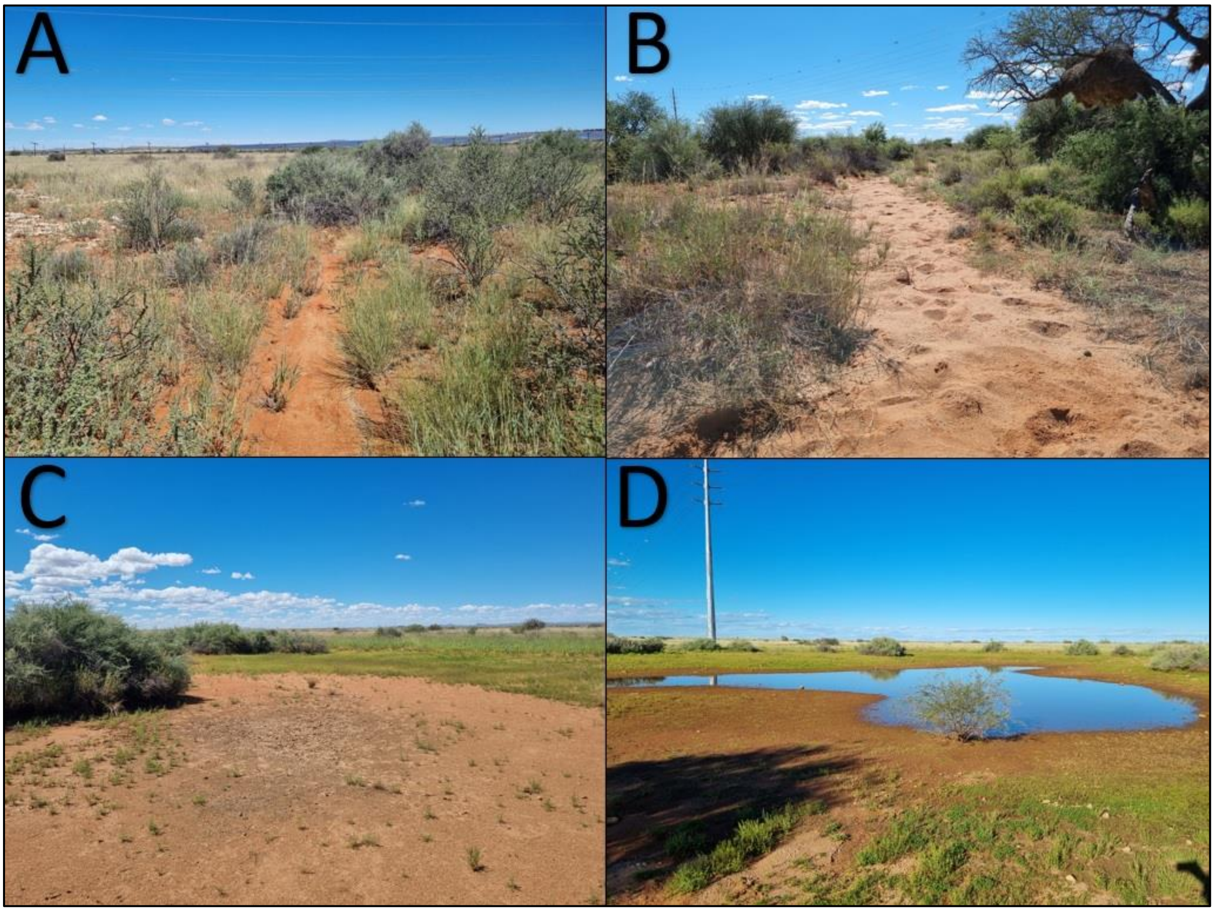

Figure 6-16: Examples provided by wetland assessment (TBC, 2022b) of the different HGM units delineated within the project area. A and B) Drainage features. C and D) Non-wetland depressions/pans

When impact points with identified and delineated watercourse features were considered a number of impact points were identified for Site A (Figure 6-17) and Site B (Figure 6-18).

For site A, the PV facility is in close proximity to a drainage system on the eastern side and two pans on the border of the area. The substation and BESS are located well away from any of the delineated watercourses and will thus have no impacts on the watercourses. The roads, pipeline and power line will have multiple crossings over the delineated drainage line and will thus have the highest impacts on the watercourses and in return have the most mitigation measure to adhere to (TBC, 2022b).

For Site B there are multiple drainage systems running through the proposed PV facility area. The substation and BESS are located to the south of a drainage system and might have some indirect impacts on the system. The roads, pipeline and power line will have multiple crossings over the delineated drainage line and will thus have the highest impacts on the watercourses and in return have the most mitigation measure to adhere to (TBC, 2022b).

Furthermore, the development site does not fall within a South African Inventory of Inland Aquatic Ecosystem (SAIIAE), Strategic Water Source Areas (SWSA), or National Freshwater Ecosystem Priority Areas (NFEPA).

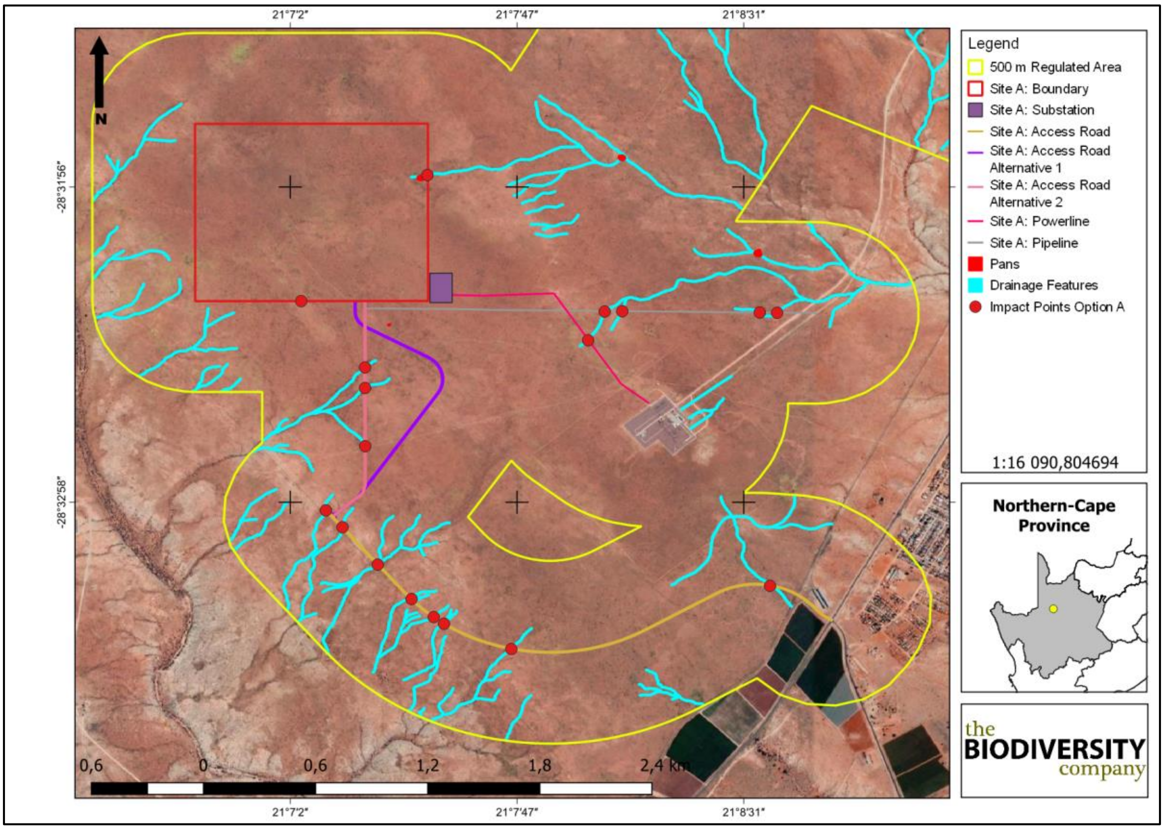

Figure 6-17: Possible points where impacts may occur during development at option A (TBC, 2022b)

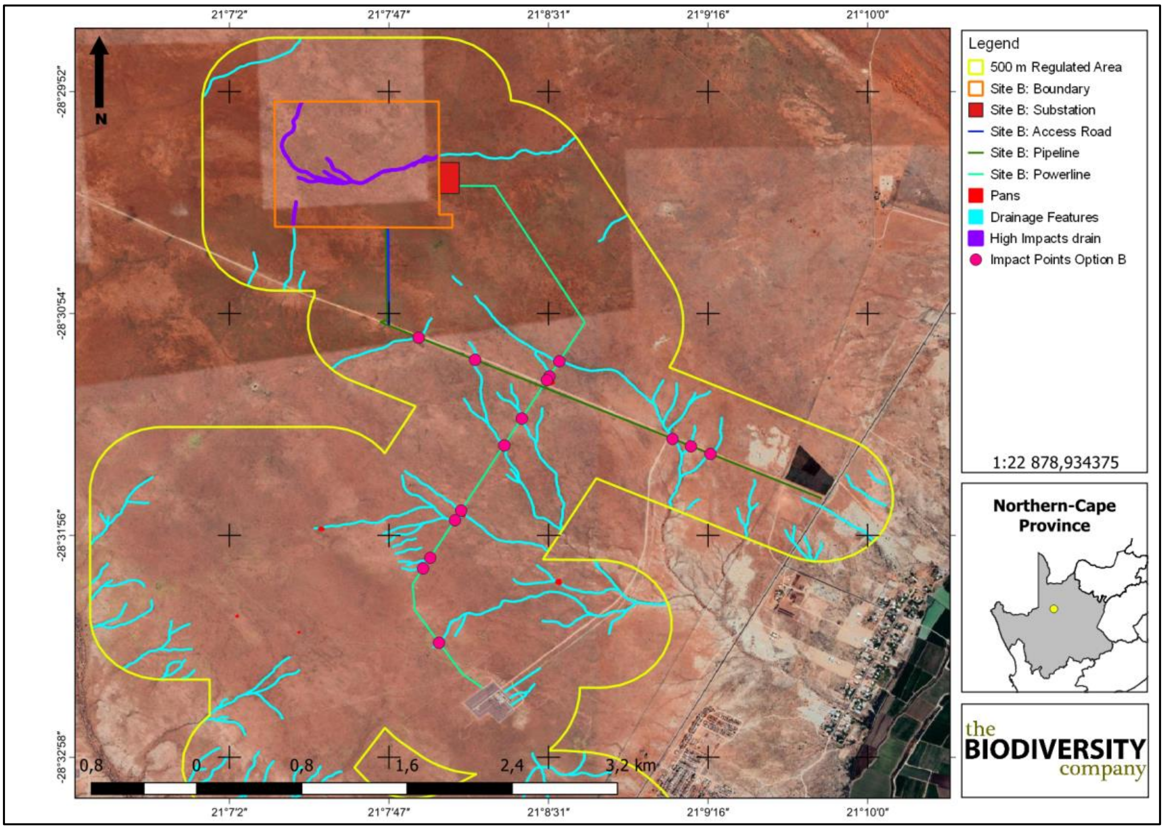

Figure 6-18: Possible points where impacts may occur during development at option B (TBC, 2022b)

6.9 Terrestrial Biodiversity (Flora and Fauna)

A Terrestrial Biodiversity and Ecological Assessment was commissioned and undertaken by The Biodiversity Company (refer to Appendix H-1) to support the application for the proposed Kiwano Solar PV and BESS development.

6.9.1 Ecologically important landscape features

The location of the proposed development site in relation to ecologically important landscape features were considered by the biodiversity specialist (TBC, 2022a) and is summarised in Table 6-3.

Table 6-3: Proposed development site in relation to ecologically important landscape features

Desktop Information Considered	Relevant/Irrelevant
Ecosystem Threat Status (ETS)	Located within a Least Concern ecosystem, see Figure 6-19.
Ecosystem Protection Level (EPL)	Located within a Not Protected ecosystem.
Protected Area (PA)s	Does not overlap, nor is it near any Protected Areas.
National Protected Area Expansion Strategy (NPAES)	Does not overlap any NPAES areas.
Important Bird Areas (IBA)	Does not overlap any IBA.
Critical Biodiversity Area (CBA) and Ecological Support Area (ESA)	Intersects CBA and ESA, see Figure 6-19.
South African Inventory of Inland Aquatic Ecosystems (SAIIAE)	The regulatory area does not overlap with any wetlands, see Figure 6-14.
Strategic Water Source Areas (SWSA)	The project area does not occur within a SWSA
Freshwater Ecosystem Priority Areas (FEPA)	The project area does not overlap with any wetlands, see Figure 6-14

6.9.2 Vegetation Type

The area falls into the Upper Karoo Vegetation Unit, within the Nama-Karoo Biome, forming the predominant karoo group, accounting for 19.6% of the extent of the entire vegetation map (Mucina & Rutherford, 2006, cited within (TBC, 2022a)). This vegetation is flanked by six biomes (the Succulent Karoo, Desert, Kalahari, Grassland, Albany Thicket and Fynbos and has a continental-type climate with highly variable rainfall and extreme temperatures (Mucina & Rutherford 2006). On a fine scale vegetation type, the proposed development overlaps with two vegetation types, the Kalahari Karroid Shrubland and the Bushmanland Arid Grassland (TBC, 2022a), refer to Figure 6-19.

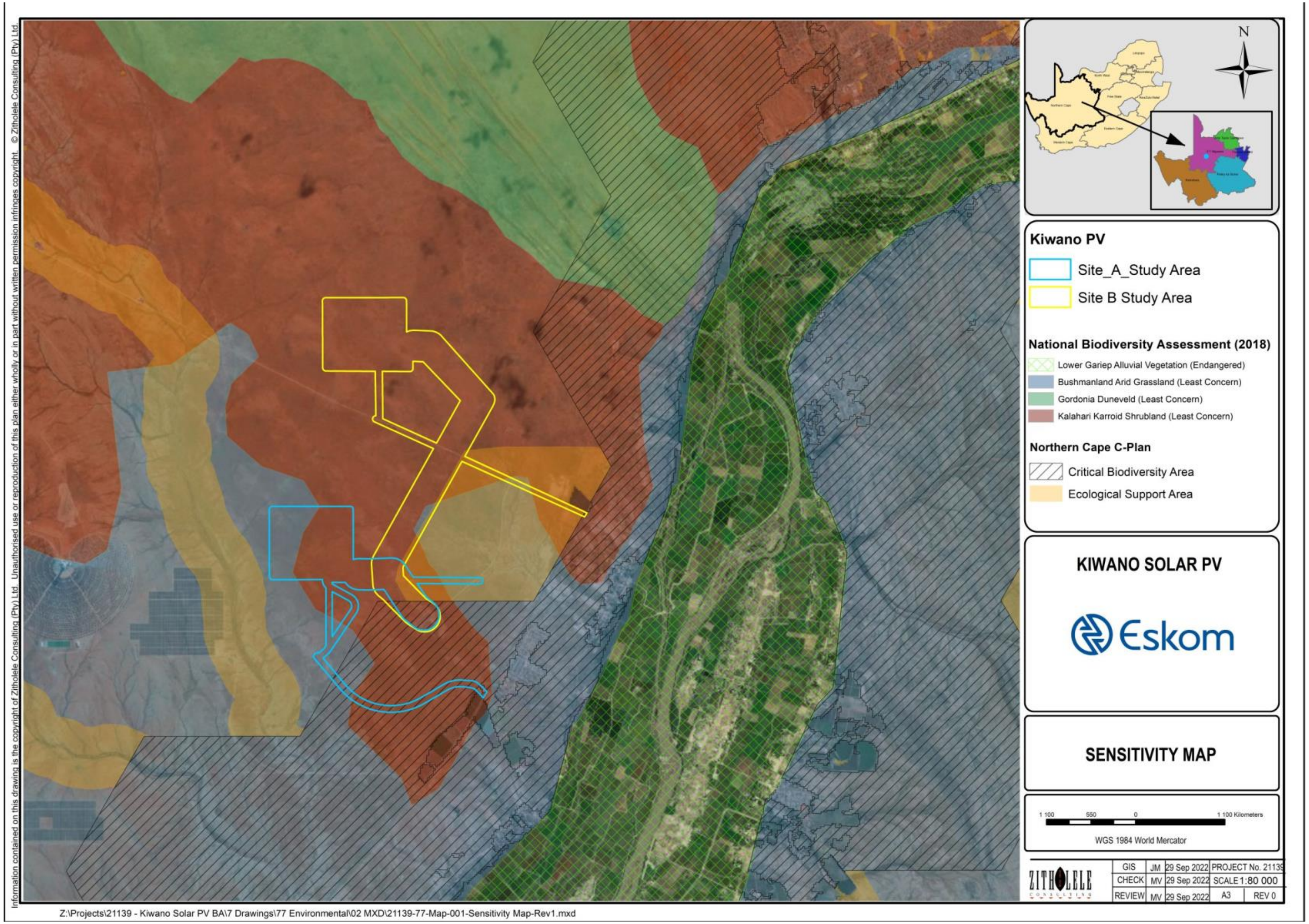

Figure 6-19: Vegetation types, ecosystem threat status and biodiversity priority areas associated with the proposed development site

In terms of Mucina & Rutherford, 2006, the **Kalahari Karroid Shrubland** is described as follows:

- **Topography and Structure –** Low karroid shrubland on flat, gravel plains. Karoo-related elements (shrubs) meet here with northern floristic elements, indicating a transition to the Kalahari region and sandy soils.

- **Geology and Soils –** Cenozoic Kalahari Group sands and small patches also on calcrete outcrops and screes on scarps of intermittent rivers (mekgacha). In places Dwyka Group tillites outcrop. The soils are deep (>300 mm), red-yellow, apedal, freely drained, with a high base status, typical of Ae land type.

- **Important Taxa –** Small Trees: *Acacia mellifera* subsp. *detinens* (d), *Parkinsonia africana* (d), *Boscia foetida* subsp. *foetida*. Tall Shrub: Rhigozum trichotomum (d). *Epiphytic Semiparasitic*. Shrub: *Tapinanthus oleifolius.* Low Shrubs: *Hermannia spinosa* (d), *Limeum aethiopicum* (d), *Phaeoptilum spinosum* (d), *Aizoon schellenbergii*, *Aptosimum albomarginatum*, *A. lineare*, *A. marlothii*, *A. spinescens*, *Barleria rigida*, *Hermannia modesta*, *Indigofera heterotricha*, *Leucosphaera bainesii*, *Monechma genistifolium* subsp. *genistifolium*, *Phyllanthus maderaspatensis*, *Polygala seminuda*, *Ptycholobium biflorum* subsp. *biflorum*, *Sericocoma avolans*, *Solanum capense*, *Tephrosia dregeana*. Herbs: *Dicoma capensis* (d), *Chamaesyce inaequilatera* (d), *Amaranthus praetermissus*, *Barleria lichtensteiniana*, *Chamaesyce glanduligera*. *Chascanum garipense*, *Cleome angustifolia* subsp. *diandra*, *Cucumis africanus*, *Geigeria ornativa*, *Hermannia abrotanoides*, *Indigastrum argyraeum*, *Indigofera alternans*, *I. auricoma*, *Kohautia cynanchica*, *Limeum argute-carinatum*, *Mollugo cerviana*, *Monsonia umbellata*, *Sesamum capense*, *Tribulus cristatus*, *T. pterophorus*, *T. terrestris*. Succulent Herbs: *Gisekia africana*, *G. pharnacioides*, *Trianthema parvifolia*. Graminoids: *Aristida adscensionis* (d), *Enneapogon desvauxii* (d), *E. scaber* (d), *Stipagrostis obtusa* (d), *Aristida congesta*, *Enneapogon cenchroides*, *Eragrostis annulata*, *E. homomalla*, *E. porosa*, *Schmidtia kalahariensis*, *Stipagrostis anomala*, *S. ciliate, S. hochstetteriana*, *S. uniplumis*, *Tragus berteronianus*, *T. racemosus*.

- **Conservation –** Least threatened. Target 21%. Very little statutorily conserved in Augrabies Falls National Park. Although only a small area has been transformed many of the belts of this type were preferred routes for early roads, thus promoting the introduction of alien plants (about a quarter of the unit has scattered Prosopis species). Erosion is very low (94%).

In terms of Mucina & Rutherford, 2006, the **Bushmanland Arid Grassland** is described as follows:

- **Topography and Structure –** Extensive to irregular plains on a slightly sloping plateau sparsely vegetated by grassland dominated by white grasses (*Stipagrostis* species) giving this vegetation type the character of semidesert ‘steppe’. In places low shrubs of *Salsola* change the vegetation structure. In years of abundant rainfall rich displays of annual herbs can be expected.

- **Geology and Soils –** A third of the area is covered by recent (Quaternary) alluvium and calcrete. Superficial deposits of the Kalahari Group are also present in the east. The extensive Palaeozoic diamictites of the Dwyka Group also outcrop in the area as do gneisses and metasediments of Mokolian age. The soils of most of the area are red-yellow apedal soils, freely drained, with a high base status and <300 mm deep, with about one fifth of the area deeper than 300 mm, typical of Ag and Ae land types.

- Important Taxa – ([W]Western and [E]Eastern regions of the unit only) Graminoids: *Aristida adscensionis* (d), *A. congesta* (d), *Enneapogon desvauxii* (d), *Eragrostis nindensis* (d), *Schmidtia kalahariensis* (d), *Stipagrostis ciliata* (d), *S. obtusa* (d), *Cenchrus ciliaris*, *Enneapogon scaber*, *Eragrostis annulata*[E], *E. porosa*[E], *E. procumbens*, *Panicum lanipes*[E], *Setaria verticillata*[E], *Sporobolus nervosus*, *Stipagrostis brevifolia*[W], *S. uniplumis*, *Tragus berteronianus*, *T. racemosus*[E]. Small Trees: *Acacia mellifera* subsp. *detinens*[E], *Boscia foetida* subsp*. foetida*. Tall Shrubs: *Lycium cinereum* (d), *Rhigozum trichotomum* (d), *Cadaba aphylla*, *Parkinsonia africana*. Low Shrubs: *Aptosimum spinescens* (d), *Hermannia spinosa* (d), *Pentzia spinescens* (d), *Aizoon asbestinum*[E], *A. schellenbergii*[E], *Aptosimum elongatum*, *A. lineare*[E], *A. marlothii*[E], *Barleria rigida*, *Berkheya annectens*, *Blepharis mitrata*, *Eriocephalus ambiguus*, *E. spinescens*, *Limeum aethiopicum*, *Lophiocarpus polystachyus*, *Monechma incanum*, *M. spartioides*, *Pentzia pinnatisecta*, *Phaeoptilum spinosum*[E], *Polygala seminuda*, *Pteronia leucoclada*, *P. mucronata*, *P. sordida*, *Rosenia humilis*, *Senecio niveus*, *Sericocoma avolans*, *Solanum capense*, *Talinum arnotii*[E], *Tetragonia arbuscula*, *Zygophyllum microphyllum*. Succulent Shrubs: *Kleinia longiflora*, *Lycium bosciifolium*, *Salsola tuberculata*, *S. glabrescens*. Herbs: *Acanthopsis hoffmannseggiana*, *Aizoon canariense*, *Amaranthus praetermissus*, *Barleria lichtensteiniana*E, *Chamaesyce inaequilatera*, *Dicoma capensis*, *Indigastrum argyraeum*, *Lotononis platycarpa*, *Sesamum capense*, *Tribulus pterophorus*, *T. terrestris*, *Vahlia capensis*. Succulent Herbs: *Gisekia pharnacioides*[E], *Psilocaulon coriarium*, *Trianthema parvifolia*. Geophytic Herb: *Moraea venenata*.

- Conservation – Least threatened. Target 21%. Only small patches statutorily conserved in Augrabies Falls National Park and Goegab Nature Reserve. Very little of the area has been transformed.

6.9.3 Flora

The POSA database, along with the iNaturalist list of species for the area (research grade identifications) and the Mucina and Rutherford (2006) diagnostic species indicate that 295 species of indigenous plants are expected to occur within the development area and surrounding landscape. Appendix B of the Terrestrial Biodiversity Assessment specialist report (TBC, 2022a) provides the list of species and their respective conservation status and endemism.

The POSA database and the screening tool indicates that 3 threatened species are expected to occur within the assessment area (Table 6-4).

Please note that the Screening Tool report includes lists of bird, mammal, reptile, amphibian, butterfly and plant species of conservation concern known or expected to occur on the proposed development footprint. Some of these SCC are sensitive to illegal harvesting. Such species have had their names obscured and are listed as sensitive plant unique number / sensitive animal unique number. As per the best practise guideline that accompanies the protocol and screening tool, the name of the sensitive species may not appear in the final EIA report nor any of the specialist reports released into the public domain. It should be referred to as sensitive plant or sensitive animal and its threat status may be included, e.g. critically endangered sensitive plant or endangered sensitive animal (TBC, 2022a).

Table 6-4: Threatened flora species that are expected to occur within the assessment area associated with proposed project area. DD = Data Deficient, DDD = Insufficient Information, EN = Endangered, NT = Near Threatened and VU = Vulnerable (TBC, 2022a)

Family	Scientific name	Conservation Status	Endemism	Habitat	Likelihood of occurrence
Asphodelaceae	*Aloidendron dichotomum*	VU		Occurs on north-facing rocky slopes (usually dolomite) in the south of its range and on slopes and sandy flats in the central and northern parts of its range.	Low
Acanthaceae	*Acanthopsis hoffmannsegg iana*	DD	Endemic	Occurs on sandy plains, stony hillsides and ridges usually associated with weathered quartz and granite but may also occur on mudstone on an elevation between 650 and 1000m.	Low
Apocynaceae	*Hoodia gordonii*	DDD		Occurs in a wide variety of arid habitat.	High

During the field assessment a total of 52 species, representing 22 families of flora species were recorded within the assessment area. The list of species encountered are provided in Table 6-5. This, however, is not a complete list of indigenous flora within the area, but only species that were able to be recorded by the biodiversity specialists within the survey area within seasonality constraints (TBC, 2022a).

None of the expected threatened flora species provided in section Table 6-4 were recorded within the assessment area during the survey period. However, four (4) of the recorded flora species are protected by legislation. Therefore, these species are not allowed to be collected, unless a permit from the Department of Environment and Nature Conservation, Kimberly (Northern Cape Province) is granted for their removal, and damage to these species by anthropogenic activities must be avoided (TBC, 2022a).

Table 6-5: Summary of flora species recorded within the assessment area and their respective growth form and conservation status. Species in bold are protected by legislation. EN = Endangered, NT= Near Threatened, VU = Vulnerable and LC = Least Concern (TBC, 2022a)

Family	Scientific name	Common name	Conservation status	Protection
	Angiospermae indet 1	flowering plants		
	Angiospermae indet 2	flowering plants		
	Magnoliopsida indet	dicots		
Acanthaceae	*Acanthaceae*	acanthus family		
Acanthaceae	*Acanthopsis*	Spikeviolets		
Acanthaceae	*Blepharis mitrata*	Stack Lashes	LC	
Acanthaceae	*Justicia*	water-willows		
Acanthaceae	*Monechma*			
Acanthaceae	*Monechma spartioides*			
Amaranthaceae	*Caroxylon calluna*	Ling Ganna		
Amaranthaceae	*Salsola*	Russian Thistles		
Asparagaceae	*Asparagus*	Asparagus		
Asparagaceae	*Asparagus*	Asparagus		
Asparagaceae	*Eriospermum capense*	Cape Woolseed	LC	
Hyacinthaceae	*Ledebouria*			
Hyacinthaceae	*Ledebouria apertiflora*	desert African hyacinth	LC	
Asteraceae	*Asteroideae*			
Asteraceae	*Eriocephalus*	Kapokbushes		
Asteraceae	*Eriocephalus punctulatus*	Boegoe Kapok	LC	
Asteraceae	*Geigeria filifolia*	Fine Vomitdaisy	LC	
Asteraceae	*Kleinia longiflora*	paintbrush flower	LC	
Asteraceae	*Rhanterium*			
Bignoniaceae	*Rhigozum trichotomum*	Trithorn	LC	
Boraginaceae	*Trichodesma africanum*	African Barbbell	LC	
Capparaceae	*Boscia albitrunca*	Shepherds tree	LC	Protected Tree; Provincially Protected Schedule 2
Capparaceae	*Boscia foetida*	Smelly Shepherds Tree	LC	Provincially Protected Schedule 2
Cleomaceae	*Cleome angustifolia*	Yellow Mouse Whiskers	LC	
Cucurbitaceae	*Cucumis myriocarpus*	paddy melon	LC	
Cucurbitaceae	*Cucurbitaceae*	gourd family		
Euphorbiaceae	*Euphorbia braunsii*	Common Vingerpol	LC	Provincially Protected Schedule 2
Fabaceae	*Parkinsonia africana*	Greenhair Tree	LC	
Geraniaceae	*Monsonia crassicaulis*	Bushman's Candle	LC	
Gisekiaceae	*Gisekia africana*		LC	

Family	Scientific name	Common name	Conservation status	Protection
Iridaceae	*Iridaceae*	irises and allies		Provincially Protected Schedule 2
Limeaceae	*Limeum viscosum*	Sticky Lizardfoot	LC	
Loranthaceae	*Tapinanthus oleifolius*	Namnambush	LC	
Pedaliaceae	*Dicerocaryum*			
Pedaliaceae	*Harpagophytum procumbens*	Kalahari Devilclaw	LC	
Poaceae	*Eragrostis intermedia*	Plains lovegrass		
Poaceae	*Eragrostis lehmanniana*	Lehmann's lovegrass	LC	
Poaceae	*Schmidtia kalahariensis*	Kalahari Sour Grass	LC	
Poaceae	*Stipagrostis*	Bushman Grasses		
Scrophulariaceae	*Aptosimum albomarginatum*		LC	
Scrophulariaceae	*Aptosimum lineare*		LC	
Scrophulariaceae	*Aptosimum spinescens*	Thorn Karooviolet	LC	
Scrophulariaceae	*Peliostomum*			
Solanaceae	*Datura innoxia*	downy thorn-apple		
Solanaceae	*Lycium*	boxthorns		
Solanaceae	*Lycium bosciifolium*	Bushmanland Honeythorn	LC	
Solanaceae	*Lycium cinereum*	Brownstem Honeythorn	LC	
Zygophyllaceae	*Tribulus cristatus*	Flanged Devilthorn	LC	
Zygophyllaceae	*Tribulus terrestris*	puncture vine	LC	

One invasive plant species (*Datura* sp.) was present within the general area but not within the proposed footprint (TBC, 2022a).

6.9.4 Fauna

Amphibians

Based on the Frog Map and iNaturalist (research grade identifications) database, 7 amphibian species are expected to occur within the assessment area (Appendix C of the Terrestrial Biodiversity Assessment specialist report (TBC, 2022a)). No species are regarded as threatened.

No amphibian species were recorded during the survey period, accounting for 0% of the expected species. The lack of species richness was attributed to the arid nature of the site and lack of suitable habitat within the project area (TBC, 2022a).

Reptiles

Based on the Reptile Map and iNaturalist (research grade identifications) database, 18 reptile species are expected to occur within the assessment area (Appendix D of the Terrestrial Biodiversity Assessment specialist report (TBC, 2022a)). Two species are regarded as threatened (Table 6-6).

Table 6-6: Threatened reptile species that are expected to occur within the assessment area of the proposed development. NT = Near Threatened and VU = Vulnerable (TBC, 2022a)

Family	Scientific Name	Common Name	Conservation Status	Likelihood of Occurrence
			Regional	
Chamaeleonidae	*Bradypodion nemorale*	Qudeni Dwarf Chameleon	NT	Low
Lamprophiidae	*Macrelaps microlepidotus*	Natal Black Snake	NT	Low

Two reptile species, representing two families were recorded within the assessment area during the survey periods (Table 6-7). This accounts for 11% of the total expected species. The lack of species richness was likely due to the combination of the inherent secretive nature of reptile species, and limited time available for fieldwork. The presence of suitable habitat suggests that the area supports a diverse reptile community (TBC, 2022a).

Table 6-7: Summary of reptile species recorded within the assessment area during the survey period. LC = Least Concern (TBC, 2022a)

Family	Scientific Name	Common Name	Conservation Status	
			Regional	Global
Agamidae	*Agama atra*	Southern Rock Agama	LC	LC
Lacertidae	*Pedioplanis lineoocellata*	Spotted Sand Lizard	LC	LC

Mammals

The IUCN Red List Spatial Data lists 26 indigenous mammal species that could be expected to occur within the assessment area (Appendix E of the Terrestrial Biodiversity Assessment specialist report (TBC, 2022a)). Four of these expected species are regarded as threatened (Table 6-8).

Table 6-8: Threatened mammal species that are expected to occur within the assessment area associated with the proposed project area. EN = Endangered, NT= Near Threatened, VU = Vulnerable and LC = Least Concern (TBC, 2022a)

Family	Scientific name	Common name	Conservation Status	Likelihood of occurrence
Felidae	*Panthera pardus*	Leopard	VU	Moderate
Muridae	*Parotomys littledalei*	Littledale's Whistling Rat	NT	Moderate
Mustelidae	*Aonyx capensis capensis*	Cape Clawless Otter	NT	Low
Mustelidae	*Hydrictis maculicollis*	Spotted-necked Otter	NT	Low

A total of one (1) mammal species were recorded within the assessment area during the survey period (Table 6-9), accounting for 4% of the expected mammal species. It is considered highly likely that additional mammal species would be recorded from the site with extensive sampling (TBC, 2022a).

Table 6-9: Mammal species recorded within the assessment area during the survey periods. NT = Near Threatened (TBC, 2022a)

Family	Scientific Name	Common Name	Conservation Status
			Regional
Bovidae	*Raphicerus campestris*	Steenbok	**LC**

6.10 Avifauna

An Avifaunal Impact Assessment were undertaken by a suitably qualified avifaunal specialist from The Biodiversity Company (Appendix H-2), to assess the impact of the proposed Kiwano Solar PV and BESS development on avifaunal distribution within the study area.

6.10.1 Desktop Assessment

Avifauna related features of the general area and habitat are provided in Table 6-10. This assessment is based on spatial data that are provided by various sources such as the provincial environmental authority and SANBI.

Table 6-10: Avifauna related features of the development site based on existing information and datasets (TBC, 2022c)

Desktop Information Considered	Relevance
Conservation Plan	The project area overlaps with areas classified as: CBA2, ESA and ONA.
Protected Areas: South African Protected Area Database (SAPAD) & South African Conservation Area Database (SACAD)	The project area is not located close to any protected areas

Desktop Information Considered	Relevance
Important Bird and Biodiversity Areas	The project area is over 20 km from the Augrabies National Park IBA
Coordinated Avifaunal Roadcount (CAR)	There are no CAR routes near to the project area
Coordinated Waterbird Count (CWAC)	There are no Coordinated Waterbird Count Areas near to the project area
Vegetation Type	The project area is situated in the Kalahari Karoid Shrubland and the Bushmanland Arid Grassland
Aquatic habitat	The study area is situated 2 km from the Orange River
REDZ Phase 1	The project area overlaps with the Upington Solar phase 1 REDZ zone.
South African Bird Atlas Project (SABAP) 2	132 Bird species have the potential to occur in the vicinity of the assessment area.
Renewable energy projects in the area (REEA)	There are several approved projects in the nearby vicinity

Based on the South African Bird Atlas Project, Version 2 (SABAP2) database, 132 bird species have the potential to occur in the vicinity of the assessment area. The full list of potential bird species is provided in Appendix B of the Avifauna Impact Assessment Report. The avifauna species list was compiled from all the pentads along the project area, i.e. 2830_2105, 2830_2100, 2825_2105 and 2825_2100 (TBC, 2022c).

Of the potential bird species, nine (9) species are listed as Species of Conservation Concern (SCC), either on a regional or global scale, see Table 6-11. The risks of collisions with powerlines, fences, electrocutions and habitat loss for the species of conservation concern is also indicated in Table 6-11. These risks are based on literature compiled by the Endangered Wildlife Trust (EWT) and Eskom on the association between birds and powerlines (Jenkins et al, 2017 and Birdlife, 2015, as cited in (TBC, 2022c).

Table 6-11: List of bird SCCs that are expected to occur in close vicinity to the assessment area and their risk rating (TBC, 2022c)

Scientific name	Common name	Conservation Status		Likelihood of Occurrence	Collisions	Electrocutions	Disturbance/ Habitat Loss
		Regional (SANBI, 2016)	IUCN (2021)				
Ardeotis kori	Kori Bustard	NT	NT	Confirmed	X		X
Ciconia abdimii	Abdim's Stork	NT	LC	Confirmed	X	X	X
Circus macrourus	Pallid Harrier	NT	NT	Moderate	X	X	
Eupodotis vigorsii	Karoo Korhaan	NT	LC	High	X	X	X
Falco biarmicus	Lanner Falcon	VU	LC	Confirmed			X
Gyps africanus	White-backed Vulture	CR	CR	Low	X	X	X
Neotis ludwigii	Ludwig's Bustard	EN	EN	High	X		X
Polemaetus bellicosus	Martial Eagle	EN	EN	Moderate	X	X	X
Sagittarius serpentarius	Secretarybird	VU	EN	Confirmed	X		X

Descriptions of the 9 SCCs as provided in TBC (2022c) are summarised below:

- ***Ardeotis kori* (Kori Bustard)** is listed as Near Threatened (NT) both on a regional and global scale. It occurs in flat, arid, mostly open country such as grassland, karoo, bushveld, thornveld, scrubland and savanna but also including modified habitats such as wheat fields and firebreaks. Collisions with high voltage powerlines are a major threat to this species in the Karoo of South Africa (IUCN, 2007, as cited in TBC, 2022c). The habitat at the project area is highly suitable for this species, therefore the likelihood of occurrence is rated as definite, as it has been recorded there.

- ***Ciconia abdimii* (Abdim's Stork)** is listed as NT on a local scale. It is a migratory bird that breeds from Senegal east across the Sahel to Ethiopia and Somalia and winters in southern Africa. It is gregarious and can usually be seen in flocks of hundreds. Birds gather beside water and roosts at night in large usually dead trees. These birds forage in irrigated lands, pastures and recently ploughed fields. Habitat includes grasslands, savanna woodland, pan edges, pastures, cultivated land and suburban areas. Can occur in semi desert areas including the Kalahari during migrations. This species has been recorded from the cultivated areas close to the Orange River, which lies to the southeast of the project area. This species is highly likely to fly over the project area.

- ***Circus macrourus* (Pallid Harrier)** is listed as NT both regionally and globally. This is a migratory species with non-breeding grounds in Southern Africa, where it is uncommon to rare. It occurs in grasslands associated with open pans or floodplains as well as croplands. This bird occurs singly or in dispersed groups and roosts in rank grass, and rarely perches in trees. The habitat for this bird is present in the cultivated lands near to the project area and its likelihood of occurrence is considered moderate.

- ***Eupodotis vigorsii* (Karoo Korhaan)** is listed as NT on a regional scale. This species prefers dwarf arid shrubland of the Nama Karoo and succulent Karoo, especially with stony ground, while in the Western Cape it also occurs in cultivated land. The habitat at the project area is highly suitable for this species, therefore the likelihood of occurrence is rated as high.

- ***Falco biarmicus* (Lanner Falcon)** is native to South Africa and inhabits a wide variety of habitats, from lowland deserts to forested mountains (IUCN, 2017, as cited in TBC, 2022c). They may occur in groups up to 20 individuals but have also been observed solitary. Their diet is mainly composed of small birds such as pigeons and francolins. This species has been recorded from the project area.

- ***Gyps africanus* (White-backed Vulture)** is listed as Critically Endangered (CR) both regionally and globally. It occurs in Africa south of the Sahel and is widespread in southern Africa. This is a resident bird with long distance movement and occurs in lightly wooded arid savanna including Mopane woodland and does not occur in forests, true deserts and usually absent within the karoo. This species roosts at night usually in tall acacias as well as on power pylons. It is a scavenger generally feeding on large carcasses. There is a lack of habitat and appropriate roosting areas in the project area, thus the likelihood of occurrence is low.

- ***Neotis ludwigii* (Ludwig's Bustard)** is listed as Endangered (EN) both locally and internationally. This species is found in the desert, grassland and shrubland specifically in rocky areas such as mountains and cliffs. The main reason for the decline in the numbers are ascribed to the collisions with powerlines. The habitat is highly suitable for this species, thus a high likelihood of occurrence of high was assigned to it.

- ***Polemaetus bellicosus* (Martial Eagle)** is listed as EN on a regional scale and on a global scale. This species has an extensive range across much of sub-Saharan Africa, but populations are declining due to deliberate and incidental poisoning, habitat loss, reduction in available prey, pollution and collisions with powerlines (IUCN, 2017, as cited in TBC, 2022c). It inhabits open woodland, wooded savanna, bushy grassland, thorn-bush and, in southern Africa, more open country and even sub-desert (IUCN, 2017, as cited in TBC, 2022c). With the presence of good habitat this species has a moderate likelihood of occurrence.

- ***Sagittarius serpentarius* (Secretary bird)** occurs in sub-Saharan Africa and inhabits grasslands, open plains, and lightly wooded savanna. It is also found in agricultural areas and sub-desert (IUCN, 2017, as cited in TBC, 2022c). This species has been recorded from the project area.

A number of avifauna studies undertaken in the broader area yielded the following results as summarised in the Avifauna Impact Assessment (TBC, 2022c):

- Todd (2019) recorded a total of 68 avifaunal species in the Project Area of Influence for the McTaggarts Solar facility. Two SCC were recorded and included Kori Bustard (*Ardeotis kori*) and Karoo Korhaan (*Eupodotis vigorsii*) (Todd 2019). Todd (2019) observed no sensitive breeding or roosting sites of any SCC within the PAOI but did mention that it is likely that Secretary birds would be nesting there.

- Van Heerden (2020) recorded 57 species at the Khi One Solar Concentration Facility (CSP) next to the Kiwano study site. Only one SCC, the Lanner Falcon (*Falco biamus*), were recorded in the area, while the author noted that larger-bodied species such as Korhaans were absent from the solar facility footprint.

  Van Heerden (2020) recorded Todd (2019) identified the Karoo Korhaan and Kori Bustard to be the most likely species to be impacted by the McTaggarts solar facility due to habitat loss and displacement. Van Heerden (2020) discovered that there are higher species diversity, abundance and density per unit area in untransformed habitat than there are in solar facilities (in this case the Khi One CSP).

In addition, breeding does not occur within solar facilities but rather in the surrounding untransformed landscape (van Heerden 2020). Van Heerden (2020) further observed that 34 species tend to collide with solar infrastructure of the Khi One CSP facility primarily due to reflective infrastructure and include in the majority Red-billed Quelea (*Qulea quela*), Lark-like bunting (*Emberiza impetuani*), White-rumped Swift (*Apus caffer*) and Red-headed Finch (*Amadina erythrocephala*) (van Heerden 2020). Two SCC were found to have collided with the infrastructure of Khi One CSP, namely the Lanner Falcon (*Falco biarmicus*) and the Great White Pelican (*Pelecanus onocrotalus*) (van Heerden 2020).

Van Heerden (2020) located four Sociable Weaver's (Philetarius socius) nests and one Northern Black Korhaan (Afrotis afraoides) nest in the undeveloped areas outside the Khi One CSP. Species recorded breeding within the Khi One solar energy site included Namaqua Sandgrouse (*Pterocles namaqua*), Laughing Dove (*Streptopelia senegalensis*), Ashy Tit (*Parus cinerascens*), Namaqua Dove (*Oena capensis*) and Southern (Common) Fiscal (*Lanius collaris*) (van Heerden 2020).

Impacts associated with the Khi One CSP include that shrubland/woodland species are the most affected as they appear in reduced numbers within the facility in comparison to in untransformed habitat surrounding the facility (van Heerden 2020). Van Heerden (2020) also shows that breeding is affected by the CSP with breeding in the transformed habitat; lower than that in the untransformed habitat.

- Van Rooyan and Froneman (2013) identifying Ludwig's Bustard (*Neotis ludwigii*) and Kori Bustard as the species with the highest collision risk for the area. Van Rooyan and Froneman (2013) indicate that no SCCs are considered likely to be displaced in the general area but that disturbance would be an impact on breeding avifauna.

- Botha (2020) indicates that no major impacts will occur to avifauna of the Siruis solar development planned for the region, with a sensitivity of Medium, no habitats of sensitivity were found within the Sirius PAOI.

6.10.2 Field Assessment

The fieldwork component of the assessment comprised of a summer (wet season) survey conducted from the 15th to the 18th of March 2022 and a winter (dry season) survey conducted from 15th to the 18th of August 2022. Findings of the wet and dry season surveys are summarised below:

<u>Wet season</u>

Ninety-eight (98) bird species were recorded in and around the project area in the wet season. Three of the species recorded were SCCs. These included the Red-footed Falcon (*Falco vespertinus*), Abdim's Stork (*Ciconia abdimii*), and Lanner Falcon (*Falco biarmicus*). All these species are sensitive to collisions, electrocutions or habitat disturbance. The Abdim's Stork (*Ciconia abdimii*), Wattled Starling (*Creatophora cinerea*) and Red-billed Quelea (*Quelea quelea*), were the most abundant species during the wet season survey (TBC, 2022c).

When trophic guilds were assessed, the avifauna were divided into 13 major groups based on their diet, habitat, and main area of activity. The analysis of the major avifaunal guilds reveals that the species composition during the survey was dominated by insectivores and granivores, followed by omnivores. The feeding groups is a healthy mix of species and illustrates the undisturbed nature of the assessment area (TBC, 2022c).

Dry season

Forty-three (43) bird species were recorded in and around the project area in the dry season survey. In total, 105 species were recorded from the study area and surrounds. Two of the species recorded were SCCs, namely Secretarybird (*Sagittarius serpentarius*) and Kori Bustard (*Ardeotis kori*). All these species are sensitive to collisions, electrocutions or habitat disturbance. The data shows that the Fawn-coloured Lark (*Calendulauda africanoides*), Red-billed Quelea (Quelea quelea) and the Northern Black Korhaan (*Afrotis afraoides*) were the most abundant avifauna species in the dry season survey.

