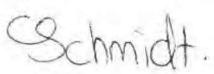
GCS Project and Work Experience

Year	Client	Project Description	Role/Responsibility
Water Resource Unit			
2019-2020	Ledjadja Coal (Pty)-LtdBoikarabelo Coal Mine	Baseline groundwater quality and groundwater level monitoring.	Project management, client liaison, data capture, trend analysis, water quality interpretation and technical report writing.
2019-2020	SRK Consulting- Modikwa Integrated Water Management Scheme	Hydrogeological investigation and development of mitigation strategy, which will form part of the integrated water management study.	Project co-ordination and field investigation which involved borehole fluid logging, surface geophysical investigation, borehole drilling supervision, Double Ring Infiltrometer (DRI) tests, soil profiling via inspection pits/ test pits, soil sampling (disturbed and undisturbed samples) and isotope water sampling. Data interpretation and reporting.
2020	PEU Group (PTY) Ltd	Groundwater availability study for proposed development in Vaalwater.	Field investigation, groundwater reserve determination, interpretation of existing aquifer testing data ad recommendations on availability of groundwater resources for the proposed development
2020	JINDAL Mining SA (Pty) LTD	Railway Siding Hydrogeological Investigation	Data analysis of aquifer testing data and water quality results, monitoring network development and groundwater reserve determination
Monitoring Unit			
2017-2018	Anglo American Platinum-Modikwa Platinum Mine	Operational platinum mine and concentrator. Monthly water quality monitoring.	Project management, client liaison, data capture, trend analysis, water quality interpretation and technical report writing.
2017-2018	Exxaro's Thabametsi Coal Mine (Thabametsi Project)	Baseline monitoring of groundwater and surface water quality, groundwater levels and dust fallout rate. Monthly surface and groundwater quality monitoring and monthly air quality monitoring.	Project management, client liaison, data capture, trend analysis, water quality interpretation, data fallout interpretation and technical report writing.
2017-2018	Letseng Diamond Mine	Operational diamond mine. Biannual groundwater quality monitoring.	Project management, client liaison, data capture, trend analysis, water quality interpretation and technical report writing.
2017-2018	Anglo Platinum- Der Brochen Project	Baseline monitoring. Monthly surface and groundwater quality monitoring and monthly air quality monitoring.	Project management, client liaison, data capture, trend analysis, water quality interpretation, data fallout interpretation and technical report writing.

DECLARATION

I, Chantelle Schmidt hereby declare that the details furnished above are true and correct to the best of my knowledge and belief and I undertake to inform you of any changes therein, immediately. In case any of the above information is found to be false or untrue or misleading or misrepresenting, I am aware that I may be held liable for it.

Signature:  Date: 31/01/2019

Appendix B4: Surface Water (Wetlands) including Peer Review by SAS

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

	(For official use only)
File Reference Number:	
NEAS Reference Number:	DEA/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

BASIC ASSESSMENT FOR THE DEVELOPMENT OF 8 NEW PV PLANTS & AMENDMENT OF 2 PV DEVELOPMENTS AT THE BOKPOORT FARM NEAR GROBLERSHOOP NORTHERN CAPE PROVINCE

Kindly note the following:

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

Postal address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

Physical address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Specialist Company Name:	Royal HaskoningDHV			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	2	Percentage Procurement recognition	
Specialist name:	Paul da Cruz			
Specialist Qualifications:	BA Hons			
Professional affiliation/registration:				
Physical address:	Building 5, Country Club Estate, Woodlands Drive, Woodmead			
Postal address:	PO Box 867, Gallo Manor			
Postal code:	2052	Cell:	084 224 0088	
Telephone:	-	Fax:	-	
E-mail:	paul.dacruz@rhdhv.com			

2. DECLARATION BY THE SPECIALIST

I, _____Paul da Cruz_____, declare that –

- I act as the independent specialist (surface water assessment) in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

Name of Company:

Royal HaskoningDHV

Date

25 May 2020

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, ___Paul da Cruz_____, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

Name of Company

Royal HaskoningDHV

Date

25 May 2020

Signature of the Commissioner of Oaths

Date

CERTIFIED TRUE COPY OF THE
ORIGINAL

Malcolm Roods

Commissioner of Oaths
BA(Hons) LLB
(011) 798 6001
PO Box 867, Gallo Manor 2052
21 Woodlands Drive, Woodmead.

1/06/2020

Royal HaskoningDHV
Enhancing Society Together

REPORT

Surface Water Report for the Development of 8 New PV Plants and Amendment of 2 PV Developments on the Farm Bokpoort, Northern Cape

Client: ACWA Power

Reference: MD4195-RHD-RP-0001-RP-0001
Status: S0/P01.01
Date: 1/30/2020

ROYAL HASKONINGDHV (PTY) LTD

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Document title:	Surface Water Report for the Development of 8 New PV Plants and Amendment of 2 PV Developments on the Farm Bokpoort, Northern Cape
Document short title:	Bokpoort 2 Surface Water
Reference:	MD4195-RHD-RP-0001-RP-0001
Status:	P01.01/S0
Date:	1/30/2020
Project name:	Basic Assessment for the Proposed Eight New PV Developments and Amendment of 2 PV Developments on the Farm Bokpoort, Northern Cape
Project number:	MD4195
Author(s):	Paul da Cruz

Drafted by:	Paul da Cruz
Checked by:	
Date / initials:	
Approved by:	
Date / initials:	

Classification
Project related

Disclaimer

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Royal HaskoningDHV

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Appendix 1 -CV's

Executive Summary

Royal HaskoningDHV (RHDHV) has been appointed by ACWA Power to undertake Basic Assessment Studies for the development of eight (8) new Photovoltaic (PV) Solar Power Plants, on the Farm Bokpoort 390 located to the north of the town of Groblershoop in the Northern Cape Province. ACWA Power previously received Environmental Authorisation for the proposed development of PV and Concentrated Solar Power (CSP) Solar Plants on the Farm Bokpoort 390. ACWA Power wishes to change the CSP component of the proposed development to 8 PV facilities. Previously, approval for 2 PV facilities was obtained, PV 1 (Ndebele) and PV 2 (Xhosa), however the proposal for these two sites did not include the BESS for either of the sites as well as the capacity increase from 75 to 200MW.

This study considers the surface water (freshwater) environment on the site of the proposed development, and whether the proposed development will exert an impact on surface water features. The site is within one of South Africa's eight renewable energy development zones and has therefore been identified as one of the most suitable areas in the country for renewable energy development, in terms of a number of environmental impact, economic and infrastructural factors.

A 2000 Megawatt (MW) Photovoltaic (PV) Solar Development is proposed in total over the area. The proposed PV solar facility will cover 150 ha each. The proposed development will each consist of the following infrastructure:

- Solar PV modules that will be able to deliver up to 200 MW to the Eskom National Grid;
- Inverters that convert direct current (DC) generated by the PV modules into alternating current (AC) to be exported to the electrical grid;
- A transformer that raises the system AC low voltage (LV) to medium voltage (MV). The transformer converts the voltage of the electricity generated by the PV panels to the correct voltage for delivery to Eskom;
- Transformer substation; and
- Instrumentation and Control consisting of hardware and software for remote plant monitoring and operation of the facility.

Associated infrastructure includes:

- Mounting structures for the solar panels will be either rammed steel piles (preferred solution in terms of piles with pre-manufactured concrete footings to support the PV panels;
- Cabling between the structures, to be lain underground where practical;
- A new 132kV overhead powerline which will connect the facility to the National Grid via Eskom's existing Garona Substation. The powerlines vary in length and will be located within a servitude spanning 15.5m meters on both sides. The powerline towers will be 35m high;
- Battery Energy Storage System (BESS) - battery Power at Point of Connection: 150MW, area required: 16ha; the BESS will store approximately 4500m^3 of hazardous substance.;
- One water pipeline connection from the river (previously authorised) and different metering points at individual PV plants;
- Internal access roads (4 – 6 m wide roads will be constructed but existing roads will be used as far as possible) and fencing (approximately 3 m in height); and
- Shared infrastructure consisting of buildings, including a workshop area for maintenance, storage (i.e. fuel tanks, etc.), laydown area, parking, warehouse, and offices (previously approved).