When trophic guilds were assessed, the avifauna were divided into 13 major groups based on their diet, habitat, and main area of activity. The analysis of the major avifaunal guilds reveals that the species composition during the survey was dominated by insectivores and granivores, followed by omnivores. The feeding groups is a healthy mix of species and illustrates the undisturbed nature of the assessment area (TBC, 2022c).

6.10.3 SCCs observed during both wet and dry season

Five SCCs were observed during both assessments. The SCCs confirmed were Lanner Falcon, Red-footed Falcon, Abdim's Stork, Secretarybird and Kori Bustard. Based on the nesting behaviour and the habitat type in the assessment area, it can be said that two of the five SCCs are permanent residents in the assessment area (TBC, 2022c).

6.10.4 Risk Species

Avifauna species that would be regarded as high-risk species found during the wet and dry season surveys are listed in Table 6-12. Risk species are species that would be sensitive to habitat loss, that are regarded as collision prone species and species that would have a high electrocution risk. These could be species that are not necessarily SCC but would be impacted on by this development. Even though the panels do not pose an extensive collision risk for larger birds, powerlines associated with the infrastructure, guidelines (anchor lines) and connection lines do pose a risk. The fence could also pose a collision risk for various species (TBC, 2022c).

Table 6-12: At risk avifauna species found in the wet and dry season surveys (TBC, 2022c)

Common name	Scientific name	Collisions	Electrocution	Disturbance / habitat loss
African Fish Eagle	*Haliaeetus vocifer*	X	X	
African Sacred Ibis	*Threskiornis aethiopicus*	X	X	
Amur Falcon	*Falco amurensis*	X		
Black-chested Snake Eagle	*Circaetus pectoralis*	X		
Black-winged kite	*Elanus caeruleus*	X		
Egyptian Goose	*Alopochen aegyptiaca*	X	X	
Grey Heron	*Ardea cinerea*		X	
Hadeda (Hadada) Ibis	*Bostrychia hagedash*		X	
Helmeted Guineafowl	*Numida meleagris*	X	X	
Kori Bustard	*Ardeotis kori*	X		
Lanner Falcon	*Falco biarmicus*	X		X
Northern Black Korhaan	*Afrotis afraoides*	X		
Pale Chanting Goshawk	*Melierax canorus*	X	X	
Pied Crow	*Corvus albus*		X	
Red-footed Falcon	*Falco vespertinus*	X		
Secretary bird	*Sagittarius serpentarius*	X	X	X
South African Shelduck	*Tadorna cana*	X		
Yellow-billed Duck	*Anas undulata*	X		

6.10.5 Flight and Nest Analysis

Nesting sites were located for only one species, the Sociable Weaver (*Philetairus socius*) with 12 nests within the PAOI (see Figure 6-20 and Figure 6-21) with no nests of SCC observed. The nests of the Sociable Weaver may also host the Pygmy Falcon (*Polihierax semitorquatus*). The low number of species recorded nesting within the PAOI should be interpreted with caution because the survey was undertaken using point surveys, and the full assessment area was not covered. It is postulated that more species are likely to be nesting if an assessment of the full PAOI is done (walked over). This is especially considering the presence of scattered trees which may be favoured by Secretary birds (*Sagittarius. serpentarius*) for nesting sites.

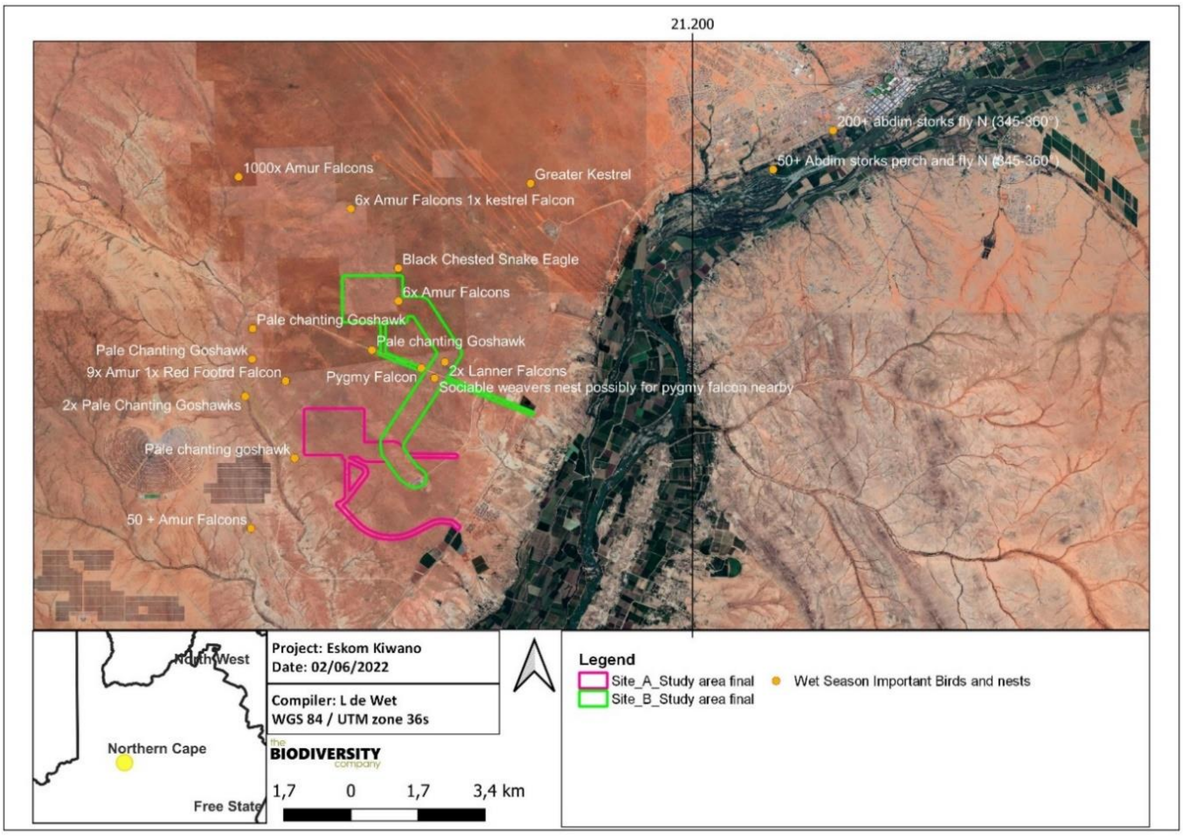

Figure 6-20: Locations of the risk species and nesting sites recorded: wet season (TBC, 2022c)

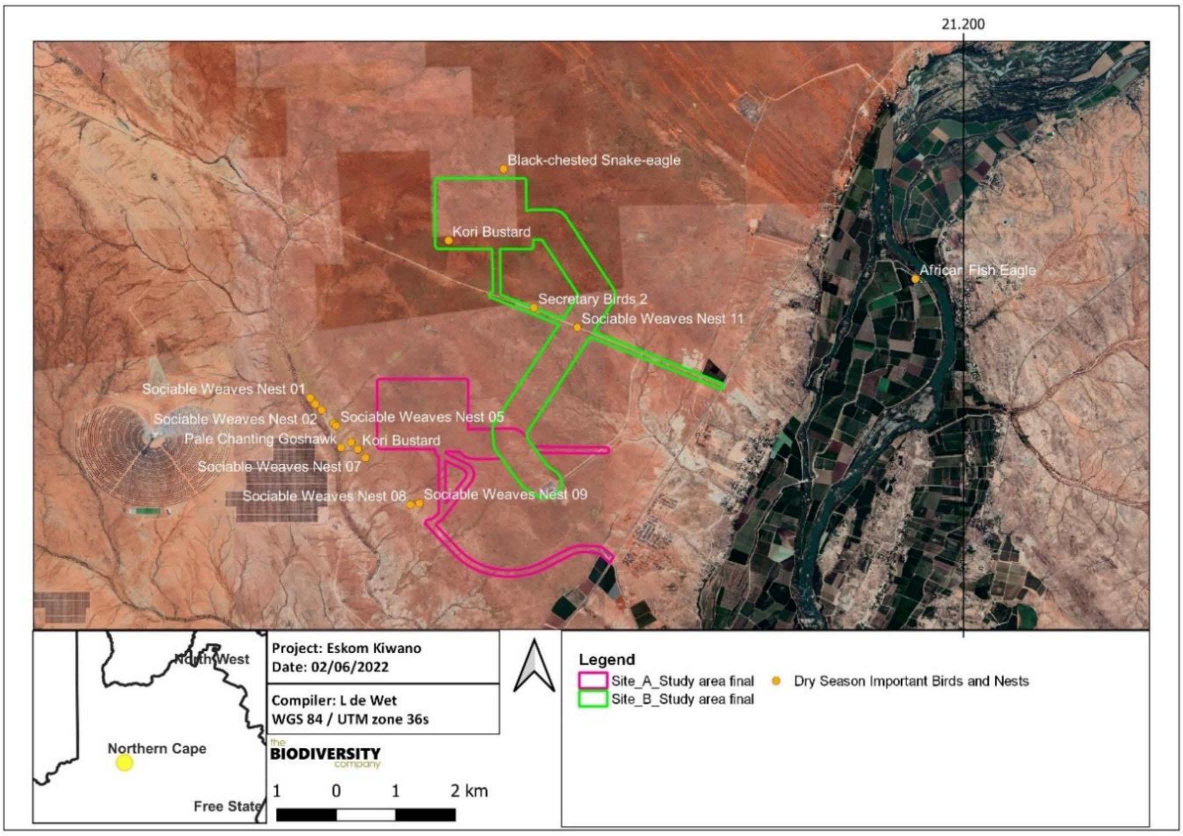

Figure 6-21: Locations of the risk species and nesting sites recorded: dry season (TBC, 2022c)

6.11 Heritage, Archaeology and Palaeontology

A Heritage and Archaeological Assessment was undertaken by a suitably qualified archaeologist from Beyond Heritage (refer to Appendix H-4), to assess the impact of the proposed Kiwano Solar PV and BESS development on archaeological resources. A Palaeontological Assessment was undertaken by a Palaeontologist, Prof. Marion Bamford to assess the impact of the proposed development on palaeontological resources (refer to Appendix H-4).

6.11.1 Heritage and Archaeology

Several previous heritage studies were conducted in the general study area (SAHRIS) mostly to the west and northwest of the study area (e.g., Beaumont 2005 & 2008, Dreyer 2006, Van Ryneveld 2007a & 2007b, Van Schalkwyk 2011, Gaigher 2012, Morris 2012, Fourie 2014, van der Walt 2015, 2019 a and b, as cited in Beyond Heritage, 2022), see Figure 6-22. These studies identified Early, Middle and Later Stone Age assemblages as well as historical structures and artefacts. None of these sites are located within the current areas being assessed (Beyond Heritage, 2022).

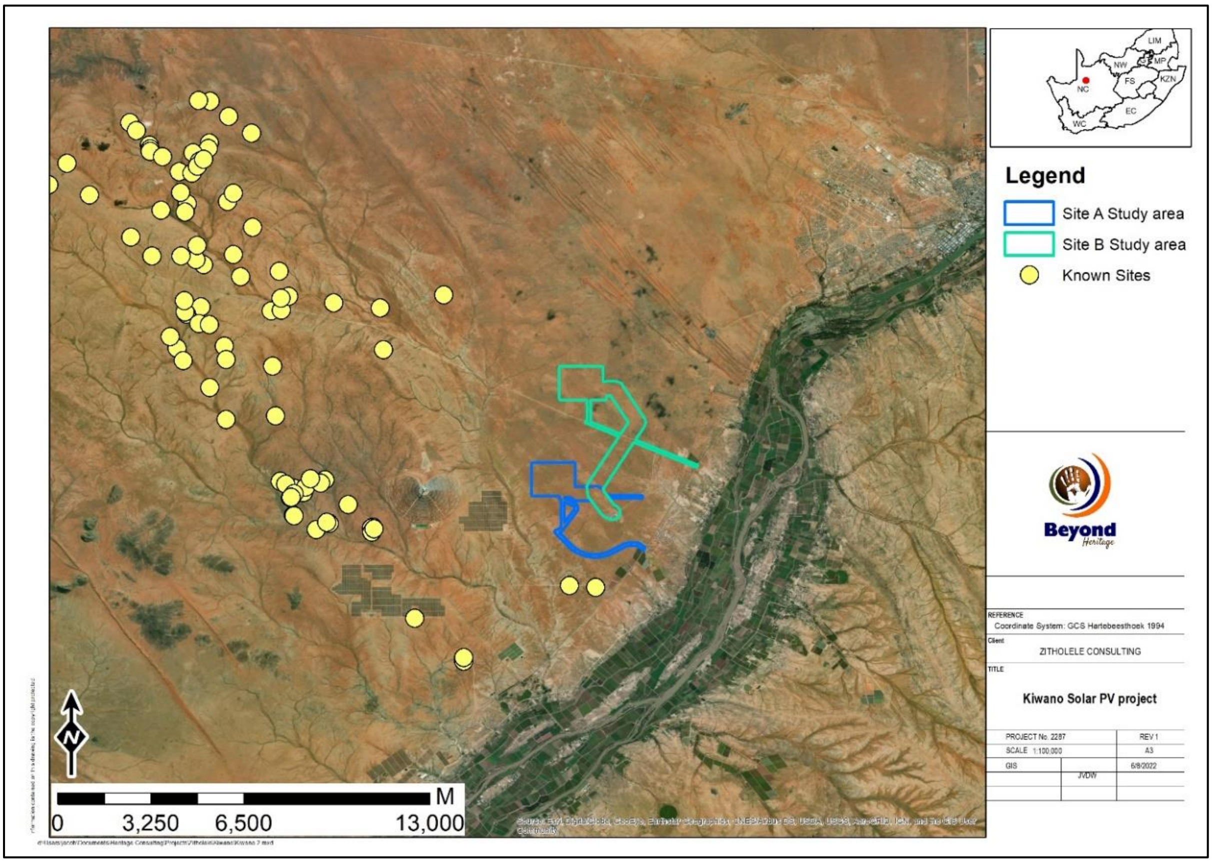

Figure 6-22: Known heritage sites in relation to the study area (Beyond Heritage, 2022)

A survey the proposed project area was undertaken on 15 and 16 March and 10 May 2022 to locate, identify, record, photograph and describe sites of archaeological, historical or cultural interest. The tracklog of the survey undertaken on foot are shown in Figure 6-23. GPS points were recorded of sites or areas identified as significant areas. Lastly, the levels of significance of the various types of heritage resources recorded in the project area were determined.

Key findings of the assessment include the following:

Widespread occurrences of Stone Age scatters were recorded in the wider area (Beaumont 2005 & 2008, Dreyer 2006, Van Ryneveld 2007a & 2007b, Van Schalkwyk 2011, Gaigher 2012, Morris 2012, Fourie 2014, van der Walt 2015, 2019 a and b). These artefacts are referred to as background scatter (Orton 2016) and generally of low heritage significance. The current study similarly recorded isolated Stone Age artefacts within the alternative development sites (Site A: Figure 6-24 and Site B: Figure 6-25) as well as a possible grave that is located outside of the development footprint (Beyond Heritage, 2022).

The recorded archaeological features in the proposed development area are summarised in Table 6-13.

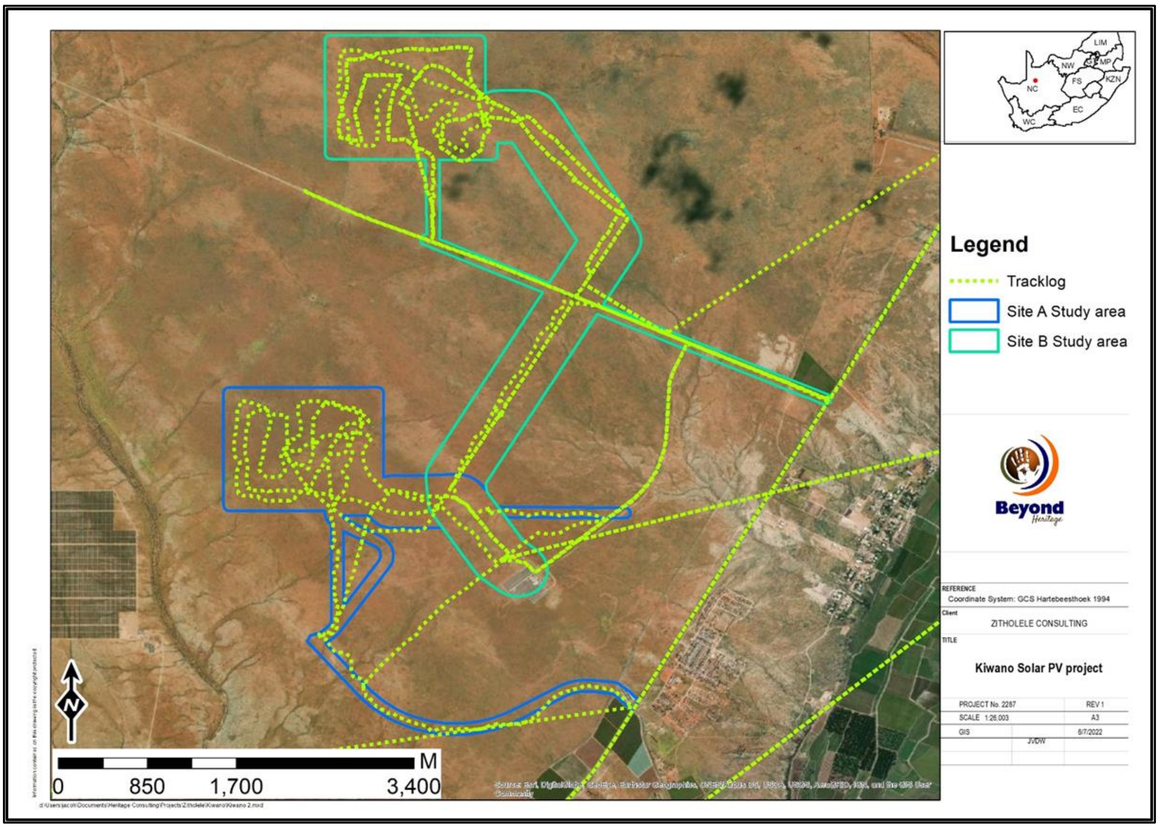

Figure 6-23: Tracklog of the survey path (in green) across the proposed development sites (Beyond Heritage, 2022)

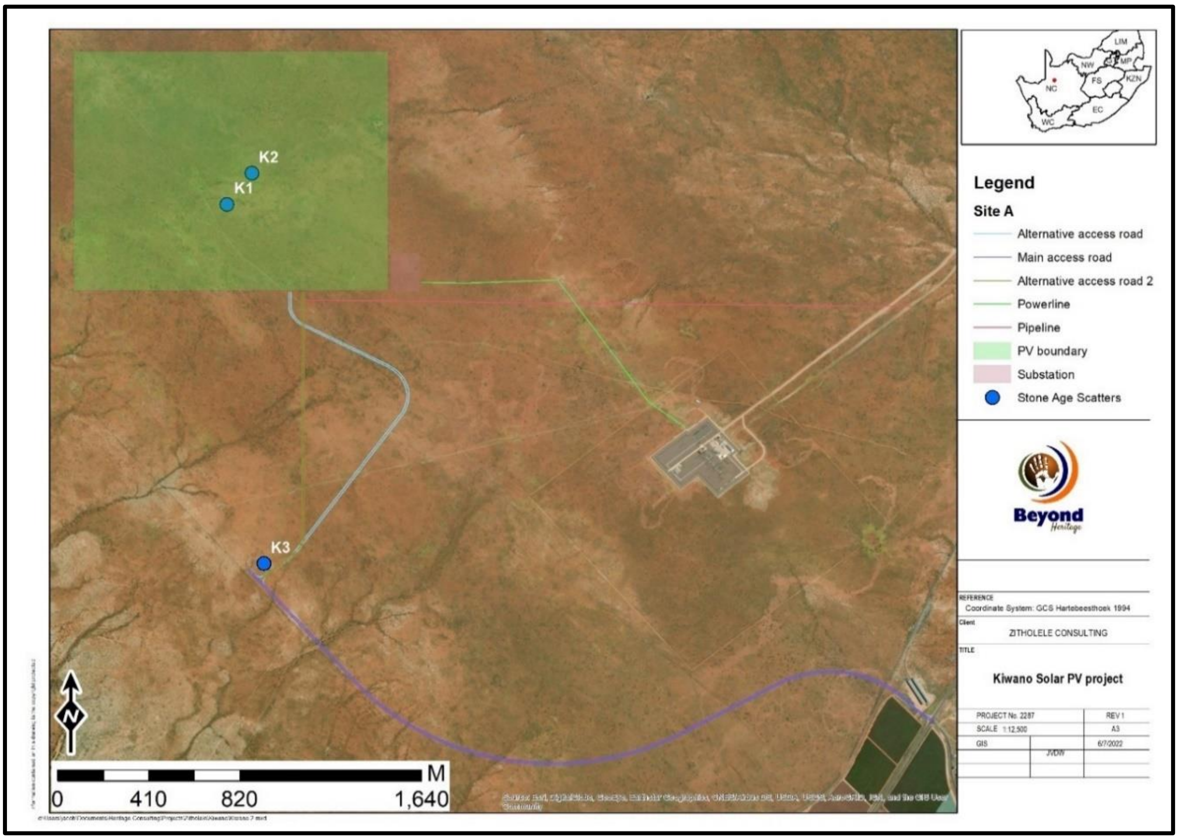

Figure 6-24: Recorded heritage and archaeological features in relation to Site A (Beyond Heritage, 2022)

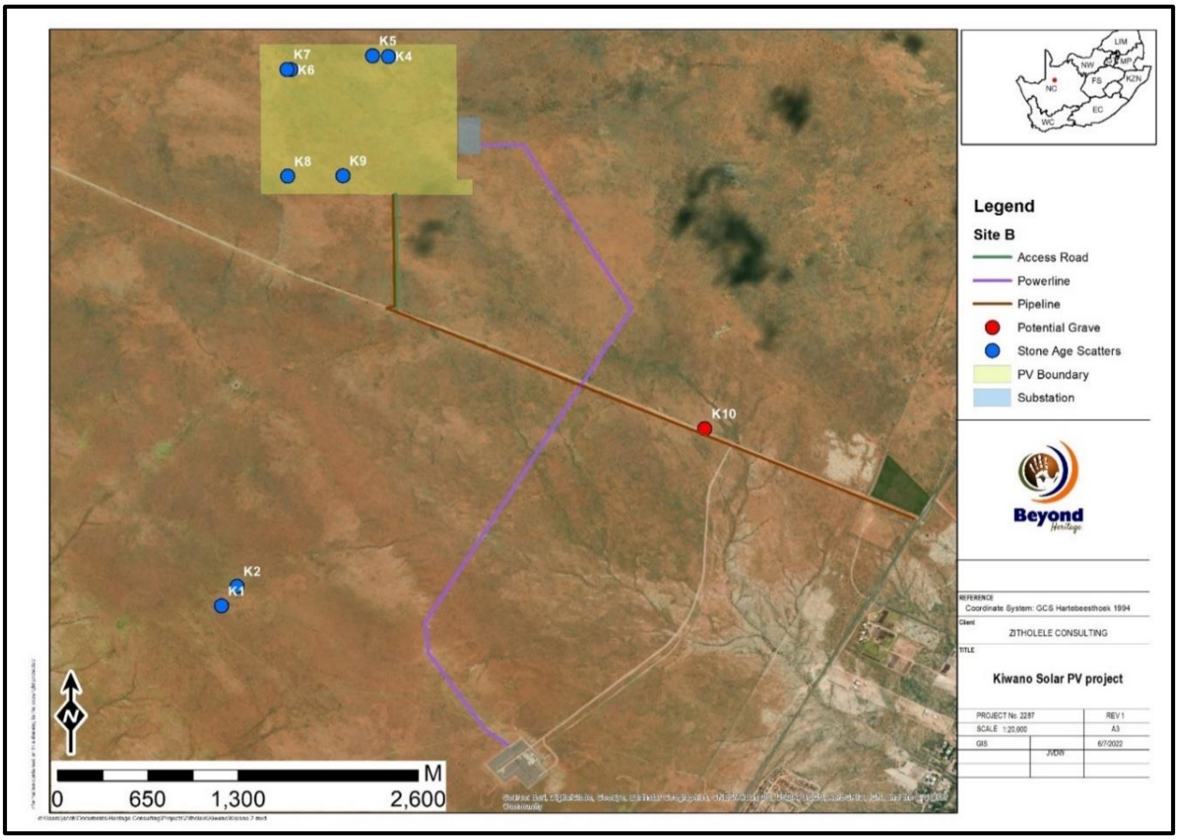

Figure 6-25: Recorded heritage and archaeological features in relation to Site B (Beyond Heritage, 2022)

Table 6-13: Recorded archaeological features in the proposed development area (Beyond Heritage, 2022)

Label	Longitude	Latitude	Description	Field rating and heritage significance
K1	21°07'05.5200" E	28°32'05.8595" S	Broken MSA flake on banded ironstone	GP C Low Significance
K2	21°07'09.1525" E	28°32'01.3055" S	Broken MSA flake on quartzite	GP C Low Significance
K3	21°07'10.8948" E	28°32'58.3333" S	Calcrete exposure with MSA flakes outside of impact area	GP C Low Significance
K4	21°07'44.4972" E	28°29'57.4188" S	Calcrete with miscellaneous flake and a end scraper.	GP C Low Significance
K5	21°07'40.8361" E	28°29'57.2676" S	Multidirectional core	GP C Low Significance
K6	21°07'21.7164" E	28°30'00.4537" S	MSA point, broken flake and chunk on top of calcrete	GP C Low Significance
K7	21°07'20.8199" E	28°30'00.4824" S	Broken flakes with dorsal removals	GP C Low Significance
K8	21°07'20.9928" E	28°30'25.4087" S	Irregular core	GP C Low Significance
K9	21°07'33.8880" E	28°30'25.3009" S	Miscellaneous flakes on Banded Iron Stone	GP C Low Significance
K10	21° 08' 58.4485" E	28° 31' 24.4451" S	Possible grave marked by a oval cairn of river pebbles, measuring ~ 1.3 meters in diameter	GP A High Social significance

6.11.2 Palaeontology

The proposed development site lies on volcanic and metamorphic rocks of the Kakamas Terrane, Namaqua-Natal Province that are dated between 1200 to 1000 Ma. This predates any body fossils, and because of their volcanic origin, they do not preserve any fossils. There are only small outcrops of the rocks in the area but not in the project footprint. Nonetheless, they would not preserve fossils.

The aeolian sands of the Gordonia Formation do not preserve fossils because they have been transported and reworked. Such environments as loose sands are not conducive to reservation because the oxygen enables fungi and invertebrates to breakdown organic matter (Cowan, 1995, as cited in Bamford, 2022). However, in some regions the sands may have covered palaeo-pan or palaeo-spring deposits and these can trap fossils, and more frequently archaeological artefacts (Goudie and Wells, 1995, as cited in Bamford, 2022). Usually these geomorphological features can be detected using satellite imagery. No such features are visible (Bamford, 2022).

According to the SAHRA Paleontological sensitivity map the study area is of moderate paleontological significance, and this was addressed in an independent study by Bamford (2022).

6.12 Visual Impact Assessment

A Visual Impact Assessment were undertaken by a recognized visual specialist, GeoNest GIS and Environmental Advisory (Geonest, 2022), to support the application for the proposed Kiwano Solar PV and BESS development on the receiving environment (refer to Appendix H-5).

A VIA is a technical evaluation of the potential impacts of a development on the visual amenity value of a landscape or place. It has the potential to be subjective given that an appreciation of landscape views, sense of place and cultural and personal associations with landscapes and their features are all aspects that people will often view differently.

A landscape is made of a wide variety of aspects comprising components associated essentially with the relationship between people and place (Swanwick, 2002, as cited in Geonest, 2022). These components are all interlinked and combine to form a person's perception of a landscape.

A baseline assessment of the visual character of the development site and surrounding areas was undertaken based on available visual and GIS data from a national, regional and local context as well as observations made during a site assessment undertaken during the visual study. The baseline assessment of the visual character of the development site and surrounding areas context is provided in the following sections.

6.12.1 Site landscape topography

The topography of the site is characterised by a dramatic lack of relief (Figure 6-26). It is a very flat landscape with very slight undulations manifesting over vast distances with a general sloping from elevated ground in the north-west, towards the lower lying Orange River. Distant isolated relief features are visible on the horizon towards the north-east and to the west of the proposed sites. This landscape form represents a potentially vulnerable area from a visual impact perspective (Geonest, 2022).

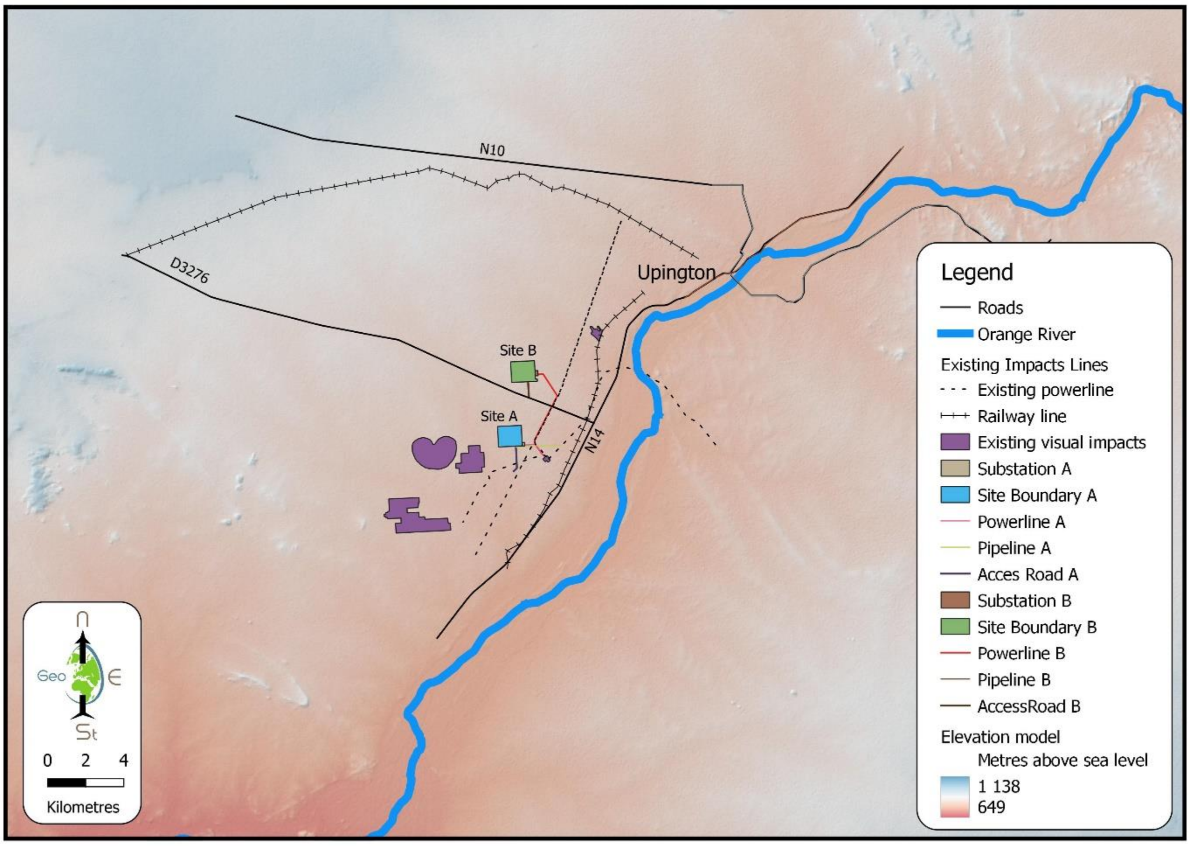

Figure 6-26: Topographical map of the study area (Geonest, 2022)

An almost imperceptible ridge / watershed runs in a north-east to south-west direction immediately to the east of the two proposed sites. The existing powerlines run along this ridge and serve as a landmark for this feature in the landscape. This ridge is actually one of the most important land forms with respect to mitigating the visual impacts associated with this development and is discussed in more detail later in this report (Geonest, 2022).

6.12.2 Land cover, vegetation and land use

The local landscape into which the proposed development will be placed is undeveloped and vegetation of the site is characterised by low grassland interspersed with shrubs. This has historically been used predominantly for livestock farming. Along the N14 road and down onto the banks of the Orange River, the cultivation of grapes and other crops dominates the land use. This area is a far busier landscape than the grassland to the north and west with settlements, various buildings and other farming related infrastructure present and generating a sense of rural business.

In addition to this, a number of linear features fragment the landscape including fences, roads (N4 and D3276), powerlines and railway lines. Importantly, to the south-west of the sites, there are a number of renewable energy facilities including two PV farms and the Khi Solar One Concentrating Solar Power (CSP) facility. Between Site B and Upington is a landfill site which itself is not visible from the N14 (Geonest, 2022).

6.12.3 Landscape character units

Given the lack of relief, there are few natural divisions in the landscape. Land use has however dramatically divided the landscape into a number of distinct landscape character units (LCUs), as can be seen in Figure 6-27.

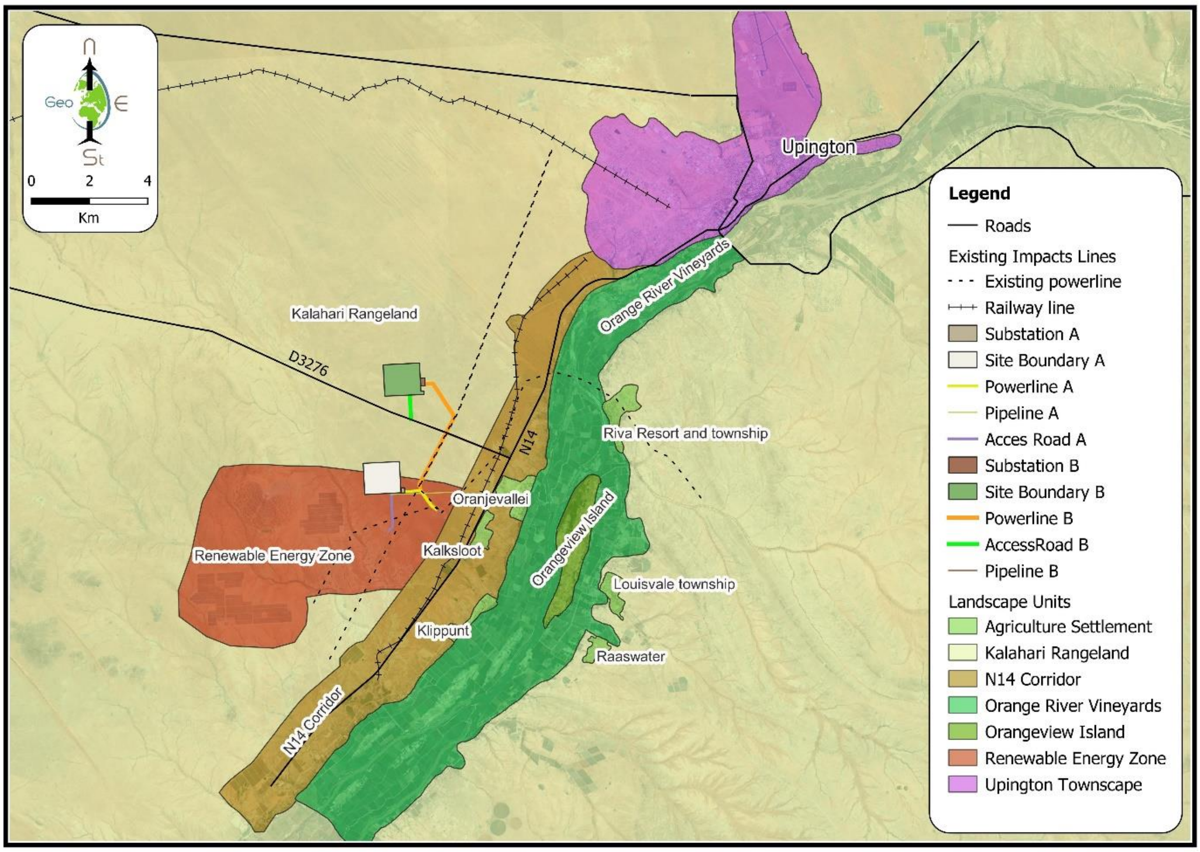

Figure 6-27: Landscape Character Units delineated for the study area (Geonest, 2022)

The LCUs delineated by the visual specialist (Geonest, 2022) include:

- **The Upington Townscape:** A busy urban environment with residential, commercial and industrial buildings and activity. Busy roads and railways add to the noise and movement and sense of business.
- **The Orange River Vineyards:** A restful agricultural scene dominated by deep to light green patchwork of irrigated grape vineyards of a largely single texture providing a stark colour contrast to the dry grassland areas lying outside of the flood plain.
- **The N14 Corridor:** A busy rural, agricultural and peri-urban mix of activities dominated by the busy N14 road. It is flanked by railway and power lines and includes the Upington landfill site. The landscape is punctuated by small agricultural townships such as Oranjevallei and Kalksloot. Whilst these have been delineated separately to assist with identifying vulnerable receptors, because of their scale, and because of the number of activities and buildings in the N14 mixed activity unit, they should be considered together with the N14 as a single LCU. This mix provides a high level of contrast in both form, colour and level of activity.

- **The Renewable Energy Zone:** Set in the flat and exposed Kalahari rangelands, a cluster of existing renewable energy infrastructure defines a small area of unique character. This includes the imposing Khi Solar One CSP, two photovoltaic facilities and a large substation. It also includes the access routes to these facilities which are clearly signposted on the N14.
- **The Kalahari Rangelands:** The vast, flat and monotonously coloured Kalahari Rangelands surround all other units. The distinct lack of contrast and relief give the impression of expansive skies and very distant horizons. The lack of movement and sound ensures the observer experiences a sense of quiet and lonely wilderness. This sense is lessened somewhat as the observer approaches the N14 Corridor.

6.12.4 Sensitive Views and Receptors

A number of potentially sensitive views and view receptors have been identified. These are largely grouped per LCU and discussed in detail in the Visual Impact Assessment report (Geonest, 2022). These include:

- Local residents and businesses
- Road users on the N14
- Road users on the D3276
- Residents and businesses on the south bank of the river

6.12.5 Value of landscape views in the region

There are presently no known cultural associations with the landscapes within a 5km buffer of the proposed sites. Whilst some features of low to moderate historical significance have been recovered on site (see the cultural heritage specialist report), these are relatively commonly encountered, and there are no living population groups associated with these features. Cultural values and perceptions of these landscapes are thus considered of low significance (Geonest, 2022).

Tourism, however, is an important part of the local economy. Tourism in Upington and surrounds is focused primarily on the wine estates and other related agricultural activity located in the Orange River Vineyards, Agricultural Townships and the N14 Corridor. The Orange River itself is also an important tourist attraction with several resorts located on the banks of the river. This form of tourism is largely focused inward towards the river and its viticultural landscape and has little association with the LCUs lying outside of the immediate Orange River valley. The area is also an important route for tourists passing through to Augrabies Falls and other tourist destinations along the Orange River (along the N14) and the Kalaghadi Transfrontier Park (along the N10). This group of tourists are likely to be more outward looking, with a greater appreciation for the expansive Kalahari landscapes (Geonest, 2022).

6.12.6 Landscape exposure / enclosure

The Kalahari Rangelands consists of an expansive flat landscape. The vast majority of the area is very exposed and enclosure potential is thus very low i.e., there is very little opportunity for mitigating visual impacts through siting developments within enclosed valleys. The exception is the very shallow valley running from the north of the site to the south in which both alternative sites are located. This valley, and its south-eastern edge is effective in ensuring views of the low profiled PV installation at either site will be limited largely to unpopulated areas and areas that have been identified as being of low sensitivity from a visual receptor perspective (Geonest, 2022).

6.12.7 Visual absorption capacity

The visual absorption capacity of the Kalahari Rangelands is considered low. The extremely flat landscape with very low vegetation and its limited colour palette provides little natural visual contrast. The lack of relief also however means that there is a lack of elevated observation points and as such the landscape is almost always viewed at a very oblique angle, exaggerating its flat and linear nature. This is important in the context of this assessment as the visual profile of a PV installation is very flat and linear. This fits within the very flat and linear landscape and allows the landscape to better absorb visual intrusion of this nature, particularly when viewed from a distance.

6.12.8 Existing impacts

There are a number of existing visual impacts in the study area that are important to consider. The most important of these is the existing Khi Solar One CSP (Figure 6-28). This structure is over 200m high and when the sun is reflecting off the heliostats onto the tower, it glows like an incandescent light bulb. This structure then catches the eye and dominates views from great distances (Geonest, 2022).

Other electricity related infrastructure is also present in the landscape and represents existing visual impact. This includes two other PV farms, a number of powerlines and a large substation. A noticeable feature of all of these facilities is the lack of noise or movement at these sites. In addition to electrical infrastructure, a railway line passes through the area and the municipal landfill site is located within 5km of Site B.

Figure 6-28: The Khi Solar One solar CSP facility dominates views and sense of place from a great distance (Geonest, 2022)

6.13 Socio-Economic Environment

A Socio-Economic Assessment were undertaken by a suitably qualified social specialist from Solarys (Solarys, 2022), to assess the impact of the proposed Kiwano Solar PV and BESS development on the receiving socio-economic environment (refer to Appendix H-6). A Socio-Economic Baseline Assessment was undertaken based on available socio-economic data from a national, regional and local context. The socio-economic baseline context is provided in the following sections.

6.13.1 Population, race and gender profile

Demographic information in this section was sourced from Statistics South Africa (Stats SA) Local Municipality Population Estimates 2002 – 3030 (MYPE 2021). Table 5 provides an overview of key demographic indicators for ZF Mgcawu District, DKLM and KGLM. The data is based on estimates for 2016 and 2021.

Table 6-14: Key demographic indicators for ZF Mgcawu District and DKLM

Indicator	ZF Mgcawu		DKLM		KGLM	
	2016	2021	2016	2021	2016	2021
Total population	262 067	283 313	109697	118259	74710	80981
% population increase	8.11		7.8		8.39	
% of population below the age of 15	27.16	26.42	29.08	28.53	22.24	20.96
% of population between 15 and 64	66.96	67.18	64.31	64.15	72.29	73.37
% of population aged 65+	5.88	6.39	6.61	7.31	5.48	5.67
Dependency ratio	49.34	48.84	55.50	55.88	38.34	36.29
Child dependency ratio	*40.55*	*39.33*	*45.22*	*44.48*	*30.76*	*28.56*
Old age dependency ratio	*8.78*	*9.52*	*10.28*	*11.40*	*7.58*	*7.73*
% of population male / female	49.97 / 50.03	50.06 / 49.94	48.51/ 51.49	48.34/ 51.66	51.50/ 48.50	52.00/ 48.00

The estimated total population of ZF Mgcawu, DKLM and KGLM increased between 7.8 and 8.39 % between 2016 and 2021, as is evident from Table 6-14. The ratio of males versus females remained largely the same over the 2016 to 2021 period for ZF Mgcawu, DKLM and KGLM (Solarys, 2022).

In all three municipalities there was an increase in the old age dependency ratio and a decrease in the child dependency ratio. In DKLM, the old age dependency ration increased by 1.12%. This trend could be attributed to declining fertility rates and increased life expectancy as a result of improved access to anti-retroviral (ARV) treatment which has enabled HIV positive people to live longer. The overall total dependency ratios for ZF Mgcawu District and KGLM has decreased slightly which represents a positive socio-economic trend in the district. The converse is however apparent in DKLM, which had a slight overall increase, suggesting that the number of elderly people that depend on the working age population (aged between 15 and 64) is increasing (Solarys, 2022).

Figure 6-29 provides an overview of the race composition of the Northern Cape Province, ZF Mgcawu District, DKLM and KGLM as recorded in the Stats SA Community Survey 2016. While the predominant race group in ZF Mgcawu, DKLM and ZF Mgcawu District is Coloured, followed by Black African, the Northern Cape Province by contrast has an almost equal percentage of Black African and Coloured people that comprise the total population. Whites comprise a higher percentage of the population in DKLM than in KGLM (11% and 6.74% respectively) (Solarys, 2022).

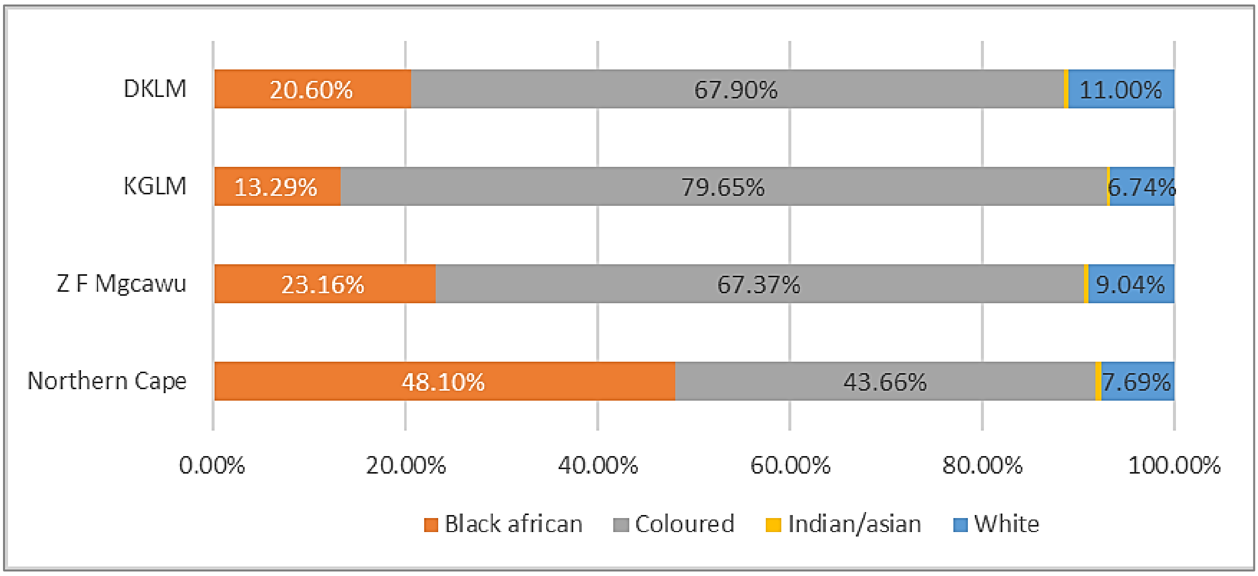

Figure 6-29: Population groups with the NC, ZF Mgcawu DM, KGLM and DKLM (Solarys, 2022)

According to the Stats SA Community Survey 2016, the dominant language in both DKLM and KGLM is Afrikaans (89.54% and 88.61% respectively). Other languages most spoken in households include IsiXhosa (3.39% of DKLM households) and Setswana (6.62% of KGLM and 2.33% of DKLM households). English is spoken by only 1.5% and 0.79% of DKLM and KGLM households respectively (Solarys, 2022).