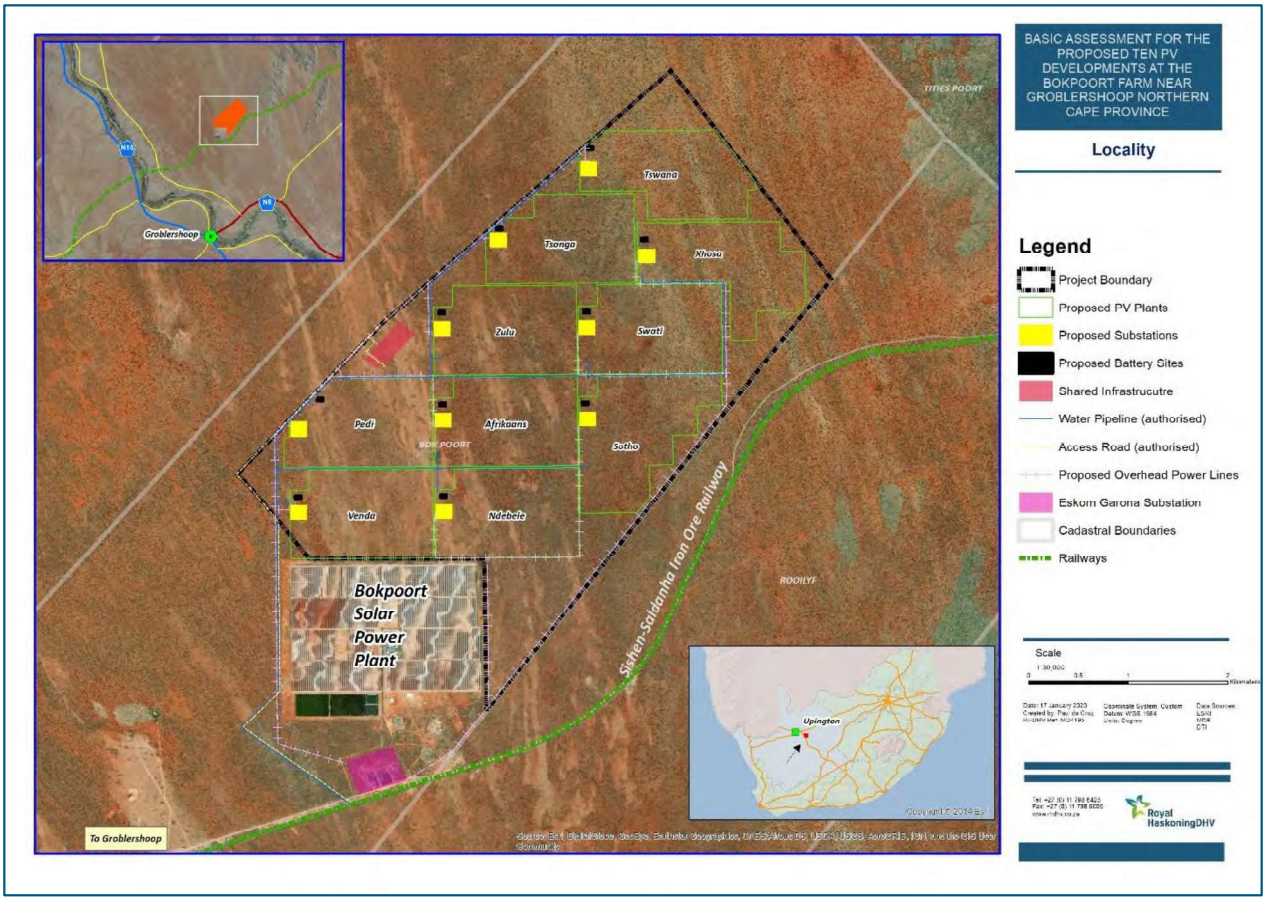

Figure i – Locality

The study area is located in a semi-arid climatic zone (semi-desert), being located on the boundary between the Great Karoo and the Kalahari semi-desert and receives a mean annual rainfall figure of approximately 215mm.

The entire development site is underlain by siliciclastic rocks of the Kalahari Group, with notable surface outcropping of calcrete. The terrain changes from the incised and more steeply-sloping terrain closer to the Orange River valley to much flatter terrain as one moves away from the river. Topographically the site can be divided into two main units – calcrete gravel plains that dominate the southern / south-western half of the site, and sandy flats that grade to Duneveld that characterise the northern-most part of the site. The Duneveld is comprised of sand of wind-blown (aeolian) origin. In the far north-eastern part of the site a number of parallel-running longitudinal dunes that are aligned in a north-south orientation are encountered. The site rises in altitude as one moves north-eastwards (i.e. away from the Orange River Valley).

Although not located near to the development site, areas characterised by a higher lying relief and rockier substrates occur to the south-west of the development site, as well as to the east and north-east. These areas are comprised of more resistant strata of the Brulpan Group, with the area to the south-west being comprised of schists, subordinate quartzite and metalava (greenstones) of the Groblershoop Formation and the areas to the east and north-east comprising of Muscovite quartzite and schist of the Prynsberg Formation. The absence of this geology on the site is very important from a surface water perspective as surface water features are largely absent from the Kalahari Group lithologies and associated landforms, whereas the more incised topography of the Brulpan Group typically contains surface drainage features.

The development site is located within the primary catchment of the Orange (Gariep) River, the largest river in a South African Context. The site is thus located in the Orange River Water Management Area (WMA).

The site is located within the D73D quarternary catchment. This catchment is comprised of a reach of the lower Orange River from Kheis (near Groblershoop) at its upstream end to Lambrechtsdrift (located between Groblershoop and Upington) at its downstream end, as well as a number of ephemeral / episodic watercourses that form tributaries of the Orange. The DHSWS WRiall500 rivers database shows no significant drainage in the vicinity of the development site, with only one watercourse to the east of the Orange River.

When the study area context drainage context is examined, a large-scale absence of drainage features in parts of the wider study area is present. Apart from the Orange which is a large regional river, drainage is largely limited to the wider Orange River valley, especially in the areas to the north and east of the river (in which the study area is located). Drainage only occurs within an area of about 4.5km of the river channel, an area which is largely characterised by rugged, incised topography, Beyond this corridor *no or very limited drainage occurs.* Limited surface water drainage occurs in areas characterised by higher-lying, rockier terrain, such as the mountainous terrain (Skurweberg Hills) located to the east and north-east of the site.