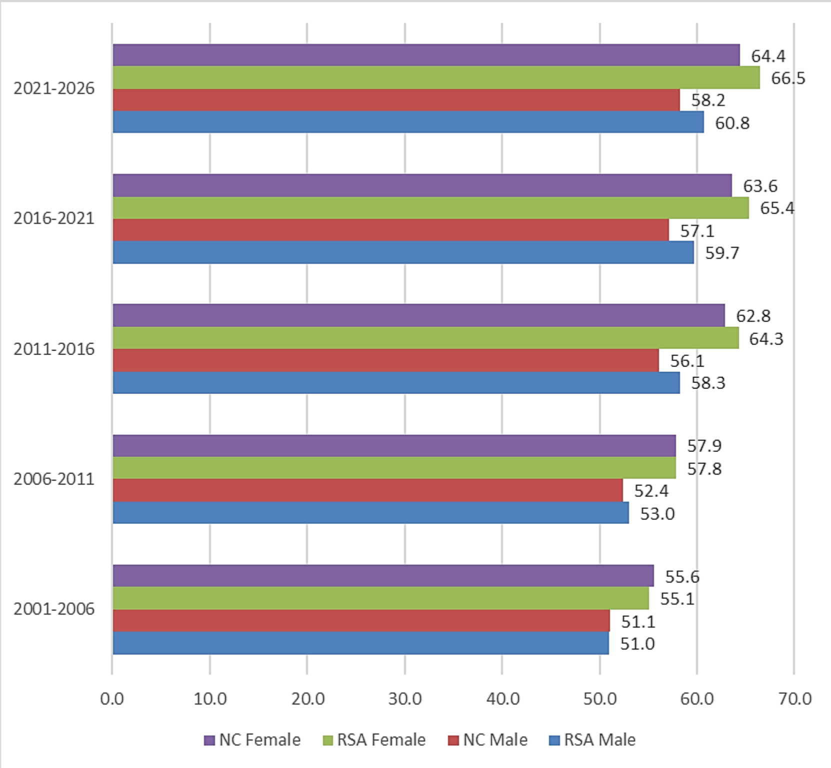

Figure 6-30: Life expectancy, Northern Cape Province vs RSA average (Solarys, 2022)

6.13.2 Health and HIV/AIDS Prevalence

According to Stats SA Mid-year Population Estimates for 2022, life expectancy in the Northern Cape Province has increased steadily for both males and females as is evident from Figure 6-30. This trend is likely to increase in the foreseeable future. Life expectancy for males in the Northern Cape Province has however been slightly below the national average for males since 2001. Female life expectancy in the province kept pace with the national average for females up until 2011. Since 2011, females in the Northern Cape Province have a shorter life expectancy than the national average for females (Figure 6-30) (Solarys, 2022).

6.13.3 Education levels

Table 6-15 provides comparative estimated education levels for the total Northern Cape Province, ZF Mgcawu District, DKLM and KGLM populations as per the Stats SA Community Survey 2016. According to these estimates, it is apparent that the DKLM and KGLM population is poorly educated, with less than a third of the total population having attained a matric certificate. This suggests a need for interventions in local education and training initiatives (Solarys, 2022).

Table 6-15: DKLM estimated education levels (2016), as per (Solarys, 2022)

Highest level of education achieved (total population, all age groups)	Northern Cape	ZF Mgcawu District	DKLM	KGLM
No / up to pre-AET level schooling	23.00%	20.75%	20.56%	17.96%
Completed primary	22.22%	22.51%	21.77%	24.72%
Completed some secondary	23.33%	25.58%	24.39%	31.27%
Completed secondary	24.75%	25.96%	27.63%	21.38%
Higher education	4.99%	3.74%	4.31%	2.78%

6.13.4 Employment levels

According to a comparative analysis of municipalities in the ZF Mgcawu District undertaken by the Northern Cape Provincial Treasury, the unemployment rate in //Khara Hais (DKLM) decreased from 26.5% in 2005 to 24.9% in 2015, according to the strict definition of unemployment which excludes discouraged work seekers. In KGLM during this period the unemployment rate decreased from a level of 14.0% to 12.5%.

Table 6-16: Race and gender distribution of unemployed people in Khara Hais (DKLM) and KGLM (2005/2015), as per (Solarys, 2022)

	Khara Hais (DKLM) % of total unemployed population		KGLM % of total unemployed population	
Race/gender	**2005**	**2015**	**2005**	**2015**
African	31.2	21	1.9	1.3
White	4.4	5.5	4.4	3.9
Coloured	31.3	30.2	26.8	25.7
Asian	27	22.8	33.2	24.4
Male	22.8	23.8	13.2	12.1
Female	31.2	26.4	15.1	13.1

Unemployment trends relating to race and gender between 2005 and 2015 in //Khara Hais (DKLM) and KGLM are presented in Table 6-16. The largest single contributor to total employment in KGLM in 2015 was agriculture (over 50%). In DKLM, the community services sector dominated (30.4%) given that Upington is the seat of local and district government (Solarys, 2022).

6.13.5 Poverty, development indicators and household income

According to the comparative analysis undertaken by the Northern Cape Provincial Treasury, the Human Development Index (HDI) for //Khara Hais (DKLM) improved between 2005 and 2015 from 0.58 to 0.67. During this period, KGLM also experienced an increase in the HDI from 0.52 to 0.63. The HDI is a composite indicator used by the United Nations (UN) to assess the relative level of socio-economic development in a region. HDI is represented as a value between 0 and 1, with 1 indicating a high level of human development and 0 indicting no human development (Solarys, 2022).

This improvement in HDI must however be understood within the context of prevailing levels of inequality in the region, which indicates that the benefits of socio-economic development are not necessarily experienced by everyone in the municipality. During the 2005 - 2015 period, the Gini coefficient of //Khara Hais (DKLM) improved from 0.609 in 2005 to 0.573 in 2015. KGLM experienced a similar trend, with the Gini coefficient improving slightly from 0.587 in 2005 to 0.563 in 2015. The Gini coefficient is an indicator of income or wealth inequality within a population. It ranges between 0 and 1, with 0 indicating complete equality and 1 complete inequality (Solarys, 2022).

Table 6-17: Annual income distribution data for ZF Mgcawu District, //Khara Hais (DKLM) and KGLM 2015, as per (Solarys, 2022)

ANNUAL INCOME			ZF Mgcawu	//Khara Hais (DKLM)	KGLM
0	-	2 400	0.03%	0.02%	0.01%
2 400	-	6 000	0.24%	0.24%	0.13%
6 000	-	12 000	1.71%	1.70%	1.19%
12 000	-	18 000	2.53%	2.49%	2.01%
18 000	-	30 000	5.66%	5.48%	5.37%
30 000	-	42 000	8.50%	7.86%	9.68%
42 000	-	54 000	9.65%	8.90%	11.78%
54 000	-	72 000	11.52%	10.77%	13.70%
72 000	-	96 000	11.60%	10.91%	13.14%
96 000	-	132 000	10.45%	11.52%	12.50%
132 000	-	192 000	11.68%	11.90%	10.58%
192 000	-	360 000	12.75%	13.83%	10.16%
360 000	-	600 000	7.52%	8.08%	5.41%
600 000	-	1 200 000	4.58%	4.86%	3.26%
1 200 000	-	2 400 000	1.33%	1.26%	0.92%
2 400 000+			0.25%	0.19%	0.16%

As is evident from Table 6-17, the percentage of households earning R3 500 per month or less was 26.69% and 30.18% for DKLM and KGLM respectively. The percentage of people in poverty decreased from a level of 52.1% in 2005 to 34.4% in 2015 for //Khara Hais (DKLM). In KGLM, the percentage of people in poverty decreased from 53.3% in 2005 to 37.8% in 2015 which signifies a positive socio-economic trend in these local municipalities.

6.13.6 Economic profile

According to the DKLM Local Economic Development (LED) Strategy, community services was the largest sector within the municipality, contributing 24.3% of the total Gross Value Added (GVA) followed by the finance (20.0%) and trade (16.5%) sectors. As is evident from Table 6-18, in 2015 //Khara Hais (DKLM) contributed 34.6% to the total ZF Mgcawu GDP, the largest in the district. KGLM was the second largest contributor at 24.9% (Solarys, 2022).

Table 6-18: Contribution of //Khara Hais (DKLM) and KGLM to ZF Mgcawu economic sector totals in 2015 (constant 2010 prices), as per (Solarys, 2022)

Sector	Contribution to ZF Mgcawu economic sector total in 2015	
	//Khara Hais (DKLM)	KGLM
Finance	50.8%	29.6%
Trade	50.1%	31.7%
Manufacturing	48.6%	30.2%
Transport	46.9%	30.1%
Construction	40.2%	34.9%
Electricity	37.2%	28.6%
Community Services	35.1%	30.1%
Agriculture	34.8%	47.9%
Mining	3.6%	2.6%

6.13.7 Housing

Figure 6-31, which is based on Stats SA Community Survey 2016 data, indicate that 66.6% of the DKLM population reside in formal dwellings while 25.7% live in informal dwellings or shacks. In KGLM, 82.5% reside in formal dwellings, while 4.7% reside in informal dwellings. Most of the residents of DKLM (53.07%) and KGLM (56.46%) own the properties they live in (Solarys, 2022).

6.13.8 Basic services

According to Stats SA mid-year population estimates (MYPE) projections for 2022, DKLM is currently comprised of approximately 33 133 households. The number of households increased by around 5.3% from an estimated number of 31 476 in 2020. Table 6-19 lists basic services available to the estimated 31 476 households in DKLM in 2020 (Solarys, 2022).

Limited information for KGLM was provided in the Stats SA Non-Financial Census of Municipalities 2020. According to the Stats SA Community Survey 2016 data, KGLM has shown improvement in provision of municipal services with 85.15% of the population having access to safe drinking water; 73% of households have access to flush toilets; and 64.3% have weekly municipal refuse removal (Solarys, 2022).

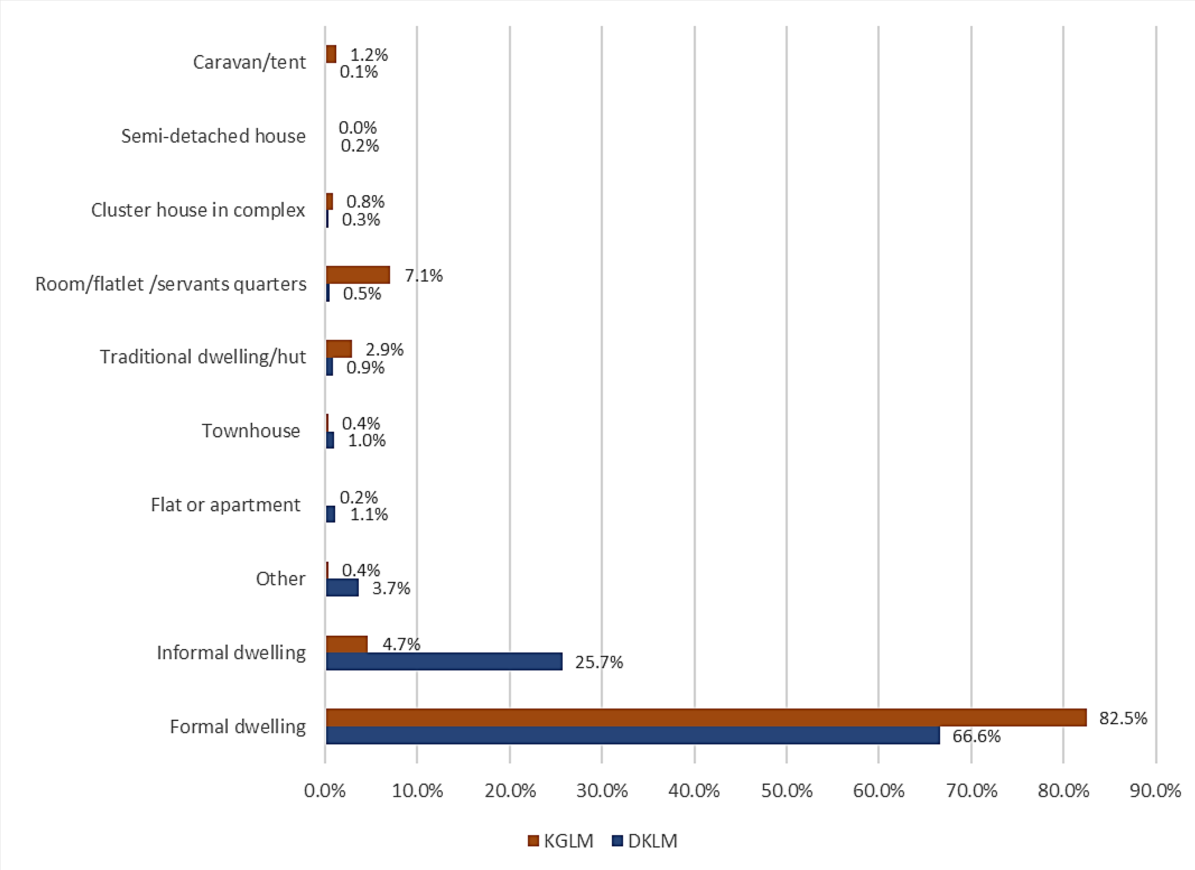

Figure 6-31: Main dwelling type in DKLM (2016), as per (Solarys, 2022)

Table 6-19: Municipal services provided/available in DKLM (2020), as per (Solarys, 2022)

Service	Domestic units provided in 2020	% of estimated household in 2020
Water inside the yard	25225	80.14%
Water less than 200m from yard	1940	6.16%
Flush toilets connected to public sewerage system	18973	60.28%
Flush toilets connected to septic tank	1825	5.80%
Bucket system	2090	6.64%
Ventilated improved pit latrine system	2341	7.44%
Other	1551	4.93%
Number of domestic units receiving free basic services (indigent support) including water; electricity; sewerage and sanitation; and solid waste management	8300	26.37%

While DKLM is performing above the district average in respect of all electricity services provided, KGLM is lagging behind, especially in respect of electricity for cooking.

Based on the desktop assessment, the majority of individuals residing in DKLM have access to water inside the yard; access to flush toilets connected to a sewerage system and electricity supplied either by Eskom or by the Municipality. There is however a large contingent (23.37%) of households in DKLM that rely on indigent support. In the event of a large influx of hopeful job seekers into the area, this number could increase, without a corresponding increase in municipal revenue generation (Solarys, 2022).

6.13.9 Land use and human settlements

The Applicant owns the directly affected farm portion, Olyvenhouts Drift Settlement Agricultural Holding 1080 Portion 0. Existing electrical infrastructure on the site includes the Eskom Upington Main Transmission Substation (MTS) and related transmission lines.

The area towards the north and west of the proposed project site is undeveloped and used predominantly for livestock grazing. While Eskom is the landowner for Erf 1080, there is a 5-year grazing agreement with the previous landowner. To the south-east, along the N14 and down towards the banks of the Orange River, livestock grazing, cultivation of grapes and other crops are the predominant land use (Solarys, 2022).

Settlement patterns in this area are characterised by a number of farmsteads, farm employee accommodation and farming related infrastructure. Inhabitants of this area are therefore likely to rely primarily on agriculture to support their livelihoods. The closest human settlement to the proposed project site is the rural agricultural settlement of Kalksloot which is located approximately 3.5 km from the Site A alternative. Oranjevallei is the next closest settlement located approximately 4.7 km from Site A. Other settlements within close proximity of the proposed project site include Louisvale (8.4 km); Dysons Klip (8.3 km); Raaswater (9.5 km); and Bloemsmond (12 km) (Solarys, 2022).

6.13.10 Land claims status

The Office of the Regional Land Claims Commissioner: Northern Cape confirmed that there are no land claims that may have an impact on the proposed project. <u>A letter received from the Office of the Regional Land Claims Commissioner: Northern Cape is included in Appendix L-4.</u>

6.1 <u>Cumulative sensitivities</u>

<u>A cumulative sensitivity map indicating all sensitivities identified by the specialist studies undertaken for the proposed Kiwano Solar PV and BESS development is included in Figure 6-32.</u>

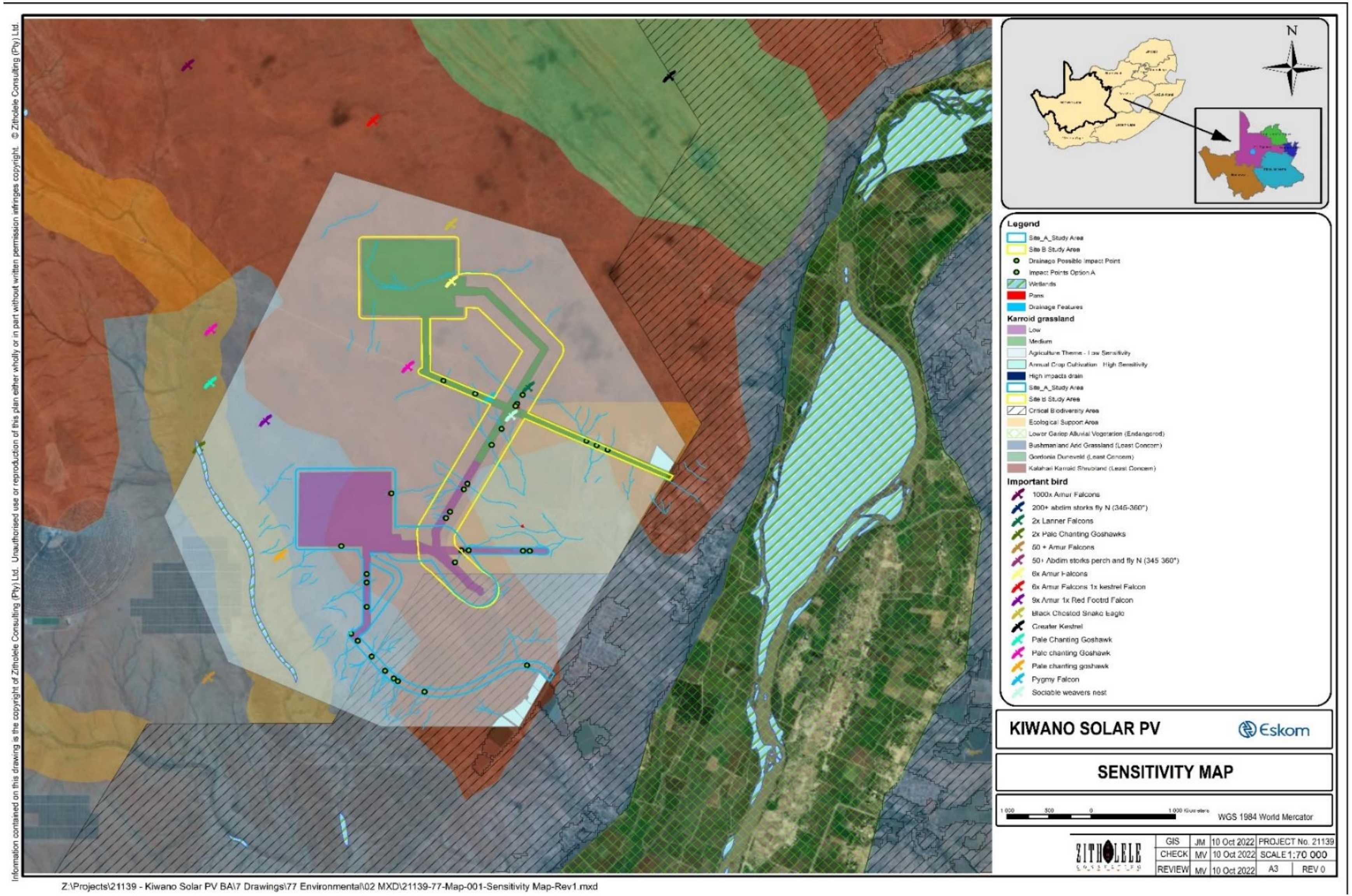

Figure 6-32: The cumulative sensitivities for the Kiwano Solar

7 BASIC ASSESSMENT AND PUBLIC PARTICIPATION PROCESS

In terms of the NEMA EIA Regulations of 2014 (as amended), the construction and operation of the proposed Kiwano Solar PV and BESS development is an activity requiring Environmental Authorisation prior to the commencement of construction. In terms of GN R114 of February 2018, the application for Environmental Authorisation is required to be undertaken by way of a BA process, since the development area is located entirely within the Upington REDZ.

The Basic Assessment process refers to that process (in line with the EIA Regulations) which involves the identification and assessment of direct, indirect, and cumulative environmental impacts associated with a proposed project / activity. The BA process culminates in the submission of a Final BAR, including an Environmental Management Programme (EMPr), to the competent authority for decision-making.

A compulsory requirement in terms of the NEMA EIA Regulations, 2014, is the requirement to undertake a Public Participation Process associated with the BA process to provide any interested and affected parties and stakeholders the opportunity to consider the proposed development and how it may impact on them whether directly or indirectly. The main steps of the PPP are illustrated below:

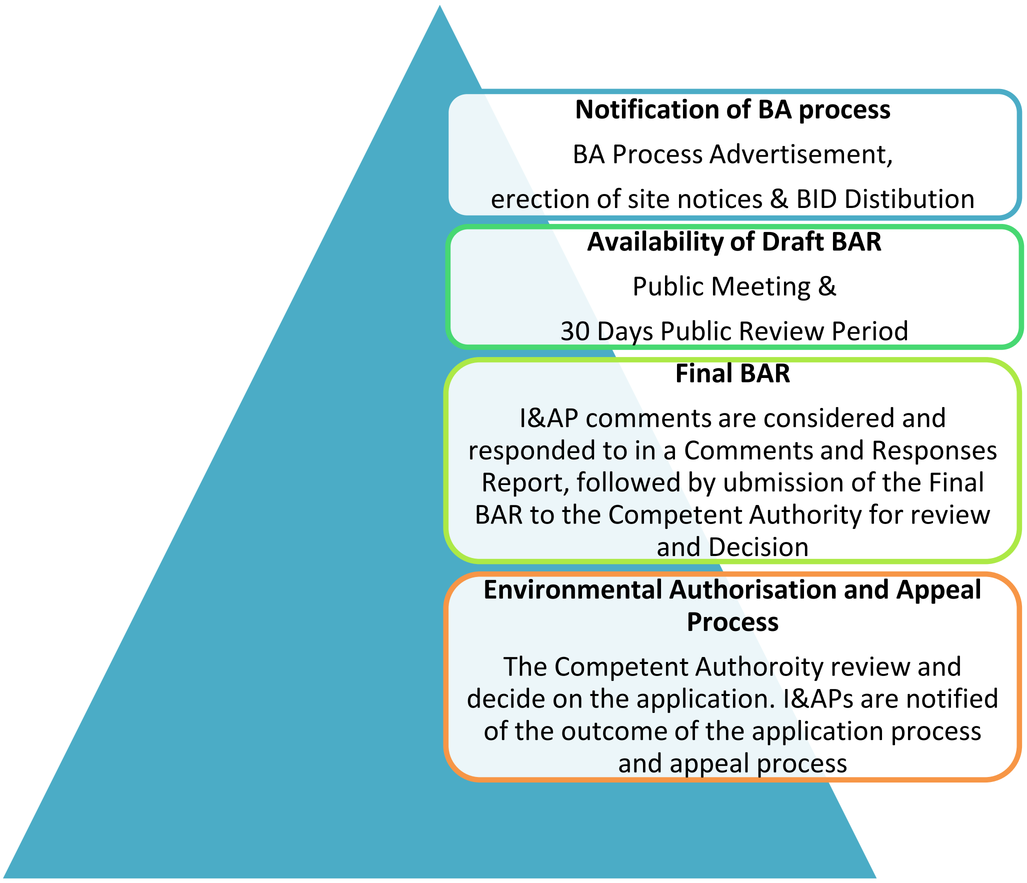

Figure 7-1: Main steps of the PPP process

7.1 Draft Basic Assessment Report

The Draft Basic Assessment Report (DBAR) for public review were prepared by Zitholele to assess the potential significance of environmental impacts associated with proposed Project in Upington in the Northern Cape Province. The Public Participation Process were undertaken as required, in terms of the legislative requirements for an application for environmental authorisation by way of a BA process. The 30-day public period for review were undertaken from 11 November 2022 to 13 December 2022. The Draft Basic Assessment Report were made available for public review at the following locations:

- Sandile Present Community Library – 5 Carlton Street, Upington, Northern Cape, South Africa
- Paballelo Library – 5 Kaizer Crescent, Paballelo, Upington, Northern Cape, South Africa
- Documents were also available electronically at the following links:
  - Zitholele Consulting Website: https://zitholele.co.za/environmental/ under heading "Kiwano Solar PV BA"
  - Online Information Portal 1: https://tinyurl.com/KiwaLink1
  - Online Information Portal 2: https://tinyurl.com/KiwaLink2

The Draft BAR is aimed to provide Interested and Affected Parties (I&APs) with the opportunity to receive information regarding the proposed project, participate in the process, and raise issues of concern. The Draft BAR is aimed at detailing the nature and extent of the proposed development, identifying potential issues associated with the proposed project, and defining the extent of studies required within the BA Process. This is achieved through an evaluation of the proposed project, involving the project proponent, appointment of specialist consultants, and a consultation process with key stakeholders that included both relevant organs of state and I&APs.

7.1.1 Tasks completed during the Basic Assessment Process

The BA process for the proposed development has been undertaken in accordance with the NEMA EIA Regulations (GN R982 of 04 December 2014), as amended. Key tasks undertaken during the BA process included the following:

- Consultation with relevant decision-making and regulating authorities (at National, Provincial and Local levels);
- Undertaking a Public Participation Process throughout the BA process in accordance with Chapter 6 of NEMA EIA regulations, 2014 (as amended) in order to identify any issues and concerns associated with the proposed project;
- Undertaking of independent Specialist Studies in accordance with Appendix 6 of NEMA EIA regulations, 2014, as amended;
- Preparation of a Draft BAR in accordance with Appendix 1 of NEMA EIA regulations, 2014, as amended; and

- Preparation of a Comments and Response Report (CRR) detailing key issues raised by I&APs as part of the BA Process and responses provided to these issues by the EAP, Specialists and/or the proponent's technical team;
- Preparation of a Final BAR in accordance with Appendix 1 of the NEMA EIA regulations, 2014, as amended.

These tasks are discussed in brief below.

7.1.2 Authority Consultation

The Department of Forestry, Fisheries and the Environment (DFFE) is the Competent Authority for this application. Since the proposed project is located within the Northern Cape Province, the Northern Cape Department of Agriculture, Environmental Affairs, Rural Development and Land Reform (DAERL) is the Commenting Authority for the application.

A record of all authority consultation undertaken is included in Appendix J within this Final Basic Assessment Report (FBAR). Consultation with the Competent Authorities has continued throughout the BA Process. On-going consultation included the following:

- Pre-Application Meeting which was held with the DFFE on the 31 May 2022. Minutes of the meeting is provided in Appendix J-10 of the FBAR.
- Notification and Consultation with Organs of State that may have jurisdiction over the project, including:
  i. Provincial Departments
  ii. Local Municipality
- The FBAR will be submitted to the DFFE for review after conclusion of the PPP public review period.

A record of the authority consultation in the BA process is included within Appendix J.

7.1.3 Public Involvement and Consultation

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

- Information containing all relevant facts in respect of the proposed project will be made available to potential stakeholders and I&APs.
- Participation by potential I&APs will be facilitated in such a manner that all potential stakeholders and I&APs will be provided with a reasonable opportunity to comment on the proposed project.
- Comments received from stakeholders and I&APs during public review of the draft BAR will be recorded and incorporated into the Final BAR.

In order to accommodate the varying needs of stakeholders and I&APs within the study area, as well as capture their inputs regarding the project, various opportunities for stakeholders and I&APs to be involved in the BA Process are provided as follows:

- Telephonic consultation sessions with stakeholders and I&APs, as required.

- Written or e-mail correspondence to stakeholders and I&APs, as well as responding to correspondence received from stakeholders.
- Providing the opportunity to attend a public meeting to raise stakeholder issues and concerns.
- The Draft BAR was available for a 30-day public review period. The comments received from I&APs will be captured within a Comments and Response Report which will be included within the FBAR, for submission to the DFFE for decision-making.

The following key public participation tasks have been undertaken in terms of the requirement of Chapter 6 of the NEMA EIA Regulations, 2014, as amended:

- Fixing a notice board at a place conspicuous to the public at the boundary or on the fence of:
    - the site where the activity to which the application relates is or is to be undertaken; and
    - any alternative site mentioned in the application;
- Giving written notice to:
    - the owner or person in control of that land if the applicant is not the owner or person in control of the land;
    - the occupiers of the site where the activity is or is to be undertaken or to any alternative site where the activity is to be undertaken;
    - owners and occupiers of land adjacent to the site where the activity is or is to be undertaken or to any alternative site where the activity is to be undertaken;
    - the municipal councilor of the ward in which the site or alternative site is situated and any organization of ratepayers that represent the community in the area;
    - the municipality which has jurisdiction in the area;
    - any organ of state having jurisdiction in respect of any aspect of the activity; and
    - any other party as required by the competent authority.
- Placing an advertisement in a local newspaper; and
- I&APs application database is open and maintained throughout the BA process.
- The DBAR made available for Public Review.
- Comments received will be collated and addressed accordingly.

In compliance with the requirements of Chapter 6 of the NEMA EIA Regulations, 2014, the following summarises the key public participation activities conducted during the BA process:

- Placement of an advertisement in Khathu Gazette on 06 August 2022.
- Placement of Site Notices and distribution of Background Information Documents (BIDs)
    - Site notices were placed on-site on and at the two local libraries i.e. Sandile Present Community Library and Paballelo Library; and

- BIDs were also distributed to potential I&APs. Proof of this distribution is included in (Appendix J-3).
- Identification of I&APs and establishment of a project database that will be maintained and updated during the BA process.
- Key stakeholders, including the Local and District Municipality, were contacted and notified of the application, and any concerns raised, were noted as part of the stakeholder's registration on the application.
- All I&APs and stakeholders were notified of the availability of the DBAR for review via email and SMS notifications.
- All I&APs and stakeholders were reminded of the availability of the DBAR for review via email and SMS notifications during the 30 day review period.
- All I&APs and stakeholders were notified of the availability of the DBAR for review via email and SMS notifications on the last day of the 30 day review period, and were reminded to submit their written comments before the end of the 30 day review period.

Identification of I&APs was undertaken by Zitholele through existing contacts and stakeholder databases, internet searches, other stakeholders and I&APs, recording responses to site notices and the newspaper advertisement, as well as through the process of networking. The key stakeholder groups identified include authorities, local and district municipalities, public stakeholders, Parastatals and Non-Governmental Organizations and is listed in Table 7-1.

Table 7-1: Key stakeholder groups notified during the BA process

Stakeholder Group	Relevant Stakeholders
National Government Departments	Department of Forestry, Fisheries and Environment (DFFE)
	Department of Water and Sanitation (DWS)
	South African Heritage Resources Agency (SAHRA)
	South African National Roads Agency Limited (SANRAL)
	Department of Agriculture, Land Reform & Rural Development
	Department of Defence
	Department of Energy
	Department of Mineral Resources and Energy
	Department of Public Works
	Department of Transport and Public Works
Government Bodies and State-Owned Companies	Eskom Holdings SOC Ltd
	National Energy Regulator of South Africa (NERSA)
	8 SA Infantry Battalion
	ACSA - Upington International Airport
	Air Traffic and Navigation Services (ATNS)
	Bakwena Ba Mogopa Traditional Authority
	South African Civil Aviation Authority (CAA)
	Councill of Geoscience
	South Africa Army Foundation
	South African Radio Astronomy Observatory (SARAO)
	Telkom SA SOC Ltd
	Transnet SOC Ltd
Provincial Government Departments	Northern Cape Department of Agriculture, Environmental Affairs, Rural Development and Land Reform (DAERL)
	Northern Cape Department of Co-operative Governance

Stakeholder Group	Relevant Stakeholders
	Northern Cape Economic Development Agency
Local Government Departments	Dawid Kruiper Local Municipality (DKLM)
	Z F Mgcawu District Municipality
	Kai !Garib Local Municipality (KGLM)
IPPs	Various IPPs located within 50km of the development site
Conservation organisations, NPO, NGO,	Cape Nature
	BirdLife South Africa
	Endangered Wildlife Trust
	Wildlife & Environment Society of South Africa (WESSA)
	Olifants-Doorn Catchment Management Agency
	Agri South Africa / Agri Northern Cape
	Boegoeberg Water Use Association
	Orange River Farmers Union: Agri SA
	Oranje Vaal Water Use Association
	South African National Parks
	South African Bat Assessment Advisory Panel (SABAAP)
Organisations and Businesses	Kudumane Manganese Resources
	SENTECH
Landowners	Neighbouring landowners and tenants

All relevant stakeholder and I&AP information has been recorded in a database of I&APs. Please refer to (Appendix J-1). While I&APs were encouraged to register their interest in the project from the onset of the process undertaken by Zitholele, the identification and registration of I&APs has been on-going for the duration of the BA Process.

7.1.4 Protection and Personal Information Act, No.4 of 2013

The Protection of Personal Information Act (POPIA), No 4 of 2013, promote the protection of personal information that is processed by public and private bodies while introducing certain conditions to establish minimum requirements for the processing of personal information. Pertinent sections of the Act became effective on 1 July 2021.

Zitholele drew all I&APs attention to the fact that the PPP team will collect, maintain and store personal information from Interested and Affected Parties that register an interest in this BA and WULA process for the purpose of executing this process only. Collected I&AP information managed by Zitholele Consulting is furthermore available to the Applicant, and Eskom Holdings SOC Ltd, during the course of the BA and WULA process.

Zitholele Consulting (Pty) Ltd further acknowledge that this BA and WULA process is a public process and all stakeholders were informed that some personal information limited to I&AP name, surname, affiliation, declaration of interest and comments and opinions provided will be included in the BA and WULA documentation that will be made available for public review and comment. Full contact details will however only be made available to the DFFE and the DWS, upon submission of the final BAR and WULA, respectively.

7.2 Final Basic Assessment Report

During the PPP, comments and concerns were received, considered and responded to in the finalisation of the Basic Assessment Report and final specialist studies. Tasks undertaken in the finalisation of the FBAR are discussed in brief below.

7.2.1 Identification and Recording of Issues and Concerns

Comments and concerns raised by I&AP's and key stakeholders over the duration of the BA process were duly considered and incorporated into the Comments and Response Report (CRR). The CRR include responses from members of the EAP Project Team, Specialists and/or the project proponent and is available in Appendix J-12.

7.2.2 Finalisation of the Specialist Assessment Reports

Comments and concerns raised that pertained to the specialist assessment reports were provided to the respective specialists to consider and respond. All specialist studies were updated to incorporate comments and concerns that were raised for each respective specialist study and were included in the FBAR for final submission to the Competent Authority.

7.2.3 Finalisation of the EMPr

Some of the comments and concerns raised by the Competent and Commenting Authorities included specific recommendations that must be included in the draft EMPr that was submitted for consideration during the public review period. Where relevant, all recommendations, management measures and/or mitigation measures were included in the EMPr for final submission to the Competent Authority.

7.2.4 Finalisation of the Basic Assessment Report

All comments and concerns raised by the key stakeholders and I&APs were considered in the finalization of the Basic Assessment Report, now referred to the Final Basic Assessment Report (FBAR). The completed and updated FBAR were subsequently submitted with associated Appendices to the Competent Authority for decision-making

7.3 Detailed information related to the PPP

All information pertaining to the PPP have been included in Appendix J to the FBAR. For ease of reference the Appendix J and associated appendices are described below in brief for navigational purposed through the appendices:

- **Appendix J – Public Participation Process Report:** This appendix include a summarized account of all the tasks and steps that were undertaken during the PPP throughout the Basic Assessment process. All supporting documents referenced in the PPP Report is provided in the subsequent sub-appendices as follow:

- **Appendix J-1: Stakeholder Database:** The detailed stakeholder database compiled during the BA process is provided with contact details for the Competent Authority's information. No contact details were divulged to stakeholders during the 30 day public review period to ensure compliance with the POPI Act.
- **Appendix J-2: Newspaper Advertisement:** The electronic tearsheet of the newspaper advertisement placed for announcement of the proposed application for EA is provided as supporting evidence.
- **Appendix J-3: Site Notice and BID:** The site notices that were placed at strategic locations, as well as the Background Information Document (BID) that was distributed to stakeholders and left at public placed are provided as supporting evidence. A photolog containing pictures of the placement of the site notices and BIDs are also included in this sub-appendix.
- **Appendix J-4: Notification letters:** The electronic notification letters compiled and distributed via email to stakeholders during the stakeholder notifications are provided as supporting evidence in this sub-appendix.
- **Appendix J-5: Proof of Notification of Stakeholders:** All email notifications, which contained the notification letters provided in Appendix J-4, to stakeholders during the stakeholder notifications are provided as supporting evidence in this sub-appendix.
- **Appendix J-6: Correspondence with Competent Authorities:** All email and verbal correspondence undertaken between Zitholele Consulting and the Competent Authorities during the Basic Assessment process are provided as supporting evidence in this sub-appendix.
- **Appendix J-7: Correspondence with Commenting Authorities:** All email and verbal correspondence undertaken between Zitholele Consulting and the Commenting Authorities during the Basic Assessment process are provided as supporting evidence in this sub-appendix.
- **Appendix J-8: Correspondence with Local Authorities:** All email and verbal correspondence undertaken between Zitholele Consulting and the Local Authorities during the Basic Assessment process are provided as supporting evidence in this sub-appendix.
- **Appendix J-9: Correspondence with Organs of State:** All email and verbal correspondence undertaken between Zitholele Consulting and the Organs of State during the Basic Assessment process are provided as supporting evidence in this sub-appendix.
- **Appendix J-10: Correspondence with Stakeholders:** All email and verbal correspondence undertaken between Zitholele Consulting and the stakeholders and I&APs during the Basic Assessment process are provided as supporting evidence in this sub-appendix.
- **Appendix J-11: Minutes of meetings:** Minutes of the following meetings are provided in this sub-appendix:

  - Minutes of pre-application meeting with the Department of Forestry, Fisheries and the Environment,
  - Minutes of the Virtual Focus Group Meeting held on 29 November 2022 during the 30 day review period,
  - Minutes of the Virtual Public Meeting held on 29 November 2022 during the 30 day review period, and
  - Minutes of the Public Meeting held at the Kalksloot Primary School, Upington, on 01 December 2022 during the 30 day review period
- **Appendix J-12: Comments and Responses Report:** The summarized account of all comments received from kay stakeholders and I&Aps, as well as responses provided by the EAP, EIA project team, respective specialists or the proponent, Eskom Holdings SOC Ltd, are provided in this sub-appendix.

8 IMPACT IDENTIFICATION AND ASSESSMENT

This chapter serves to assess the significance of the positive and negative environmental impacts (direct, indirect, and cumulative) expected to be associated with the proposed Project.

This impact assessment will evaluate the following phases of this project:

- Pre-Construction – will include planning activities and pre-construction surveys.
- Construction – will include site preparation, establishment of the access road, electricity generation infrastructure, transportation of material to site; and undertaking site rehabilitation including implementation of a stormwater management plan.
- Operation – will include operation of the solar PV and BESS facility, and associated infrastructures.
- Decommissioning – Note that impacts associated with decommissioning are expected to be similar to those associated with construction activities. Therefore, these impacts are not considered separately within this chapter.

8.1 Impact Assessment Rating Methodology

8.1.1 Impact Assessment Methodology

The impacts will be ranked according to the methodology described below. Where possible, mitigation measures will be provided to manage impacts. In order to ensure uniformity, a standard impact assessment methodology will be utilised so that a wide range of impacts can be compared with each other. The impact assessment methodology makes provision for the assessment of impacts against the following criteria, as discussed below.

<u>Direct, Indirect & Cumulative</u>

Impacts can either be direct impact, indirect impacts or cumulative impacts. Impact type descriptors are defined in Table 8-1 below.

Table 8-1: Impact type descriptors

Descriptor	Definition
Direct Impact	Direct impacts are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.
Indirect Impact	Indirect impacts of an activity are indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential 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 Impact	Cumulative impacts are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or

	reasonably foreseeable future activities. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.

Impact Direction

Impact direction can either be a positive impact, negative impacts or neutral impact. Impact direction descriptors are defined in Table 8-2 below.

Table 8-2: Impact Direction Descriptors

Descriptor	Definition
Positive	Environment overall will benefit from the impact/risk
Negative	Environment overall will be adversely affected by the impact/risk
Neutral	Environment overall will not be affected

Spatial Extent of Impact

Spatial extent intends to assess the footprint of the impact. The larger the footprint, the higher the impact rating will be. Table 8-3 below provides the descriptors and criteria for assessment.

Table 8-3: Criteria for the assessment of the extent of the impact

Extent Descriptor	Definition	Rating
Site	Impact footprint remains within the boundary of the site.	1
Local	Impact footprint extends beyond the boundary of the site to the adjacent surrounding areas.	2
Regional	Impact footprint includes the greater surrounds and may include an entire municipal or provincial jurisdiction.	3
National	The scale of the impact is applicable to the Republic of South Africa.	4
Global	The impact has global implications	5

Duration of Impact

The duration of the impact is the period of time that the impact will manifest on the receiving environment. The concept of reversibility is linked to some degree to the duration rating. The longer the impact endures, the less likely it is to be reversible. Table 8-4 provides the criteria for rating duration of impacts.

Table 8-4: Criteria for the rating of the duration of an impact

Duration descriptor	Definition	Rating
Construction / Decommissioning phase only	The impact endures for only as long as the construction or the decommissioning period of the project activity. This implies that the impact is fully reversible.	1
Short term	The impact continues to manifest for a period of between 3 and 5 years beyond construction or decommissioning. The impact is still reversible.	2

Duration descriptor	Definition	Rating
Medium term	The impact continues between 6 and 15 years beyond the construction or decommissioning phase. The impact is still reversible with relevant and applicable mitigation and management actions.	3
Long term	The impact continues for a period in excess of 15 years beyond construction or decommissioning. The impact is only reversible with considerable effort in implementation of rigorous mitigation actions.	4
Permanent	The impact will continue indefinitely and is not reversible.	5

Potential Intensity of Impact

The concept of the potential intensity of an impact is the acknowledgement at the outset of the project of the potential significance of the impact on the receiving environment. For example, SO_2 emissions have the potential to result in significant adverse human health effects, and this potential intensity must be accommodated within the significance rating. The importance of the potential intensity must be emphasised within the rating methodology to indicate that, for an adverse impact to human health, even a limited extent and duration will still yield a significant impact.

Potential intensity provides a measure for comparing significance across different specialist assessments. This is possible by aligning specialist ratings with the potential intensity rating provided here. This allows for better integration of specialist studies into the environmental impact assessment. See Table 8-5 and Table 8-6 below.

Table 8-5: Criteria for impact rating of potential intensity of a negative impact

Potential Intensity Descriptor	Definition of negative impact	Rating
Low	Negative change with no associated consequences.	1
Moderate-Low	Nuisance impact	2
Moderate	Substantial alteration and/or reduction in environmental quality/loss of habitat/loss of heritage/loss of welfare amenity	4
Moderate-High	Severe alteration to faunal or floral populations/loss of livelihoods/individual economic loss.	8
High	Extreme alteration to human health linked to mortality/loss of a species/endemic habitat.	16

Table 8-6: Criteria for the impact rating of potential intensity of a positive impact

Potential Intensity Descriptor	Definition of positive impact	Rating
Low	Positive change with no other consequences.	1
Moderate-Low	Economic development	2
Moderate	Improved environmental quality/improved individual livelihoods.	4
Moderate-High	Net improvement in human welfare	8

It must be noted that there is no HIGH rating for positive impacts under potential intensity, as it must be understood that no positive spinoff of an activity can possibly raise a similar significance rating to a negative impact that affects human health or causes the irreplaceable loss of a species.

Probability / Likelihood of Impact

This is the likelihood of the impact potential intensity manifesting. This is not the likelihood of the activity occurring. If an impact is unlikely to manifest then the likelihood rating will reduce the overall significance. Table 8-7 provides the rating methodology for likelihood.

The rating for likelihood is provided in fractions in order to provide an indication of percentage probability, although it is noted that mathematical connotation cannot be implied to numbers utilised for ratings.

Table 8-7: Criteria for the rating of the likelihood of the impact occurring

Likelihood Descriptor	Definition	Rating
Improbable	The possibility of the impact occurring is negligible and only under exceptional circumstances.	0.1
Very Unlikely	The possibility of the impact occurring is low with a less than 30% chance of occurring.	0.2
Unlikely	The impact has a 30% to 50% chance of occurring.	0.5
Likely	The impact has a 51% to 90% chance of occurring.	0.75
Definite	The impact has a >90% chance of occurring regardless of preventative measures.	1

1.6 Cumulative Impacts

In order to assess any impact on the environment, cumulative impacts must be considered in order to determine an accurate significance. Impacts cannot be assessed in isolation. An integrated approach requires that cumulative impacts be included in the assessment of individual impacts.

The nature of the impact should be described in such a way as to detail the potential cumulative impact of the activity.

Significance Rating Scale

The significance assessment assigns numbers to rate impacts in order to provide a more quantitative description of impacts for purposes of decision making. Significance is an expression of the risk of damage to the environment, should the proposed activity be authorised.

To allow for impacts to be described in a quantitative manner in addition to the qualitative description given above, a rating scale of between 1 and 5 was used for each of the assessment criteria. Thus the total value of the impact is described as the function of significance, which takes cognisance of extent, duration, potential intensity and likelihood.

Impact Significance = (extent + duration + potential intensity) x likelihood

Table 8-8 provides the resulting significance rating of the impact as defined by the equation as above.

Table 8-8: Significance rating formulas.

Score	Implications for Decision-making	Rating
< 3	The risk/impact may result in minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures and will not have an influence on decision-making. Project can be authorised with low risk of environmental degradation	Low
3 - 9	The risk/impact will result in moderate alteration of the environment and can be reduced or avoided by implementing the appropriate mitigation measures and will only have an influence on the decision-making if not mitigated. Project can be authorised but with conditions and routine inspections. Mitigation measures must be implemented.	Moderate
10 - 20	The risk/impact will result in major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making. Project can be authorised but with strict conditions and high levels of compliance and enforcement. Monitoring and mitigation are essential.	High
21 - 26	The risk/impact will result in very major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making. The project cannot be authorised unless major changes to the engineering design are carried out to reduce the significance rating.	Fatally Flawed

Reversibility of the Impacts:

The reversibility of an impact refers to the extent to which the impacts/risks are reversible assuming that the project has reached the end of its life cycle (decommissioning phase). Reversibility descriptors are provided in Table 8-9.

Table 8-9: Reversibility descriptors and definitions

Descriptor	Definition
High reversibility	Impact is highly reversible at end of project life.
Moderate reversibility	Moderate reversibility of impacts.
Low reversibility	Low reversibility of impacts.
Impacts are non-reversible	The impact is permanent, i.e., this is the least favourable assessment for the environment.

<u>Irreplaceability of Receiving Environment/Resource Loss caused by impacts/risks</u>

Irreplaceability of an impact refers to the degree to which the impact causes irreplaceable loss of resources assuming that the project has reached the end of its life cycle (decommissioning phase). Irreplaceability descriptors are provided in Table 8-10.

Table 8-10: Irreplaceability descriptors and definitions

Descriptor	Definition
High irreplaceability	The project will destroy unique resources that cannot be replaced, i.e. this is the least favourable assessment for the environment
Moderate irreplaceability	Moderate irreplaceability of resources
Low irreplaceability	Low irreplaceability of resources.
Resources are replaceable	The affected resource is easy to replace/rehabilitate, i.e. this is the most favourable assessment for the environment.

<u>Confidence</u>

Confidence refers to the degree of confidence in predictions based on available information and specialist knowledge. Confidence descriptors are provided in Table 8-11.

Table 8-11: Confidence descriptors and definitions

Descriptor	Definition
Low	EAP / Specialist has low confidence in assessment due to significant limitations such as unavailability of data or information
Medium	EAP / Specialist has medium confidence in assessment due to some limitations such as unavailability of data or information
High	EAP / Specialist has high confidence in assessment.

8.2 Design, Planning and Pre-Construction Phase

8.2.1 Impacts resulting from BESS

No impacts associated with the implementation of the BESS facility have been identified during the Pre-Construction Phase of the proposed development.

8.2.2 Terrestrial Biodiversity

No impacts on terrestrial biodiversity have been identified during the Pre-Construction Phase of the proposed development.

8.2.3 Surface Water and Wetlands

No impacts on surface water and wetlands have been identified during the Pre-Construction Phase of the proposed development.

8.2.4 Avifauna

Impacts identified

The pre-construction phase activities are considered a low risk as they typically involve desktop assessments and initial site inspections. This phase of the assessment would include, amongst others, site visits of various contractors, environmental and social impact assessment and compiling of management plans. Only one minor impact was assessed regarding the planning phase:

- Temporary disturbance of avifauna due to increased human presence and possible use of machinery and/or vehicles.

Impact Assessment

Alternatives include two site options with associated infrastructure, i.e. Site A and Site B. The impacts on birds for each of the options was assessed and considered to be identical in nature (TBC, 2022c). A combined impact assessment was therefore undertaken for both Site A and B.

The impact of this disturbance was rated as LOW prior to the mitigation and was Absent (represented by “0 – LOW” in Table 8-12) post mitigation.

Table 8-12: Avifauna impact assessment during Pre-Construction: Site A and B (TBC, 2022c)

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
Impact	Direct Impact:	Significance without Mitigation					
Impact Direction:	Negative	Existing Impact	1	1	2	0.1	0 - LOW
Aspect:		Project Impact	1	1	2	0.5	2 - LOW
Potential Impact:		Significance with Mitigation					
Temporary disturbance of avifauna due to increased human presence and possible use of machinery and/or vehicles		Residual Impact	1	1	1	0.1	0 - LOW
		Reversibility	Moderate reversibility				
		Irreplaceability	Resources are replaceable				
		Cumulative Impact					
		Cumulative Impact	2	1	1	0.5	2 - LOW
		Confidence	Medium				

Proposed Mitigation Measures (Impact Management Actions)

- All areas to be developed must be walked through prior to any activity to ensure no nests or avifauna species are found in the area. Should any Species of Conservation Concern be found and not move out of the area or their nest be found in the area a suitably qualified specialist must be consulted to advise on the correct actions to be taken.

- The design of the proposed PV must be of a type or similar structure as endorsed by the Eskom-EWT Strategic Partnership on Birds and Energy, considering the mitigation guidelines recommended by Birdlife South Africa (Jenkins et al., 2017).
- Infrastructure should be consolidated where possible in order to minimise the amount of ground and air space used.
- All the parts of the infrastructure must be nest proofed and anti-perch devices placed on areas that can lead to electrocution
- Fencing mitigations:
  - Top 2 strands must be smooth wire
  - Routinely retention loose wires
  - Minimum 30cm between wires
  - Place markers on fences
- As far as possible power cables within the project area should be thoroughly insulated and preferably buried.
- Any exposed parts must be covered (insulated) to reduce electrocution risk
- White strips should be placed along the edges of the panels, to reduce similarity to water and deter birds and insects (Horvath et al, 2010). Consider the use of bird deterrent devices to limit collision risk.

8.2.5 Heritage, Archaeology and Palaeontology

Impacts identified

It is assumed that the pre-construction phase involves the removal of topsoil and vegetation as well as the establishment of infrastructure. These activities can have a negative and irreversible impact on heritage features if any occur. Impacts include destruction or partial destruction of non-renewable heritage resources.

No palaeontological sensitive areas were identified within the study area, hence this insignificant impact was not further assessed during the impact assessment phase.

Impact Assessment – Site A and B

Alternatives include two site options with associated infrastructure, i.e. Site A and Site B. The impacts on heritage, archaeological and palaeontological resources for each of the options was assessed and considered to be identical in nature (Beyond Heritage, 2022). A combined impact assessment was therefore undertaken for both Site A and B.

No significant heritage, archaeology or palaeontology resources were identified within the proposed development site. As such, the impact significance of all impacts is rated as LOW before and after mitigation (Table 8-13).

Table 8-13: Heritage, Archaeology and Palaeontology impact assessment during Pre-construction: Site A and B (Beyond Heritage, 2022)

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
Impact	Direct Impact:	Significance without Mitigation					
Impact Direction:	Negative	Existing Impact	1	5	1	0,2	1 - LOW
Aspect:	Isolated Stone Age Artefacts	Project Impact	1	5	1	0,2	1 - LOW
Potential Impact:		Significance with Mitigation					
Destruction of isolated Stone Age scatters in the project area.		Residual Impact	1	5	1	0,2	1 - LOW
		Reversibility	Impacts are non-reversible				
		Irreplaceability	Moderate irreplaceability				
		Cumulative Impact					
		Cumulative Impact	1	5	1	0,2	1 - LOW
		Confidence	High				
Impact Description		Impact type	E	D	P	L	IR&S
Impact	Indirect Impact:	Significance without Mitigation					
Impact Direction:	Negative	Existing Impact	2	5	4	0,1	1 - LOW
Aspect:	Possible grave at K10.	Project Impact	2	5	4	0,1	1 - LOW
Potential Impact:		Significance with Mitigation					
Damage or destruction to the possible grave at K10.		Residual Impact	1	5	4	0,1	1 - LOW
		Reversibility	Impacts are non-reversible				
		Irreplaceability	High irreplaceability				
		Cumulative Impact					
		Cumulative Impact	2	5	4	0,1	1 - LOW
		Confidence					

Proposed Mitigation Measures (Impact Management Actions)

- Implementation of a Chance Finds Procedure for heritage, archaeological and palaeontological resources and artefacts that may be identified or unearthed.
- The potential burial site (K10) should be indicated on development plans and avoided.

8.2.6 Visual Aspects

There are a number of existing visual impacts in the study area that are important to consider. The most important of these is the Khi Solar One CSP. This structure is over 200m high and when the sun is reflecting off the heliostats onto the tower, it glows like an incandescent light bulb. This structure then catches the eye and dominates views from great distances.

Other electricity-related infrastructure is also present in the landscape and represents existing visual impact. This includes two other PV farms, a number of powerlines and a large substation. A noticeable feature of all of these facilities is the lack of noise or movement at these sites. In addition to electrical infrastructure, a railway line passes through the area and the municipal landfill site is located within 5km of Site B (Geonest, 2022).

Impacts identified

The following impacts have been identified during the design, planning and pre-construction phase:

- Structures' colour and design potentially contrast vividly with the surrounding landscape, causing reflection, enhancing visibility and increasing artificial contrast in the landscape
- Powerline infrastructure adds additional visual impact to the existing impacted landscape
- PV panels will be visible in the landscape and will interrupt and fragment the natural monochromatic landscape
- Security and other operational lighting will introduce unnatural lighting into an unlit landscape

Impact Assessment – Site A

The impact significance of the existing impact within the landscape ranges from MODERATE to HIGH, with the project impact potentially resulting in an impact significance rating of MODERATE pre-mitigation. However, the visual specialist has rated that if mitigation and management measures proposed in this assessment is followed and implemented, the residual visual impact can be reduced to LOW across all identified impacts, as is evident from Table 8-14.

Table 8-14: Visual impact assessment during Pre-construction: Site A (Geonest, 2022)

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	2	3	8	1	13 - HIGH
Aspect:	Visual Impact	Project Impact	2	1	2	1	5 - MOD
Potential Impact:		**Significance with Mitigation**					
Structures' colour and design potentially contrast vividly with the surrounding landscape, causing reflection, enhancing visibility and increasing artificial contrast in the landscape		Residual Impact	2	3	1	0.1	1 - LOW
		Reversibility	High reversibility				
		Irreplaceability	Resources are replaceable				
		Cumulative Impact					
		Cumulative Impact	2	3	8	1	13 - HIGH
		Confidence	High				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	2	3	2	1	7 - MOD
Aspect:	Visual Impact	Project Impact	2	1	2	0.5	3 - MOD

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
Potential Impact:		**Significance with Mitigation**					
Powerline infrastructure adds additional visual impact to the existing impacted landscape		Residual Impact	2	3	1	0.2	1 - LOW
		Reversibility	High reversibility				
		Irreplaceability	Resources are replaceable				
		Cumulative Impact					
		Cumulative Impact	2	3	2	1	7 - MOD
		Confidence	High				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	2	3	4	1	9 - MOD
Aspect:	Visual Impact	Project Impact	2	1	2	0.5	3 - MOD
Potential Impact:		**Significance with Mitigation**					
PV panels will be visible in the landscape and will interrupt and fragment the natural monochromatic landscape		Residual Impact	2	1	1	0.2	1 - LOW
		Reversibility	High reversibility				
		Irreplaceability	Resources are replaceable				
		Cumulative Impact					
		Cumulative Impact	2	3	4	1	9 - MOD
		Confidence	High				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	2	3	2	1	7 - MOD
Aspect:	Visual Impact	Project Impact	2	1	2	1	5 - MOD
Potential Impact:		**Significance with Mitigation**					
Security and other operational lighting will introduce unnatural lighting into an unlit landscape		Residual Impact	1	3	1	0.2	1 - LOW
		Reversibility	High reversibility				
		Irreplaceability	Resources are replaceable				
		Cumulative Impact					
		Cumulative Impact	2	3	2	1	7 - MOD
		Confidence	High				

Proposed Mitigation Measures (Impact Management Actions)

Similarly to site A, when the impact significance of the existing impact within the landscape is considered, it ranges from MODERATE to HIGH, with the project impact potentially resulting in an impact significance rating of MODERATE across all the identified impacts pre-mitigation. The visual specialist has, however, rated that if mitigation and management measures proposed in this assessment is followed and implemented, the residual visual impact for all identified impacts, besides the impact relating to security and other operational lighting introducing unnatural lighting into an unlit landscape, can be reduced to LOW, as is evident from Table 8-15. The impact significance of the residual impact relating to security and other operational lighting that will introduce unnatural lighting into an unlit landscape has been rated as MODERATE post-mitigation (Geonest, 2022).

Table 8-15: Visual impact assessment during Pre-construction: Site B (Geonest, 2022)

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	2	3	8	1	13 - HIGH
Aspect:	Visual Impact	Project Impact	2	1	2	1	5 - MOD
Potential Impact:		**Significance with Mitigation**					
Structures' colour and design potentially contrast vividly with the surrounding landscape enhancing visibility and increasing artificial contrast in the landscape		Residual Impact	2	1	2	0.2	1 - LOW
		Reversibility	High reversibility				
		Irreplaceability	Resources are replaceable				
		Cumulative Impact					
		Cumulative Impact	2	3	8	1	13 - HIGH
		Confidence	High				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	2	3	2	1	7 - MOD
Aspect:	Visual Impact	Project Impact	2	1	2	0.5	3 - MOD
Potential Impact:		**Significance with Mitigation**					
Powerline infrastructure adds additional visual impact to the existing impacted landscape		Residual Impact	2	1	1	0.2	1 - LOW
		Reversibility	High reversibility				
		Irreplaceability	Resources are replaceable				
		Cumulative Impact					
		Cumulative Impact	2	3	2	1	7 - MOD
		Confidence	High				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	2	3	4	1	9 - MOD
Aspect:	Visual Impact	Project Impact	2	1	2	0.5	3 - MOD
Potential Impact:		**Significance with Mitigation**					
PV panels will be visible in the landscape and will interrupt and fragment the natural monochromatic landscape		Residual Impact	2	1	1	0.5	2 - LOW
		Reversibility	High reversibility				
		Irreplaceability	Resources are replaceable				
		Cumulative Impact					
		Cumulative Impact	2	3	4	1	9 - MOD
		Confidence	High				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	2	3	2	1	7 - MOD
Aspect:	Visual Impact	Project Impact	2	1	2	1	5 - MOD
Potential Impact:		**Significance with Mitigation**					
Security and other operational lighting will introduce unnatural lighting into an unlit landscape		Residual Impact	2	1	1	0.75	3 - MOD
		Reversibility	High reversibility				
		Irreplaceability	Resources are replaceable				
		Cumulative Impact					
		Cumulative Impact	2	3	2	1	7 - MOD
		Confidence	High				

Proposed Mitigation Measures

- A colour palette should be selected for the development that matches the surrounding landscape. This palette should be documented in the EMPr and all structures and roofs (faces of PV panels obviously excluded) should be colour treated / painted to conform to this colour palette. This includes small surfaces such as the reverse side of signs, fence poles and fencing mesh, etc. No reflective metal surfaces should be left exposed.
- Power pylons should be treated in the same manner as those pylons already in place to limit any source of contrast.
- A suggested colour palette is provided in Figure 8-1. The colours used have been drawn from photographs of the site, and RGB and Hexadecimal colour codes are provided.

Figure 8-1: Suggested colour palette for colour treatment of all infrastructure (Geonest, 2022)

- Powerline and pylon placement should wherever possible be aligned with existing powerlines.
- A lighting plan should be drawn up to identify the minimum number and locations of required lights. This can be drawn up by Eskom but should be done in consultation with a lighting specialist. The plan should be approved by the project Environmental Control Officer. The plan should:
  - Consist of a detailed plan of the development site;
  - Map out the activities / facilities requiring lighting;
  - Identify critical lighting requirements such as minimum brightness required for safe working conditions;

  - Position luminaires on the plan with the associated extent of lit area – this is to ensure the minimum number of luminaries are used.
  - Provide specifications as to the type of luminaires (fully shielded cutoff, motion sensor etc.), the lumens required, mounting height etc.
- Wherever possible, non-permanent lighting options should be used (e.g., motion sensor lights instead of permanent security flood lights) and reflective markers should be used rather than illuminated signs.
- Any lighting used should be focused downward and inward to eliminate light spill.
- All lights should be fully shielded to ensure no escape of uplight and sky glow.
- All lights should be amber or warm colours as opposed to blueish white lights.

8.2.7 Socio-economic environment

No impacts on the socio-economic environment have been identified during the Pre-Construction Phase of the proposed development by the social specialist.

8.3 Construction Phase

8.3.1 Impacts resulting from BESS

Solid state and flow batteries contain several toxic and hazardous substances depending on the battery chemistry implemented as discussed in section 3.4.2 of this BAR.

Impacts identified

Impacts identified with the construction and installation of the BESS facility include:

- Spillages or leakage of electrolyte or hazardous substances during transportation, handling, storage or installation resulting in adverse impacts on the environment, soil and flora.
- Spillages or leakage of electrolyte or hazardous substances during transportation, handling, storage or installation resulting in adverse impacts on fauna, and people.

Spillages or leakage could occur during transportation as a result of the battery units or components not being secured properly or due to bad road conditions such as travelling on roads littered with potholes causing breakages of packaging or containers. Spillages during storage can furthermore result from inappropriate storage methods and not adhering to the manufacturers storage instructions. In addition, spillages and leakages during the installation of the BESS units can result from the contractor’s staff not adhering to recommended handling and storage instructions, or as a result of poor or no supervision during installation activities.

Impacts resulting from this include the spillage of electrolyte or hazardous substances resulting in the contamination of surrounding environment, soil and flora. Indirect impacts include injury to fauna and people coming into contact with the electrolyte or hazardous substances.

Impact Assessment – BESS Technology Alternative 1: Solid State Batteries

The impact assessment undertaken for BESS Technology Alternative 1: Solid State Batteries during the construction phase is provided in Table 8-16. When the impact assessment for Solid State Batteries is considered, the fact that the assembled batteries, battery components and electrolyte will most likely be transported over provincial boundaries requires the assessment to consider the spatial extent over a national scale. The potential intensity of spillages resulting from the transport, handling, storage and installation of the Solid State Batteries are considered Moderate as the potential impact is largely related to the size of the individual battery units or component units. As such the impact significance of the project impact before implementation of mitigation and management measures are MODERATE (-).

However, because mitigation measures are largely related to effective management of the battery units, components and electrolyte during the transportation, storage, handling and installation of the Solid State Batteries, the impact significance of the residual impact can be reduced to LOW (-) with the effective implementation of the management measures proposed below.

Table 8-16: Impact assessment during construction: BESS Technology Alternative 1: Solid State Batteries

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	1	1	1	0.1	0 - LOW
Aspect:	Spillage of hazardous substances	Project Impact	4	1	4	0.5	5 - MOD
Potential Impact:		**Significance with Mitigation**					
Spillages or leakage of electrolyte or hazardous substances during transportation, handling, storage or installation resulting on adverse impacts on the environment, soil and flora.		Residual Impact	4	1	4	0.1	1 - LOW
		Reversibility	High reversibility				
		Irreplaceability	Moderate irreplaceability				
		Cumulative Impact					
		Cumulative Impact	1	1	4	0.2	1 - LOW
		Confidence	High				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Indirect Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	1	1	1	0.1	0 - LOW
Aspect:	Spillage of hazardous substances	Project Impact	4	1	8	0.5	7 - MOD
Potential Impact:		**Significance with Mitigation**					
		Residual Impact	4	1	8	0.1	1 - LOW

Spillages or leakage of electrolyte or hazardous substances during transportation, handling, storage or installation resulting on adverse impacts on fauna, and people.	Reversibility	Moderate reversibility				
	Irreplaceability	Moderate irreplaceability				
	Cumulative Impact					
	Cumulative Impact	1	1	4	0.2	1 - LOW
	Confidence	High				

Impact Assessment – BESS Technology Alternative 2: Flow Batteries

The impact assessment undertaken for BESS Technology Alternative 2: Flow Batteries during the construction phase is provided in Table 8-17. When the impact assessment for Flow Batteries is considered, the fact that the assembled batteries, battery components and electrolyte will most likely be transported over provincial boundaries requires the assessment to consider the spatial extent over a national scale.

The potential intensity of spillages resulting from the transport, handling, storage and installation of the Flow Batteries are considered Moderate-High for the identified impacts on the environment, soil and flora, but High for the impacts identified on Fauna and people. This is due to the fact that a large amount of electrolyte is used in the operation of flow batteries which will need to be transported, handled, stored and installed. Unlike Solid State Batteries where the electrolyte is confined to many smaller units and the likelihood of several units failing at the same time is diminished, at least the installation of the flow batteries will require large quantities of electrolyte being placed in a tank forming a component of the flow battery unit. The potential intensity of a spillage occurring from the large electrolyte tank is therefore increased. The impact significance of the project impact before implementation of mitigation and management measures are therefore rated as MODERATE (-) for impacts on the environment, soil and flora, and HIGH (-) for impacts on fauna and people.

However, because mitigation measures are largely related to effective management of the battery units, components and electrolyte during the transportation, storage, handling and installation of the Solid State Batteries, the impact significance of the residual impact can be reduced to LOW (-) with the effective implementation of the management measures proposed below.

Table 8-17: Impact assessment during construction: BESS Technology Alternative 2: Flow Batteries

Impact Description		**Impact type**	**Extent (E)**	**Duration (D)**	**Potential Intensity (P)**	**Likelihood (L)**	**Impact Rating & Significance (IR&S)**
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	1	1	1	0.1	0 - LOW
Aspect:	Spillage of hazardous substances	Project Impact	4	1	8	0.5	7 - MOD
Potential Impact:		**Significance with Mitigation**					
		Residual Impact	3	1	8	0.1	1 - LOW

<table>
<tr><th colspan="2">Impact Description</th><th>Impact type</th><th>Extent (E)</th><th>Duration (D)</th><th>Potential Intensity (P)</th><th>Likelihood (L)</th><th>Impact Rating & Significance (IR&S)</th></tr>
<tr><td colspan="2" rowspan="5">Spillages or leakage of electrolyte or hazardous substances during transportation, handling, storage or installation resulting on adverse impacts on the environment, soil and flora.</td><td>Reversibility</td><td colspan="5">High reversibility</td></tr>
<tr><td>Irreplaceability</td><td colspan="5">Moderate irreplaceability</td></tr>
<tr><td colspan="6">Cumulative Impact</td></tr>
<tr><td>Cumulative Impact</td><td>1</td><td>1</td><td>4</td><td>0.2</td><td>1 - LOW</td></tr>
<tr><td>Confidence</td><td colspan="5">High</td></tr>
<tr><th colspan="2">Impact Description</th><th>Impact type</th><th>E</th><th>D</th><th>P</th><th>L</th><th>IR&S</th></tr>
<tr><td>Impact</td><td>Indirect Impact:</td><td colspan="6">Significance without Mitigation</td></tr>
<tr><td>Impact Direction:</td><td>Negative</td><td>Existing Impact</td><td>1</td><td>1</td><td>1</td><td>0.1</td><td>0 - LOW</td></tr>
<tr><td>Aspect:</td><td>Spillage of hazardous substances</td><td>Project Impact</td><td>4</td><td>1</td><td>16</td><td>0.5</td><td>11 - HIGH</td></tr>
<tr><td colspan="2">Potential Impact:</td><td colspan="6">Significance with Mitigation</td></tr>
<tr><td colspan="2" rowspan="6">Spillages or leakage of electrolyte or hazardous substances during transportation, handling, storage or installation resulting on adverse impacts on fauna, and people.</td><td>Residual Impact</td><td>4</td><td>1</td><td>16</td><td>0.1</td><td>2 - LOW</td></tr>
<tr><td>Reversibility</td><td colspan="5">Moderate reversibility</td></tr>
<tr><td>Irreplaceability</td><td colspan="5">Moderate irreplaceability</td></tr>
<tr><td colspan="6">Cumulative Impact</td></tr>
<tr><td>Cumulative Impact</td><td>1</td><td>1</td><td>4</td><td>0.2</td><td>1 - LOW</td></tr>
<tr><td>Confidence</td><td colspan="5">High</td></tr>
</table>

Proposed Mitigation Measures (Impact Management Actions)

- A transport company accredited and licenced to transport dangerous goods on public roads must be used at all times for the transportation of the battery electrolyte and hazardous substances.
- Before transporting battery electrolyte and hazardous substances, the cargo must be properly secured, checked by the responsible person and signed off for transportation.
- Risk assessment must be conducted by a responsible and qualified person who will also inspect the packaging for any signs of damage before signing off the risk assessment.
- Electrolyte and active materials must be encapsulated with protective covering during transportation.
- Propper route planning must be undertaken by the developer in conjunction with the appointed transport company and necessary transport approvals and permits must be in place before the cargo leaves from its origin.
- Store and handling must be undertaken strictly according to manufacturer's instructions and in line with the Environmental Management Programme, and relevant best practices and standards applicable to the storage of hazardous and dangerous goods.
- During off-loading accredited operators with the correct equipment must be used at all times.

- Installation of BESS components must be undertaken by accredited staff or contractor. A copy pf such staff or contractor's relevant credentials and accreditations must be saved in the EMPr site file for auditing and verification at any time.
- An agreement or contract with an accredited HazMat company for first response, site clean-up and rehabilitation of any spillage must be concluded before transportation of the batteries, components or electrolyte is undertaken.
- All Material Safety Data Sheets (MSDS) for hazardous and dangerous substances to be used in the BESS must be available during transportation, storage, handling and installation of the BESS.

8.3.2 Terrestrial Biodiversity

Impacts identified

The Biodiversity Company assessed potential impacts on terrestrial biodiversity during the construction and operational phases of the proposed development (TBC, 2022a). A summary of the potential impacts during the construction and operational phases of the proposed activity are presented in Table 8-18.

Table 8-18: Summary of potential impacts to biodiversity associated with the proposed activity (including both underground and overhead powerlines) (TBC, 2022a)

Main Impact	Project Activities	Secondary Impacts Anticipated
Loss of karroid grassland	• Direct loss as a result of construction and operation of the proposed kV line • Secondary impacts associated with noise, dust and influx of alien invasive plants into these areas	• Habitat fragmentation. • Loss of ecosystem services. • Emigration of fauna species including SCC.
Degradation of surrounding highly sensitive habitats.	• Prevention of fires or incorrect fire regimes. • Removal of vegetation. • Improper solid waste disposal • Dust precipitation. • Spilling of hazardous chemicals from machinery. • Illegal hunting in sensitive areas.	• Loss of flora and fauna including SCC. • Increased potential for soil erosion. • Habitat fragmentation. • Increased potential for establishment of invasive alien vegetation.
Encroachment of invasive alien species in disturbed areas.	• Vegetation removal. • Soil disturbance • Vehicles potentially spreading seed.	• Habitat loss for native flora & fauna (including SCC). • Alteration of fauna assemblages due to habitat modification.
Direct mortality of fauna.	• Preparation of soil with heavy machinery • Intentional killing of fauna for food (hunting) or persecution (especially with regards to herpetofauna). • Pollution of water resources due to spilling of hazardous chemicals from heavy machinery during construction.	• Loss of ecosystem services.
Emigration of fauna	• Disturbance from construction activities. • Loss of habitat and degradation of surrounding habitats.	• Reduced population of SCC • Loss of ecosystem services.

Anthropogenic activities drive habitat destruction causing displacement of fauna and flora and possibly direct mortality. Land clearing destroys local wildlife habitat and can lead to the loss of local breeding grounds, nesting sites and wildlife movement corridors such as rivers, streams and drainage lines, or other locally important features. The removal of natural vegetation may reduce the habitat available for fauna species and may reduce animal populations and species compositions within the area.

Existing anthropogenic impacts to biodiversity within the proposed development site were observed during the assessment. These include:

- Erosion and loss of habitat as a result of runoff;
- Overgrazing;
- Litter; and
- Loss of indigenous flora and associated edge effects from existing infrastructure.

Impacts that were assessed for both site alternatives and the associated infrastructures, and both sites have similar terrestrial features, flora and fauna. The following potential impacts to terrestrial biodiversity were considered during the construction phase:

- Impact Aspect: Habitat loss
  - Impact: Destruction, further loss and fragmentation of the vegetation community (including a portion of an area classified as an CBA-irreplaceable and ESA as well as EN vegetation type),
- Impact Aspect: Protected flora
  - Impact: Destruction of protected plant species
- Impact Aspect: Loss of fauna:
  - Impact: Displacement of the faunal community due to habitat loss, direct mortalities and disturbance (road collisions, noise, dust, vibration and poaching); and

<u>Impact Assessment - Site A</u>

The impact assessment undertaken for Site A during the construction phase is provided in Table 8-19. The impact significance for all impacts identified and rated in Table 8-19 were rated as MODERATE before implementation of mitigation measures. However, assuming the mitigation measures as proposed by the biodiversity specialist were implemented and done so effectively and successfully, the impact significance for all impacts reduced to LOW (Table 8-19).

Table 8-19: Terrestrial Biodiversity impact assessment during construction: Site A (TBC, 2022a)

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	1	1	2	0,2	1 - LOW
Aspect:	Habitat loss	Project Impact	2	5	2	0,75	7 - MOD
Potential Impact:		**Significance with Mitigation**					
Destruction, further loss and fragmentation of the vegetation community (including a portion of an area classified as an CBA-irreplaceable and ESA as well as EN vegetation type); and		Residual Impact		3	1	0,5	2 - LOW
		Reversibility	Moderate reversibility				
		Irreplaceability	Moderate irreplaceability				
		Cumulative Impact					
		Cumulative Impact	2	3	2	0,5	4 - MOD
		Confidence	Medium				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	1	1	1	0,2	1 - LOW
Aspect:	Protected flora	Project Impact	2	4	2	0,75	6 - MOD
Potential Impact:		**Significance with Mitigation**					
Destruction of protected plant species.		Residual Impact	2	3	2	0,2	1 - LOW
		Reversibility	Moderate reversibility				
		Irreplaceability	Moderate irreplaceability				
		Cumulative Impact					
		Cumulative Impact	2	2	4	0,2	2 - LOW
		Confidence	High				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	2	3	2	0,5	4 - MOD
Aspect:	Loss of fauna	Project Impact	3	5	2	0,75	8 - MOD
Potential Impact:		**Significance with Mitigation**					
Displacement of faunal community due to habitat loss, direct mortalities and disturbance (noise, dust and vibration		Residual Impact	1	2	2	0,2	1 - LOW
		Reversibility	Moderate reversibility				
		Irreplaceability	Moderate irreplaceability				
		Cumulative Impact					
		Cumulative Impact	2	4	4	0,75	8 - MOD
		Confidence	Medium				

Impact Assessment - Site B

The biodiversity specialist identified the same impacts for Site B as was identified and rated for site A. When impacts associated with site B was considered, the impacts associated with *Habitat Loss* and *Loss of Fauna* were allocated an impact significance of MODERATE before implementation of mitigation measures. However, assuming the mitigation measures as proposed by the biodiversity specialist were implemented and done so effectively and successfully, the impact significance for *Habitat Loss* were reduced to LOW. The impact significance of the impact of *Loss of Fauna* remained within the same impact significance category, i.e. MODERATE, but were assigned a lower impact score within the MODERATE impact significance category (Table 8-20).

The impact relating to the *Destruction of protected plant species* were rated as a HIGH impact before implementation of the proposed mitigation measures. However, assuming the mitigation measures as proposed by the biodiversity specialist were implemented and done so effectively and successfully, the impact significance for *Destruction of protected plant species* reduced to LOW (Table 8-20).

Table 8-20: Terrestrial Biodiversity impact assessment during construction: Site B (TBC, 2022a)

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	1	1	2	0,2	1 - LOW
Aspect:	Habitat loss	Project Impact	2	5	4	0,75	8 - MOD
Potential Impact:		**Significance with Mitigation**					
Destruction, further loss and fragmentation of the vegetation community (including a portion of an area classified as an CBA-irreplaceable and ESA as well as EN vegetation type); and		Residual Impact		3	1	0,5	2 - LOW
		Reversibility	Moderate reversibility				
		Irreplaceability	Moderate irreplaceability				
		Cumulative Impact					
		Cumulative Impact	2	3	4	0,5	5 - MOD
		Confidence	Medium				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	1	1	1	0,2	1 - LOW
Aspect:	Protected flora	Project Impact	2	5	4	1	11 - HIGH
Potential Impact:		**Significance with Mitigation**					
Destruction of protected plant species.		Residual Impact	2	4	2	0,2	2 - LOW
		Reversibility	Moderate reversibility				
		Irreplaceability	Moderate irreplaceability				
		Cumulative Impact					
		Cumulative Impact	2	2	4	0,5	4 - MOD
		Confidence	High				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	2	3	2	0,5	4 - MOD
Aspect:	Loss of fauna	Project Impact	3	5	2	0,75	8 - MOD
Potential Impact:		**Significance with Mitigation**					
Displacement of faunal community due to habitat loss, direct mortalities and disturbance (noise, dust and vibration		Residual Impact	1	2	2	0,5	3 - MOD
		Reversibility	Moderate reversibility				
		Irreplaceability	Moderate irreplaceability				
		Cumulative Impact					
		Cumulative Impact	2	4	4	0,75	8 - MOD
		Confidence	Medium				

Proposed Mitigation Measures (Impact Management Actions)

Mitigation and management measures proposed by the biodiversity specialist during the construction phase include:

- All development areas must be clearly demarcated and restricted to the proposed development areas/corridors.
- Areas of indigenous vegetation outside of the direct project footprint, should under no circumstances be fragmented or disturbed further.
- All activities must make use of existing roads and tracks as far as practically and feasibly possible. Eroded areas must be rehabilitated using the appropriate techniques and re-vegetated using indigenous flora.
- Apply for a permit to relocate protected plant species into the on-site relocation areas already used for transplantation of rescued plants or if not available, then to similar habitat recommended by a specialist.
- A qualified environmental control officer must be on site when construction begins to identify fauna species that will be directly disturbed and to relocate protected fauna/flora that are found during the construction activities. The area must be walked though prior to construction to ensure no faunal species remain in the habitat and get killed. Should animals not move out of the area on their own relevant specialists must be contacted to advise on how the species can be relocated. No trapping, killing, or poisoning of any wildlife is to be allowed

8.3.3 Surface Water and Wetlands

Impacts identified

The wetland specialist identified various drainage features and some more significant depressions/pans were identified throughout the 500 m regulated area. These drainage features, however, are not characterised by riparian vegetation and grasses and rather represent bare surfaces with evidence of surface run-off. No wetlands were therefore identified within the study area and 500m radius around the study area.

The impact assessment considered both direct and indirect impacts, to the delineated systems, by the different proposed activities. It is evident from these illustrations that the proposed Options A and B are going to have direct and indirect impacts on the delineated drainage features. Both options will have access roads and powerlines crossing different drainage features as well as option B’s PV facility will cross over a drainage system.

The following potential impacts to were considered during the construction phase of the proposed development:

- Destruction, further loss, and fragmentation of the watercourses;
- Clearing of vegetation;

- Removal of soils;
- Altering overland flows; and
- Dust suppressants.

Since no wetlands were identified within the study area, the wetland specialist has assessed impacts of the non-perennial drainage lines by consideration of the above impact in relation to the respective infrastructure types.

Impact Assessment – Site A

The different activities taking place for this project will pose different impacts on the delineated watercourses. The PV facility is in close proximity to a drainage system on the eastern side and two pans on the border of the area. The substation and BESS are located well away from any of the delineated watercourses and will thus have no impacts on the watercourses. The roads, pipeline and power line will have multiple crossings over the delineated drainage line and will thus have the highest impacts on the watercourses and in return have the most mitigation measure to adhere too (TBC, 2022b).

The impact significance of the impact of construction of the PV facility, BESS facility and access roads on delineated non-perennial water courses through removal of soils, increased surface runoff and loss of topsoil before mitigation was rated as MODERATE. However, with the implementation of mitigation and management measures as proposed by the wetland specialist, the impact significance will be reduced to LOW, as is evident from Table 8-21.

The impact significance of the digging of holes for pylons associated with the installation of the proposed powerline has, however, been rated as LOW prior to and after the implementation of proposed mitigation and management measures (Table 8-21).

Table 8-21: Surface Water and Wetland impact assessment during construction: Site A (TBC, 2022b)

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	1	2	1	0,1	0 - LOW
Aspect:	**Construction of PV Facility**	Project Impact	1	1	8	0,5	5 - MOD
Potential Impact:		**Significance with Mitigation**					
Removal of Soils. Increase surface runoff. Loss of topsoil.		Residual Impact	1	1	2	0,2	1 - LOW
		Reversibility	Moderate reversibility				
		Irreplaceability	Low irreplaceability				
		Cumulative Impact					
		Cumulative Impact	2	5	2	0,2	2 - LOW
		Confidence	High				

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
Impact Description		Impact type	E	D	P	L	IR&S
Impact	Direct Impact:	Significance without Mitigation					
Impact Direction:	Negative	Existing Impact	2	1	1	0,2	1 - LOW
Aspect:	**Construction of Roads**	Project Impact	1	1	8	0,5	5 - MOD
Potential Impact:		Significance with Mitigation					
Loss of topsoil. Loss of vegetation. Increase surface runoff. Increase erosion potential.		Residual Impact	2	1	4	0,2	1 - LOW
		Reversibility	Moderate reversibility				
		Irreplaceability	Moderate irreplaceability				
		Cumulative Impact					
		Cumulative Impact	2	5	4	0,2	2 - LOW
		Confidence	Medium				
Impact Description		Impact type	E	D	P	L	IR&S
Impact	Indirect Impact:	Significance without Mitigation					
Impact Direction:	Neutral	Existing Impact	1	1	4	0,1	1 - LOW
Aspect:	**Installation of powerlines**	Project Impact	1	1	2	0,1	0 - LOW
Potential Impact:		Significance with Mitigation					
Digging of holes for pylons.		Residual Impact	1	1	4	0,1	1 - LOW
		Reversibility	Low reversibility				
		Irreplaceability	High irreplaceability				
		Cumulative Impact					
		Cumulative Impact	2	1	2	0,2	1 - LOW
		Confidence	High				
Impact Description		Impact type	E	D	P	L	IR&S
Impact	Indirect Impact:	Significance without Mitigation					
Impact Direction:	Negative	Existing Impact	1	1	1	0,1	0 - LOW
Aspect:	**Installation of BESS and Substation**	Project Impact	1	1	4	0,5	3 - MOD
Potential Impact:		Significance with Mitigation					
Removal of Soils. Increase surface runoff. Loss of topsoil.		Residual Impact	1	1	2	0,2	1 - LOW
		Reversibility	Moderate reversibility				
		Irreplaceability	Low irreplaceability				
		Cumulative Impact					
		Cumulative Impact	1	1	1	0,1	0 - LOW
		Confidence	High				

Impact Assessment – Site B

The different activities taking place for this project will pose different impacts on the delineated watercourses. There are multiple drainage systems running through the proposed PV facility area. The substation and BESS are located to the south of a drainage system and might have some indirect impacts on the system. The roads, pipeline and power line will have multiple crossings over the delineated drainage line and will thus have the highest impacts on the watercourses and in return have the most mitigation measure to adhere too (TBC, 2022b).

The same impacts were identified and assessed for Site B as for Site A. The impact significance of the impact of construction of the PV facility, BESS facility and access roads on delineated non-perennial water courses through removal of soils, increased surface runoff and loss of topsoil before mitigation was rated as MODERATE. However, with the implementation of mitigation and management measures as proposed by the wetland specialist, the impact significance will be reduced to LOW, as is evident from Table 8-22.

The impact significance of the digging of holes for pylons associated with the installation of the proposed powerline has, however, been rated as LOW prior to and after the implementation of proposed mitigation and management measures (Table 8-22).

Table 8-22: Surface Water and Wetland impact assessment during construction: Site B (TBC, 2022b)

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	1	2	1	0,1	0 - LOW
Aspect:	**Construction of PV Facility**	Project Impact	2	1	8	0,75	8 - MOD
Potential Impact:		**Significance with Mitigation**					
Removal of Soils. Increase surface runoff. Loss of topsoil.		Residual Impact	1	1	2	0,5	2 - LOW
		Reversibility	Moderate reversibility				
		Irreplaceability	Low irreplaceability				
		Cumulative Impact					
		Cumulative Impact	2	5	2	0,2	2 - LOW
		Confidence	High				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	2	1	1	0,2	1 - LOW
Aspect:	**Construction of Roads**	Project Impact	1	1	8	0,5	5 - MOD
Potential Impact:		**Significance with Mitigation**					
Loss of topsoil. Loss of vegetation. Increase surface runoff. Increase erosion potential.		Residual Impact	2	1	4	0,2	1 - LOW
		Reversibility	Moderate reversibility				
		Irreplaceability	Moderate irreplaceability				
		Cumulative Impact					
		Cumulative Impact	2	5	4	0,2	2 - LOW
		Confidence	Medium				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Indirect Impact:	**Significance without Mitigation**					

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
Impact Direction:	Neutral	Existing Impact	1	1	4	0,1	1 - LOW
Aspect:	**Installation of powerlines**	Project Impact	1	1	2	0,1	0 - LOW
Potential Impact:		**Significance with Mitigation**					
Digging of holes for pylons.		Residual Impact	1	1	4	0,1	1 - LOW
		Reversibility	Low reversibility				
		Irreplaceability	High irreplaceability				
		Cumulative Impact					
		Cumulative Impact	2	1	2	0,2	1 - LOW
		Confidence	High				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Indirect Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	1	1	1	0,1	0 - LOW
Aspect:	**Installation of BESS and Substation**	Project Impact	1	1	4	0,5	3 - MOD
Potential Impact:		**Significance with Mitigation**					
Removal of Soils. Increase surface runoff. Loss of topsoil.		Residual Impact	1	1	2	0,2	1 - LOW
		Reversibility	Moderate reversibility				
		Irreplaceability	Low irreplaceability				
		Cumulative Impact					
		Cumulative Impact	1	1	1	0,1	0 - LOW
		Confidence	High				

Proposed Mitigation Measures (Impact Management Actions)

The following mitigation measures have been prescribed to ensure the conservation of drainage features by limiting any indirect impacts;

- **General Management and Mitigation Measures**
    - 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;
    - All construction activities must be restricted to the development footprint area. This includes laydown and storage areas, ablutions, offices etc.;
    - During construction activities, all rubble generated must be removed from the site;
    - Construction vehicles and machinery must make use of existing access routes;
    - All chemicals and toxicants to be used for the construction must be stored in a bunded area;
    - All machinery and equipment should be inspected regularly for faults and possible leaks, these should be serviced off-site;

  - All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good "housekeeping";
  - Adequate sanitary facilities and ablutions on the servitude must be provided for all personnel throughout the project area. Use of these facilities must be enforced (these facilities must be kept clean so that they are a desired alternative to the surrounding vegetation);
  - All removed soil and material stockpiles must be protected from erosion, stored on flat areas where run-off will be minimised, and be surrounded by bunds;
  - Any exposed earth should be rehabilitated promptly by planting suitable vegetation (vigorous indigenous grasses) to protect the exposed soil;
  - No dumping of construction material on site may take place; and
  - All waste generated on site during construction must be adequately managed. Separation and recycling of different waste materials should be supported.
- **Construction of PV Facility**
  - Keep the footprint of the PV facility as small as possible;
  - When removing topsoil keep it separate to be able to use it to fill up holes;
  - Revegetate bare areas after construction, and
  - Construction should be done during dry season.
- **Construction of Roads**
  - The footprint area of the road should be kept a minimum. The footprint area must be clearly demarcated to avoid unnecessary disturbances to adjacent areas;
  - Exposed road surfaces awaiting grading must be stabilised to prevent the erosion of these surfaces. Signs of erosion must be addressed immediately to prevent further erosion of the road;
  - Silt traps and fences must be placed in the preferential flow paths along the road to prevent sedimentation of the watercourse;
  - Temporary stormwater channels should be filled with aggregate and/or logs (branches included) to dissipate flows;
  - A suitable stormwater plan must be compiled for the road. This plan must attempt to displace and divert stormwater from the road and discharge the water into adjacent areas without eroding the receiving areas. It is preferable that run-off velocities be reduced with energy dissipaters and flows discharged into the local watercourses;
  - All areas outside of the demarcated areas should be declared a 'no-go' area during the construction phase and all efforts must be made to prevent access to this area from construction workers and machinery;
  - Dust-reducing mitigation measures must be put in place and must be strictly adhered to. This includes wetting of exposed soft soil surfaces and not conducting activities on windy days which will increase the likelihood of dust being generated;

- Areas that are cleared during construction need to be re-vegetated with indigenous vegetation to prevent erosion and reduce the likelihood of encroachment by alien invasive plant species upon completion of the road; and
- Any topsoil that is removed during construction must be appropriately removed and stored. This includes on-going maintenance of such topsoil piles so that they can be utilised during decommissioning phases and re-vegetation.