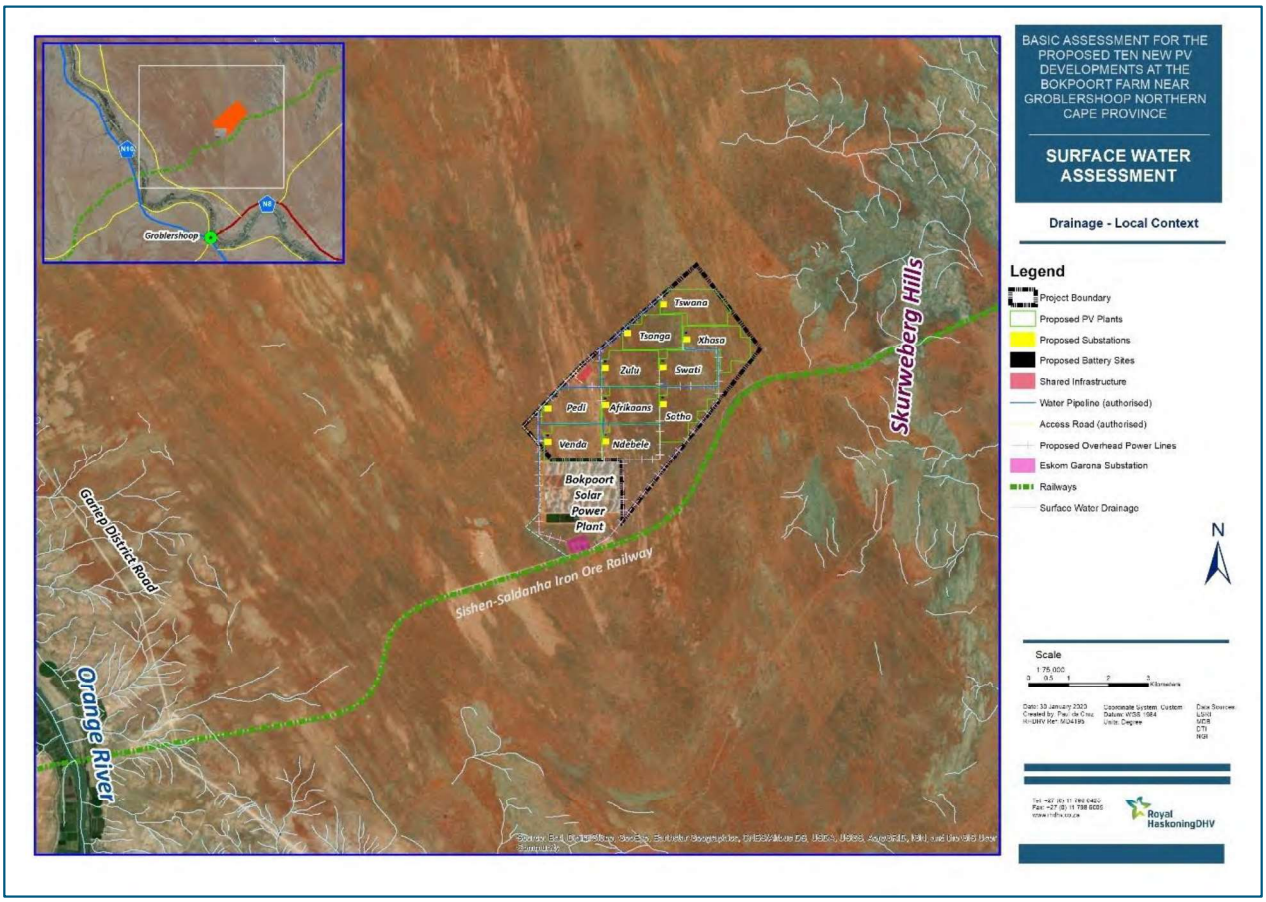

Figure ii – Local Drainage Context

The 1:50,000 scale topo-cadastral maps indicate that there are no drainage or surface water features on the development site. A site visit confirmed that no surface water features are located on the site of the proposed development. Of the two primary landforms located on the development site, the calcrete gravel

plains are extremely flat, with no linear surface water drainage features present. Pans can occur in such very flat terrain where no linear drainage occurs, but there are no pans that occur on the site.

The topography of most remainder of the site, in particular the central parts of the site is similarly very flat, but with a different substrate in the form of red aeolian sands. There is similarly no linear drainage in this part of the site and no pan occurrence.

The Duneveld that occurs in the far north-eastern quarter of the site is comprised of low, parallel-aligned dunes, with intervening flat areas of sandy substrate covered in a grassy vegetation cover. No surface water drainage was observed in this Duneveld, in spite of the site becoming more sloping, with an increase in altitude to the north-east. The combination of a highly permeable substrate (sandy material) and the presence of parallel-aligned dunes that run roughly perpendicular to the direction of the slope prevents the development of surface drainage features that would under other circumstances be aligned south-westwards in the direction of the slope.

The closest surface water features to the development site are located 900m-1km to the east and north-east of the development site's north-eastern boundary where the underlying geology changes and a concomitant change in topography from Duneveld to rocky hills is encountered. In this area, the presence of these watercourses is due to the sloping terrain of the ridge hillslopes which naturally promote surface water flows and accompanying incision. It is important to note that the courses of these watercourses are short, as they drain into the Duneveld and dissipate as they reach the Duneveld topography that lies adjacent to the hilly terrain.

To the south-west of the development site the closest surface water features are located just over 7km distant, being located where the rugged, incised topography that occurs closer to the Orange River valley is first encountered.

The absence of any surface water features on the development site entails that no surface water impacts will result due to the proposed development. The closest surface water features are located within a sufficient distance from the site that to ensure that the likelihood of the development impacting these features is very limited. In addition these features are not downstream or downslope of the site, thus making it even less likely that these could be impacted by the proposed development.

Accordingly no legislative process for the authorisation of the proposed development in terms of Section 21 c) & i) of the National Water Act will be required.

In spite of the absence of surface water features on the site, stormwater and pollution controls must be implemented on the development site, in order to ensure that uncontrolled stormwater flows do not cause erosion of the underlying substrate.

Acronyms

Acronym	Acronym description
CBA	Critical Biodiversity Area
CSP	Concentrated Solar Power
DHSWS	Department of Water and Sanitation
ESA	Ecological Support Area
FEPA	Freshwater Ecosystem Priority Area
FSA	Fish Support Area
NFEPA	National Freshwater Ecosystem Priority Areas
NWA	National Water Act 36 of 1998
PV	Photovoltaic
RHDHV	Royal HaskoningDHV
WUA	Water Use Authorisation

Glossary

Glossary Term	Glossary Text
Aeolian	Wind-borne – i.e. referring to wind-borne and deposited materials, and erosion caused by wind
Alluvial Material / Deposits	Sedimentary deposits resulting from the action of rivers, including those deposited within river channels, floodplains, etc.
Calcrete	A type of rock cemented together by calcareous material, formed in soils in semi-arid conditions
Ephemeral	A river or watercourse that only flows at the surface periodically, especially those drainage systems that are only fed by overland flow (runoff).
Episodic	Relating to rivers and watercourses typically located within arid or semi-arid environments that only carry flow in response to isolated rainfall events
Semi-arid	A description of a climatic zone that is not sufficiently dry to be termed arid (arid climates are typically defined as having annual rainfall less than 250mm/year), but which is characterised by very low annual rainfall. Under the Köppen climate classification semi-arid climates are termed at steppe climates – being intermediate between desert climates and humid climates in ecological characteristics and agricultural potential.
Semi-desert	The transition zone between true desert and more mesic (moist) climatic areas, generally receiving annual rainfall in a range between 250 - 500mm/year. In terms of the Köppen climate classification, semi-desert climatic zones are intermediate between the desert climates and humid climates in ecological characteristics and agricultural potential.

Specialist Declaration

I, **Paul da Cruz**, declare that I –

- act as a specialist consultant in the field of Surface Water assessment
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2014 (as amended in 2017);
- have and will not have any vested interest in the proposed activity proceeding;
- have no, and will not engage in, conflicting interests in the undertaking of the activity;
- undertake to disclose, to the competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the Environmental Impact Assessment Regulations, 2014 (as amended in 2017); and
- will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not.

PAUL DA CRUZ

Expertise of Specialist

Paul da Cruz of RHDHV is a very experienced wetland assessment practitioner, having undertaken wetland assessments for over 17 years. Paul's key list of wetland experience at RHDHV is listed below.

Paul da Cruz Surface Water Assessment (Wetland and Riparian Assessment) Experience at Royal HaskoningDHV (SSI) – April 2012 to present time:

- Surface Water Assessment for the Lydenburg-Merensky 132kV power line, Mpumalanga-Limpopo Provinces, Eskom Distribution
- Wetland Rehabilitation Plan for the Eskom UCG Plant Section 24G application, Amersfoort Area, Mpumalanga, Eskom Generation
- Detailed wetland delineation and assessment study for the Eskom UCG Project, Amersfoort Area, Mpumalanga, Eskom Generation
- Wetland Delineation and assessment study for the construction of a road at the Ingula Pumped Storage Scheme, KwaZulu-Natal.
- Wetland delineation and assessment study, as well as the compilation of a wetland rehab plan and risk assessment for the BA and WUA processes for the Decommissioning and replacement of a section of the Firham-Platrand Power Line, Mpumalanga
- Freshwater Study (wetland assessment) for the Basic Assessment for the Development of a Battery Storage Site (Substation) near Mount Fletcher, Eastern Cape

- Surface Water Assessment and Wetland Delineation for the Letaba NDP Project (Eskom Distribution) in the Tzaneen Area, Limpopo Province, Eskom Distribution
- Wetland Delineation Assessment for the Kliphoek-Uitkoms-Panbult 132kV power line Basic Assessment in the Ermelo Area, Mpumalanga, Eskom Distribution
- Surface Water Assessment for the continued operation of the Matimba Ash Disposal Facility EIA, Lephalale, Limpopo Province, Eskom Generation
- Surface Water Assessment for the Gamma-Kappa Transmission Power line EIA, Western Cape Karoo, Eskom Transmission
- Surface Water Study for the proposed Mbumbu-Tsakane Power line, Acornhoek area. Mpumalanga, Eskom Distribution
- Riparian Assessment for the Derdepoort-Wegval Power line, North West, Eskom Distribution
- Riparian Delineation and Assessment Study for the Mooinooi Power line Project, North West, Eskom Distribution
- Wetland Delineation and Assessment Study, as well as wetland rehabilitation planning for the proposed NEO1 20MW Photovoltaic Power (PV) Generation Development Project in Mafeteng, Lesotho
- Wetland Delineation and EcoStatus Assessments for the Water Use Licence Application for the Margate Wastewater Treatment Works, KwaZulu-Natal, Ugu District Municipality
- Surface Water Assessment Study for the Impendle Bulk Water Supply Water Use License Application, Impendle area, KZN, uMgungundlovu District Municipality
- Wetland Delineation Assessment for a proposed sewer pipeline upgrade along Eastbury Road, Phoenix, Durban, eThekwini Municipality
- Wetland Delineation and EcoStatus assessments for the KwaMeyi-Teekloof Bulk Water Supply Project. KwaZulu-Natal, Sisonke District Municipality
- Wetland EcoStatus Assessments for the Dube Tradeport Agrizone, KwaZulu-Natal, Dube Tradeport
- Undertook the Surface Water and Terrestrial Ecology Component of the Precinct Planning for the development of Precinct Plans for the Ekurhuleni Metropolitan Municipality
- Undertook the wetland component of the Freshwater Study for the project (Phases 1&2) for the Maintenance and/or Upgrade of the Patrol Roads and Fencing on the Borders between RSA, Swaziland & Mozambique – Phases 1& 2.
- Wetland Assessment for the Valleyview Housing Development EIA, eMalahleni, Mpumalanga Province. Before the Wind Investments
- Wetland Delineation and Assessment Study for the proposed establishment of housing in Fochville, Gauteng, Fochville Municipality
- Surface Water (Riparian) Assessment for the proposed development of a water pipeline near Groblershoop, Northern Cape, Solafrica
- Wetland Delineation and Assessment Study for a proposed Biogas Digester Plant at Fort Hare, Eastern Cape, Fort Hare University
- Wetland Delineation and EcoStatus Assessments for the development of an abattoir facility in Amersfoort, Mpumalanga; MDARDLEA
- Wetland Screening Assessment at Barton Place, eThekwini Municipality, eThekwini Municipality