- **Construction of Powerlines**
  - Move pylons outside of the drainage systems;
  - Make sure to revegetate bare areas after construction, and
  - Ensure that construction is done during dry season, where feasible.
- **Construction of Substation and BESS**
  - Keep the footprint as small as possible;
  - Install spill trays under the BESS;
  - Store topsoil's to use to fill up holes after installation, and
  - Revegetate the bare areas after installation.
- **Conservation of Drainage Systems -** This section is critical to those drainage systems proposed to be crossed by means of roads;
  - Crossings are to be constructed during the low flow period;
  - Well-engineered, and wide enough culvert systems should be installed at all drainage systems, including those minor systems not identified during the site assessment;
  - It is critical to spread flows across the system, avoiding incisions in the landscape caused by concentrated flows. Temporary stormwater channels should be filled with aggregate and/or logs (branches included) to dissipate flows;
  - It is recommended that the material surrounding and holding the culverts in place include a coarse rock layer that has been specifically incorporated to increase the porosity and permeability to accommodate flooding and very low flows;
  - The culverts used in the design should be as large as possible, partially sunken and energy dissipating material must be placed at the discharge area of each culvert to prevent erosion of these areas.
  - The use of larger culverts will prevent the build-up of debris by allowing the free movement of debris through the large culverts;
  - Culverts should avoid inundation (damming) of upstream areas by facilitating streamflow and catering properly for both low flows and high flows;
  - Surface run-off from the roads flowing down the embankments often scours the watercourse on the sides of the culvert causing sedimentation of the channel. This should be catered for with adequate concreted stormwater drainage depressions and channels with energy dissipaters that channel these flows into the river in a controlled manner;
  - The culvert installations should further take into account the scouring action of high flows and gabion structures or similar should be placed on both sides of the culvert on the embankments both upstream and downstream. This will

serve as retention of the soils from scouring around and underneath the culvert structures aiding in the protection of the structure;
- Large aggregate outsourced or from the project area (if available) can be used for energy dissipation in the channel downstream of the culverts to reduce the likelihood of scouring the riverbed and sedimentation of the catchment. It is preferable that larger aggregate be used to avoid flows removing material from the site;
- Signs of erosion must be addressed immediately to prevent further erosion;
- Monthly erosion monitoring must take place from May to August to identify erosion alongside the proposed road;
- Silt traps and fences must be placed in the preferential flow paths along the road to prevent sedimentation of the watercourse; and
- In addition to the roads, there are three wind turbines (wind turbines in specific that are located in close proximity to the identified drainage systems, these are to be moved to ensure that no development takes place within 15 m of the drainage systems.

8.3.4 Avifauna

Impacts identified

Considering the anthropogenic activities and influences within the landscape, several existing and current negative impacts to biodiversity were observed within the assessment area. These include:

- Erosion and loss of habitat as a result of runoff;
- Overgrazing;
- Litter; and
- Loss of indigenous flora and associated edge effects from existing infrastructure.

During the construction phase vegetation clearing and brush cutting of vegetation for the associated infrastructure will lead to direct habitat loss. Vegetation clearing will create a disturbance and will therefore potentially lead to the displacement of avifaunal species. The operation of construction machinery on site will generate noise and cause dust pollution. Should non-environmentally friendly dust suppressants be used, chemical pollution can take place. Increased human presence can lead to poaching and the increase in vehicle traffic will potentially lead to roadkill (TBC, 2022c).

The following potential impacts were considered:

- Habitat Loss (Destroy, fragment, and degrade habitat, ultimately displacing avifauna);
- Sensory disturbances (e.g. noise, dust, vibrations);
- Collection of eggs and poaching;
- Roadkill;

- Chemical pollution associated with dust suppressants; and
- Displacement or death of SCCs.

Impact Assessment – Site A and B

Alternatives include two site options with associated infrastructure, i.e. Site A and Site B. The impacts on birds for each of the options was assessed and considered to be identical in nature (TBC, 2022c). A combined impact assessment was therefore undertaken for both Site A and B.

The construction will impact a small area of CBA area as well as an ESA area and an ONA. Mitigations such as the restriction and demarcation of the footprint can reduce this impact, it can however not be mitigated completely as some habitat will still be lost or fragmented. By installing signs and including a toolbox talk regarding environmental awareness during meetings, collection of eggs and poaching can successfully be mitigated. These impacts can then be reduced from MODERATELY HIGH to LOW. Based on the known occurrence of 5 SCCs of which some are likely breeding in the assessment area the pre-mitigation impact was rated as VERY HIGH (rated 'Critical' in the avifauna specialist' impact assessment methodology). This impact can be somewhat mitigated to MODERATELY HIGH.

Table 8-23: Avifauna impact assessment during Construction: Site A and B (TBC, 2022c)

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	1	5	1	0.2	1 - LOW
Aspect:	Habitat Loss	Project Impact	3	5	4	1	12 - HIGH
Potential Impact:		**Significance with Mitigation**					
Habitat Loss (Destroy, fragment and degrade CBA, ESA and ONA habitat, ultimately displacing avifauna)		Residual Impact	2	4	4	0.75	8 - MOD
		Reversibility	Impacts are non-reversible				
		Irreplaceability	High irreplaceability				
		Cumulative Impact					
		Cumulative Impact	3	5	8	0.75	12 - HIGH
		Confidence	Medium				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	1	5	1	0.2	1 - LOW
Aspect:	Sensory Disturbance	Project Impact	2	4	8	0.75	11 - HIGH
Potential Impact:		**Significance with Mitigation**					
Sensory disturbances (e.g. noise, dust, light, vibrations)		Residual Impact	2	3	4	0.5	5 - MOD
		Reversibility	High reversibility				
		Irreplaceability	Low irreplaceability				
		Cumulative Impact					

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
		Cumulative Impact	3	5	8	0.5	8 - MOD
		Confidence	Medium				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Indirect Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	1	5	1	0.2	1 - LOW
Aspect:	Collection and Poaching	Project Impact	3	3	8	0.75	11 - HIGH
Potential Impact:		**Significance with Mitigation**					
Collection of eggs and poaching		Residual Impact	2	2	2	0.2	1 - LOW
		Reversibility	Low reversibility				
		Irreplaceability	Moderate irreplaceability				
		Cumulative Impact					
		Cumulative Impact	3	5	4	0.5	6 - MOD
		Confidence	Medium				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Indirect Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	2	5	2	0.2	2 - LOW
Aspect:	Roadkill	Project Impact	2	3	4	0.75	7 - MOD
Potential Impact:		**Significance with Mitigation**					
Roadkill		Residual Impact	1	2	4	0.2	1 - LOW
		Reversibility	Impacts are non-reversible				
		Irreplaceability	Moderate irreplaceability				
		Cumulative Impact					
		Cumulative Impact	3	5	4	0.5	6 - MOD
		Confidence	Medium				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Indirect Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	1	1	1	0.1	0 - LOW
Aspect:	Dust suppression	Project Impact	3	3	8	0.75	11 - HIGH
Potential Impact:		**Significance with Mitigation**					
Chemical pollution associated with dust suppressants		Residual Impact	1	2	2	0.2	1 - LOW
		Reversibility	Moderate reversibility				
		Irreplaceability	Moderate irreplaceability				
		Cumulative Impact					
		Cumulative Impact	3	5	4	0.5	6 - MOD
		Confidence	Low				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	3	5	2	0.2	2 - LOW
Aspect:	SCCs	Project Impact	3	5	16	1	24 - FLAW
Potential Impact:		**Significance with Mitigation**					

Impact Description	Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
Displacement or death of SCCs	Residual Impact	3	4	4	0.75	8 - MOD
	Reversibility	Low reversibility				
	Irreplaceability	High irreplaceability				
	Cumulative Impact					
	Cumulative Impact	3	5	16	1	24 - FLAW
	Confidence	Medium				

Proposed Mitigation Measures (Impact Management Actions)

- Areas of already fragmented indigenous vegetation, even secondary communities outside of the direct project footprint, should under no circumstances be fragmented or disturbed further. Clearing of vegetation should be minimized and avoided where possible. Clearing beneath panels should be avoided.
- The site ecological importance for SCCs is rated as high, and therefore the site area should be avoided where possible. The extent should be minimised, with drainage lines avoided where possible. Clearing of vegetation beneath panels should be avoided and roads kept to a minimum.
- Where possible, existing access routes and walking paths must be made use of.
- Erosion control and alien invasive management plan must be compiled.
- A fire management plan needs to be compiled and implemented to restrict the impact fire might have on the surrounding areas.
- The areas to be developed must be specifically demarcated to prevent movement of staff or any individual into the surrounding environments. Signs must be put up to enforce this.
- All personnel should undergo environmental induction with regards to avifauna and in particular awareness about not harming, collecting, or hunting terrestrial species (e.g., guineafowl and francolin), and owls, which are often persecuted out of superstition. Signs must be put up to enforce this.
- The duration of the construction should be kept to a minimum to avoid disturbing avifauna.
- Outside lighting should be designed and limited to minimize impacts on fauna. All outside lighting should be directed away from highly sensitive areas. Fluorescent and mercury vapor lighting should be avoided and sodium vapor (red/green) motion detection lights should be used wherever possible.
- All construction and maintenance motor vehicle operators should undergo an environmental induction that includes instruction on the need to comply with speed limit (40km/h), to respect all forms of wildlife. Speed limits must still be enforced to ensure that road killings and erosion is limited.
- Schedule or limit (where feasible) activities during least sensitive periods, to avoid migration, nesting and breeding seasons (May – August)

- All project activities must be undertaken with appropriate noise mitigation measures to avoid disturbance to avifauna population in the region
- All areas to be developed must be walked through prior to any activity to ensure no nests or avifauna species are found in the area. Should any Species of Conservation Concern be found and not move out of the area or their nest be found in the area a suitably qualified specialist must be consulted to advise on the correct actions to be taken.
- The design of the proposed PV must be of a type or similar structure as endorsed by the Eskom-EWT Strategic Partnership on Birds and Energy, considering the mitigation guidelines recommended by Birdlife South Africa (Jenkins et al., 2017).
- Infrastructure should be consolidated where possible in order to minimise the amount of ground and air space used.
- All the parts of the infrastructure must be nest proofed and anti-perch devices placed on areas that can lead to electrocution
- Use environmentally friendly cleaning and dust suppressant products
- Fencing mitigations:
  - Top 2 strands must be smooth wire
  - Routinely retention loose wires
  - Minimum 30cm between wires
  - Place markers on fences
- As far as possible power cables within the project area should be thoroughly insulated and preferably buried.
- Any exposed parts must be covered (insulated) to reduce electrocution risk
- White strips should be placed along the edges of the panels, to reduce similarity to water and deter birds and insects (Horvath et al, 2010). Consider the use of bird deterrent devices to limit collision risk.

8.3.5 Heritage, Archaeology and Palaeontology

Impacts identified

During this phase, the impacts and effects are similar in nature but more extensive than the pre-construction phase. Potential impacts include destruction or partial destruction of non-renewable heritage resources.

No palaeontological sensitive areas were identified within the study area, hence this insignificant impact was not further assessed during the impact assessment phase.

Impact Assessment – Site A and B

Alternatives include two site options with associated infrastructure, i.e. Site A and Site B. The impacts on heritage, archaeological and palaeontological resources for each of the options was assessed and considered to be identical in nature (Beyond Heritage, 2022). A combined impact assessment was therefore undertaken for both Site A and B.

No significant heritage, archaeology or palaeontology resources were identified within the proposed development site. As such, the impact significance of all impacts is rated as LOW before and after mitigation (Table 8-13).

Table 8-24: Heritage, Archaeology and Palaeontology impact assessment during Construction: Site A and B (Beyond Heritage, 2022)

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	1	5	1	0,2	1 - LOW
Aspect:	Isolated Stone Age Artefacts	Project Impact	1	5	1	0,2	1 - LOW
Potential Impact:		**Significance with Mitigation**					
Destruction of isolated Stone Age scatters in the project area.		Residual Impact	1	5	1	0,2	1 - LOW
		Reversibility	Impacts are non-reversible				
		Irreplaceability	Moderate irreplaceability				
		Cumulative Impact					
		Cumulative Impact	1	5	1	0,2	1 - LOW
		Confidence	High				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Indirect Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	2	5	4	0,1	1 - LOW
Aspect:	Possible grave at K10.	Project Impact	2	5	4	0,1	1 - LOW
Potential Impact:		**Significance with Mitigation**					
Damage or destruction to the possible grave at K10.		Residual Impact	1	5	4	0,1	1 - LOW
		Reversibility	Impacts are non-reversible				
		Irreplaceability	High irreplaceability				
		Cumulative Impact					
		Cumulative Impact	2	5	4	0,1	1 - LOW
		Confidence					

Proposed Mitigation Measures (Impact Management Actions)

- Implementation of a Chance Finds Procedure for heritage, archaeological and palaeontological resources and artefacts that may be identified or unearthed.
- The potential burial site (K10) should be indicated on development plans and avoided.

8.3.6 Visual Aspects

In assessing the construction phase, it is assumed that all activities will be undertaken within the site boundaries supplied, and that any disturbance of areas outside of these boundaries will be prohibited.

Impacts identified

The following visual impacts have been identified during the Construction phase of the proposed development:

- The construction activities may disturb the quiet sense of peaceful solitude of the Kalahari rangelands. This impact would be moderate to low given that there are few sensitive receptors.
- Construction activities, particularly noise and dust, heavy vehicles and abnormal load vehicles, may impact the experience of tourists to the region and result in impacts to tourist sentiment and tourism revenue.
- The construction activities related to the construction of the KBPF facility may negatively affect the expansive views of the Kalahari Rangelands from the N14, D3257 and other sensitive viewpoints by introducing unnatural elements, movement and contrast.

Impact Assessment – Site A

In assessing the construction phase, it is assumed that all activities will be undertaken within the site boundaries supplied, and that any disturbance of areas outside of these boundaries will be prohibited.

The anticipated impact significance of the impacts identified during the construction phase for Site A range from LOW to MODERATE pre-mitigation. However, the impact significance of all the impacts will be reduced to LOW assuming the mitigation measures proposed by the visual specialist has been implemented successfully and effectively (Table 8-25).

Table 8-25: Visual impact assessment during Construction: Site A (Geonest, 2022)

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	1	1	1	0.1	0 - LOW
Aspect:	Visual Impact	Project Impact	2	1	2	0.75	4 - MOD
Potential Impact:		**Significance with Mitigation**					
The construction activities may disturb the quiet sense of peaceful solitude of the Kalahari rangelands. This impact would be moderate to low given that there are few sensitive receptors		Residual Impact	2	1	1	0.5	2 - LOW
		Reversibility	High reversibility				
		Irreplaceability	Resources are replaceable				
		Cumulative Impact					
		Cumulative Impact	2	1	1	0.5	2 - LOW
		Confidence	High				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Indirect Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	1	1	1	0.1	0 - LOW
Aspect:	Visual Impact	Project Impact	3	1	2	0.2	1 - LOW

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
Potential Impact:		Significance with Mitigation					
Construction activities, particularly noise and dust, heavy vehicles and abnormal load vehicles, may impact the experience of tourists to the region and result in impacts to tourist sentiment and tourism revenue.		Residual Impact	2	1	1	0.1	0 - LOW
		Reversibility	High reversibility				
		Irreplaceability	Resources are replaceable				
		Cumulative Impact					
		Cumulative Impact	3	1	1	0.1	1 - LOW
		Confidence	Medium				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Direct Impact:	Significance without Mitigation					
Impact Direction:	Negative	Existing Impact	2	2	1	1	5 - MOD
Aspect:	Visual Impact	Project Impact	2	1	2	0.5	3 - MOD
Potential Impact:		Significance with Mitigation					
The construction activities related to the construction of the KBPF facility may negatively affect the expansive views of the Kalahari Rangelands from the N14, D3257 and other sensitive view points by introducing unnatural elements, movement and contrast.		Residual Impact	2	1	1	0.5	2 - LOW
		Reversibility	High reversibility				
		Irreplaceability	Resources are replaceable				
		Cumulative Impact					
		Cumulative Impact	2	1	1	1	4 - MOD
		Confidence	High				

Impact Assessment – Site B

In assessing the construction phase, it is assumed that all activities will be undertaken within the site boundaries supplied, and that any disturbance of areas outside of these boundaries will be prohibited.

Similar to Site A, the anticipated impact significance of the impacts identified during the construction phase for Site B range from LOW to MODERATE pre-mitigation. However, the impact significance of all the impacts will be reduced to LOW assuming the mitigation measures proposed by the visual specialist has been implemented successfully and effectively (Table 8-26).

Table 8-26: Visual impact assessment during Construction: Site B (Geonest, 2022)

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity	Likelihood (L)	Impact Rating & Significanc e (IR&S)
Impact	Direct Impact:	Significance without Mitigation					
Impact Direction:	Negative	Existing Impact	1	1	1	0.1	0 - LOW
Aspect:	Visual Impact	Project Impact	2	1	2	0.75	4 - MOD
Potential Impact:		Significance with Mitigation					
The construction activities may disturb the quiet sense of peaceful solitude of the Kalahari rangelands.		Residual Impact	2	1	1	0.5	2 - LOW
		Reversibility	High reversibility				
		Irreplaceability	Resources are replaceable				

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity	Likelihood (L)	Impact Rating & Significance (IR&S)
This impact would be moderate to low given that there are few sensitive receptors		Cumulative Impact					
		Cumulative Impact	2	1	1	0.5	2 - LOW
		Confidence	High				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Indirect Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	1	1	1	0.1	0 - LOW
Aspect:	Visual Impact	Project Impact	3	1	2	0.2	1 - LOW
Potential Impact:		**Significance with Mitigation**					
Construction activities, particularly noise and dust, heavy vehicles and abnormal load vehicles, may impact the experience of tourists to the region and result in impacts to tourist sentiment and tourism revenue.		Residual Impact	2	1	1	0.1	0 - LOW
		Reversibility	High reversibility				
		Irreplaceability	Resources are replaceable				
		Cumulative Impact					
		Cumulative Impact	3	1	1	0.1	1 - LOW
		Confidence	Medium				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	2	2	1	1	5 - MOD
Aspect:	Visual Impact	Project Impact	2	1	2	0.5	3 - MOD
Potential Impact:		**Significance with Mitigation**					
The construction activities related to the construction of the KBPF facility may negatively affect the expansive views of the Kalahari Rangelands from the N14, D3257 and other sensitive view points by introducing unnatural elements, movement and contrast.		Residual Impact	2	1	1	0.5	2 - LOW
		Reversibility	High reversibility				
		Irreplaceability	Resources are replaceable				
		Cumulative Impact					
		Cumulative Impact	2	2	1	1	5 - MOD
		Confidence	High				

Proposed Mitigation Measures (Impact Management Actions)

- Vegetation removal should be kept to a minimum and vegetation should be retained wherever possible.
- Areas that are temporarily cleared must be rehabilitated as soon as the need for the use of that area ends.
- Locally indigenous shrubs and trees should be planted along perimeter fencing facing the D3276
- A dust suppression plan must be developed and implemented.
- Reversing of construction vehicles should be kept to a minimum to minimise the use of reverse warning sounds and wherever possible vehicles should be turned around without using reverse gear.
- Any abnormal loads that are to be delivered to or from site or activities involving a large numbers of delivery vehicles, should be scheduled to avoid peak traffic times on the N14 to limit the impact of traffic on the tourist experience.

8.3.7 Socio-economic environment

Assessment of alternatives

The findings of the SIA indicate that social impacts associated with each of the two project site alternatives are similar. Both alternatives are located on the farm Olyvenhouts Drift Settlement Agricultural Holding 1080 Portion 0, which is owned by the Applicant. Separate assessments have therefore not been undertaken and the significance ratings indicated in this section apply to each of the two site alternatives (Solarys, 2022).

Impacts identified

The following socio-economic impacts have been identified during the Construction phase of the proposed development:

- **Creation of employment opportunities (Positive Impact):** It is anticipated that the construction phase will extend over a period of approximately 24 months. According to estimates provided by the Applicant, approximately 120 temporary employment opportunities will be created during the peak construction phase.
- **Creation of procurement and business opportunities (Positive Impact):** Local and regional businesses should be granted opportunities to tender for contracts associated with the provision of goods and services associated with the construction phase.
- **Increased demand for low-cost housing and municipal services:** Housing of temporary employees in the low and semi-skilled income range could be problematic if they are brought in from other areas during the construction phase. Without mitigation, an additional contingent of temporary construction workers in the area could increase the burden on the local municipalities given that it will increase the demand for services (accommodation, water, sanitation, electricity, etc).
- **Strain on community health and safety services:** The presence of non-local construction workers could exacerbate existing social pathologies, including substance abuse, increase in incidences of crime, disintegration of close relationships with significant others (spouse, fiancé, girlfriend, etc.), prostitution, unplanned pregnancies and spread of communicable diseases, placing further strain on family structures and social networks.
- **Influx of jobseekers:** In-migration of jobseekers can be anticipated where there is the possibility of large-scale employment creation. While the proposed project on its own is not likely to be the primary driver of influx in the area, the simultaneous establishment of similar renewal energy facilities could cumulatively encourage people to seek employment and settle in the area.
- **Risk to livestock, crops, houses and farm infrastructure:** With many of the adjacent properties, particularly the properties located to the south of the proposed project site being used for livestock grazing and grape cultivation, the presence and movement of construction workers might result in loss or damage to farm infrastructure

and livestock as a result of for example, gates being left open; livestock ingesting plastic/litter; and the potential for grass fires.

- **Impact on tourism:** Based on an evaluation of the various tourism clusters located within DKLM and KGLM, it is unlikely that the proposed project will have an impact on tourism activities in the area. The proposed project site is located within an established industrial area on land that is currently being used for livestock grazing. The existing Eskom Upington MTS is also located on the site.
- **Loss of farmland:** Both the preferred and alternative powerline routes traverse land currently owned by the Applicant and used for the existing Eskom Upington MTS. The area is also used for livestock grazing by the previous owner in terms of a 5-year agreement with the Applicant. The establishment of the proposed Kiwano BESS and PV will therefore result in loss of grazing rights for the previous landowner. The grazing agreement currently in force is for a limited duration, while the development site is large enough for livestock to graze on areas not yet affected by the proposed development.

<u>Impact Assessment – Site A and B</u>

The impact assessment of the identified socio-economic assessment during the Construction phase is provided in Table 8-27.

Given the high levels of unemployment in DKLM and KGLM, the proposed project presents a localised socio-economic benefit with the potential to improve the quality of life for residents of DKLM and the adjacent KGLM. However, in the absence of implementation of recommended enhancements, the significance of this positive impact is likely to be Low (+) given that the preference may be to use skilled and experienced workers from outside the area rather than to train local community members where skilled workers are not immediately available. With the implementation of the recommended enhancements, the significance of this positive impact is likely to remain Moderate (+), as there is increased probability that local people will be employed during the construction phase (Solarys, 2022).

The impact significance of creation of procurement and business opportunities (positive impact) is likely to improve from Low (+) before enhancements to Moderate (+) after implementation of recommended enhancements given that the proposed measures may increase the probability that investment in the local economy is maximised to the extent possible. In this manner, both direct and indirect benefits will accrue to local community members.

The impact significance of the increased demand for low-cost housing and municipal services impact is likely to be Low (-) without mitigation. With implementation of recommended mitigation measures detailed below, the significance of this impact is likely to remain Low (-).

In the absence of mitigation, the significance of the impact relating to additional strain on community health and safety services is likely to be High (-). This is due to the very high intensity/magnitude of the impact (e.g. dealing with an unplanned pregnancy, contracting AIDS or TB, injury or even loss of life due to violent crime) and the high probability of the impact occurring. With mitigation, the significance of this impact is likely to be Low (-), largely due to the lower probability of the impact occurring.

With the implementation of the recommended mitigation measures, the impact significance of the Loss of Farmland to the risk to livestock, crop, houses and farm infrastructure is likely to be Low (-), as opposed to a Moderate (-) significance without mitigation, given that the intensity and probability of the impact occurring can be reduced (Solarys, 2022).

Table 8-27: Socio-economic impact assessment during Construction: Site A and B (Solarys, 2022)

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
Impact	Direct Impact:	Significance without Mitigation					
Impact Direction:	Positive	Existing Impact	2	1	1	0.1	0 - LOW
Aspect:	Social	Project Impact	2	1	2	0.2	1 - LOW
Potential Impact:		Significance with Mitigation					
Creation of employment, skills development, procurement and business opportunities		Residual Impact	2	1	2	0.5	3 - MOD
		Reversibility	High reversibility				
		Irreplaceability					
		Cumulative Impact					
		Cumulative Impact	2	1	2	0.75	4 - MOD
		Confidence	Medium				
Impact Description		Impact type	E	D	P	L	IR&S
Impact	Indirect Impact:	Significance without Mitigation					
Impact Direction:	Negative	Existing Impact	2	1	2	0.2	1 - LOW
Aspect:	Social	Project Impact	2	1	2	0.2	1 - LOW
Potential Impact:		Significance with Mitigation					
Increased demand for low-cost housing and municipal services		Residual Impact	2	1	1	0.2	1 - LOW
		Reversibility	High reversibility				
		Irreplaceability	Resources are replaceable				
		Cumulative Impact					
		Cumulative Impact	2	1	2	0.2	1 - LOW
		Confidence	Medium				
Impact Description		Impact type	E	D	P	L	IR&S
Impact	Direct Impact:	Significance without Mitigation					
Impact Direction:	Negative	Existing Impact	2	4	4	0.5	5 - MOD
Aspect:	Social	Project Impact	2	4	16	0.5	11 - HIGH
Potential Impact:		Significance with Mitigation					
Strain on community health & safety services		Residual Impact	2	4	16	0.1	2 - LOW
		Reversibility	Moderate reversibility				
		Irreplaceability					
		Cumulative Impact					
		Cumulative Impact	2	4	16	0.1	2 - LOW
		Confidence	High				

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
Impact Description		Impact type	E	D	P	L	IR&S
Impact	Indirect Impact:	Significance without Mitigation					
Impact Direction:	Negative	Existing Impact	2	1	4	0.2	1 - LOW
Aspect:	Social	Project Impact	2	1	4	0.2	1 - LOW
Potential Impact:		Significance with Mitigation					
Influx of jobseekers		Residual Impact	2	1	4	0.2	1 - LOW
		Reversibility	High reversibility				
		Irreplaceability	Moderate irreplaceability				
		Cumulative Impact					
		Cumulative Impact	2	1	2	0.2	1 - LOW
		Confidence					
Impact Description		Impact type	E	D	P	L	IR&S
Impact	Direct Impact:	Significance without Mitigation					
Impact Direction:	Negative	Existing Impact	2	1	4	0.5	4 - MOD
Aspect:	Social	Project Impact	2	1	4	0.5	4 - MOD
Potential Impact:		Significance with Mitigation					
Risk to livestock, crops, houses and farm infrastructure		Residual Impact	2	1	2	0.2	1 - LOW
		Reversibility	High reversibility				
		Irreplaceability	Moderate irreplaceability				
		Cumulative Impact					
		Cumulative Impact					
		Confidence	Medium				
Impact Description		Impact type	E	D	P	L	IR&S
Impact	Indirect Impact:	Significance without Mitigation					
Impact Direction:	Negative	Existing Impact	2	1	1	0.2	1 - LOW
Aspect:	Social	Project Impact	2	1	1	0.2	1 - LOW
Potential Impact:		Significance with Mitigation					
Impact on tourism		Residual Impact	2	1	1	0.2	1 - LOW
		Reversibility	High reversibility				
		Irreplaceability	Resources are replaceable				
		Cumulative Impact					
		Cumulative Impact	2	1	1	0.2	1 - LOW
		Confidence	High				
Impact Description		Impact type	E	D	P	L	IR&S
Impact	Direct Impact:	Significance without Mitigation					
Impact Direction:	Negative	Existing Impact	1	4	2	1	7 - MOD
Aspect:	Social	Project Impact	1	4	2	1	7 - MOD
Potential Impact:		Significance with Mitigation					
Loss of farmland		Residual Impact	1	4	1	1	6 - MOD
		Reversibility	Moderate reversibility				
		Irreplaceability	Resources are replaceable				
		Cumulative Impact					
		Cumulative Impact					
		Confidence					

Enhancement of Positive Impacts

To enhance the potential positive impact associated with the creation of temporary employment opportunities during the construction phase, the following measures should be implemented:

- To the extent possible, the Applicant and any contractors appointed to undertake construction related activities should prioritise employment of local people from DKLM and KGLM, particularly for semi and unskilled job categories.
- Employment of Coloured and Black African people; women; and youth should be prioritised.
- Before the construction phase commences, the Applicant and its contractors should meet with officials from the ZF Mgcawu District as well as DKLM and KGLM to enquire about the possibility and process of hiring people who are registered on district or local skills databases.
- Where feasible, training and on-the-job skills development programmes for temporary employees should be implemented during the construction phase.
- Where feasible, efforts should be made to employ local contactors that are compliant with Broad Based Black Economic Empowerment (BBBEE) criteria.
- Recruitment and employment practises must be aligned with prevailing labour legislation in South Africa.
- Vacancies should be advertised in the local media when they become available.
- The Applicant should engage with the DKLM and KGLM LED and IDP officials as well as representatives of the local business chambers to identify strategies aimed at maximising the potential positive impact on local procurement and short-term business opportunities within the municipalities.
- Procurement planning and decisions should prioritise spend with Coloured, Black African, women and youth owned local companies to the extent possible.

Proposed Mitigation Measures (Impact Management Actions)

- Prioritise employment of local people from various communities within the DKLM and KGLM, particularly people residing within a 50 km radius of the proposed project.
- For temporary employees brought in from other areas, suitable housing and living arrangements must be put in place before commencement of construction activities. This could include establishment of a temporary worker accommodation camp that considers aspects such as access to the construction site, services and materials. Access to all necessary amenities to ensure the health and safety of employees must be provided by the Applicant. Unless the Applicant is the owner of the land on which the proposed accommodation camp is to be established, an agreement with the relevant landowner must be concluded prior to commencement of construction activities.

- The Applicant should take steps to ensure that adequate arrangements for daily transport to and from the construction site are in place before commencement of construction phase activities.
- Where necessary, the Applicant should take steps to ensure that arrangements are in place to enable non-local low and semi-skilled workers to return home when they are not required on site (i.e. weekends, etc.).
- The Applicant should take steps to ensure that all non-local construction workers are transported back to their place of residence within one week of their temporary employment contracts coming to an end.
- The Applicant as well as any contractors that are appointed to undertake the construction phase activities should develop and agree a code of conduct which sets standards for acceptable behaviour and outlines behaviour and activities which could constitute grounds for dismissal. Any employee or contractor appointed by the Applicant to undertake construction phase activities that is found to be in breach of the code of conduct should be dismissed after following due process in accordance with prevailing labour legislation. Criminal activities should be reported to SAPS immediately for investigation and further action.
- The Applicant and contractor should agree and implement an HIV/AIDS/TB awareness programme.
- The Applicant should develop and implement an appropriate method of communication with the local community. A community liaison officer should be appointed during the construction phase to engage with local community members regarding any issues, complaints or grievances that they may have.
- In consultation with the DKLM and KGLM, investigate the option of establishing a Monitoring Forum to monitor and identify potential influx related problems associated with the proposed project. The Monitoring Forum should include other renewable energy operators in the area.
- Employment for ‘walk-in’ temporary / casual labourers at the proposed construction site should not be permitted.
- The construction site should be fenced off prior to commencement of the construction phase. Movement of construction workers should be restricted to the construction site during work hours.
- The Applicant as well as any contractors appointed to undertake the construction work activities should develop and agree a code of conduct which sets standards for acceptable behaviour and outlines behaviour and activities which could constitute grounds for dismissal. Consequences for wilful or negligent damage to private property must be outlined, communicated with all employees and enforced accordingly when alleged infringements are reported.
- Any loss or damage associated with construction phase activities, or the actions of employees or contractors appointed by the Applicant must be compensated according to a value/scale agreed with the affected landowner.
- Movement of people and vehicles associated with construction phase activities should be confined to designated areas or public roads.
- A strict speed limit must be enforced.

- All farm gates must be closed after accessing/exiting a property.
- The Applicant and any contractor appointed to undertake construction related activities should provide daily transport for low and semi-skilled workers to and from site. This will not only benefit workers, but it will also reduce the amount of pedestrians traffic on private property.
- Provision should be made in the Environmental Management Programme (EMPr) to store and manage waste on site. In particular, plastic waste which could be ingested by livestock must be managed appropriately.
- The possibility and practicality of establishing firebreaks around the perimeter of the construction site prior to commencement of construction activities should be investigated.
- Smoking on site must be confined to designated areas.
- Construction related activities that could pose a potential fire risk must be managed in accordance with safety protocols and procedures outlined in the EMPr in compliance with prevailing fire, health and safety legislation.
- No construction phase employees should be permitted on site after work hours, with the exception of security staff.
- Prior to commencement of construction, the Applicant must ensure that all terms and conditions related to the 5-year agreement with the previous landowner are honoured and closed out in accordance with the agreement.

8.4 Operation Phase

8.4.1 Impacts resulting from BESS

Solid state and flow batteries contain several toxic and hazardous substances depending on the battery chemistry implemented as discussed in section 3.4.2 of this BAR.

Impacts identified

Impacts identified with the operation of the BESS facility include:

- Spillages or leakage of electrolyte or hazardous substances during operation resulting on adverse impacts on the environment, soil and flora.
- Spillages or leakage of electrolyte or hazardous substances during operation resulting in adverse impacts on fauna, and people.
- Damage to plant and the environment resulting from explosion and/or fire due to equipment failure, short circuit, overcharging or overheating.
- Injury or death to people resulting from explosion and/or fire due to equipment failure, short circuit, overcharging or overheating.
- Contamination of the environment, soil and flora due to inappropriate management of hazardous waste generated from maintenance and replacement of batteries, battery components, or electrolyte.

- Adverse impacts on fauna and people due to inappropriate management of hazardous waste generated from maintenance and replacement of batteries, battery components, or electrolyte.

The main concern relating to the operation of the BESS facility is the potential spillage or leakage of hazardous substances and electrolyte from the battery units and the risk of fire and explosion within the plant. These impacts could result during normal operation and maintenance of the facility.

Impact Assessment – BESS Technology Alternative 1: Solid State Batteries

The impact assessment undertaken for BESS Technology Alternative 1: Solid State Batteries during the operation phase is provided in Table 8-28. When the project impact is considered, the impact significance of all impacts, besides the impact relating to *Injury or death to people resulting from explosion and/or fire due to equipment failure, short circuit, overcharging or overheating*, are rated as MODERATE (-). This is largely due to the fact that the impact will be localised occurring within the development site.

The impact relating to *Injury or death to people resulting from explosion and/or fire due to equipment failure, short circuit, overcharging or overheating*, however, has an impact significance of HIGH since the impact could possibly affect staff, employees or contractors that will likely be resident within the region. Furthermore, injury or death to people will have a high potential intensity, thus contributing to the overall HIGH (-) impact significance before mitigation.

The impact significance of all impacts, besides the impact relating to *Injury or death to people resulting from explosion and/or fire due to equipment failure, short circuit, overcharging or overheating*, after the implementation of mitigation measures are rated as LOW (-). This is largely due to the fact that the prevention of the impact occurring will eliminate the impact in its entirety, irrespective of the potential intensity of the impact or probability of the impact occurring.

Table 8-28: Impact assessment during operation: BESS Technology Alternative 1: Solid State Batteries

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	1	5	1	0.2	1 - LOW
Aspect:	Spillage of hazardous substances	Project Impact	1	4	4	0.5	5 - MOD
Potential Impact:		**Significance with Mitigation**					
		Residual Impact	1	4	4	0.1	1 - LOW

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
Spillages or leakage of electrolyte or hazardous substances during transportation, handling, storage or installation resulting on adverse impacts on the environment, soil and flora.		Reversibility	High reversibility				
		Irreplaceability	Moderate irreplaceability				
		Cumulative Impact					
		Cumulative Impact	1	4	4	0.1	1 - LOW
		Confidence	High				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Indirect Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	1	5	1	0.1	1 - LOW
Aspect:	Spillage of hazardous substances	Project Impact	1	4	8	0.5	7 - MOD
Potential Impact:		**Significance with Mitigation**					
Spillages or leakage of electrolyte or hazardous substances during operation resulting in adverse impacts on fauna, and people.		Residual Impact	1	4	8	0.1	1 - LOW
		Reversibility	Moderate reversibility				
		Irreplaceability	Moderate irreplaceability				
		Cumulative Impact					
		Cumulative Impact	1	4	8	0.2	3 - MOD
		Confidence	High				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	1	5	4	0.2	2 - LOW
Aspect:	Explosion and fire	Project Impact	1	4	4	0.5	5 - MOD
Potential Impact:		**Significance with Mitigation**					
Damage to plant and the environment resulting from explosion and/or fire due to equipment failure, short circuit, overcharging or overheating.		Residual Impact	1	4	4	0.1	1 - LOW
		Reversibility	Moderate reversibility				
		Irreplaceability	Moderate irreplaceability				
		Cumulative Impact					
		Cumulative Impact	1	4	4	0.2	2 - LOW
		Confidence	High				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	1	5	1	0.2	1 - LOW
Aspect:	Explosion and fire	Project Impact	3	4	16	0.5	12 - HIGH
Potential Impact:		**Significance with Mitigation**					
Injury or death to people resulting from explosion and/or fire due to equipment failure, short circuit, overcharging or overheating.		Residual Impact	3	4	16	0.2	5 - MOD
		Reversibility	High reversibility				
		Irreplaceability	Moderate irreplaceability				
		Cumulative Impact					
		Cumulative Impact	3	4	16	0.2	5 - MOD
		Confidence	High				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	1	5	1	0.2	1 - LOW
Aspect:	Waste mangement	Project Impact	1	4	4	0.5	5 - MOD
Potential Impact:		**Significance with Mitigation**					
Contamination of the environment, soil and flora due to inappropriate		Residual Impact	1	4	4	0.1	1 - LOW
		Reversibility	High reversibility				

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
management of hazardous waste generated from maintenance and replacement of batteries, battery components, or electrolyte.		Irreplaceability	Moderate irreplaceability				
		Cumulative Impact					
		Cumulative Impact	1	4	4	0.2	2 - LOW
		Confidence	High				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Indirect Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	1	5	1	0.1	1 - LOW
Aspect:	Waste mangement	Project Impact	1	4	8	0.5	7 - MOD
Potential Impact:		**Significance with Mitigation**					
Adverse impacts on fauna and people due to inappropriate management of hazardous waste generated from maintenance and replacement of batteries, battery components, or electrolyte.		Residual Impact	1	4	8	0.1	1 - LOW
		Reversibility	Moderate reversibility				
		Irreplaceability	Moderate irreplaceability				
		Cumulative Impact					
		Cumulative Impact	1	4	4	0.2	2 - LOW
		Confidence	High				

Impact Assessment – BESS Technology Alternative 2: Flow Batteries

The impact assessment undertaken for BESS Technology Alternative 2: Flow Batteries during the operation phase is provided in Table 8-29.

As with the impact assessment for BESS Technology 1: Solid State Batteries, when the project impact is considered, the impact significance of all impacts, besides the impact relating to *Injury or death to people resulting from explosion and/or fire due to equipment failure, short circuit, overcharging or overheating*, are rated as MODERATE (-) before mitigation. This is largely due to the fact that the impact will be localised occurring within the development site.

The impact relating to *Injury or death to people resulting from explosion and/or fire due to equipment failure, short circuit, overcharging or overheating*, however, has an impact significance of HIGH (-) since the impact could possibly affect staff, employees or contractors that will likely be resident within the region. Furthermore, injury or death to people will have a high potential intensity, thus contributing to the overall HIGH (-) impact significance before mitigation.

The impact significance of all impacts, besides the impact relating to *Injury or death to people resulting from explosion and/or fire due to equipment failure, short circuit, overcharging or overheating*, after the implementation of mitigation measures are rated as LOW (-). Again, this is largely due to the fact that the prevention of the impact occurring will eliminate the impact in its entirety, irrespective of the potential intensity of the impact or probability of the impact occurring.

Table 8-29: Impact assessment during operation: BESS Technology Alternative 2: Flow Batteries

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	1	5	1	0.2	1 - LOW
Aspect:	Spillage of hazardous substances	Project Impact	1	4	8	0.5	7 - MOD
Potential Impact:		**Significance with Mitigation**					
Spillages or leakage of electrolyte or hazardous substances during transportation, handling, storage or installation resulting on adverse impacts on the environment, soil and flora.		Residual Impact	1	4	8	0.1	1 - LOW
		Reversibility	High reversibility				
		Irreplaceability	Moderate irreplaceability				
		Cumulative Impact					
		Cumulative Impact	1	4	4	0.1	1 - LOW
		Confidence	High				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Indirect Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	1	5	1	0.1	1 - LOW
Aspect:	Spillage of hazardous substances	Project Impact	1	4	8	0.5	7 - MOD
Potential Impact:		**Significance with Mitigation**					
Spillages or leakage of electrolyte or hazardous substances during operation resulting in adverse impacts on fauna, and people.		Residual Impact	1	4	8	0.1	1 - LOW
		Reversibility	Moderate reversibility				
		Irreplaceability	Moderate irreplaceability				
		Cumulative Impact					
		Cumulative Impact	1	4	8	0.2	3 - MOD
		Confidence	High				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	1	5	4	0.2	2 - LOW
Aspect:	Explosion and fire	Project Impact	1	4	4	0.5	5 - MOD
Potential Impact:		**Significance with Mitigation**					
Damage to plant and the environment resulting from explosion and/or fire due to equipment failure, short circuit, overcharging or overheating		Residual Impact	1	4	4	0.1	1 - LOW
		Reversibility	Moderate reversibility				
		Irreplaceability	Moderate irreplaceability				
		Cumulative Impact					
		Cumulative Impact	1	4	4	0.2	2 - LOW
		Confidence	High				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	1	5	1	0.2	1 - LOW
Aspect:	Explosion and fire	Project Impact	3	4	16	0.5	12 - HIGH
Potential Impact:		**Significance with Mitigation**					
Injury or death to people resulting from explosion and/or fire due to equipment		Residual Impact	3	4	16	0.2	5 - MOD
		Reversibility	High reversibility				

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
failure, short circuit, overcharging or overheating		Irreplaceability	Moderate irreplaceability				
		Cumulative Impact					
		Cumulative Impact	3	4	16	0.2	5 - MOD
		Confidence	High				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	1	5	1	0.2	1 - LOW
Aspect:	Waste mangement	Project Impact	1	4	4	0.5	5 - MOD
Potential Impact:		**Significance with Mitigation**					
Contamination of the environment, soil and flora due to inappropriate management of hazardous waste generated from maintenance and replacement of batteries, battery components, or electrolyte		Residual Impact	1	4	4	0.1	1 - LOW
		Reversibility	High reversibility				
		Irreplaceability	Moderate irreplaceability				
		Cumulative Impact					
		Cumulative Impact	1	4	4	0.2	2 - LOW
		Confidence	High				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Indirect Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	1	5	1	0.1	1 - LOW
Aspect:	Waste management	Project Impact	1	4	8	0.5	7 - MOD
Potential Impact:		**Significance with Mitigation**					
Adverse impacts on fauna and people due to inappropriate management of hazardous waste generated from maintenance and replacement of batteries, battery components, or electrolyte		Residual Impact	1	4	8	0.1	1 - LOW
		Reversibility	Moderate reversibility				
		Irreplaceability	Moderate irreplaceability				
		Cumulative Impact					
		Cumulative Impact	1	4	4	0.2	2 - LOW
		Confidence	High				

Proposed Mitigation Measures (Impact Management Actions)

- An Operating and Maintenance programme must be developed and put in place, with OEM operating and maintenance documentation available in the EMPr site file at all times
- Auditing of all operating and maintenance functions must be undertaken as stipulated in the Operating and Maintenance programme.
- A waste management programme must be developed and implemented.
- Primary, secondary and tertiary containment of hazardous substances within the BESS equipment must be implemented through appropriate bunded areas or containment structures that can accommodate at least 110% of the capacity of the largest battery unit or electrolyte storage unit.
- Battery Management Systems must be employed to ensure proper charging and effective cooling of systems. This system must include cell level temperature

monitoring, cell level protective devices which disconnect faulty cells / modules, and fire detection and suppression systems installed.

- No discharge of hazardous substances into the environment will be allowed at any time.
- Hazard detection and effective safety controls must be implemented.
- Designated staff and first responders must be suitably trained and equipped to effectively respond to on-site incidents, plant fires and explosions. A copy of the appointment, accreditation and certificate documents for these designated staff and first responders must be kept in the EMPr site file.
- Store and handling must be undertaken strictly according to manufacturer's instructions and in line with the Environmental Management Programme, and relevant best practices and standards applicable to the storage of hazardous and dangerous goods.
- An agreement or contract with an accredited HazMat company for first response, site clean-up and rehabilitation of any spillage or emergency incident must be during the operation phase of the development.
- All Material Safety Data Sheets (MSDS) for hazardous and dangerous substances to be used in the BESS must be available during transportation, storage, handling and installation of the BESS

8.4.2 Terrestrial Biodiversity

<u>Impacts identified</u>

It is anticipated that daily activities associated with the operation phase will lead to further spread the Invasive Alien Plants (IAP), as well as the deterioration of the habitats due to the increase of dust and edge effect impacts. Dust reduces the ability of plants to photosynthesize and thus leads to degradation/retrogression of the veld. Moving maintenance vehicles do not only cause sensory disturbances to fauna, affecting their life cycles and movement, but will lead to direct mortalities due to collisions.

The following potential impacts were considered:

- Impact Aspect: Alien Invasive Plant (AIP) encroachment
  - Impact: Continued encroachment and displacement of the vegetation community due to alien invasive plant species, particularly in previously disturbed areas;
- Impact Aspect: Fauna displacement:
  - Impact: Continued displacement and fragmentation of the faunal community due to ongoing anthropogenic disturbances (noise, traffic and dust);
- Impact Aspect: Habitat degradation
  - Impact: Habitat degradation through litter and alien vegetation encroachment;

Impact Assessment - Site A

The impact relating to AIP encroachment have been assigned an impact significance rating of HIGH before mitigation. However, assuming the mitigation measures as proposed by the biodiversity specialist were implemented and done so effectively and successfully, the impact significance for impact relating to AIP encroachment would be reduced to MODERATE (Table 8-30).

The impact relating to Fauna displacement were assigned an impact significance of MODERATE before mitigation, but was reduced to LOW with the implementation of the proposed mitigation measures. On the other hand, Habitat degradation remained in the MODERATE impact significance category, albeit the impact score reducing somewhat after the implementation of the proposed mitigation measures (Table 8-30).