- Wetland Screening Assessments for three proposed K-route roads in Gauteng, Gauteng Department of Transport
- Surface Water Screening Assessment for the proposed Waterberg Heavy Haul Coal Transport Railway from Lephalale to Ermelo, Transnet
- Wetland Delineation Assessments and Wetland EcoStatus Assessments (Wetland Functionality, Ecological Importance and Sensitivity and State Assessments) for the development of the proposed P166 Road in the Nelspruit-White River area of Mpumalanga, SANRAL
- Wetland Delineation Assessment for a proposed waterborne sewer in eMpuluzi, Mpumalanga, MDARDLEA
- Wetland Delineation and EcoStatus assessments for the mining application for a quarry in Ekangala, Gauteng, City of Tshwane
- Wetland and Riparian Assessment study for the proposed development of a cattle feedlot in Mzinti, Mpumalanga, MDARDLEA
- Wetland Delineation Assessment for the proposed expansion and repair of the Rietspruit Dam wall in Ventersdorp, North West, DWS
- Riparian Delineation and assessment studies for the development of a water pipeline in Roodeplaat, Gauteng, Magalies Water
- Surface Water Assessment for the proposed Sanddraai Solar Power Plant, Groblershoop, Northern Cape, Solafrica

1 Introduction

Royal HaskoningDHV (RHDHV) has been appointed by ACWA Power to undertake Basic Assessment Studies for the development of eight (8) new Photovoltaic (PV) Solar Power Plants on the Farm Bokpoort 390 located to the north of the town of Groblershoop in the Northern Cape Province. ACWA Power previously received Environmental Authorisation (EA) for the proposed development of PV and Concentrated Solar Power (CSP) Solar Plants on the Farm Bokpoort 390. As part of the suite of specialist studies associated with the original application, Golder compiled a Surface Water Baseline and Impact Assessment Report. This report characterised the surface water environment in the study area and this report is an update of that report. ACWA Power wishes to change the CSP component of the proposed development to PV. Previously, approval for 2 PV facilities was obtained, PV 1 (Ndebele) and PV 2 (Xhosa), however the proposal for these two sites did not include the BESS for either of the sites as well as the capacity increase from 75 to 200MW.

This study considers the surface water (freshwater) environment on the site of the proposed development, and whether the proposed development will exert an impact on surface water features. The site is within one of South Africa's eight renewable energy development zones and has therefore been identified as one of the most suitable areas in the country for renewable energy development, in terms of a number of environmental impact, economic and infrastructural factors.

A 2000 Megawatt (MW) Photovoltaic (PV) Solar Development is proposed. The proposed PV solar facility will cover 150 ha. The proposed development will consist of the following infrastructure:

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- One water pipeline connection from the river (previously authorised) and different metering points at individual PV plants;

- Internal access roads (4 – 6 m wide roads will be constructed but existing roads will be used as far as possible) and fencing (approximately 3 m in height); and
- Shared infrastructure consisting of buildings, including a workshop area for maintenance, storage (i.e. fuel tanks, etc.), laydown area, parking, warehouse, and offices (previously approved).

1.1 Aims of the Study

The aims of the study are to:

- Identify any surface water features on the development site and in its immediate vicinity;
- Map boundaries of such surface water (freshwater) features within the area of assessment, if such features are found to occur on the site; and
- Identify the likely impacts of the proposed development on surface water (freshwater) features.

1.1.1 Project (Study Area) Location and Description

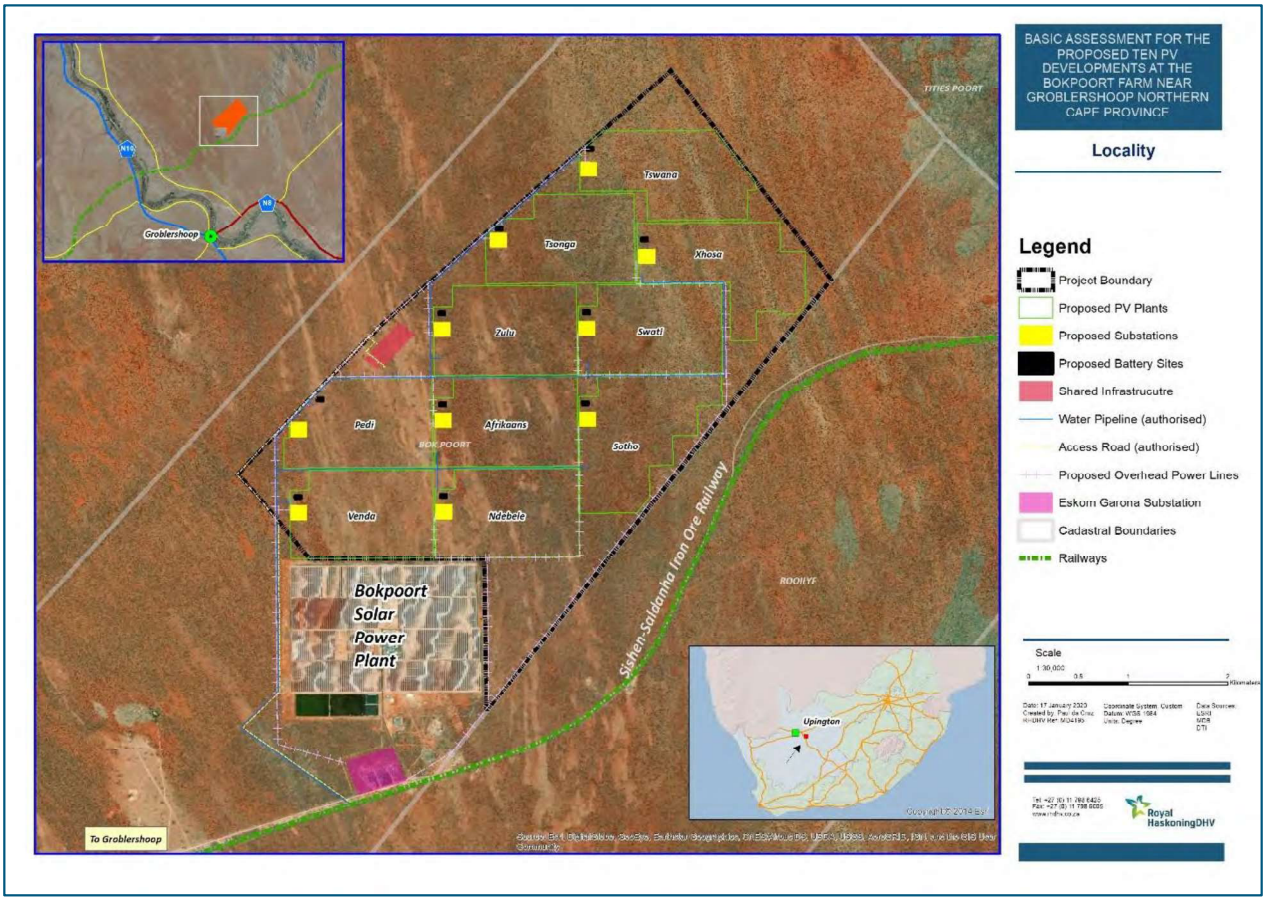

Figure 1 – Locality Map

1.2 Assumptions and Limitations

This report has not assessed the potential impact of abstraction on the Orange (Gariep) River, or the construction of a water pipeline from the Orange River to the proposed development as it is understood that that abstraction and development of a water pipeline were previously authorised. This aspect of the original environmental studies (conducted in 2016) was covered in the report undertaken by Golder (Surface Water Baseline and Impact Assessment Report for the Proposed 75 MW PV 1 Solar Facility, 2016). The report considered the water demand requirements of the proposed development in the context of the proposed abstraction of water from the Orange River.

This report does not consider stormwater generation and impacts. It is assumed that the Golder Surface Water Baseline and Impact Assessment Report for the Proposed 75 MW PV 1 Solar Facility, 2016 adequately covers this aspect of the proposed development.

1.3 Definition of Surface Water (Freshwater) Features

In the context of the identification, delineation and assessment of surface water features on the study site, it is important to detail the definition of surface water features to set the parameters for the investigation.

1.3.1 Surface Water / Freshwater Features

To set out a framework in which to assess surface water features, it is useful to set out what this report defines as surface water / freshwater resources. In this context, the National Water Act (Act 36 of 1998) (NWA) is used as a guideline. The NWA includes a number of features under the definition of water resources, i.e. watercourses, surface waters, estuaries and aquifers. The latter two features do not apply in the context of this study as this report does not consider groundwater (in the case of aquifers) and estuaries are coastal features, thus surface waters and water courses are applicable in this context. The Act defines a watercourse as (*inter alia*):

- a river or spring;
- a natural channel in which water flows regularly or intermittently;
- a wetland, lake or dam into which, or from which, water flows.

The definition of a water course as used in the Act is taken to describe surface water / freshwater features in this report.

It is important to note that the Act makes it clear that reference to a watercourse includes, where relevant, ***its bed and banks***.

It should be noted that due to the aridity of the study area which is located in a semi-desert, no wetlands or wetland habitat is likely to occur on the development site. Surface water features, if present on the development site, are likely to take the form of ephemeral or episodic water watercourses.

1.3.2 Riparian Habitat and Riparian Zones

The National Water Act defines riparian habitat as:

"the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas"

As detailed in the Department of Human Settlements, Water and Sanitation (DHSWS – formerly DWS, DWA and DWAF) 2005 guidelines for the delineation of wetlands and riparian areas, riparian areas typically perform important ecological and hydrological functions, some of which are the same as those performed by wetlands (DWAF, 2005).

Riparian areas include plant communities adjacent to and affected by surface and underground water features such as rivers, streams, lakes, or watercourses. It is important to note that these areas may be a few metres wide along smaller systems or more than a kilometre in floodplains. Both perennial and non-perennial streams support riparian vegetation (DWAF, 2005).

Because riparian areas represent the interface between aquatic and upland ecosystems, the vegetation in the riparian area may have characteristics of both aquatic and upland habitats. Many of the plants in the riparian area require large volumes of water (moisture) and are adapted to shallow water table conditions. Due to water availability and rich alluvial soils, riparian areas are usually very productive. Tree growth rate is high. This is certainly the case in riparian zones in the arid western interior of South Africa, as they typically contain trees and shrubs of a height, density and species diversity that is not present in the surrounding terrestrial habitats.