Table 8-30: Terrestrial Biodiversity impact assessment during operation: Site A (TBC, 2022a)

Impact Description		**Impact type**	**Extent (E)**	**Duration (D)**	**Potential Intensity (P)**	**Likelihood (L)**	**Impact Rating & Significance (IR&S)**
Impact	Indirect Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	2	3	2	0,5	4 - MOD
Aspect:	AIP encroachment	Project Impact	3	5	8	0,75	12 - HIGH
Potential Impact:		**Significance with Mitigation**					
Continued encroachment and displacement of the vegetation community due to alien invasive plant species, particularly in previously disturbed areas.		Residual Impact	2	4	4	0,5	5 - MOD
		Reversibility	High reversibility				
		Irreplaceability	Moderate irreplaceability				
		Cumulative Impact					
		Cumulative Impact	3	4	4	0,75	8 - MOD
		Confidence	Low				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Indirect Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	2	2	4	0,5	4 - MOD
Aspect:	Fauna displacement	Project Impact	2	5	4	0,5	6 - MOD
Potential Impact:		**Significance with Mitigation**					
Continued displacement and fragmentation of the faunal community due to ongoing anthropogenic disturbances (noise, traffic and dust);		Residual Impact	1	4	2	0,2	1 - LOW
		Reversibility	Moderate reversibility				
		Irreplaceability	Moderate irreplaceability				
		Cumulative Impact					
		Cumulative Impact	3	4	4	0,5	6 - MOD
		Confidence	Medium				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Indirect Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	1	2	1	0,2	1 - LOW

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
Aspect:	Habitat degradation	Project Impact	2	5	4	0,5	6 - MOD
Potential Impact:		Significance with Mitigation					
Habitat degradation (litter and alien vegetation encroachment);		Residual Impact	1	3	2	0,5	3 - MOD
		Reversibility	Moderate reversibility				
		Irreplaceability	Low irreplaceability				
		Cumulative Impact					
		Cumulative Impact	2	3	4	0,5	5 - MOD
		Confidence	Medium				

Impact Assessment - Site B

The biodiversity specialist identified the same impacts for Site B as was identified and rated for site A. When impacts associated with site B was considered, the impact significance for all three impacts at site B was rated as MODERATE after the implementation of mitigation measures (Table 8-31), assuming the mitigation measures as proposed by the biodiversity specialist were implemented and done so effectively and successfully.

Table 8-31: Terrestrial Biodiversity impact assessment during operation: Site B (TBC, 2022a)

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
Impact	Indirect Impact:	Significance without Mitigation					
Impact Direction:	Negative	Existing Impact	2	3	2	0,5	4 - MOD
Aspect:	AIP encroachment	Project Impact	3	5	8	0,75	12 - HIGH
Potential Impact:		Significance with Mitigation					
Continued encroachment and displacement of the vegetation community due to alien invasive plant species, particularly in previously disturbed areas.		Residual Impact	2	4	4	0,5	5 - MOD
		Reversibility	High reversibility				
		Irreplaceability	Moderate irreplaceability				
		Cumulative Impact					
		Cumulative Impact	3	4	4	0,75	8 - MOD
		Confidence	Low				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Indirect Impact:	Significance without Mitigation					
Impact Direction:	Negative	Existing Impact	2	2	4	0,5	4 - MOD
Aspect:	Fauna displacement	Project Impact	2	5	4	0,5	6 - MOD
Potential Impact:		Significance with Mitigation					
Continued displacement and fragmentation of the faunal community due to ongoing		Residual Impact	1	4	2	0,5	4 - MOD
		Reversibility	Moderate reversibility				
		Irreplaceability	Moderate irreplaceability				

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
anthropogenic disturbances (noise, traffic and dust);		**Cumulative Impact**					
		Cumulative Impact	3	4	4	0,5	6 - MOD
		Confidence	Medium				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Indirect Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	1	2	1	0,2	1 - LOW
Aspect:	Habitat degradation	Project Impact	2	5	8	0,5	8 - MOD
Potential Impact:		**Significance with Mitigation**					
Habitat degradation (litter and alien vegetation encroachment);		Residual Impact	1	3	2	0,5	3 - MOD
		Reversibility	Moderate reversibility				
		Irreplaceability	Low irreplaceability				
		Cumulative Impact					
		Cumulative Impact	2	3	4	0,5	5 - MOD
		Confidence	Medium				

Proposed Mitigation Measures (Impact Management Actions)

Mitigation and management measures proposed by the biodiversity specialist during the operation phase include:

- Progressive rehabilitation of areas that have been cleared of invasive plants will enable topsoil to be returned more rapidly, thus ensuring more recruitment from the existing seedbank. Any woody material removed can be shredded and used in conjunction with the topsoil to augment soil moisture and prevent further erosion.

- Areas that have been disturbed but will not undergo development must be revegetated with indigenous vegetation. An AIP management plan must be developed and implemented.

- Noise must be kept to an absolute minimum during the evenings and at night to minimize all possible disturbances to amphibian species and nocturnal mammals.

- All activities must make use of existing roads and tracks as far as practically and feasibly possible. Speed limits must be enforced, and speed humps installed.

- Eroded areas must be rehabilitated using the appropriate techniques and re-vegetated using indigenous flora.

8.4.3 Surface Water and Wetlands

Impacts identified

The operational phase is the impacts of the daily activities when the development is functioning. These impacts are small impacts over a long-time frame. These impacts are associated with the movement of people to ensure that the facilities are maintained. The main impacts are thus the traffic through the project area (Table 5 4). The following potential impacts were considered:

- Erosion inside watercourses due to overland flows;
- Water quality impairment;
- Drainage pattern changes; and
- Deposition of dust.

Impact Assessment – Site A and B

The erosion and water quality impairment within the delineated watercourses are rated as LOW pre-mitigation and VERY LOW post mitigation by the wetland specialist (TBC, 2022b). To ensure that the water used to clean the PV panels does not impair the water quality workers should use normal tap water without any chemicals.

All proposed activities are expected to be long term (> 15 years) and have been considered “permanent” on this basis, which renders the decommissioning phase irrelevant.

The impacts during the operations phase for Site A and B is expected to be the same. Hence a single impact assessment was undertaken for both sites as is evident from Table 8-32

Table 8-32: Surface Water and Wetland impact assessment during construction: Site A and B

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
Impact	Indirect Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	1	4	1	0,1	1 - LOW
Aspect:	Traffic during Maintenance	Project Impact	1	5	2	1	8 - MOD
Potential Impact:		**Significance with Mitigation**					
Traffic during maintenance will cause erosion and increase flow dynamics into the drainage systems.		Residual Impact	1	5	2	0,2	2 - LOW
		Reversibility	Moderate reversibility				
		Irreplaceability	Low irreplaceability				
		Cumulative Impact					
		Cumulative Impact	1	4	4	0,2	2 - LOW
		Confidence	High				

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Indirect Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	1	4	1	0,1	1 - LOW
Aspect:	Altered Overflow Dynamics	Project Impact	1	5	2	1	8 - MOD
Potential Impact:		**Significance with Mitigation**					
Overflow of water from the PV panels and roads		Residual Impact	1	4	1	0,2	1 - LOW
		Reversibility	Moderate reversibility				
		Irreplaceability	Low irreplaceability				
		Cumulative Impact					
		Cumulative Impact	1	4	2	0,2	1 - LOW
		Confidence	High				

<u>Proposed Recommendations and Management Measures during Construction and Operation</u>

- Those powerline pylons located near drainage features needs to be moved away far enough so that the edge of the pylon's footprint areas is located at least 10 m away from the edge of the drainage feature; and
- Stormwater management principles must be incorporated for the design of the site, these include:
  - Prevent concentration of stormwater flow at any point where the ground is susceptible to erosion.
  - Reduce stormwater flows as far as possible by the effective use of attenuating devices (such as swales, berms, silt fences). As construction progresses, the stormwater control measures must be monitored and adjusted to ensure complete erosion and pollution control at all times.
  - Minimise the area of exposure of bare soils to minimise the erosive forces of wind, water and all forms of traffic.
  - Plan and construct stormwater management systems to remove contaminants before they pollute surface waters or groundwater resources.
  - Contain soil erosion, whether induced by wind or water forces, by constructing protective works to trap sediment at appropriate locations. This applies particularly during construction.
  - Avoid situations where natural or artificial slopes may become saturated and unstable, both during and after the construction process.
  - Design and construct roads to avoid concentration of flow along and off the road.
  - Design culvert inlet structures to ensure that the capacity of the culvert does not exceed the pre-development stormwater flow at that point. Provide detention storage on the road and/or upstream of the stormwater culvert.
  - Design outlet culvert structures to dissipate flow energy. Any unlined downstream channel must be adequately protected against soil erosion.

- Where construction causes a change in the vegetative cover of the site that might result in soil erosion, the risk of soil erosion by stormwater must be minimised by the provision of appropriate artificial soil stabilisation mechanisms or re-vegetation of the area.
- Preferably all drainage channels on site and contained within the larger area of the property (i.e. including buffer zone) should remain in the natural state so that the existing hydrology is not disturbed.

8.4.4 Avifauna

Impacts identified

The principal impacts of the operational phase are electrocution, collisions, fencing, chemical pollution due to chemical for the cleaning of the PV panels and habitat loss. Solar panels have been implicated as a potential risk for bird collisions. Collisions are thought to arise when birds (particularly waterbirds) mistake the panels for waterbodies, known as the “lake effect” (Lovich & Ennen, 2011), or when migrating or dispersing birds become disorientated by the polarised light reflected by the panels. This “lake-effect” hypothesis has not been substantiated or refuted to date (Visser et al., 2019). It can however be said that the combination of powerlines, fencing and large infrastructure will influence avifauna species (TBC, 2022c).

Large passerines are particularly susceptible to electrocution because owing to their relatively large bodies, they are able to touch conductors and ground/earth wires or earthed devices simultaneously. The chances of electrocution are increased when feathers are wet, during periods of high humidity or during defecation. Prevailing wind direction also influences the rate of electrocution casualties (TBC, 2022c).

Fencing of the PV site can influence birds in six ways (Birdlife SA, 2015, as cited in TBC, 2022c);

1. Snagging: Occurs when a body part is impaled on one or more barbs or razor points of a fence.
2. Snaring: When a birds foot/leg becomes trapped between two overlapping wires.
3. Impact injuries: birds flying into a fence, the impact may kill or injure the bird
4. Snarling: When birds try and push through a mesh or wire stands, ultimately becoming trapped (uncommon).
5. Electrocution: Electrified fence can kill or severely injure birds.
6. Barrier effect: Fences may limit flightless birds (e.g. Moulting waterfowl) from resources.

Chemical pollution from PV cleaning, if not environmentally friendly will result in either long term or short term poisoning. Should this chemical run into the water sources it would also impact the whole bird population and not just species found in and around the PV footprint. PV sites require the overall removal of vegetation, this is a measure that is implemented to restrict the risk of fire (Birdlife, 2017). The removal of vegetation results in the loss of habitat for a number of species in this case it would be displacing shrubland endemics and SCCs (TBC, 2022c).

The following potential impacts were considered during the construction phase:

- Habitat Loss (Destroy, fragment, and degrade habitat, ultimately displacing avifauna);
- Sensory disturbances (e.g. noise, light, dust, vibrations);
- Collection of eggs and poaching;
- Roadkill;
- Collisions with PV and associated infrastructure;
- Electrocution by infrastructure and connections to PV;
- Chemical pollution associated with measures to keep PV clean;
- Fencing of PV site, especially a risk for larger birds; and
- Displacement or death of SCCs.

Impact Assessment – Site A and B

The impact significance of electrocution and collisions were rated as HIGH prior to mitigations, this was rated based on the large number of risk species known to occur in the area. Implementation of mitigation measures reduced the significance of these impacts to a MODERATE level. It cannot be reduced completely as the risk will still persist, the addition of white stripes on the edges of the PV panels and nest proofing will reduce the impact but will not completely remove it. The impact significance of the fencing was rated as HIGH, based on the high number of species at risk that are present. Implementation of mitigation measures as specified by Birdlife South Africa (2017) reduced the significance of the impact to a LOW level. Even with the implementation of all these mitigations there is still a likelihood that the species would be impacted.

Table 8-33: Avifauna impact assessment during Operation: Site A and B (TBC, 2022c)

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	3	5	1	0.2	2 - LOW
Aspect:		Project Impact	3	5	4	1	12 - HIGH
Potential Impact:		**Significance with Mitigation**					
Continued Habitat Loss (Destroy, fragment and degrade CBA, ESA and ONA habitat, ultimately displacing avifauna)		Residual Impact	2	4	4	0.75	8 - MOD
		Reversibility	Impacts are non-reversible				
		Irreplaceability	High irreplaceability				
		Cumulative Impact					
		Cumulative Impact	3	5	4	0.75	9 - MOD

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
		Confidence	Medium				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	1	1	1	0.2	1 - LOW
Aspect:		Project Impact	2	4	4	0.5	5 - MOD
Potential Impact:		**Significance with Mitigation**					
Sensory disturbances (e.g. noise, dust, vibrations)		Residual Impact	1	2	1	0.5	2 - LOW
		Reversibility	High reversibility				
		Irreplaceability	Low irreplaceability				
		Cumulative Impact					
		Cumulative Impact	3	5	4	0.5	6 - MOD
		Confidence	Low				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Indirect Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	3	5	2	0.2	2 - LOW
Aspect:		Project Impact	3	4	8	0.75	11 - HIGH
Potential Impact:		**Significance with Mitigation**					
Collection of eggs and poaching (especially of SCCs)		Residual Impact	1	3	2	0.2	1 - LOW
		Reversibility	Moderate reversibility				
		Irreplaceability	High irreplaceability				
		Cumulative Impact					
		Cumulative Impact	3	5	4	0.5	6 - MOD
		Confidence	Medium				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	3	5	4	0.2	2 - LOW
Aspect:		Project Impact	2	4	16	0.75	17 - HIGH
Potential Impact:		**Significance with Mitigation**					
Roadkill		Residual Impact	1	2	2	0.2	1 - LOW
		Reversibility	Moderate reversibility				
		Irreplaceability	Moderate irreplaceability				
		Cumulative Impact					
		Cumulative Impact	3	5	2	0.5	5 - MOD
		Confidence	Low				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	1	1	1	0.1	0 - LOW
Aspect:		Project Impact	3	5	16	0.75	18 - HIGH
Potential Impact:		**Significance with Mitigation**					
Collisions with PV and associated infrastructure		Residual Impact	2	3	8	0.5	7 - MOD
		Reversibility	Moderate reversibility				
		Irreplaceability	Moderate irreplaceability				

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
		Cumulative Impact					
		Cumulative Impact	3	5	8	0.5	8 - MOD
		Confidence	Medium				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	1	1	1	0.1	0 - LOW
Aspect:		Project Impact	3	5	8	0.75	12 - HIGH
Potential Impact:		**Significance with Mitigation**					
Electrocution by infrastructure and connections to PV		Residual Impact	2	3	4	0.5	5 - MOD
		Reversibility	Moderate reversibility				
		Irreplaceability	Moderate irreplaceability				
		Cumulative Impact					
		Cumulative Impact	3	5	8	0.75	12 - HIGH
		Confidence	Medium				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Indirect Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	1	1	1	0.1	0 - LOW
Aspect:		Project Impact	3	5	8	1	16 - HIGH
Potential Impact:		**Significance with Mitigation**					
Chemical pollution associated with measures to keep PV clean		Residual Impact	1	2	1	0.5	2 - LOW
		Reversibility	Low reversibility				
		Irreplaceability	Moderate irreplaceability				
		Cumulative Impact					
		Cumulative Impact	3	5	8	0.5	8 - MOD
		Confidence	Low				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	1	1	1	0.1	0 - LOW
Aspect:	Fencing impact	Project Impact	3	5	8	1	16 - HIGH
Potential Impact:		**Significance with Mitigation**					
Fencing of PV site, especially a risk for larger birds		Residual Impact	1	2	1	0.5	2 - LOW
		Reversibility	Moderate reversibility				
		Irreplaceability	Moderate irreplaceability				
		Cumulative Impact					
		Cumulative Impact	3	5	8	0.5	8 - MOD
		Confidence	Medium				

Proposed Mitigation Measures (Impact Management Actions)

- Areas of already fragmented indigenous vegetation, even secondary communities outside of the direct project footprint, should under no circumstances be fragmented or disturbed further. Clearing of vegetation should be minimized and avoided where possible. Clearing beneath panels should be avoided.
- The site ecological importance for SCCs is rated as high, and therefore the site area should be avoided where possible. The extent should be minimised, with drainage lines avoided where possible. Clearing of vegetation beneath panels should be avoided and roads kept to a minimum.
- Where possible, existing access routes and walking paths must be made use of.
- Rehabilitation of the disturbed areas existing in the project area must be made a priority. Topsoil must also be utilised, and any disturbed area must be re-vegetated with plant and grass species which are endemic to this vegetation type.
- Erosion control and alien invasive management plan must be compiled.
- Environmentally friendly dust suppressants need to be utilised
- A fire management plan needs to be compiled and implemented to restrict the impact fire might have on the surrounding areas.
- The areas to be developed must be specifically demarcated to prevent movement of staff or any individual into the surrounding environments. Signs must be put up to enforce this.
- All personnel should undergo environmental induction with regards to avifauna and in particular awareness about not harming, collecting, or hunting terrestrial species (e.g., guineafowl and francolin), and owls, which are often persecuted out of superstition. Signs must be put up to enforce this.
- The duration of the construction should be kept to a minimum to avoid disturbing avifauna.
- Outside lighting should be designed and limited to minimize impacts on fauna. All outside lighting should be directed away from highly sensitive areas. Fluorescent and mercury vapor lighting should be avoided and sodium vapor (red/green) motion detection lights should be used wherever possible.
- All construction and maintenance motor vehicle operators should undergo an environmental induction that includes instruction on the need to comply with speed limit (40km/h), to respect all forms of wildlife. Speed limits must still be enforced to ensure that road killings and erosion is limited.
- Schedule or limit (where feasible) activities during least sensitive periods, to avoid migration, nesting and breeding seasons (May – August)
- All project activities must be undertaken with appropriate noise mitigation measures to avoid disturbance to avifauna population in the region
- Use environmentally friendly cleaning and dust suppressant products
- Fencing mitigations:
    - Top 2 strands must be smooth wire
    - Routinely retention loose wires
    - Minimum 30cm between wires

- Place markers on fences

8.4.5 Heritage, Archaeology and Palaeontology

No impacts are expected during the operation phase (Beyond Heritage, 2022). As such, no impact assessment was undertaken.

8.4.6 Visual Aspects

<u>Impacts identified</u>

The following impacts have been identified:

- The presence of the Kiwano Battery Energy Storage System (BESS) and photovoltaic (PV) facility (KBPF) may negatively affect the expansive views of the Kalahari Rangelands from the D3276 due to reflection, glare, night lighting and contrast of buildings in the monochromatic landscape.
- The presence of the KBPF facility may negatively affect the expansive views of the Kalahari Rangelands from the N14 due to reflection, glare, night lighting and contrast of buildings in the monochromatic landscape.
- The presence of the KBPF facility may negatively affect the experience of tourists visiting the Orange River Vineyards and resorts along the N14 corridor.
- The presence of the KBPF facility may negatively affect the views and thus the quality of life of people in residential areas and businesses along the N14 corridor.
- The presence of the KBPF facility may negatively affect the views and thus the quality of life of people in residential areas, tourist resorts and businesses on the opposite side of the Orange River.
- Erection of powerlines may adversely impact views of Kalahari landscapes from key viewpoints.

<u>Impact Assessment – Site A</u>

The visual impact assessment undertaken for Site A during the operation phase is provided in Table 8-34.The residual for all impacts besides the impact relating to *Erection of powerlines may adversely impact views of Kalahari landscapes from key viewpoints* are rated as LOW. The impact relating to *Erection of powerlines may adversely impact views of Kalahari landscapes from key viewpoints,* however, are rated as MODERATE after implementation of the proposed mitigation measures.

Table 8-34: Visual impact assessment during Operation – Site A (Geonest, 2022)

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	2	3	4	1	9 - MOD
Aspect:	Visual Impact	Project Impact	2	1	2	0.5	3 - MOD
Potential Impact:		**Significance with Mitigation**					
The presence of the KBPF facility may negatively affect the expansive views of the Kalahari Rangelands from the D3276 due to reflection, glare, night lighting and contrast of buildings in the monochromatic landscape.		Residual Impact	2	1	1	0.2	1 - LOW
		Reversibility	High reversibility				
		Irreplaceability	Resources are replaceable				
		Cumulative Impact					
		Cumulative Impact	2	3	4	1	9 - MOD
		Confidence	High				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	2	3	4	1	9 - MOD
Aspect:	Visual Impact	Project Impact	2	1	1	0.2	1 - LOW
Potential Impact:		**Significance with Mitigation**					
The presence of the KBPF facility may negatively affect the expansive views of the Kalahari Rangelands from the N14 due to reflection, glare, night lighting and contrast of buildings in the monochromatic landscape.		Residual Impact	2	1	1	0.2	1 - LOW
		Reversibility	High reversibility				
		Irreplaceability	Resources are replaceable				
		Cumulative Impact					
		Cumulative Impact	2	3	4	1	9 - MOD
		Confidence	High				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	2	3	4	1	9 - MOD
Aspect:	Visual Impact	Project Impact	2	1	1	0.2	1 - LOW
Potential Impact:		**Significance with Mitigation**					
The presence of the KBPF facility may negatively affect the experience of tourists visiting the Orange River Vineyards and resorts along the N14 corridor.		Residual Impact	2	1	1	0.2	1 - LOW
		Reversibility	High reversibility				
		Irreplaceability	Resources are replaceable				
		Cumulative Impact					
		Cumulative Impact	2	3	4	1	9 - MOD
		Confidence	High				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	2	3	4	1	9 - MOD
Aspect:	Visual Impact	Project Impact	2	3	1	0.2	1 - LOW
Potential Impact:		**Significance with Mitigation**					
The presence of the KBPF facility may negatively affect the views and thus the quality of life of people in residential areas and businesses along the N14 corridor.		Residual Impact	2	3	1	0.2	1 - LOW
		Reversibility	High reversibility				
		Irreplaceability	Resources are replaceable				
		Cumulative Impact					
		Cumulative Impact	2	3	4	1	9 - MOD
		Confidence	High				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Direct Impact:	**Significance without Mitigation**					

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
Impact Direction:	Negative	Existing Impact	2	3	4	1	9 - MOD
Aspect:	Visual Impact	Project Impact	2	3	1	0.2	1 - LOW
Potential Impact:		**Significance with Mitigation**					
The presence of the KBPF facility may negatively affect the views and thus the quality of life of people in residential areas, tourist resorts and businesses on the opposite side of the Orange River.		Residual Impact	2	3	1	0.2	1 - LOW
		Reversibility	High reversibility				
		Irreplaceability	Resources are replaceable				
		Cumulative Impact					
		Cumulative Impact	2	3	4	1	9 - MOD
		Confidence	High				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	3	4	2	1	9 - MOD
Aspect:	Visual Impact	Project Impact	2	2	1	1	5 - MOD
Potential Impact:		**Significance with Mitigation**					
Erection of powerlines may adversely impact views of Kalahari landscapes from key viewpoints		Residual Impact	2	2	1	0.2	1 - LOW
		Reversibility	High reversibility				
		Irreplaceability	Resources are replaceable				
		Cumulative Impact					
		Cumulative Impact	3	4	2	1	9 - MOD
		Confidence	High				

Impact Assessment – Site B

The visual impact assessment undertaken for Site B during the operation phase is provided in Table 8-35. The residual for all impacts associated with Site B are rated as LOW after implementation of the proposed mitigation measures.

Table 8-35: Visual impact assessment during Operation – Site B (Geonest, 2022)

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	2	3	4	1	9 - MOD
Aspect:	Visual Impact	Project Impact	2	1	4	0.75	5 - MOD
Potential Impact:		**Significance with Mitigation**					
The presence of the KBPF facility may negatively affect the expansive views of the Kalahari Rangelands from the D3276 due to reflection, glare, night lighting and contrast of buildings in the monochromatic landscape.		Residual Impact	2	1	2	0.2	1 - LOW
		Reversibility	High reversibility				
		Irreplaceability	Resources are replaceable				
		Cumulative Impact					
		Cumulative Impact	2	3	4	1	9 - MOD
		Confidence	High				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Direct Impact:	**Significance without Mitigation**					

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
Impact Direction:	Negative	Existing Impact	2	3	4	1	9 - MOD
Aspect:	Visual Impact	Project Impact	2	3	1	0.1	1 - LOW
Potential Impact:		**Significance with Mitigation**					
The presence of the KBPF facility may negatively affect the expansive views of the Kalahari Rangelands from the N14 due to reflection, glare and contrast of buildings in the monochromatic landscape.		Residual Impact	2	3	1	0.1	1 - LOW
		Reversibility	High reversibility				
		Irreplaceability	Resources are replaceable				
		Cumulative Impact					
		Cumulative Impact	2	3	4	1	9 - MOD
		Confidence	High				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	2	3	4	1	9 - MOD
Aspect:	Visual Impact	Project Impact	2	1	1	0.5	2 - LOW
Potential Impact:		**Significance with Mitigation**					
The presence of the KBPF facility may negatively affect the experience of tourists visiting the Orange River Vineyards and resorts along the N14 corridor.		Residual Impact	2	3	1	0.2	1 - LOW
		Reversibility	High reversibility				
		Irreplaceability	Resources are replaceable				
		Cumulative Impact					
		Cumulative Impact	2	3	4	1	9 - MOD
		Confidence	High				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	2	3	4	1	9 - MOD
Aspect:	Visual Impact	Project Impact	2	3	1	0.2	1 - LOW
Potential Impact:		**Significance with Mitigation**					
The presence of the KBPF facility may negatively affect the views and thus the quality of life of people in residential areas and businesses along the N14 corridor.		Residual Impact	2	3	1	0.2	1 - LOW
		Reversibility	High reversibility				
		Irreplaceability	Resources are replaceable				
		Cumulative Impact					
		Cumulative Impact	2	3	4	1	9 - MOD
		Confidence	High				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	2	3	4	1	9 - MOD
Aspect:	Visual Impact	Project Impact	2	3	2	0.5	4 - MOD
Potential Impact:		**Significance with Mitigation**					
The presence of the KBPF facility may negatively affect the views and thus the quality of life of people in residential areas, tourist resorts and businesses on the opposite side of the Orange River.		Residual Impact	2	3	1	0.2	1 - LOW
		Reversibility	High reversibility				
		Irreplaceability	Resources are replaceable				
		Cumulative Impact					
		Cumulative Impact	2	3	4	1	9 - MOD
		Confidence	High				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	3	4	2	1	9 - MOD
Aspect:	Visual Impact	Project Impact	2	2	1	1	5 - MOD

Impact Description	Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
Potential Impact:	**Significance with Mitigation**					
Erection of powerlines may adversely impact views of Kalahari landscapes from key viewpoints	Residual Impact	2	2	1	0.2	1 - LOW
	Reversibility	High reversibility				
	Irreplaceability	Resources are replaceable				
	Cumulative Impact					
	Cumulative Impact	3	4	2	1	9 - MOD
	Confidence	High				

Proposed Mitigation Measures (Impact Management Actions)

- Wherever possible, mobile lights should be used for night time maintenance activities (e.g., cleaning PV panels) and permanent lighting should not be installed for this purpose.
- All considerations given to lighting in the design phase should apply to maintenance or addition of lighting in the operational phase.
- All considerations given to colour and painting of reflective surfaces in the design phase should apply to any further construction (including erection of signage etc.) or maintenance activities on site in the operational phase.

8.4.7 Socio-economic environment

Impacts identified

The following socio-economic impacts have been identified during the Operation phase of the proposed development:

- **Creation of employment opportunities (Positive Impact):** It is anticipated that the proposed development will remain in operation for at least 25 years, which is the minimum design life of the solar PV plant. According to estimates provided by the Applicant, approximately 18 employment opportunities will be created during the operational phase.
- **Creation of procurement and business opportunities (Positive Impact):** Local and regional businesses should be granted opportunities to tender for contracts associated with the provision of goods and services associated with the construction phase.
- **Strengthening energy supply:** As South Africa’s population and economy continue to grow, so does the electricity demand and the strain on natural resources. The project will add new generation capacity (58 MW) and augment existing Eskom generation and transmission infrastructure in the Northern Cape. The proposed development will furthermore provide ancillary support in terms of enhanced frequency control of the network, reactive power support and improved quality of supply performance near existing Distributed Generation Renewable Energy plants.

- **Strain on community health and safety services:** The presence of non-local construction workers could exacerbate existing social pathologies, including substance abuse, increase in incidences of crime, disintegration of close relationships with significant others (spouse, fiancé, girlfriend, etc.), prostitution, unplanned pregnancies and spread of communicable diseases, placing further strain on family structures and social networks.
- **Increased demand for low-cost housing and municipal services:** Housing of temporary employees in the low and semi-skilled income range could be problematic if they are brought in from other areas during the operational phase.
- **Biodiversity, water, visual and heritage impacts:** Biodiversity, water, visual and heritage impacts related to the proposed project are considered and assessed under the various specialist disciplines and more broadly in the BA report. Mitigation measures proposed in these studies are considered to be realistic, reducing the likelihood of a long-term burden for current or future generations to manage.
- **Influx of jobseekers:** In-migration of jobseekers can be anticipated where there is the possibility of large-scale employment creation. While the proposed project on its own is not likely to be the primary driver of influx in the area, the simultaneous establishment of similar renewal energy facilities could cumulatively encourage people to seek employment and settle in the area.
- **Impact on tourism:** Based on an evaluation of the various tourism clusters located within DKLM and KGLM, it is unlikely that the proposed project will have an impact on tourism activities in the area. The proposed project site is located within an established industrial area on land that is currently being used for livestock grazing. The existing Eskom Upington MTS is also located on the site.

<u>Impact Assessment – Site A and B</u>

The impact assessment of the identified socio-economic assessment during the Construction phase is provided in Table 8 25.

Given the high levels of unemployment in DKLM or KGLM, the proposed project presents a localised socio-economic benefit with the potential to improve the quality of life for residents in these municipalities. However, in the absence of implementation of recommended enhancements, the significance of this positive impact is likely to be Low (+) given that the preference may be to use skilled and experienced workers from outside the area rather than to train local community members where skilled workers are not immediately available. With the implementation of the recommended enhancements, the significance of this positive impact is likely to remain Low (+), as there the proposed project will only employ a limited number of people during the operational life of the facility. As such, the intensity of the potential impact is rated LOW (Solarys, 2022).

While the significance of this positive impact relating to the creation of procurement opportunities is likely to be Low (+) with and without mitigation, implementation of recommended enhancements will increase the probability that investment in the local economy is maximised to the extent possible. In this manner, both direct and indirect benefits will accrue to local community members (Solarys, 2022).

The proposed development, once approved and operational, will support efforts to increase and stabilise electricity supply, thereby helping to reduce instances of electricity disruptions and associated negative socio-economic impacts. It will allow the realisation of the energy mix as envisaged by the IRP and as such, the significance of this impact is assessed as Moderate (+) (Solarys, 2022).

In the absence of mitigation, the significance of the impact relating to additional strain on community health and safety services is likely to be High (-). This is due to the very high intensity/magnitude of the impact (e.g. dealing with an unplanned pregnancy, contracting AIDS or TB, injury or even loss of life due to violent crime) and the medium probability of the impact occurring. With mitigation, the significance of this impact is likely to be Low (-), largely due to the lower probability of the impact occurring (Solarys, 2022).

Given the low number of unskilled and semi-skilled workers who could be employed during the operational phase of the proposed project, no long-term increase in demand for low-cost housing and municipal services is anticipated as a result of the project. No significant impacts on the local demand for low-cost housing and municipal services in the broader DKLM and KGLM are anticipated during the operational phase of the proposed project (Solarys, 2022).

Table 8-36: Socio-economic impact assessment during Operation: Site A and B (Solarys, 2022)

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Positive	Existing Impact	2	1	1	0.1	0 - LOW
Aspect:	Social	Project Impact	2	1	1	0.5	2 - LOW
Potential Impact:		**Significance with Mitigation**					
Creation of employment, skills development, procurement and business opportunities		Residual Impact	2	1	1	0.5	2 - LOW
		Reversibility	High reversibility				
		Irreplaceability					
		Cumulative Impact					
		Cumulative Impact	2	1	2	0.5	3 - MOD
		Confidence	Medium				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Positive	Existing Impact	4	4	2	0.5	5 - MOD
Aspect:	Social	Project Impact	4	4	2	0.5	5 - MOD
Potential Impact:		**Significance with Mitigation**					
Strengthening energy supply		Residual Impact	4	4	2	0.5	5 - MOD
		Reversibility	High reversibility				
		Irreplaceability	Resources are replaceable				
		Cumulative Impact					

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
		Cumulative Impact	4	4	2	0.5	5 - MOD
		Confidence	High				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	2	4	4	0.5	5 - MOD
Aspect:	Social	Project Impact	2	4	16	0.5	11 - HIGH
Potential Impact:		**Significance with Mitigation**					
Strain on community health & safety services		Residual Impact	2	4	16	0.1	2 - LOW
		Reversibility	Moderate reversibility				
		Irreplaceability					
		Cumulative Impact					
		Cumulative Impact	2	4	16	0.1	2 - LOW
		Confidence	High				

Enhancement of Positive Impacts

To enhance the potential positive impact associated with the creation of employment opportunities during the operational phase, the following measures should be implemented:

- To the extent possible, the Applicant and any contractors appointed to undertake activities during the operational phase should prioritise employment of local people from DKLM and KGLM, particularly for semi and unskilled job categories.
- Employment of Coloured and Black African people; women; and youth should be prioritised. Compliance with Department of Employment and Labour (DoEL) requirements and the Employment Equity Act 55 of 1998 (EEA) must be prioritised.
- Before the operational phase commences, the Applicant and its contractors should meet with officials from the ZF Mgcawu District, DKLM and KGLM to enquire about the possibility and process of hiring people who are registered on the District and Local skills database.
- The Applicant should prioritise skills development by appointing a suitably qualified skills development facilitator; ensuring registration with the appropriate SETA; developing a skills development plan; and compiling the necessary Workplace Skills Plan/Annual Training Report as required in terms of the Skills Development Act 97 of 1998 (SDA).
- Where feasible, efforts should be made to employ local contactors that are compliant with Broad Based Black Economic Empowerment (BBBEE) criteria.
- Recruitment and employment practises must be aligned with prevailing labour legislation in South Africa.
- Vacancies should be advertised in the local media when they become available.

- The Applicant should engage with LED and IDP officials as well as representatives of a LED Forum or Business Chamber to identify strategies aimed at maximising the potential positive impact on local procurement within the DKLM and KGLM.

Proposed Mitigation Measures (Impact Management Actions)

- Prioritise employment of local people from DKLM and KGLM, particularly for semi and unskilled job categories as far as possible.
- Implement training and on-the-job skills development programmes for temporary employees where feasible.

8.5 Decommissioning Phase

8.5.1 Impacts resulting from BESS

Solid state and flow batteries contain several toxic and hazardous substances depending on the battery chemistry implemented as discussed in section 3.4.2 of this BAR.

Impacts identified

Impacts identified with the decommissioning of the BESS facility include:

- Incorrect or illegal handling and disposal of different types of waste leading to spillages or leakage of electrolyte or hazardous substances resulting in adverse impacts on the environment, soil and flora.
- Incorrect or illegal handling and disposal of different types of waste leading to spillages or leakage of electrolyte or hazardous substances resulting in adverse impacts on fauna, people or communities.

The main concern relating to the decommissioning of the BESS facility is the potential spillage or leakage of hazardous substances and electrolyte from the battery units during the decommissioning activities.

Impact Assessment – BESS Technology Alternative 1: Solid State Batteries

The impact assessment undertaken for BESS Technology Alternative 1: Solid State Batteries during the decommissioning phase is provided in Table 8-37. The impact significance of the impacts identified during the decommissioning phase were all rated as MODERATE (-) before the implementation of mitigation measures (impact management actions). However, with the implementation of the proposed mitigation measures the impact significance of the identified impact reduce to LOW (-). This is largely due to the fact that the proposed mitigation measures are aimed at the prevention of the impact occurring, which will eliminate the impact in its entirety, irrespective of the potential intensity of the impact or probability of the impact occurring.

Table 8-37: Impact assessment during decommissioning: BESS Technology Alternative 1: Solid State Batteries

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
Impact	Direct Impact:	Significance without Mitigation					
Impact Direction:	Negative	Existing Impact	1	1	1	0.2	1 - LOW
Aspect:	Incorrect waste handling	Project Impact	1	1	4	0.5	3 - MOD
Potential Impact:		Significance with Mitigation					
Incorrect or illegal handling and disposal of different types of waste leading to spillages or leakage of electrolyte or hazardous substances resulting in adverse impacts on the environment, soil and flora.		Residual Impact	1	1	4	0.2	1 - LOW
		Reversibility	High reversibility				
		Irreplaceability	Moderate irreplaceability				
		Cumulative Impact					
		Cumulative Impact	3	1	4	0.2	2 - LOW
		Confidence	Medium				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Indirect Impact:	Significance without Mitigation					
Impact Direction:	Negative	Existing Impact	1	1	4	0.2	1 - LOW
Aspect:	Incorrect waste handling	Project Impact	1	1	8	0.5	5 - MOD
Potential Impact:		Significance with Mitigation					
Incorrect or illegal handling and disposal of different types of waste leading to spillages or leakage of electrolyte or hazardous substances resulting in adverse impacts on fauna, people or communities.		Residual Impact	1	1	8	0.2	2 - LOW
		Reversibility	High reversibility				
		Irreplaceability	Moderate irreplaceability				
		Cumulative Impact					
		Cumulative Impact	1	1	8	0.2	2 - LOW
		Confidence	Medium				

Impact assessment – BESS Technology Alternative 2: Flow Batteries

The impact assessment undertaken for BESS Technology Alternative 1: Solid State Batteries during the decommissioning phase is provided in Table 8-38. The impact significance of the impacts identified during the decommissioning phase were all rated as MODERATE (-) before the implementation of mitigation measures (impact management actions). However, with the implementation of the proposed mitigation measures the impact significance of the impact *Incorrect or illegal handling and disposal of different types of waste leading to spillages or leakage of electrolyte or hazardous substances resulting in adverse impacts on the environment, soil and flora* could be reduce to LOW (-). This is largely due to the fact that the proposed mitigation measures are aimed at the prevention of the impact occurring, which will eliminate the impact in its entirety, irrespective of the potential intensity of the impact or probability of the impact occurring.

The impact significance of the impact *Incorrect or illegal handling and disposal of different types of waste leading to spillages or leakage of electrolyte or hazardous substances resulting in adverse impacts on fauna, people or communities*, however, remained at MODERATE (-)

due to the fact that the potential intensity of the impact on fauna, people or surrounding communities was rated as HIGH (-).

Table 8-38: Impact assessment during decommissioning: BESS Technology Alternative 2: Flow Batteries

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	1	1	1	0.2	1 - LOW
Aspect:	Incorrect waste handling	Project Impact	1	1	8	0.5	5 - MOD
Potential Impact:		**Significance with Mitigation**					
Incorrect or illegal handling and disposal of different types of waste leading to spillages or leakage of electrolyte or hazardous substances resulting in adverse impacts on the environment, soil and flora.		Residual Impact	1	1	8	0.2	2 - LOW
		Reversibility	High reversibility				
		Irreplaceability	Moderate irreplaceability				
		Cumulative Impact					
		Cumulative Impact	3	1	4	0.2	2 - LOW
		Confidence	Medium				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Indirect Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	1	1	4	0.2	1 - LOW
Aspect:	Incorrect waste handling	Project Impact	1	1	16	0.5	9 - MOD
Potential Impact:		**Significance with Mitigation**					
Incorrect or illegal handling and disposal of different types of waste leading to spillages or leakage of electrolyte or hazardous substances resulting in adverse impacts on fauna, people or communities.		Residual Impact	1	1	16	0.2	4 - MOD
		Reversibility	High reversibility				
		Irreplaceability	Moderate irreplaceability				
		Cumulative Impact					
		Cumulative Impact	1	1	8	0.2	2 - LOW
		Confidence	Medium				

Proposed Mitigation Measures (Impact Management Actions)

- All decommissioning activities must be undertaken in line with Environmental Management Programme and Waste Management Plan.
- A decommissioning strategy must be developed and implemented top guide the decommissioning of the BESS facility. This decommissioning strategy must identify and document all waste streams that will be generated during the decommissioning of the facility.
- All necessary waste permits and licences must be identified, applied for and be in place before decommissioning of the facility commence.
- The waste management hierarchy must be implemented in that waste generation must first be avoided, reduced and minimised during the decommissioning phase. Where the generation of waste is inevitable, all waste that can be recycled must be recycled. Disposal of waste to landfill must therefore be the last remaining option in the management of waste generated during the decommissioning of the BESS facility.

- Where unrecyclable waste must be disposed to landfill, only disposal to licenced and accredited waste disposal facilities must be allowed.
- An EIA for the decommissioning of the BESS plant will be required and could trigger the need for a waste management license. Such applications must be undertaken well in advance of the actual decommissioning date to prevent illegal commencement of a listed activity in terms of the NEMA EIA regulations, 2014, or listed waste activity in terms of NEMWA List of waste activities.
- Where necessary, the use of suitable equipment to minimise or eliminate any spillages during decommissioning must be prioritised.
- Decommissioning of the BESS components must be undertaken by accredited staff or contractor. A copy pf such staff or contractor's relevant credentials and accreditations must be saved in the EMPr site file for auditing and verification at any time.
- An agreement or contract with an accredited HazMat company for first response, site clean-up and rehabilitation of any spillage must be concluded before transportation of the batteries, components or electrolyte is undertaken.
- All Material Safety Data Sheets (MSDS) for hazardous and dangerous substances to be used in the BESS must be available during transportation, storage, handling and installation of the BESS.

8.5.2 Terrestrial Biodiversity

The anticipated impacts associated with the decommissioning phase of the project is anticipated to be largely similar to impacts experienced during the construction phase. The impact assessment undertaken in section 8.3.1 is therefore applicable to the decommissioning phase of the project.

8.5.3 Surface Water and Wetlands

The anticipated impacts associated with the decommissioning phase of the project is anticipated to be largely similar to impacts experienced during the construction phase. The impact assessment undertaken in section 8.3.3 is therefore applicable to the decommissioning phase of the project.

8.5.4 Avifauna

Impacts identified

During the decommissioning phase should the infrastructure not be removed, and the area rehabilitated, the infrastructure will eventually start oxidising possibly resulting in heavy metal pollution of the water sources. The habitat will, even after rehabilitation, not return to a pre-development state but the rehabilitation of the area will reduce the likelihood of alien plant infestation and erosion (TBC, 2022c).

The following impacts were considered for the PV sites:

- Habitat Loss (Destroy, fragment, and degrade habitat, ultimately displacing avifauna);
- Sensory disturbances (e.g. noise, dust, vibrations);
- Roadkill;
- Collisions with PV and associated infrastructure; and
- Fencing of PV site, especially a risk for larger birds.

Impact Assessment – Site A and B

The habitat will be disturbed again and will need to be rehabilitated post removal of the infrastructure. The impact of habitat loss and disturbance were rated as MODERATELY-HIGH pre-mitigation and LOW post-mitigations. The removal of the infrastructure and more specifically the solar panels will reduce the impact of collisions from MODERATELY HIGH to Absent (0 – LOW). The risk of fencing becoming slack and causing birds to become entangled is HIGH, should this be removed along with all the other infrastructure the impact can successfully be reduced to Absent (0 – LOW).

Table 8-39: Avifauna impact assessment during Decommissioning: Site A and B

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	1	4	1	0.2	1 - LOW
Aspect:		Project Impact	2	5	8	1	15 - HIGH
Potential Impact:		**Significance with Mitigation**					
Habitat Loss (Destroy, fragment and degrade habitat, ultimately displacing avifauna)		Residual Impact	1	2	2	0.2	1 - LOW
		Reversibility	Low reversibility				
		Irreplaceability	Moderate irreplaceability				
		Cumulative Impact					
		Cumulative Impact	3	4	8	0.2	3 - MOD
		Confidence	Low				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Indirect Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	1	1	1	0.2	1 - LOW
Aspect:		Project Impact	2	4	4	0.5	5 - MOD
Potential Impact:		**Significance with Mitigation**					
Sensory disturbances (e.g. noise, dust, vibrations)		Residual Impact	1	2	1	0.5	2 - LOW
		Reversibility	High reversibility				
		Irreplaceability	Moderate irreplaceability				
		Cumulative Impact					
		Cumulative Impact	3	4	4	0.5	6 - MOD
		Confidence	Low				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	2	5	1	0.2	2 - LOW

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
Aspect:		Project Impact	2	4	8	0.75	11 - HIGH
Potential Impact:		Significance with Mitigation					
Roadkill		Residual Impact	1	1	1	0.2	1 - LOW
		Reversibility	Moderate reversibility				
		Irreplaceability	Moderate irreplaceability				
		Cumulative Impact					
		Cumulative Impact	3	5	8	0.5	8 - MOD
		Confidence	Medium				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Direct Impact:	Significance without Mitigation					
Impact Direction:	Negative	Existing Impact	1	1	1	0.1	0 - LOW
Aspect:		Project Impact	3	4	8	0.75	11 - HIGH
Potential Impact:		Significance with Mitigation					
Collisions with PV and associated infrastructure		Residual Impact	1	1	1	0.1	0 - LOW
		Reversibility	Moderate reversibility				
		Irreplaceability	Moderate irreplaceability				
		Cumulative Impact					
		Cumulative Impact	3	4	8	0.5	8 - MOD
		Confidence	Medium				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Direct Impact:	Significance without Mitigation					
Impact Direction:	Negative	Existing Impact	1	1	1	0.1	0 - LOW
Aspect:		Project Impact	3	5	8	1	16 - HIGH
Potential Impact:		Significance with Mitigation					
Fencing of PV site, especially a risk for larger birds		Residual Impact	1	1	1	0.2	1 - LOW
		Reversibility	Moderate reversibility				
		Irreplaceability	Moderate irreplaceability				
		Cumulative Impact					
		Cumulative Impact	3	5	8	0.5	8 - MOD
		Confidence	Medium				

Proposed Mitigation Measures (Impact Management Actions)

- Areas of already fragmented indigenous vegetation, even secondary communities outside of the direct project footprint, should under no circumstances be fragmented or disturbed further. Clearing of vegetation should be minimized and avoided where possible. Clearing beneath panels should be avoided.
- The site ecological importance for SCCs is rated as high, and therefore the site area should be avoided where possible. The extent should be minimised, with drainage lines avoided where possible. Clearing of vegetation beneath panels should be avoided and roads kept to a minimum.

- Areas that are denuded during construction need to be re-vegetated with indigenous vegetation to prevent erosion during flood and wind events. This will also reduce the likelihood of encroachment by alien invasive plant species.
- Any woody material removed can be shredded and used in conjunction with the topsoil to augment soil moisture and prevent further erosion.
- Rehabilitation of the disturbed areas existing in the project area must be made a priority. Topsoil must also be utilised, and any disturbed area must be re-vegetated with plant and grass species which are endemic to this vegetation type.
- Erosion control and alien invasive management plan must be compiled.
- A fire management plan needs to be compiled and implemented to restrict the impact fire might have on the surrounding areas.
- All personnel should undergo environmental induction with regards to avifauna and in particular awareness about not harming, collecting, or hunting terrestrial species (e.g., guineafowl and francolin), and owls, which are often persecuted out of superstition. Signs must be put up to enforce this.
- All construction and maintenance motor vehicle operators should undergo an environmental induction that includes instruction on the need to comply with speed limit (40km/h), to respect all forms of wildlife. Speed limits must still be enforced to ensure that road killings and erosion is limited.
- All areas to be developed must be walked through prior to any activity to ensure no nests or avifauna species are found in the area. Should any Species of Conservation Concern be found and not move out of the area or their nest be found in the area a suitably qualified specialist must be consulted to advise on the correct actions to be taken.

8.5.5 Heritage, Archaeology and Palaeontology

No impacts are expected during the operation phase (Beyond Heritage, 2022). As such, no impact assessment was undertaken.

8.5.6 Visual Aspects

<u>Impacts identified</u>

Impacts identified during the Decommissioning phase of the proposed development include:

- The decommissioning activities may disturb the quiet sense of peaceful solitude of the Kalahari rangelands. This impact would be moderate to low given that there are few sensitive receptors.
- Decommissioning activities, particularly those that generate noise and dust, heavy vehicles and abnormal load vehicles, may impact the experience of tourists to the region and result in impacts to tourist sentiment and tourism revenue.
- Structures' colour and design potentially contrast vividly with the surrounding landscape enhancing visibility and increasing artificial contrast in the landscape

- Powerline infrastructure adds additional visual impact to the existing impacted landscape
- Security and other operational lighting will introduce unnatural lighting into an unlit landscape

Impact Assessment – Site A

The impact assessment undertaken for visual impacts resulting from the decommissioning phase for Site A is provided in Table 8-40. It is not possible to know what the level of activity and noise will be at the time of decommissioning. Scoring therefore only includes activities related to the decommissioning of the proposed development.

Table 8-40: Visual impact assessment for Decommissioning: Site A

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
Impact	Direct Impact:	Significance without Mitigation					
Impact Direction:	Negative	Existing Impact	1	1	1	0.1	0 - LOW
Aspect:	Visual Impact	Project Impact	2	1	1	0.75	3 - MOD
Potential Impact:		Significance with Mitigation					
The decommissioning activities may disturb the quiet sense of peaceful solitude of the Kalahari rangelands. This impact would be moderate to low given that there are few sensitive receptors		Residual Impact	2	1	1	0.5	2 - LOW
		Reversibility	High reversibility				
		Irreplaceability	Resources are replaceable				
		Cumulative Impact					
		Cumulative Impact	2	1	1	0.5	2 - LOW
		Confidence	Medium				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Direct Impact:	Significance without Mitigation					
Impact Direction:	Negative	Existing Impact	2	1	1	0.1	0 - LOW
Aspect:	Visual Impact	Project Impact	2	1	1	0.5	2 - LOW
Potential Impact:		Significance with Mitigation					
Decommissioning activities, particularly those that generate noise and dust, heavy vehicles and abnormal load vehicles, may impact the experience of tourists to the region and result in impacts to tourist sentiment and tourism revenue.		Residual Impact	2	1	1	0.2	1 - LOW
		Reversibility	High reversibility				
		Irreplaceability	Resources are replaceable				
		Cumulative Impact					
		Cumulative Impact	2	1	1	0.2	1 - LOW
		Confidence	Medium				

Impact Assessment – Site B

The impact assessment undertaken for visual impacts resulting from the decommissioning phase for Site B is provided in Table 8-41. It is not possible to know what the level of activity and noise will be at the time of decommissioning. Scoring therefore only includes activities related to the decommissioning of the proposed development.

Table 8-41: Visual impact assessment for Decommissioning: Site B

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	1	1	1	0.1	0 - LOW
Aspect:	Visual Impact	Project Impact	2	1	1	0.75	3 - MOD
Potential Impact:		**Significance with Mitigation**					
The decommissioning activities may disturb the quiet sense of peaceful solitude of the Kalahari rangelands. This impact would be moderate to low given that there are few sensitive receptors		Residual Impact	2	1	1	0.5	2 - LOW
		Reversibility	High reversibility				
		Irreplaceability	Resources are replaceable				
		Cumulative Impact					
		Cumulative Impact	2	1	1	0.5	2 - LOW
		Confidence	Medium				
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	2	1	1	0.1	0 - LOW
Aspect:	Visual Impact	Project Impact	2	1	1	0.5	2 - LOW
Potential Impact:		**Significance with Mitigation**					
Decommissioning activities, particularly those that generate noise and dust, heavy vehicles and abnormal load vehicles, may impact the experience of tourists to the region and result in impacts to tourist sentiment and tourism revenue.		Residual Impact	2	1	1	0.2	1 - LOW
		Reversibility	High reversibility				
		Irreplaceability	Resources are replaceable				
		Cumulative Impact					
		Cumulative Impact	2	1	1	0.2	1 - LOW
		Confidence	Medium				

Proposed Mitigation Measures (Impact Management Actions)

- As with construction, vegetation removal should be kept to a minimum and vegetation should be retained wherever possible.
- All bare areas should be rehabilitated to a form resembling a natural vegetated state as soon as possible using locally indigenous shrubs and trees.
- A dust suppression plan must be developed and implemented while unvegetated areas are still present.
- Reversing of construction vehicles should be kept to a minimum to minimise the use of reverse warning sounds and wherever possible vehicles should be turned around without using reverse gear.
- Any abnormal loads that are to be delivered to or from site or activities involving a large numbers of delivery vehicles, should be scheduled to avoid peak traffic times on the N14 to limit the impact of traffic on the tourist experience.

8.5.7 Socio-economic environment

Impacts identified

- **Creation of local employment opportunities:** The closure and decommissioning of the proposed Kiwano BESS and PV facility will result in the creation of several temporary employment opportunities for people from the local community. Opportunities for on-job training and skills development will also be created. Most of the people employed to undertake decommissioning phase activities will be involved in the demolition of the solar PV plant and related infrastructure.
- **Loss of employment:** The closure and decommissioning of the proposed solar PV plant will result in the loss of permanent employment opportunities.

Impact Assessment - Site A and B

With the implementation of the proposed enhancements associated with the creation of employment opportunities, the significance of this positive impact is likely remain LOW (+) as there is the increased probability that local people will be employed for the proposed decommissioning activities (Solarys, 2022).

The closure and decommissioning of the proposed solar PV plant will result in the loss of permanent employment opportunities. The significance of this impact is likely to be LOW (-) with and without the implementation of the recommended mitigation measures (Solarys, 2022).

Table 8-42: Socio-economic impact assessment during Decommissioning: Site A and B (Solarys, 2022)

Impact Description		Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Positive	Existing Impact					
Aspect:	Social	Project Impact	2	1	1	0.5	2 - LOW
Potential Impact:		**Significance with Mitigation**					
Creation of local employment opportunities associated with decommissioning activities		Residual Impact	2	1	1	0.5	2 - LOW
		Reversibility					
		Irreplaceability					
		Cumulative Impact					
		Cumulative Impact					
		Confidence					
Impact Description		**Impact type**	**E**	**D**	**P**	**L**	**IR&S**
Impact	Direct Impact:	**Significance without Mitigation**					
Impact Direction:	Negative	Existing Impact	2	1	1	0.5	2 - LOW
Aspect:	Social	Project Impact	2	1	1	0.5	2 - LOW
Potential Impact:		**Significance with Mitigation**					

Impact Description	Impact type	Extent (E)	Duration (D)	Potential Intensity (P)	Likelihood (L)	Impact Rating & Significance (IR&S)
Loss of employment	Residual Impact	2	1	1	0.5	2 - LOW
	Reversibility	Low reversibility				
	Irreplaceability	Low irreplaceability				
	Cumulative Impact					
	Cumulative Impact					
	Confidence					

Proposed Mitigation Measures (Impact Management Actions)

- Prior to a scheduled closure, engage with all relevant stakeholders such as the ZF Mgcawu District, DKLM, KGLM and Labour Unions regarding the proposed closure and decommissioning timeframes and possible socio-economic interventions to ameliorate the impact on individuals and the broader community.
- Provide counselling and guidance to employees who will need to be retrenched.
- Provide assistance with claiming UIF and other state assistance if required.
- Assistance with registering as a jobseeker (with the relevant local and district municipalities, DoEL, employment agencies or other solar PV operators).

8.6 Assessment of 'Do Nothing' Alternative

The do-nothing' alternative (i.e. no-go alternative) is the option of not constructing the development and operation of the proposed Kiwano Solar PV and BESS facility. Should this alternative be selected, there would be no environmental impacts on the site due to the construction and operation activities of a Solar PV and BESS facility.

8.6.1 Land use and agriculture

There are no high potential soils present within the development area and the soils are of moderate potential at best due mainly to a combination of the shallow depth and the sandy texture which will lead to rapid water infiltration resulting in the soils drying out under normal climatic conditions. In addition, the low rainfall in the area means that there is little potential for rain-fed arable agriculture in the area.

In general, the soils that do occur within the broader study area and development area are suited for extensive grazing at best and furthermore the grazing capacity of the area is very low, at around 3040 ha / large stock unit. Considering the state of the agricultural potential and land capability of the broader study area, the undertaking of productive agricultural activities will not be possible.

On the other hand, the proposed Kiwano Solar PV and BESS development provides an opportunity to undertake a productive land use activity on properties which has strategically been earmarked for renewable energy production.

The implementation of the ’do-nothing’ alternative would leave the land-use restricted to the current land use (i.e. grazing), losing out on the opportunity to generate renewable energy from solar energy in addition to the current land use activities.

Therefore, from a land-use perspective, the ‘do-nothing' alternative is not preferred as there will be a loss of viable and compatible land use for the broader study area which allows the current land-use activities to continue.

8.6.2 Socio-economic environment

From a socio-economic perspective, the impacts of pursuing the no-go alternative are largely negative. The benefits would be that there is no disruption from an influx of jobseekers into the Upington area, nuisance impacts (noise and dust during construction), visual impacts and safety and security impacts. The impact is therefore neutral.

An opportunity would be lost in terms of job creation, skills development and associated economic business opportunities for the local economy. Foregoing the proposed development would not necessarily compromise the development of renewable energy facilities in South Africa. However, the socio-economic benefits for local communities at this location and within the surrounding area would be forfeited. Therefore, from a socio-economic perspective, the ‘do-nothing’ alternative is not preferred as there is a perceived loss of socio-economic benefits, when considering the current socio-economic conditions of the area.

Some of the benefits that can result from the project expenditure will be localised in the communities located near the site, such as the towns of Upington, Keimoes and Kakamas, as well as the smaller settlements located within the surrounding areas of the development area. The local services sector and specifically the trade, transportation, catering and accommodation, renting services, personal services and business services are expected to benefit the most from the project activities during the construction phase. New business sales that will be stimulated as a result of the establishment of the solar PV facility, albeit for a temporary period, will be lost with the implementation of the ‘do nothing’ alternative. Therefore, from a business perspective, the ‘do-nothing’ alternative is not preferred as there is a perceived loss of new business opportunities.

as well as a loss of the opportunity to generate energy from a renewable resource. The impact of this ‘Do Nothing’ alternative is therefore negative.

It is anticipated that approximately 120 temporary employment opportunities will be created during the peak construction. the construction phase will extend over a period of approximately 24 months. According to estimates provided by the Applicant, it is further anticipated that approximately 33% (40) of the employment opportunities will be available to unskilled workers (construction labourers, security staff, cleaners, etc.), 25% (30) for semi-skilled workers (drivers, equipment operators etc.); and 17% (20) for skilled personnel (welders, electricians, solar PV installer, etc.)

The establishment of the proposed Kiwano Solar PV and BESS facility will offer numerous opportunities for skills transfer and development. This is relevant for both on-site activities and manufacturing activities. Various PV facilities are proposed to be developed in the area, which means that the transfer of skills from foreign experts to the local engineers and construction workers will take place, similar to what has taken place where PV facilities have been constructed and operated within the Province and the rest of the country. The skills training and transfer benefits for individuals within local communities would be lost with the implementation of the 'do nothing' alternative.

In consideration of municipal goals, the implementation of the proposed Kiwano Solar PV and BESS facility would contribute towards addressing the Local Municipality's key issue regarding high levels of poverty and unemployment, skills shortage, and inequalities, through the creation of employment opportunities, the provision of skills training opportunities, and local economic growth. The 'Do Nothing' alternative will therefore result in the above economic benefits not being realised and a subsequent loss of income and opportunities to local people. From this perspective the no-go alternative is not preferred.

9 ASSESSMENT OF POTENTIAL CUMULATIVE IMPACTS

One of the key information requirements as set out in Appendix 1 of the NEMA EIA regulations, 2014, as amended is the assessment of potentially significant cumulative impacts and risks that may be associated with a proposed development.

The definition of "cumulative impact" in terms of the NEMA EIA Regulations, 2014, as amended state that cumulative impact: "*in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities*". A key aspect of considering cumulative impacts is therefore the consideration of project impacts together with impacts that may arise from similar developments within a reasonable proximity to the proposed development that is being assessed.

As described in section 6.3 and shown in Figure 6-4, the project site is located entirely within the Upington REDZ and the Northern Strategic Powerline Corridor. As a result of the establishment of these REDZs, several renewable energy developments have already been constructed with these REDZ, with numerous other in varying stages of approval and development. With regards to the Upington REDZ, several other existing and planned developments are situated within close proximity to the proposed Kiwano Solar PV and BESS development site. The proximity of these developments could therefore contribute to an overall cumulative impact on the receiving environment when impacts from the proposed development is also considered.

Potential cumulative impacts associated with the Kiwano Solar PV and BESS facility are discussed in this chapter.

9.1 Cumulative Impacts of the area

The project may have effects (positive and negative) on natural resources; the social environment; and on the people living in the project area.

Specialist studies also considered cumulative impacts associated with similar developments within a 30km radius of the proposed project. The purpose of the cumulative assessment is to test if such impacts are relevant to the proposed project in the proposed location (i.e., whether the addition of the proposed project in the area will increase the impact). In this regard, specialist studies considered whether the construction of the project will result in:

- Unacceptable risk to environmental sensitivities Unacceptable loss of environmental features
- Complete or whole-scale changes to the environment or sense of place.
- Unacceptable increase in impact.

A conclusion regarding whether the project will result in any unacceptable loss or impact considering all the projects proposed in the area is included in the respective specialist reports.

The impacts as well as a brief overview of the cumulative impacts are assessed for each of the identified sensitivities in the below tables. This assessment is based on information currently available and considers impacts from similar solar power generation developments in the vicinity of the proposed project.

Figure 6-5 indicates the location of the project in relation to all known solar power generation developments located within a radius of 30km. These developments were identified using DFFE database which list all renewable projects which currently have environmental authorisation, and information available in the public domain at the time of this assessment.

It should be noted that not all the solar facilities presently under consideration by various developers will be built for operation. Not all proposed developments will be granted all relevant permits by the relevant authorities (DFFE, DMRE, NERSA) due to the following reasons:

- There may be limitations to the capacity of the existing or future Eskom grid.
- Not all applications will receive a positive EA.
- Where projects are to be developed as part of the national energy mix, stringent requirements must be met by applicants in terms of the Renewable Energy Independent Power Producer Procurement (REIPPP) Programme and a highly competitive process that only selects the most competitive projects.
- Not all proposed PV facilities will be able to reduce the associated negative impacts to acceptable levels or mitigate the impacts to acceptable levels (fatally flawed).
- Not all proposed facilities will eventually be granted a generation license by NERSA and/or sign a Power Purchase Agreement.
- Not all developers will be successful in securing financial support to advance their projects further.

It is not anticipated that the proposed PV development will have a negative cumulative impact on the broader landscape which is already dominated by infrastructure and agriculture. In terms of renewable development activities which can have an industrial feel, it is recommended that such infrastructure be grouped or clustered to avoid sprawl across natural landscapes.

9.2 Terrestrial Biodiversity

Potential cumulative impacts on the terrestrial biodiversity (vegetation, flora and fauna) were assessed by the biodiversity specialist (TBC, 2022a) and include:

- Loss of re-seeding resources to the local region.
- Disruption of corridors of habitat and loss of regional foraging area.

- Seeding of AIP species into adjacent properties and watercourses.
- The extensive number of solar developments in the region reduces habitat connectivity and foraging resources, and increases the likelihood of direct and indirect fatalities.
- Disruption of corridors of habitat and loss of regional foraging area.

Cumulative impacts are assessed in context of the extent of the proposed project area, other developments in the area, and general habitat loss and transformation resulting from other activities in the area, including surrounding renewable energy facilities, powerlines and associated infrastructure in the region.

The impacts of projects are often assessed by comparing the post-project situation to a pre-existing baseline. Where projects can be considered in isolation this provides a good method of assessing a project's impact. However, in areas where baselines have already been affected, or where future development will continue to add to the impacts in an area or region, it is appropriate to consider the cumulative effects of development. This is similar to the concept of shifting baselines, which describes how the environmental baseline at a point in time may represent a significant change from the original state of the system. This section describes the potential impacts of the project that are cumulative for fauna and flora. Localised cumulative impacts include the cumulative effects from operations that are close enough to potentially cause additive effects on the environment or sensitive receivers, dust deposition, noise and vibration, disruption of corridors or habitat, groundwater drawdown, groundwater and surface water quality, and transport (TBC, 2022a).

Assessment of the cumulative impact by the biodiversity specialist in Table 9-1 indicate that the considered cumulative impact on biodiversity resources in the broader study area will have a MODERATE (Medium) impact significance rating. The loss of vegetation cannot be mitigated. However, this impact will not be significance if the ecosystem threat status of the vegetation type is listed as Least Concern, which is the case for the 2 alternative sites. The loss of EN, VU or CR vegetation, on the other hand, will constitute a significant impact and therefore contribute to the cumulative impact in the broader study area.

Table 9-1: Cumulative Impacts to biodiversity associated with the proposed project (TBC, 2022a)

The development of the proposed infrastructure will contribute to cumulative habitat loss, thereby impacting ecological processes in the region.		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Moderate (3)	Moderate (3)
Duration	Short term (2)	Short term (2)
Magnitude	Low (4)	Moderate (6)
Probability	Probable (3)	Probable (3)
Significance	**Low (27)**	**Medium (33)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation:		

Should the vegetation be removed, the impact cannot be mitigated.
Residual Impacts:
Will result in the loss of: • Less migratory species will be found in the area. • Road killings are still a possibility. • Migratory routes of fauna will change. • Fauna and flora species composition will change.

9.3 Surface Water and Wetlands

No cumulative impacts were identified for surface water and wetland features given that all impacts are mitigated to an impact significance category of LOW or negligible (TBC, 2022b). This is also evident due to the fact that no “true” wetland features were identified within the development footprint or area.

9.4 Avifauna

Localised cumulative impacts include the cumulative effects from operations that are close enough to potentially cause additive effects on the environment or sensitive receivers such as nearby solar farm activities within the area. These include dust deposition, noise and vibration, disruption of corridors or habitat, groundwater drawdown, groundwater and surface water quality, and transport (TBC, 2022c).

Based on the number of known and planned PV sites and their associated powerlines in the area the cumulative impact is expected to be HIGH. These would collectively result in a large area of habitat loss, and it increases the risk of collisions and electrocutions for avifauna. This risk is especially high as a number of species expected and recorded is in a high-risk category for collisions and electrocutions (TBC, 2022c).

A total area of 30 km surrounding the project area were used to assess the total habitat loss in the area and subsequently the cumulative impact. To determine the intact remnant habitat the NBA (2018) remnant spatial data was utilised. The future renewable energy projects were also considered by utilising the REEA Q1 (2022) spatial dataset. In order to remove any duplication, only the areas that overlap with the remnant areas were considered. The total cumulative loss was found to be 5.3% (Table 9-2 and Figure 9-1).

Table 9-2: Total cumulative habitat loss (TBC, 2022c)

Total Area of 30km^2	Intact Remnant Habitat	REEA area that overlaps with undisturbed areas	Total Disturbed/Transformed habitat	Percentage area lost
343753 Ha	325298 Ha	21520 Ha	18455 Ha	5.3 %

The mitigation of cumulative impacts revolves around implementation of all the mitigation measures proposed during the pre-construction, construction, operation and decommissioning phases. Given the fact that the applicant don't have control over the management and mitigation measures proposed for surrounding renewable facilities, it is only in minimising the potential impacts from the proposed development on avifauna that the effective management of the impacts associated with the proposed development can contribute to the reduction of cumulative impact on avifauna in the region.

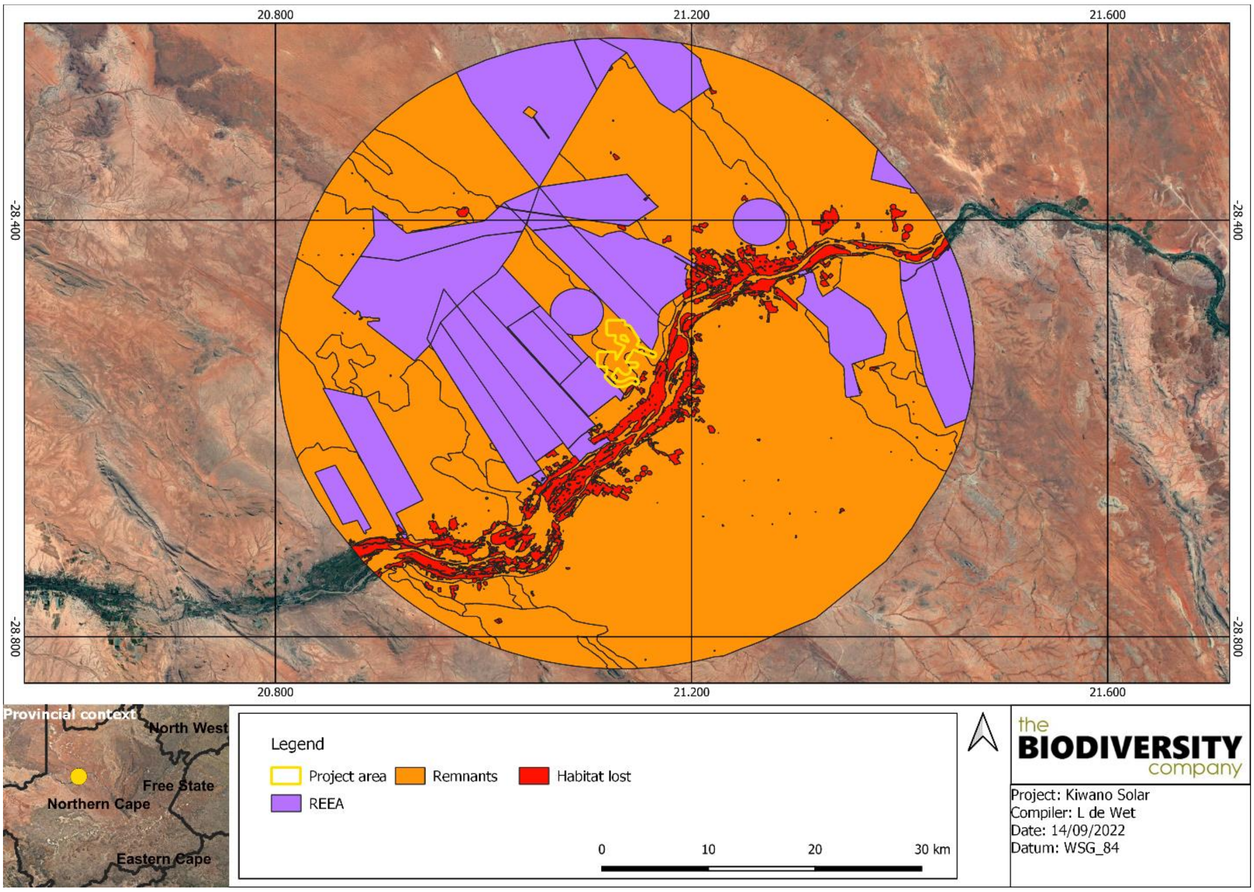

Figure 9-1: Cumulative habitat loss in the area as calculated by avifauna specialist (TBC, 2022c)

9.5 Heritage, Archaeology and Palaeontology

Widespread Stone Age background scatter occurs throughout the Northern Cape and is considered to be of low significance. The impact of the project on the isolated artefacts is considered LOW.

The possible grave is shielded from potential impact by existing infrastructure and no impact is expected by the project. The cumulative impact is therefore considered VERY LOW (Beyond Heritage, 2022).

9.6 Visual Aspects

There are several renewable energy facilities in existence in the immediate vicinity of the proposed sites. In particular, the Khi Solar One CSP is a strong visual presence that has impacted the vast majority of views in this area. Views from the D3276 towards site A are dominated by this facility. The existing visual impact of other renewable energy facilities will still dominate the landscape, particularly the Khi One CSP. Furthermore, the contrast offered by the busy orange river valley additionally mitigates this impact, while tourist views are largely focused on the river and vineyards and the contribution of the development to the cumulative development is thus negligible. The new facility would add slightly to this existing impact, but its contribution to the cumulative impact is VERY LOW (Geonest, 2022).

The existing infrastructure operates with minimal noise or activity and no existing noise and construction activity is present in the broader study area and would not contribute to a cumulative impact. The addition of the Kiwano PV infrastructure will add to this. If site A is selected the cumulative impacts will be clustered together and less area visually impacted, particularly since one side of the D3276 is left undisturbed. The bulk of the cumulative impact is however imposed by existing infrastructure. The N14 national road does provide road noise and movement to the east and south of the site (Geonest, 2022).

Whilst there are no other construction activities currently present in the landscape, the existing impacts of powerlines, railway, agricultural activities etc present a relatively active landscape. The construction activities will be visible only from a limited number of viewpoints, and as such will not add significantly to the existing impacts. There are presently no large construction projects underway in this area, though the landfill site provides a level of smoke and dust. The proposed project will potentially add to this for a short period (Geonest, 2022).

A number of existing powerlines are also present in the area. The proposed development will add to this situation, however, if designed with parallel and adjacent alignment, this cumulative impact will be minimised. The new facility would add slightly to this existing impact but would be largely overshadowed by existing infrastructure (Geonest, 2022).

A relatively strong night lighting impact from Upington and from the vehicles, homes and businesses along the N14 corridor already exist. The existing renewable energy infrastructure and substation also emit light. Any impacts by the proposed Site A or Site B will be limited insofar as when viewed from the D3671, they are integrated into these existing impacts (Geonest, 2022).

A number of powerlines are already present in the landscape and various sections of these lines are visible from almost all points in the area. If the additional lines are aligned parallel and adjacent to these existing lines, the contribution of the new powerlines to the cumulative impact will be minimised (Geonest, 2022).

9.7 Socio-economic environment

Potential cumulative impacts were considered in the socio-economic impact assessment report (Solarys, 2022) and relate to:

- **Employment, skills and economic opportunities:** It is anticipated that the proposed development will contribute positively to employment, skills development and creation of economic opportunities for people residing in DKLM and KGLM and the broader ZF Mgcawu District.
- **Influx, housing and demand for municipal services:** In the event that similar developments to the proposed Kiwano BESS and PV project initiate construction or operational activities within a similar timeframe, potential negative cumulative impacts may occur related to an influx of jobseekers. This potential cumulative impact may be significant, particularly if developers do not prioritise employment of and procurement of services from local people. In particular, if local employment of people in the unskilled and semi-skilled job categories is not prioritised, the cumulative pressure on available low-cost accommodation and municipal services is likely to materialise.
- **Community health, safety and security:** While the local municipality is in a reasonably good position to deal with a potential increase in communicable diseases, the presence of a largely external workforce employed by various developers could place strain on local health resources. Furthermore, an increase in accidents related to industrial events could place strain on the existing local health infrastructure.

The establishment of the Upington REDZ and other similar proposed solar PV and CSP developments in the region could cumulatively, with the proposed Kiwano BESS and PV project, result in MODERATE (+) socio-economic benefits for local communities as it relates to short-term employment, skills development and procurement of goods and services. However, these cumulative benefits will depend on the extent to which employment and procurement of local resources is prioritised by the various developers.

Mitigation of cumulative impacts associated with an influx of people into the area are dependent on the implementation of mitigation measures as set out in the Socio-economic Impact Assessment Report for this proposed solar PV and BESS project, as well as mitigation measures implemented on other similar developments in the broader study area. Given that the Applicant is not able to influence the hiring and procurement strategies of other developers, this cumulative impact is assessed as LOW (-) (Solarys, 2022).

Furthermore, the mitigation of cumulative impacts associated with health and safety risks related to transmission of communicable diseases and industrial accidents are dependent on the implementation of mitigation measures as set out in the Socio-economic Impact Assessment Report for this proposed solar PV and BESS project, as well as mitigation measures implemented on other similar developments in the broader study area. Given that the Applicant has no control over measures to mitigate health and safety risks related to transmission of communicable diseases and industrial accidents that may arise from other developments, this potential cumulative impact is assessed at LOW (-) (Solarys, 2022).

9.8 Conclusion

The environmental assessment of the development area (including the development footprint) was undertaken by independent specialists and their findings have informed the results of this BA Report.

As part of the process of identifying the most environmentally acceptable development footprint for the Kiwano Solar PV facility, a funnel down approach was followed: initially a high-level desktop screening assessment from an environmental acceptability perspective was undertaken on the project site, with the primary objective of highlighting or red-flagging potential environmental sensitivities.

Specialists assesses the entire development area in order to highlight any features of very high sensitivity, or no-go area. The aim was for the developer to use the findings from the assessment and field surveys to identify the placement of the development footprint in an area which avoids, as best possible, any environmentally sensitive features.

In addition to implementing the 'funnel down' approach, the Kiwano Solar PV development also considered and implemented the mitigation hierarchy[5]; a tool which aims to assist in the management of environmental risks.

- Avoidance: Specialists evaluated the development area, and features were rated based on the significance of sensitive features (No Go, Very High, High, Medium, and Low). Avoidance of features of high sensitivity indicated that the development footprint should be located within the northern section of the development area.
- Minimisation: Consideration of practicable mitigation measures for the development to reduce the duration, intensity and/or extent of impacts that cannot be completely avoided.
- Rehabilitation/restoration: Improve degraded ecosystems following exposure to impacts that cannot be completely avoided or minimised. Rehabilitation and restoration are frequently needed towards the end of a project life cycle but may be possible in some areas during operation (this has further been addressed in the EMPr).

[5] The mitigation hierarchy is tool which is used reiteratively throughout a project lifecycle to limit negative impacts on the environment. The first tier considers how to avoid the impact entirely and is considered early in the project to allow for alternatives to be considered. The impacts which cannot be avoided should be minimised. Effective minimisation can eliminate some impacts and reduce others allowing for sustainability targets to be met. The next consideration is restoration and takes place where minimisation efforts have failed to reach the required target. Finally, and as a last resort to compensate for ecological loss or residual impacts, the environmental loss or damage can be offset through compensation. The intention of this level is to ensure the protection of equivalent or greater ecological assets than those lost, or to rehabilitate a degraded environment restoring equivalent ecological assets.

It can be concluded that the project is environmentally acceptable (subject to the implementation of the recommended mitigation and enhancement measures).

From the specialist studies undertaken, no environmental fatal flaws were identified to be associated with the project as long as all the high environmental sensitivities and no-go areas have been avoided. All impacts associated with the project can be mitigated to acceptable levels. As detailed above, the benefits associated with the project outweigh the costs; and the project is therefore considered sustainable. The costs of the ‘do-nothing’ alternative are expected to outweigh the benefits and therefore, this alternative is not preferred and not proposed to be implemented for the project.

10 SUMMARY OF KEY ENVIRONMENTAL FINDINGS

This chapter provides a summary of the impacts identified and significance ratings, summary of key findings and recommendations from specialists, a summary of the findings of the alternatives assessment, and motivation for the preferred layout alternatives.

10.1 Summary of key findings and recommendations

This section summarises the key findings and recommendations from the respective specialist assessments that has materially contributed to the conclusions and overall recommendations made by the EAP for this application.

10.1.1 Surrounding Land use and Infrastructure

The project site is located entirely within the Upington REDZ and the Northern Strategic Powerline Corridor (Figure 6-4). Due to the location of the Upington REDZ, the broader area around the development site is characterised by numerous renewable energy installations, including Solar Photovoltaic (PV) and Concentrated Solar Power (CSP) facilities.

10.1.2 Soil and Agricultural Potential

The most sensitive soil forms identified within the assessment area are the Hutton and Dundee soil forms. The land capability sensitivities (DAFF, 2017) indicate land capabilities with “Very low to Low” sensitivities, which correlates with the findings from the baseline assessment.

The assessment area is associated with non-arable lands, due to the type of soils in the area. The available climate limits crop production significantly. The harsh climatic conditions are associated with low annual rainfall and high evapotranspiration potential demands of the area, which consequently result into a very restricted choice of crops due to the heat and moisture stress. The area is not favourable for most cropping practices, which corresponds to the current agriculture (grazing) and renewable energy facilities activities.

The proposed Kiwano BESS and PV project is characterised with “Very Low” to “Low” land capability sensitivities. It is also the specialist’s opinion that the land capability and land potential of the resources in the regulated area is characterised by “Very Low” to “Low” sensitivities (TBC, 2022d).

It was therefore concluded that the impact of the proposed development on soil, land capability and agricultural potential was INSIGNIFICANT. No Impact Assessment was resultantly undertaken for impacts on soil, land capability and agricultural potential in Chapter 8 of this Basic Assessment Report.

10.1.3 Hydrology and Surface Water

Various non-wetland drainage features and two non-wetland depressions (pans) were identified within the 500 m regulated area. None of these systems are characterised by hydromorphic signs of wetness, and therefore do not constitute wetland habitat. The drainage features are not characterised by riparian vegetation and grasses, these systems represent bare surfaces with evidence of surface run-off. A large number of small drainage features were identified within the assessment area. None of these systems are characterised by wetland features as only alluvial soils and no hydrophytic vegetation is present (TBC, 2022b).

A number of impact points with delineated watercourse features were identified for Site A (Figure 6-17) and Site B (Figure 6-18). For Site A, the roads, pipeline and power line will have multiple crossings over the delineated drainage line and will thus have the highest impacts on the watercourses. For Site B there are two drainage features running through the proposed PV facility area and the roads, pipeline and power line will have multiple crossings over the delineated drainage line and will thus have the highest impacts on the watercourses.

Furthermore, the development site does not fall within a South African Inventory of Inland Aquatic Ecosystem (SAIIAE), Strategic Water Source Areas (SWSA), or National Freshwater Ecosystem Priority Areas (NFEPA).

10.1.4 Terrestrial Biodiversity (Flora and Fauna)

The proposed development overlaps with two vegetation types, the Kalahari Karroid Shrubland and the Bushmanland Arid Grassland (TBC, 2022a). Both these vegetation types are listed as Least Threatened in terms of the National Biodiversity Assessment, 2018 database.

Site Layout Alternative A proposes an access road to be constructed from the N14 national road to the western boundary of the development site. The proposed access road will traverse through a CBA area for a distance of approximately 2.8km and will have a direct impact on the CBA resulting in the permanent clearing of vegetation. For Site Layout Alternative B neither the access road, Solar PV or BESS development footprint nor powerline will travel through a CBA.

295 Species of indigenous plants are expected to occur within the development area and surrounding landscape. During the field assessment a total of 52 species, representing 22 families of flora species were recorded within the assessment area. None of the expected threatened flora species were recorded within the assessment area during the survey period. However, four (4) of the recorded flora species are protected by legislation. No amphibian species were recorded during the survey period, accounting for 0% of the expected species, whereas two reptile species were recorded within the assessment area during the survey periods.

10.1.5 Avifauna

Based on the South African Bird Atlas Project, Version 2 (SABAP2) database, 132 bird species have the potential to occur in the vicinity of the assessment area. Of the potential bird species, nine (9) species are listed as Species of Conservation Concern (SCC), either on a regional or global scale. These include Kori Bustard (*Ardeotis kori*), Abdim's Stork (*Ciconia abdimii*), Pallid Harrier (*Circus macrourus*), Karoo Korhaan (*Eupodotis vigorsii*), Lanner Falcon (*Falco biarmicus*), White-backed Vulture (*Gyps africanus*), Ludwig's Bustard (*Neotis ludwigii*), Martial Eagle (*Polemaetus bellicosus*), and Secretarybird (*Sagittarius serpentarius*).

Five SCCs were observed during the wet and dry season assessments. The SCCs confirmed were Lanner Falcon, Red-footed Falcon, Abdim’s Stork, Secretarybird and Kori Bustard. Based on the nesting behaviour and the habitat type in the assessment area, it can be said that two of the five SCCs are permanent residents in the assessment area (TBC, 2022c).

10.1.6 Heritage, Archaeology and Palaeontology

Isolated Stone Age artefacts were recorded within the alternative development sites as well as a possible grave that is located outside of the development footprint (Beyond Heritage, 2022). The heritage significance of the Stone Age artefacts is of Low Significance, while the possible grave site is of High Social significance.

The palaeontological study concluded that it is extremely unlikely that any fossils would be preserved in the aeolian sands of the Gordonia Formation, Kalahari Group (Quaternary). There is a very small chance that fossils may have been trapped in features such as palaeo-pans or palaeo-springs, and buried by the aeolian sands, but no such feature is visible in the satellite imagery. Nonetheless, a Fossil Chance Find Protocol should be added to the EMPr (Bamford 2022). No palaeontological sensitive areas were identified within the study area.

Although no further mitigation measures were required due to the low heritage, archaeological and palaeontological sensitivity of within the development footprint, the implementation of a chance find procedure was recommended, nonetheless.

10.1.7 Visual

Whilst the landscape in the region of the proposed sites is potentially sensitive to visual impacts due to lack of visual contrast in the landscape and the lack of significant enclosure or relief, the specific sites chosen for the alternative sites (Site A and Site B), the limited number of visual receptors and sensitive views in the area and the low height and flat, linear nature of the development mean that there will be limited impact on the visual and aesthetic environment. This is primarily due to the very subtle ridge of high lying ground located between the proposed sites and the N14 that screens the majority of receptors from any visual impacts (Geonest, 2022).

Important also is the fact that such a development, once constructed, involves very little movement or noise in its operation. It will thus not intrude on the sense of quiet solitude in the area. There are also a number of existing renewable energy facilities in the area which have asserted a change on the visual character of the area. The proposed development is in keeping with this character and whilst further PV infrastructural development may be considered adding to the cumulative impact, the development is also consistent with local, regional and national planning policy (Geonest, 2022).

10.1.8 Socio-economic environment

The Applicant owns the directly affected farm portion, Olyvenhouts Drift Settlement Agricultural Holding 1080 Portion 0. Existing electrical infrastructure on the site includes the Eskom Upington Main Transmission Substation (MTS) and related transmission lines.

The area towards the north and west of the proposed project site is undeveloped and used predominantly for livestock grazing. While Eskom is the landowner for Erf 1080, there is a 5-year grazing agreement with the previous landowner. To the south-east, along the N14 and down towards the banks of the Orange River, livestock grazing, cultivation of grapes and other crops are the predominant land use (Solarys, 2022).

Settlement patterns in this area are characterised by a number of farmsteads, farm employee accommodation and farming related infrastructure. Inhabitants of this area are therefore likely to rely primarily on agriculture to support their livelihoods. The closest human settlement to the proposed project site is the rural agricultural settlement of Kalksloot which is located approximately 3.5 km from the Site A alternative. Oranjevallei is the next closest settlement located approximately 4.7 km from Site A. Other settlements within close proximity of the proposed project site include Louisvale (8.4 km); Dysons Klip (8.3 km); Raaswater (9.5 km); and Bloemsmond (12 km) (Solarys, 2022).

The findings of the SIA indicate that social impacts associated with each of the two project site alternatives are similar. Both alternatives are located on the farm Olyvenhouts Drift Settlement Agricultural Holding 1080 Portion 0, which is owned by the Applicant. Separate assessments have therefore not been undertaken and the significance ratings indicated in this section apply to each of the two site alternatives (Solarys, 2022).

10.1.9 Tabulated summary of specialist recommendations

A summary of the specialist findings for Site layout alternatives A and B, as well as final recommendations for the preferred development site is provided in Table 10-1 below.

Table 10-1: Summary of specialist findings for Site layout alternatives and final recommendation of preferred site

Specialist Field	Company	Assessment of Site A	Assessment of Site B	Final Recommendation
Terrestrial Ecology	The Biodiversity Company	Although site A impacts on CBA2 areas, these were found to exist in a degraded state of a low-functionality and the surrounding area was thus assigned a Low sensitivity by the specialist.	Although site B does not occur over CBA or ESA area, it was found to exist in a more functional state than that of site A and thus it was assigned a Medium sensitivity by the specialist.	Site layout alternative A represents the most preferable option. Development over this area would likely produce the least significant overall impacts to biodiversity, and habitat fragmentation is reduced.
Avifauna	The Biodiversity Company	Five SCCs were observed during the wet and dry season assessments. The SCCs confirmed were Lanner Falcon, Red-footed Falcon, Abdim's Stork, Secretarybird and Kori Bustard.	Five SCCs were observed during the wet and dry season assessments. The SCCs confirmed were Lanner Falcon, Red-footed Falcon, Abdim's Stork, Secretarybird and Kori Bustard.	To avoid fragmenting the current ecosystem, it is recommended that site A is preferred as this site is located closer to existing facilities and concentrating these may reduce overall fragmentation of the ecosystem. Site B is also considered developable if all mitigation measures are put into place
Wetlands	The Biodiversity Company	Two non-wetland pans located inside Site layout alternative A's PV area and that the roads and powerlines will have 18 crossing with drainage systems. Given the size of the pans and the drainage systems the impacts of the activities will be limited.	Site layout alternative B have a big drainage system running through the PV area. This option's powerline and roads will also have 15 crossings of the drainage systems. This option does have an existing road that will minimise the impact of the new development.	Either of the two alternatives may be chosen as neither pose any threats towards wetland resources. Site B can also be developed if mitigation measures proposed are implemented around the potential burial site (K10), namely demarcation and avoidance with a 30m buffer.
Heritage and Archaeology	Beyond Heritage	Isolated Stone Age artefacts were recorded within Site layout Alternative A. The heritage significance of	Isolated Stone Age artefacts were recorded within the alternative development sites as well as a possible grave	Both Site alternatives (Site A & Site B) are acceptable from a heritage point of view although site A is the

Specialist Field	Company	Assessment of Site A	Assessment of Site B	Final Recommendation
		the Stone Age artefacts is of Low Significance	that is located outside of the development footprint of Site layout alternative B. The heritage significance of the Stone Age artefacts is of Low Significance, while the possible grave site is of High Social significance.	preferred alternative due to the close proximity of the potential burial site (K10) to a pipeline for Site B.
Palaeontology		The palaeontological study concluded that it is extremely unlikely that any fossils would be preserved in the aeolian sands of the Gordonia Formation, Kalahari Group (Quaternary).	The palaeontological study concluded that it is extremely unlikely that any fossils would be preserved in the aeolian sands of the Gordonia Formation, Kalahari Group (Quaternary).	Both Site layout alternative A and B is therefore suitable for development.
Visual	Geonest	The visual impact of this development is considered to be LOW for both alternative sites.	The visual impact of this development is considered to be LOW for both alternative sites.	Site A is slightly preferred as the more suitable alternative from a visual impact perspective as siting the development there will cluster the development together with existing renewable energy related impacts. Either Site layout alternative A or B is however considered a viable development option from a visual impact perspective.
Socio-Economic	Solarys	The findings of the SIA indicate that social impacts associated with each of the two project site alternatives are similar. Both alternatives are located on the farm Olyvenhouts Drift Settlement Agricultural Holding 1080 Portion 0, which is owned by the Applicant.	The findings of the SIA indicate that social impacts associated with each of the two project site alternatives are similar. Both alternatives are located on the farm Olyvenhouts Drift Settlement Agricultural Holding 1080 Portion 0, which is owned by the Applicant.	No preference between the Site layout alternatives A and B exist and either of the two site alternatives may be developed.
Agricultural Compliance Statement	The Biodiversity Company	The land capability and land potential of the resources within Site Alternative A is	The land capability and land potential of the resources within Site Alternative B is	The impact of the proposed development on soil, land capability and agricultural

Specialist Field	Company	Assessment of Site A	Assessment of Site B	Final Recommendation
		characterised by "Very Low" to "Low" sensitivities.	characterised by "Very Low" to "Low" sensitivities.	potential at both Site A and B is INSIGNIFICANT. Both Site A and Site B is therefore recommended for development.

10.2 Summary of impacts and significance ratings

10.2.1 Site Layout Alternatives A and B

A concise summary of the impacts that has been identified for the site layout alternatives for the proposed Solar PV and BESS facility, as well as the residual impact significance ratings after the implementation of the proposed mitigation measures (impact management actions) are provided in Table 10-2.

As is evident from Table 10-2 and sections 8.2.5, 8.3.5, 8.4.5 and 8.5.5, no impacts were identified on palaeontological resources as the study areas did not coincide with underlying geology and soil where fossils were readily preserved.

Overall, successful mitigation of the **majority of identified impacts resulted in a residual impact of LOW (-).** Furthermore, **none of the residual impacts remained with a HIGH (-) or VERY HIGH (-) impact rating** after the implementation of the proposed mitigation measures (impact management actions).

When the negative residual impacts associated with Site Layout A are considered, the following impacts remained with a residual impact of MODERATE (-) (Table 10-2):

- Avifauna (Construction phase): Habitat Loss (Destroy, fragment and degrade CBA, ESA and ONA habitat, ultimately displacing avifauna).
- Avifauna (Construction phase): Sensory disturbances (e.g. noise, dust, light, vibrations).
- Avifauna (Construction phase): Displacement or death of SCCs.
- Socio-economic (Construction phase): Creation of employment, skills development, procurement and business opportunities.
- Socio-economic (Construction phase): Loss of farmland.
- Terrestrial Biodiversity (Operation phase): Continued encroachment and displacement of the vegetation community due to alien invasive plant species, particularly in previously disturbed areas.
- Terrestrial Biodiversity (Operation phase): Habitat degradation (litter and alien vegetation encroachment).
- Avifauna (Operation phase): Continued Habitat Loss (Destroy, fragment and degrade CBA, ESA and ONA habitat, ultimately displacing avifauna).

- Avifauna (Operation phase): Collisions with PV and associated infrastructure.
- Avifauna (Operation phase): Electrocution by infrastructure and connections to PV

When the positive residual impacts associated with Site Layout A are considered, the following impacts remained with a residual impact of MODERATE (+) (Table 10-2):

- Socio-economic (Operation phase): Strengthening energy supply

When the negative residual impacts associated with Site Layout B are considered, the following impacts remained with a residual impact of MODERATE (-) (Table 10-2). Impacts highlighted in **bold** are impacts rated as MODERATE impact significance for Site B, however LOW significance for Site A:

- **Visual (Pre-construction): Security and other operational lighting will introduce unnatural lighting into an unlit landscape.**
- **Terrestrial Biodiversity (Construction): Displacement of faunal community due to habitat loss, direct mortalities and disturbance (noise, dust and vibration.**
- Avifauna (Construction): Habitat Loss (Destroy, fragment and degrade CBA, ESA and ONA habitat, ultimately displacing avifauna).
- Avifauna (Construction): Sensory disturbances (e.g. noise, dust, light, vibrations).
- Avifauna (Construction): Displacement or death of SCCs.
- Socio-economic (Construction): Creation of employment, skills development, procurement and business opportunities.
- Socio-economic (Construction): Loss of farmland.
- Terrestrial Biodiversity (Operation): Continued encroachment and displacement of the vegetation community due to alien invasive plant species, particularly in previously disturbed areas.
- **Terrestrial Biodiversity (Operation): Continued displacement and fragmentation of the faunal community due to ongoing anthropogenic disturbances (noise, traffic and dust).**
- Terrestrial Biodiversity (Operation): Habitat degradation (litter and alien vegetation encroachment).
- Avifauna (Operation): Continued Habitat Loss (Destroy, fragment and degrade CBA, ESA and ONA habitat, ultimately displacing avifauna).
- Avifauna (Operation): Collisions with PV and associated infrastructure.
- Avifauna (Operation): Electrocution by infrastructure and connections to PV
- **Terrestrial Biodiversity (Decommissioning): Displacement of faunal community due to habitat loss, direct mortalities and disturbance (noise, dust and vibration**

When the positive residual impacts associated with Site Layout B are considered, the following impacts remained with a residual impact of MODERATE (+) (Table 10-2):

- Socio-economic (Operation phase): Strengthening energy supply

Table 10-2: Summary of impacts and residual impact significance ratings for site layout alternatives A and B

Phase	Environmental Component / Impact	Impact identified	Residual Impact	
			Site Layout A	Site Layout B
Pre-Construction	Terrestrial Biodiversity	No impacts identified	-	-
Pre-Construction	Surface Water and Wetlands	No impacts identified	-	-
Pre-Construction	Avifauna	Temporary disturbance of avifauna due to increased human presence and possible use of machinery and/or vehicles	LOW (-)	LOW (-)
Pre-Construction	Heritage & Archaeology	Destruction of isolated Stone Age scatters in the project area.	LOW (-)	LOW (-)
		Damage or destruction to the possible grave at K10.	-	LOW (-)
Pre-Construction	Palaeontology	No impacts identified	-	-
Pre-Construction	Visual	Structures' colour and design potentially contrast vividly with the surrounding landscape, causing reflection, enhancing visibility and increasing artificial contrast in the landscape	LOW (-)	LOW (-)
		Powerline infrastructure adds additional visual impact to the existing impacted landscape	LOW (-)	LOW (-)
		PV panels will be visible in the landscape and will interrupt and fragment the natural monochromatic landscape	LOW (-)	LOW (-)
		Security and other operational lighting will introduce unnatural lighting into an unlit landscape	LOW (-)	MODERATE (-)
Pre-Construction	Socio-economic	No impacts identified	-	-
Construction	Terrestrial Biodiversity	Destruction, further loss and fragmentation of the vegetation community (including a portion of an area classified as an CBA-irreplaceable and ESA as well as EN vegetation type);	LOW (-)	LOW (-)
		Destruction of protected plant species.	LOW (-)	LOW (-)
		Displacement of faunal community due to habitat loss, direct mortalities and disturbance (noise, dust and vibration	LOW (-)	MODERATE (-)
Construction	Surface Water and Wetlands	Removal of Soils. Increase surface runoff. Loss of topsoil (PV facility)	LOW (-)	LOW (-)
		Loss of topsoil. Loss of vegetation. Increase surface runoff. Increase erosion potential (Construction of roads)	LOW (-)	LOW (-)
		Digging of holes for pylons (Installation of powerlines)	LOW (-)	LOW (-)
		Removal of Soils. Increase surface runoff. Loss of topsoil (BESS and Substation)	LOW (-)	LOW (-)
Construction	Avifauna	Habitat Loss (Destroy, fragment and degrade CBA, ESA and ONA habitat, ultimately displacing avifauna)	MODERATE (-)	MODERATE (-)
		Sensory disturbances (e.g. noise, dust, light, vibrations)	MODERATE (-)	MODERATE (-)
		Collection of eggs and poaching	LOW (-)	LOW (-)
		Roadkill	LOW (-)	LOW (-)

Phase	Environmental Component / Impact	Impact identified	Residual Impact	
			Site Layout A	Site Layout B
		Chemical pollution associated with dust suppressants	LOW (-)	LOW (-)
		Displacement or death of SCCs	MODERATE (-)	MODERATE (-)
Construction	Heritage & Archaeology	Destruction of isolated Stone Age scatters in the project area.	LOW (-)	LOW (-)
		Damage or destruction to the possible grave at K10.	LOW (-)	LOW (-)
Construction	Palaeontology	No impacts identified	-	-
Construction	Visual	The construction activities may disturb the quiet sense of peaceful solitude of the Kalahari rangelands. This impact would be moderate to low given that there are few sensitive receptors	LOW (-)	LOW (-)
		Construction activities, particularly noise and dust, heavy vehicles and abnormal load vehicles, may impact the experience of tourists to the region and result in impacts to tourist sentiment and tourism revenue.	LOW (-)	LOW (-)
		The construction activities related to the construction of the KBPF facility may negatively affect the expansive views of the Kalahari Rangelands from the N14, D3257 and other sensitive view points by introducing unnatural elements, movement and contrast.	LOW (-)	LOW (-)
Construction	Socio-economic	Creation of employment, skills development, procurement and business opportunities	MODERATE (+)	MODERATE (+)
		Increased demand for low-cost housing and municipal services	LOW (-)	LOW (-)
		Strain on community health & safety services	LOW (-)	LOW (-)
		Influx of jobseekers	LOW (-)	LOW (-)
		Risk to livestock, crops, houses and farm infrastructure	LOW (-)	LOW (-)
		Impact on tourism	LOW (-)	LOW (-)
		Loss of farmland	MODERATE (-)	MODERATE (-)
Operation	Terrestrial Biodiversity	Continued encroachment and displacement of the vegetation community due to alien invasive plant species, particularly in previously disturbed areas.	MODERATE (-)	MODERATE (-)
		Continued displacement and fragmentation of the faunal community due to ongoing anthropogenic disturbances (noise, traffic and dust);	LOW (-)	MODERATE (-)
		Habitat degradation (litter and alien vegetation encroachment);	MODERATE (-)	MODERATE (-)
Operation	Surface Water and Wetlands	Traffic during maintenance will cause erosion and increase flow dynamics into the drainage systems.	LOW (-)	LOW (-)
		Overflow of water from the PV panels and roads	LOW (-)	LOW (-)
Operation	Avifauna	Continued Habitat Loss (Destroy, fragment and degrade CBA, ESA and ONA habitat, ultimately displacing avifauna)	MODERATE (-)	MODERATE (-)

Phase	Environmental Component / Impact	Impact identified	Residual Impact	
			Site Layout A	Site Layout B
		Sensory disturbances (e.g. noise, dust, vibrations)	LOW (-)	LOW (-)
		Collection of eggs and poaching (especially of SCCs)	LOW (-)	LOW (-)
		Roadkill	LOW (-)	LOW (-)
		Collisions with PV and associated infrastructure	MODERATE (-)	MODERATE (-)
		Electrocution by infrastructure and connections to PV	MODERATE (-)	MODERATE (-)
		Chemical pollution associated with measures to keep PV clean	LOW (-)	LOW (-)
		Fencing of PV site, especially a risk for larger birds	LOW (-)	LOW (-)
Operation	Heritage & Archaeology	No impacts identified	-	-
Operation	Palaeontology	No impacts identified	-	-
Operation	Visual	The presence of the KBPF facility may negatively affect the expansive views of the Kalahari Rangelands from the D3276 due to reflection, glare, night lighting and contrast of buildings in the monochromatic landscape.	LOW (-)	LOW (-)
		The presence of the KBPF facility may negatively affect the expansive views of the Kalahari Rangelands from the N14 due to reflection, glare, night lighting and contrast of buildings in the monochromatic landscape.	LOW (-)	LOW (-)
		The presence of the KBPF facility may negatively affect the experience of tourists visiting the Orange River Vineyards and resorts along the N14 corridor.	LOW (-)	LOW (-)
		The presence of the KBPF facility may negatively affect the views and thus the quality of life of people in residential areas and businesses along the N14 corridor.	LOW (-)	LOW (-)
		The presence of the KBPF facility may negatively affect the views and thus the quality of life of people in residential areas, tourist resorts and businesses on the opposite side of the Orange River.	LOW (-)	LOW (-)
		Erection of powerlines may adversely impact views of Kalahari landscapes from key viewpoints	LOW (-)	LOW (-)
Operation	Socio-economic	Creation of employment, skills development, procurement and business opportunities	LOW (+)	LOW (+)
		Strengthening energy supply	MODERATE (+)	MODERATE (+)
		Strain on community health & safety services	LOW (-)	LOW (-)
Decommissioning	Terrestrial Biodiversity	Destruction, further loss and fragmentation of the vegetation community (including a portion of an area classified as an CBA-irreplaceable and ESA as well as EN vegetation type);	LOW (-)	LOW (-)
		Destruction of protected plant species.	LOW (-)	LOW (-)

Phase	Environmental Component / Impact	Impact identified	Residual Impact	
			Site Layout A	Site Layout B
		Displacement of faunal community due to habitat loss, direct mortalities and disturbance (noise, dust and vibration	LOW (-)	MODERATE (-)
Decommissioning	Surface Water and Wetlands	Removal of Soils. Increase surface runoff. Loss of topsoil (PV facility)	LOW (-)	LOW (-)
		Loss of topsoil. Loss of vegetation. Increase surface runoff. Increase erosion potential (Construction of roads)	LOW (-)	LOW (-)
		Digging of holes for pylons (Installation of powerlines)	LOW (-)	LOW (-)
		Removal of Soils. Increase surface runoff. Loss of topsoil (BESS and Substation)	LOW (-)	LOW (-)
Decommissioning	Avifauna	Habitat Loss (Destroy, fragment and degrade habitat, ultimately displacing avifauna)	LOW (-)	LOW (-)
		Sensory disturbances (e.g. noise, dust, vibrations)	LOW (-)	LOW (-)
		Roadkill	LOW (-)	LOW (-)
		Collisions with PV and associated infrastructure	LOW (-)	LOW (-)
		Fencing of PV site, especially a risk for larger birds	LOW (-)	LOW (-)
Decommissioning	Heritage & Archaeology	No impacts identified	-	-
Decommissioning	Palaeontology	No impacts identified	-	-
Decommissioning	Visual	The decommissioning activities may disturb the quiet sense of peaceful solitude of the Kalahari rangelands. This impact would be moderate to low given that there are few sensitive receptors	LOW (-)	LOW (-)
		Decommissioning activities, particularly those that generate noise and dust, heavy vehicles and abnormal load vehicles, may impact the experience of tourists to the region and result in impacts to tourist sentiment and tourism revenue.	LOW (-)	LOW (-)
Decommissioning	Socio-economic	Creation of local employment opportunities associated with decommissioning activities	LOW (+)	LOW (+)
		Loss of employment	LOW (-)	LOW (-)

10.2.2 BESS Technology Alternatives 1 and 2

A concise summary of the impacts that has been identified for the BESS technology alternatives for the proposed Solar PV and BESS facility, as well as the residual impact significance ratings after the implementation of the proposed mitigation measures (impact management actions) are provided in Table 10-3.

Overall, successful mitigation of the **majority of identified impacts resulted in a residual impact of LOW (-).** Furthermore, **none of the residual impacts remained with a HIGH (-) or VERY HIGH (-) impact rating** after the implementation of the proposed mitigation measures (impact management actions).

When the negative residual impacts associated with BESS Technology Alternative 1: Solid State Batteries are considered, the following impacts remained with a residual impact of MODERATE (-) (Table 10-3):

- BESS Impacts (Operation): Injury or death to people resulting from explosion and/or fire due to equipment failure, short circuit, overcharging or overheating.

When the negative residual impacts associated with BESS Technology Alternative 2: Flow Batteries are considered, the following impacts remained with a residual impact of MODERATE (-) (Table 10-3). Impacts highlighted in **bold** are impacts rated as MODERATE impact significance for BESS Technology Alternative 2, however LOW significance for BESS Technology Alternative 1:

- BESS Impacts (Operation): Injury or death to people resulting from explosion and/or fire due to equipment failure, short circuit, overcharging or overheating.
- BESS Impacts (Decommissioning): Incorrect or illegal handling and disposal of different types of waste leading to spillages or leakage of electrolyte or hazardous substances resulting in adverse impacts on fauna, people or communities.

Table 10-3: Summary of impacts and residual impact significance ratings for BESS technology alternatives 1 (Solid State Batteries) and 2 (Flow Batteries)

Phase	Environmental Component / Impact	Impact identified	Residual Impact	
			Tech Alt: SSB	Tech Alt: FB
Pre-Construction	BESS Impacts	No impacts identified	-	-
Construction	BESS Impacts	Spillages or leakage of electrolyte or hazardous substances during transportation, handling, storage or installation resulting in adverse impacts on the environment, soil and flora.	LOW (-)	LOW (-)
		Spillages or leakage of electrolyte or hazardous substances during transportation, handling, storage or installation resulting in adverse impacts on fauna, and people.	LOW (-)	LOW (-)
Operation	BESS Impacts	Spillages or leakage of electrolyte or hazardous substances during operation resulting in adverse impacts on the environment, soil and flora.	LOW (-)	LOW (-)
		Spillages or leakage of electrolyte or hazardous substances during operation resulting in adverse impacts on fauna, and people.	LOW (-)	LOW (-)
		Damage to plant and the environment resulting from explosion and/or fire due to equipment failure, short circuit, overcharging or overheating.	LOW (-)	LOW (-)
		Injury or death to people resulting from explosion and/or fire due to equipment failure, short circuit, overcharging or overheating.	MODERATE (-)	MODERATE (-)

Phase	Environmental Component / Impact	Impact identified	Residual Impact	
			Tech Alt: SSB	Tech Alt: FB
		Contamination of the environment, soil and flora due to inappropriate management of hazardous waste generated from maintenance and replacement of batteries, battery components, or electrolyte.	LOW (-)	LOW (-)
		Adverse impacts on fauna and people due to inappropriate management of hazardous waste generated from maintenance and replacement of batteries, battery components, or electrolyte.	LOW (-)	LOW (-)
Decommissioning	BESS Impacts	Incorrect or illegal handling and disposal of different types of waste leading to spillages or leakage of electrolyte or hazardous substances resulting in adverse impacts on the environment, soil and flora.	LOW (-)	LOW (-)
		Incorrect or illegal handling and disposal of different types of waste leading to spillages or leakage of electrolyte or hazardous substances resulting in adverse impacts on fauna, people or communities.	LOW (-)	MODERATE (+)

10.3 Summary of the findings of alternatives assessment

10.3.1 Site Layout alternatives

Sensitivities associated with the Site Layout Alternatives are shown visually in Figure 10-1, and are summarised in the sections that follow.

<u>Geology, Soil and Agricultural Potential</u>

It is the specialist's opinion that the proposed project and associated infrastructure will have no impacts on the agricultural ability of the land (TBC, 2022d).

Either of the two alternatives may be chosen as both are associated with land capabilities with "Very Low to Low" sensitivities (TBC, 2022d).

Although the specialist preferred Site A is to Site B due to the presence of "High" sensitivity crop fields within the Site B pipeline corridor, it should be noted that the pipeline corridor (buffer) was only implemented to generate a suitable study area to encompass the total development footprint. The pipeline will be located within the existing road reserve, this confirms that no High" sensitivity crop fields will be impacted. Either site A or Site B is therefore equally suitable for development.

Hydrology and Surface Water

Two non-wetland pans located inside option A's PV area and that the roads and powerlines will have 18 crossing with drainage systems. Given the size of the pans and the drainage systems the impacts of the activities will be limited (TBC, 2022b).

Option B have a big drainage system running through the PV area. This option's powerline and roads will also have 15 crossings of the drainage systems. This option does have an existing road that will minimise the impact of the new development. The main concern will be the drainage system inside the PV area but will not be reason to not develop in the area (TBC, 2022b).

Either of the two alternatives may be chosen as neither pose any threats towards wetland resources. Therefore, the proposed activities may proceed as have been planned with the condition that all mitigation measures and recommendations be considered by the issuing authority (TBC, 2022b).

Terrestrial Biodiversity (Flora and Fauna)

Both sites are considered suitable for development as no High or Very High sensitivity areas were identified and there were no fatal flaws noted.

Although site A impacts on CBA2 areas, these were found to exist in a degraded state of a low-functionality and the surrounding area was thus assigned a Low sensitivity by the specialist. Although site B does not occur over CBA or ESA area, it was found to exist in a more functional state than that of site A and thus it was assigned a Medium sensitivity by the specialist.

Where site A occurs close to existing infrastructure and areas that have been exposed to historical disturbance, site B occurs in a more isolated area that still represents a functional ecological corridor. Based on this overview, it is the opinion of the specialists that site A represents the most preferable option. Development over this area would likely produce the least significant overall impacts to biodiversity, and habitat fragmentation is reduced.

Avifauna

In order to avoid fragmenting the current ecosystem, it is recommended that site A is preferred as this site is located closer to existing facilities and concentrating these may reduce overall fragmentation of the ecosystem. It is, however, important that natural corridors between these developments are maintained. Minimisation measures have resulted in the reduction of most impacts to a Moderate or Low impact significance, which is considered within the limits of acceptable change. Site B is also considered developable if all mitigation measures are put into place (TBC, 2022c).

Heritage, Archaeology and Palaeontology

Both Site alternatives (Site A & Site B) are acceptable from a heritage point of view although site A is the preferred alternative due to the close proximity of the potential burial site (K10) to a pipeline for Site B.

Site B can also be developed if mitigation measures proposed are implemented around the potential burial site (K10), namely demarcation and avoidance with a 30m buffer. No adverse impact on heritage resources is expected by the project and it is recommended that the project can commence on the condition that the following recommendations (Section 10) are implemented as part of the EMPr and based on approval from SAHRA (Beyond Heritage, 2022).

Visual Impact Assessment

The visual impact of this development is considered to be **LOW for both alternative sites**. Site A is slightly preferred as the more suitable alternative from a visual impact perspective as siting the development there will cluster the development together with existing renewable energy related impacts. It will also result in less powerline being required to be built, lessening that component's visual impact. Either site is however considered a viable development option from a visual impact perspective.

Socio-Economic Environment

The findings of the SIA indicate that social impacts associated with each of the two project site alternatives are similar. Both alternatives are located on the farm Olyvenhouts Drift Settlement Agricultural Holding 1080 Portion 0, which is owned by the Applicant. Separate assessments have therefore not been undertaken and the significance ratings indicated in this section apply to each of the two site alternatives (Solarys, 2022).

It is therefore concluded that no preference between the Site A and Site B exist and either of the two site alternatives may be developed.

Technical Considerations

An important technical consideration relating to the development of the Solar PV and BESS facility at either Site A or Site B include the proximity of the facility to the existing Upington MTS. While the construction of the Solar PV and BESS facility is feasible at Site A the close proximity of Site A to the Upington MTS will severely limit the available space in which future transmission and distribution powerlines and grid connection infrastructure from new renewable power generation facilities within the Upington REDZ can be constructed and tie into the Upington MTS. With the development of Site A, the internal layout of the Upington MTS may need to change to accommodate powerlines approaching the MTS from different directions.

Site B, on the other hand, is situated an ideal distance away from the Upington MTS not to limit the tie in options for new powerline infrastructure into the Upington MTS, yet close enough to the Upington MTS to make the capital investment for development of the 132kV powerline from the Kiwano substation to the Upington MTS feasible. The location of Site B will therefore not constrain the routing of new and planned grid connection and powerline infrastructure to the Upington MTS.

Given the fact that the development area falls within the Upington REDZ where the primary land use objective is to develop renewable energy developments, the development of Site B as the preferred site is justified.

Site B also requires the construction of a shorter access route, when compared to the access route required for Site A which starts at the N14 national road and traverse ~4.5 km to the site.

Both Site A and Site B are considered technically feasible. However, Eskom Distribution indicated preference for Site B due to the fact that the Site B location enables expandability in the area, allowing easier electrical connection of future projects via the Kiwano substation.

Site B is therefore the technically preferred Site Layout Alternative, while Site A can be considered as an alternative for the proposed development.

10.3.2 Access road alternatives for Site A

Two access road alternatives, Access road alternative 1 and Access road alternative 2, has been proposed (see section 3.3.2 above).

Access road alternative 1 avoids a minor drainage line feature by traversing around the feature, whereas Access road alternative 2 will traverse through the drainage feature (see Figure 6-17).

Considering the mitigation hierarchy, which requires impacts to firstly be avoided, it stands to reason that Access road alternative 1 is the preferred access road alternative as it avoids three potential impact points with non-perennial drainage features even though Access road alternative 1 is approximately 350m longer than Access road alternative 2.

Access road alternative 1 is therefore the preferred access road alternative for Site A.

10.3.3 BESS technology alternatives

Consideration of the BESS technology alternatives include consideration of Solid State Batteries (BESS technology alternative 1) and Flow Batteries (BESS technology alternative 2). Overall, successful mitigation of the majority of identified impacts resulted in a residual impact of LOW (-). Furthermore, none of the residual impacts remained with a HIGH (-) or

VERY HIGH (-) impact rating after the implementation of the proposed mitigation measures (impact management actions).

The main impacts associated with the BESS technology alternative include spillages or leakage of electrolyte or hazardous substances and the potential for explosions and/or fire. The risk of spillages or leakage of electrolyte or hazardous substances is slightly larger in Flow Batteries (BESS technology alternative 2) due to the large size of the storage tanks for electrolyte required. It is reasoned that the intensity of a spill from a large holding tank will be more severe than from smaller battery units such as in the Solid State Batteries.

Solid State Batteries (BESS technology alternative 1) are therefore slightly preferred, however given that the impacts for both BESS technology alternatives can be mitigated to acceptable levels, both BESS technology alternatives are feasible for implementation.

10.3.4 Composite Site Sensitivity Map

A composite site sensitivity map indicating all sensitivities for the development sites in relation to the assessed Site Layout Alternatives are provided in Figure 10-1.

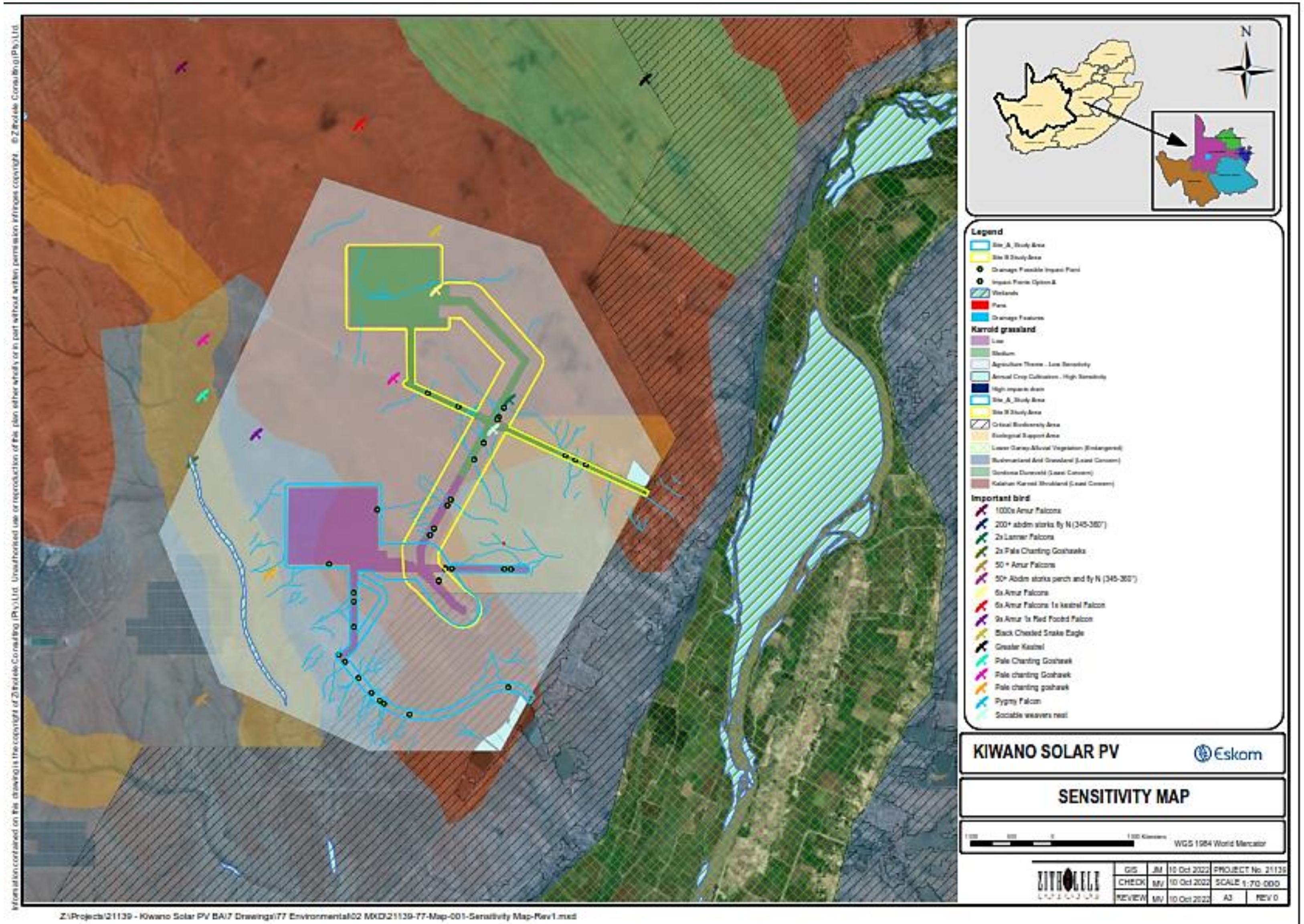

Figure 10-1: Composite site sensitivity map for proposed Site Layout Alternatives A and B

11 CONCLUSION AND RECOMMENDATIONS

11.1 Comparison of Site Layout Alternative A and B

A comparison of the Site A and B, including the feasibility of each for the proposed development on each site are provided in Table 11-1.

Table 11-1: Comparison of suitability and feasibility of the proposed Site Layout Alternatives

	Site A	Site B
Advantages	• Site located close to the Upington MTS, when compared to Site B • A short powerline of ~1.4 km will be required to tie into the Upington MTS. • The development site is located close to the existing Khi Solar One CSP plant, Sirius 1 Solar PV plant which will confine impacts to a smaller area of influence.	• The development site can be access via the existing D3276 road. The construction of only a short access road of ~800 m will therefore be required to access the site from the D3276. • The development site is located further from the N14 when compared to Site A. This will make the development site less visible from the N14 when compared to Site A. • The development site is located on a plateau with the closest drainage line located more than 2.2 km away from the site. • Most of the proposed powerline route can align with an existing powerline located south of the development site. This will reduce the visual impact of the powerline proposed for the Kiwano Solar PV and BESS development. • The location of the development site will not constrain the routing of new and planned grid connection and powerline infrastructure to the Upington MTS. • The pipeline will be placed within the existing road reserve of the D3276 road.
Disadvantages	• Site located close (~ 660 m) to a major non-perennial drainage line. • Require a new access road of ~4.5 km to be constructed from the N14 national road to the site. • The new access road will traverse a Critical Biodiversity Area (CBA). • The close proximity of the development site to the Upington MTS will result in a constrained area around the Upington MTS where new and planned grid connection infrastructure and powerlines can be aligned to connect to the MTS. This may require internal infrastructure changes to the existing MTS.	• The site is located further away from the Upington MTS, hence a longer powerline will be required when compared to Site A. • The site is further away from the existing Khi Solar One CSP plant and Sirius 1 Solar PV plant, therefore the potential exist to increase the cumulative impact from renewable energy facilities in the area.
Environmental sensitivities	• Site A impacts on CBA2 areas, these were found to exist in a degraded state of a low-	• Site B does not occur within a CBA or ESA area and was found to exist in a more

	functionality and the surrounding area was thus assigned a Low sensitivity by the biodiversity specialist. • Five bird SCCs were observed during the wet and dry season assessments within the broader development area, however can be mitigated successfully with proposed mitigation measures. • No significant sensitivities that cannot be mitigated successfully relating to agricultural potential, wetlands, archaeology, heritage, palaeontology, or visual impacts were identified on Site A. • The findings of the SIA indicate that social impacts associated with each of the two project site alternatives are similar and can be managed and mitigated successfully.	functional state than that of site A and thus it was assigned a Medium sensitivity by the biodiversity specialist. • Five bird SCCs were observed during the wet and dry season assessments within the broader development area, however can be mitigated successfully with proposed mitigation measures. • No significant sensitivities that cannot be mitigated successfully relating to agricultural potential, wetlands, archaeology, heritage, palaeontology, or visual impacts were identified on Site B. • The findings of the SIA indicate that social impacts associated with each of the two project site alternatives are similar and can be managed and mitigated successfully.
Feasibility of the Site Layout Alternative	• No fatal flaws were identified during the assessment of Site A from a technical or environmental sensitivity perspective. • Site Alternative A is therefore feasible for development. • It was however noted that the DFFE consider the fact that the access road will fall within an identified CBA as a fatal flaw, although the biodiversity specialist concluded that the CBA was found to exist in a degraded state of a low-functionality and the surrounding area was thus assigned a Low sensitivity by the specialist.	• No fatal flaws were identified during the assessment of Site B from a technical or environmental sensitivity perspective. • Site Alternative B is therefore feasible for development.
Developable footprint in Ha	• 136.9	• 136.9
Recommended Site Layout Alternative	Site Layout Alternative A was **NOT** recommended as the preferred site layout alternative due to the following deciding factors: • The alternative require a new access road of ~4.5 km to be constructed from the N14 national road to the site which will traverse a Critical Biodiversity Area (CBA). • The close proximity of the development site to the Upington MTS will result in a constrained area around the Upington MTS where new and planned grid connection infrastructure and powerlines can be aligned to connect to the MTS. This may require internal infrastructure changes to the existing MTS.	Site Layout Alternative B **was recommended as the preferred site layout alternative** due to the following deciding factors: • No fatal flaws were identified within the development site footprint. • All identified impacts can be mitigated successfully to an acceptable level • Site B is located an ideal distance from the Upington MTS to allow routing of new and planned grid connection and powerline infrastructure to the Upington MTS for future developments. • Existing road infrastructure is used as far as possible to reduce the need to impact on intact vegetation.

11.2 Impact Statement

Eskom Holdings SOC Limited ("Eskom") is proposing to develop, construct and operate a 58 Megawatt (MW) Solar Photovoltaic (PV) facility and a Battery Energy Storage System (BESS) with an envisaged capacity of 40 Megawatt (MW) / 200 Megawatt Hour (MWh). The development further include construction of the 132 kilovolt (kV) Kiwano substation with 5 feeder bays and a single Twin-Tern 132 kV overhead powerline on a double circuit support structure connecting Kiwano substation to the Upington substation.

The proposed development will be located on Erf 1080 Olyvenhouts Drift Settlement Agricultural Holding approximately 14km southwest of the Upington Central Business District. Erf 1080 is very large in size, measuring in excess of 8000 ha, while a proposed development area, excluding linear services, of approximately 136.9 ha is required for the development of the proposed Kiwano Solar PV and BESS with substation.

A development Study Area for each of the two site alternatives were compiled by the addition of a 50m buffer on the Solar PV and BESS site delineation, substation delineation and access road alignment received from Eskom. A 250m buffer on either site of the proposed powerline alignment (500 m powerline development corridor) was implemented to allow minor changes to the alignment of the powerlines during detail design and construction.

Environmental sensitivities were identified through the DFFE online screening tool as well as a desktop screening independently undertaken by the EAP. Several specialist studies were identified as a result of the screening undertaken for the proposed development and the following studies were commissioned to support the application for Environmental Authorisation:

- Soil and Agricultural Compliance Statement
- Terrestrial Biodiversity Impact Assessment, including Animal and Plant Species Assessment
- Wetlands and Surface Water Impact Assessment
- Avifauna Impact Assessment
- Heritage, Archaeology and Palaeontology Impact Assessment
- Visual Impact Assessment
- Socio-economic Impact Assessment

A summary of the specialist assessments was compiled in Chapter 8, 9 and 10 of this BAR. It was concluded that not fatal flaws were identified on either of the site layout alternatives proposed or either of the BESS technologies proposed. Impact significance after mitigation ranged between LOW and MODERATE, while no impact significance of HIGH or VERY HIGH were reported.

All specialists concluded that the development of both site layout alternatives was feasible, although Site A were slightly favoured in all of the assessments. However, the development footprint does infringe on pockets of sensitive features, which include a small non-wetland pans, sections of non-perennial drainage lines and habitat for avifauna species of conservation concern. The placement of infrastructure within these features constitutes an acceptable loss, based on the development footprint assessed within this BAR and the avoidance of the larger and more significant drainage features.

Key technical considerations that were considered in the site layout alternative assessment included the proximity of the facility to the existing Upington MTS. While the construction of the Solar PV and BESS facility is feasible at Site A the close proximity of Site A to the Upington MTS will severely limit the available space in which future transmission and distribution powerlines and grid connection infrastructure from new renewable power generation facilities within the Upington REDZ can be constructed and tie into the Upington MTS. Site B, on the other hand, is situated an ideal distance away from the Upington MTS not to limit the tie in options for new powerline infrastructure into the Upington MTS, yet close enough to the Upington MTS to make the capital investment for development of the 132kV powerline from the Kiwano substation to the Upington MTS feasible. The location of Site B will therefore not constrain the routing of new and planned grid connection and powerline infrastructure to the Upington MTS.

When access road alternative for Site A was considered, Access Road alternative 1 was confirmed as the preferred access road alternative as it avoids a minor drainage line feature by traversing around the feature, whereas Access road alternative 2 will traverse through the drainage feature.

Consideration of the BESS technology alternatives include consideration of Solid State Batteries (BESS technology alternative 1) and Flow Batteries (BESS technology alternative 2). The main impacts associated with the BESS technology alternative include spillages or leakage of electrolyte or hazardous substances and the potential for explosions and/or fire. The risk of spillages or leakage of electrolyte or hazardous substances is slightly larger in Flow Batteries (BESS technology alternative 2) due to the large size of the storage tanks for electrolyte required. It is reasoned that the intensity of a spill from a large holding tank will be more severe than from smaller battery units such as in the Solid State Batteries. Solid State Batteries (BESS technology alternative 1) are therefore slightly preferred, however given that the impacts for both BESS technology alternatives can be mitigated to acceptable levels, both BESS technology alternatives are feasible for implementation.

11.3 EAP's reasoned opinion

Based on the findings of independent specialist studies and the suitability of the implementation of the development footprint assessed as part of this BAR, it is the EAP's recommendation that the Site Layout Alternative B be authorised as the preferred development footprint of the proposed Kiwano Solar PV and BESS development.

Furthermore, although the BESS Technology Alternative 1 (Solid State Batteries) has emerged as the preferred BESS technology alternative, it must be noted that both BESS technology alternatives (Solid State Batteries and Flow Batteries) are feasible technology alternatives. Final BESS technology selection will however only occur during the design and implementation phase once the EPC contractor has been appointed.

All impacts identified can be mitigated to acceptable levels or enhanced through the implementation of the recommended mitigation or enhancement measures. Through the assessment of the development of the proposed Kiwano Solar PV and BESS within the broader study area, and the implementation of the preferred layout map, it can be concluded that the development of the solar PV and BESS facility is environmentally acceptable, however subject to the implementation of the recommended mitigation measures.

Considering the findings of the independent specialist studies, the impacts identified, the preferred development footprint proposed by the proponent, the avoidance of the high sensitive environmental features within the development area, as well as, the potential to further minimise the impacts to acceptable levels through mitigation, it is the reasoned opinion of the EAP that the development of the proposed Kiwano Solar PV and BESS facility is acceptable within the landscape and can reasonably be authorised for Site Layout Alternative B.

11.4 Proposed recommendations for inclusion in EA

The following key conditions should be included in the Environmental Authorisation issued for the proposed Kiwano Solar PV and BESS development:

- All mitigation measures detailed within this BAR, as well as the specialist reports contained within Appendix H, are to be implemented.
- The EMPr as contained within Appendix I of this BAR should form part of the contractual documentation concluded with the Contractors appointed to construct and maintain the solar PV facility in order to ensure compliance with environmental specifications and management measures.
- Following the final design of Kiwano Solar PV and BESS facility, a final layout must be submitted to the DFFE for review and approval prior to commencing with construction. <u>The final layout must include:</u>
    - <u>A map combining the final layout map superimposed (overlain) on the environmental sensitivity map. This map must reflect the proposed infrastructure's location.</u>
    - <u>• The 'no-go' areas of the development property must be clearly demarcated and must be excluded from the final layout plan.</u>
- A pre-construction walk-through of the final development footprint for species of conservation concern that would be affected and that can be translocated must be undertaken prior to the commencement of the construction phase.

- Before construction commences individuals of listed species within the development footprint that would be affected, must be counted and marked and translocated, where deemed necessary by the ecologist conducting the pre-construction walk-through survey. Permits from the relevant national and provincial authorities, i.e. the Northern Cape Department of Agriculture, Environmental Affairs, Rural Development and Land Reform (DAERL) and the Department of Agriculture, must be obtained before the individuals are disturbed.
- The necessary water use authorisation must be obtained from the Department of Water and Sanitation (DWS) for impacts to a watercourse prior to construction.
- A comprehensive rehabilitation plan must be implemented within watercourse areas from the project onset to ensure a net benefit to the aquatic environment. This should from part of the suggested walk down as part of the final EMPr preparation.
- The final project footprint must be kept as small as possible and must consider all sensitive environmental features not considered to be suitable for development as identified by the respective specialist studies.
- A Chance Find Protocol must be developed and implemented in the event that archaeological or palaeontological resources are unearthed or identifies. In the case where the proposed construction activities bring such artifacts to the surface, work must cease and SAHRA must be contacted immediately.
- The environmental authorisation sought through this application is for a 10-year period.
- <u>All relevant sections and regulations of the National Water Act, 1998 (Act No.36 of 1998) regarding water use must be adhered to.</u>
- <u>An Environmental Compliance Audit of the development must be undertaken annually to audit the level of compliance of the licence holder to the conditions of the EA and EMPr. Audits shall commence once construction has been initiated and the first audit must be undertaken within 365 days of the start date of construction as communicated to the Competent Authority.</u>
- <u>An independent environmental auditor must be appointed with the relevant experience and qualifications in the field of Environmental Management</u>
- <u>The Environmental Compliance Audit must be submitted to the Competent Authorities Compliance Monitoring Directorate within 30 days of concluding the site audit.</u>
- <u>Environmental compliance monitoring during the construction phase must be undertaken by a suitably qualified Environmental Control Officer (ECO). The first compliance monitoring must be undertaken no later than 1 month after the commencement of construction activities; and</u>
- <u>Thereafter environmental compliance monitoring must be undertaken at monthly intervals, at a minimum or as per EA requirement.</u>

12 REFERENCES

Bamford, 2022. *Palaeontological Impact Assessment for the proposed Eskom Kiwano BESS and PV facility, soutwest of Upington, Northern Cape Province: Desktop Study (Phase 1),* Johannesburg: Prof. Marion Bamford, April 2022.

Beyond Heritage, 2022. *Heritage Impact Assessment for the Kiwano Solar PV Plant, Battery Energy Storage System, Substation and 132 KV Powerline near Upington, Northern Cape Province,* s.l.: Beyond Heritage, August 2022.

DEA, 2015. *EIA Guidelines for Renewable Energy Projects. Department of Environmental Affairs,* Pretoria, South Africa: DEA.

DEA, 2017. *Guideline on Need and Desirability, Department of Environmental Affairs,* Pretoria, South Africa: DEA.

DEA, 2017. *Public PArticipation guideline in terms of NEMA EIA Regulations, Department of Environmental Affairs,* Pretoria, South Africa: DEA.

DEAT, 2004. *Cumulative Efects Assessment, Integrated Environmental Management, Information Series 7,* Pretoria: Department of Environmental Affairs and Tourism (DEAT).

Eskom, 2017a. *Pro-active Bird Mortality Mitigation in Distribution, Unique Identifier: 240-115756171,* Johannesburg: Eskom Holdings SOC Limited, April 2017.

Eskom, 2017b. *The safe handling, transportation and disposal of cells, batteries and electrolyte, Unique Identifier: 240-89797258,* Johannesburg: Eskom Hoildings SOC Limited, September 2017.

Eskom, 2018. *Contract Specification for Vegetation Management Services on Eskom Networks, Document reference: 240-52456757,* Johannesburg: Eskom Holdings SOC Limited.

Eskom, 2019a. *Land and Biodiversity Standard< Document Identifier: 32-815,* Johannesburg: Eskom Holdings SOC Limited, September 2019.

Eskom, 2019b. *Vegetation management and maintenance within Eskom land, servitudes and right of way, Unique Identifier: 240-70172585,* Johannesburg: Eskom Holdings SOC Limited, June 2019.

Eskom, 2020. *BESS Phase 2 Distribution Planning Proposal: Kiwano Substation, Northern Cape Operating Unit,* Johannesburg: Eskom Holdings SOC Ltd, 19 August 2020.

Eskom, 2020. *High Risk Securoity Mesh Fencing, Unique Identifier: 240-76368574,* Johannesburg: Eskom Holdings SOC Limited, July 2020.

Eskom, 2021a. *Eskom Waste Management Standard, Document Identifier: 32-245,* Johannesburg: Eskom Holdings SOC Limited, December 2021.

Eskom, 2021b. *Generic Environmental Management Programme for Operation and Maintenance: Distribution Division, Document Identifier: 240-71555378,* Johannesburg: Eskom Holdings SOC Limited, October 2021.

Eskom, 2021c. *Draft Standard for non-lethal energised perimeter detection system (NLEPDS), Unique Identifier: 240-78980848,* Johannesburg: Eskiom Holdings SOC Limited.

Eskom, 2021d. *Technical evaluation criteria for Non-Lethal Energized Perimeter Detection System (NLEPDS), Unique Identifier: 240-134779125,* Johannesburg: Eskom Holdings SOC Limited, October 2021.

Eskom, 2021e. *Scope of Work for Non-lethal Energized Perimiter Detection System (NLEPDS), Unique Identified: 240-170000192,* Johannesburg: Eskom Holdings SOC Limited, October 2021.

Eskom, 2021f. *Draft Specification for the design and construction of telecoms security fences, Unique Identifier: 240-170000712,* Johannesburg: Eskom Holdings SOC Limited.

Eskom, 2022. *Transportation, Storage and Disposal of Hazardous Substances and Dangerous Goods in GEMMA Cluster: Distribution, Document Identifier: GCEMS020,* Johannesburg: Eskom Holdings SOC Limited, June 2022.

Geonest, 2022. *Visual Impact Asserssment for the Proposed Eskom Kiwano Solar PV and BESS facility,* s.l.: Geonest GIS and Envireonmental Advisory, August 2022.

Let's Respond Toolkit, 2022. *Let's Respond Toolkit.* [Online] Available at: https://letsrespondtoolkit.org/municipalities/northern-cape/

Meteoblue, 2022. *Simulated historical climate & weather data for Upington.* [Online] Available at: https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/upington_south-africa_945945

Solargis, 2022. *Solar resource maps of South Africa.* [Online] Available at: https://solargis.com/maps-and-gis-data/download/south-africa

Solarys, 2022. *Social Impact Assessment for the proposed Kiwano Battery Energy Storage System and Solar Photovoltaic Project, Upington, Northern Cape, South Africa,* Johannesburg: Solarys (Pty) Ltd, September 2022.

StatsSA, 2021. *Mid-year population estimates, Statistical Release P0302,* Pretoria: Statistics South Afrtica.

TBC, 2022a. *Terrestrial Biodiversity Assessment for the proposed Kiwano Battery Energy Storage System and Solar Photovoltaic Project,* Johannesburg: The Biodiversity Company.

TBC, 2022b. *Wetland Baseline and Risk Assessment for the Proposed Kiwano BESS and PV Project,* Johannesburg: The Biodiversity Company.

TBC, 2022c. *Proposed Development of the Kiwano Nattery Energy Storage System and Solar Photovolteic Project - Avifauna Assessment,* Johannesburg: The Biodiversity Company, September 2022.

TBC, 2022d. *Soil and Agricultural Assessment Report for the proposed Kiwano Battery Energy Storage System and Solar Photovolteic Project,* Johannesburg: The Biodiversity Company, April 2022.

ZITHOLELE CONSULTING (PTY) LTD