Riparian areas are important as they perform the following functions (DWAF, 2005):

- Storing water and thus assisting to reduce floods;
- Stabilising stream banks;
- Improving water quality by trapping sediment and nutrients;
- Maintaining natural water temperature for aquatic species;
- Providing shelter and food for birds and other animals;
- Providing corridors for movement and migration of different species;
- Acting as a buffer between aquatic ecosystems and adjacent land uses;
- Can be used as recreational sites; and
- Providing material for building, muti, crafts and curios.

These ecosystems may be considered 'critical transition zones' as they process substantial fluxes of materials from closely connected adjacent ecosystems (Ewel *et al*, 2001).

As discussed below riparian habitat is important from a legislative perspective – in terms of the National Water Act.

1.4 Methodology for Assessment

As a first part of the assessment a desktop assessment of the site was undertaken to identify all surface water features on, and in the immediate vicinity of the development site. Use was made of 1:50 000-scale topo-cadastral maps and associated vectorised drainage and river data, as well as high-resolution aerial photography to identify the presence of surface water features of the site.

As the desktop assessment revealed the absence of any surface water features, a focussed field assessment was undertaken to confirm / groundtruth the findings of the desktop assessment. The site was traversed in a high clearance 4x4 vehicle utilising the farm tracks on the development site, and by foot where necessary, to access all relevant parts of the development site.

As no surface water features were confirmed to occur on the site or in its immediate vicinity, components of the standard methodology that typically form part of surface water / freshwater assessments in terms of delineation of surface water features and assessment of state and ecological importance and sensitivity were not required to be undertaken.

A report was compiled which detailed:

- the relevant physical aspects of the study area,
- the presence / absence of surface features on and in the vicinity of the development site, and
- implications for development.

1.4.1 Duration, Date and Season of the Site Investigation

A single site was undertaken as part of the investigation. The purpose of the site investigation was to confirm / groundtruth the findings of the desktop assessment which had revealed no surface water occurrence on the development site.

The site visit was undertaken on the 20th November 2019, with the duration of the site visit being one day. The project site was traversed with a high clearance 4x4 vehicle on the existing farm tracks to check for the presence / absence of surface water features.

The season of the site visit was early summer, in the nominal rainy season of the study area. A summer field visit is usually preferred from a surface water perspective as in a semi-arid summer rainfall area, this is the period when surface water features are most likely to be inundated / saturated due to rainfall. A late summer season site visit would have been most preferable as in the context of the climate of the study area, late summer is the period of year when most rainfall is typically received, but this does not affect the outcome of the assessment as no surface water features were confirmed to occur on the site.

2 Legislative Context

The following section briefly examines the legislation that is relevant to the scope of the surface water assessment. The stipulations / contents of the legislation and policy that is relevant to the study are explored.

2.1 The National Water Act (Act 36 of 1998)

It is important to note that water resources are protected under the NWA. 'Protection' of a water resource, as defined in the Act entails:

- Maintenance of the quality of the water resource to the extent that the water use may be used in a sustainable way;
- Prevention of degradation of the water resource; and
- The rehabilitation of the water resource.

In the context of the current study and the identification of potential threats to the surface water features potentially posed by the proposed development, the definition of pollution and pollution prevention contained within the Act is relevant. 'Pollution', as described by the Act is the direct or indirect alteration of the physical, chemical or biological properties of a water resource, so as to make it (inter alia)-

- less fit for any beneficial purpose for which it may reasonably be expected to be used; or
- harmful or potentially harmful to the welfare or human beings, to any aquatic or non-aquatic organisms, or to the resource quality.

The inclusion of physical properties of a water resource within the definition of pollution entails that any physical alterations to a water body, for example the excavation of a wetland or changes to the morphology of a water body can be considered as pollution. Activities which cause alteration of the biological properties of a watercourse, i.e. the fauna and flora contained within that watercourse are also considered pollution.

In terms of Section 19 of the Act owners / managers / people occupying land on which any activity or process undertaken which causes or is likely to cause pollution of a water resource must take all reasonable measures to prevent any such pollution from occurring, continuing or recurring. These measures may include measures to (inter alia):

- cease, modify, or control any act or process causing the pollution;
- comply with any prescribed waste standard or management practice;
- contain or prevent the movement of pollutants;
- remedy the effects of the pollution; and
- remedy the effects of any disturbance to the bed and banks of a watercourse.

These general stipulations of the Act have ramifications for the proposed development as impacts on freshwater features associated with the proposed development would be relevant in terms of the above stipulations of the NWA.

2.1.1 The National Water Act and Riparian Areas

Riparian habitat is afforded protection under the National Water Act in a number of ways. Firstly reference in the National Water Act to a watercourse includes its banks, on which riparian habitat is encountered. Riparian areas are thus afforded the same degree of protection as the rivers and channels alongside which they occur.

Riparian habitat is also important in the context of resource quality objectives that are a critical part of the Act. In terms of section 13(1) of the Act resource quality objectives must be determined for every significant water resource and are central part of data type specifications relating to national monitoring systems and national information systems as determined in section 137(2) and section 139(2) of the Act respectively. Under Section 27 of the Act resource quality objectives must be considered in the issuing of any licence or general authorisation and form a critical part of the duties of catchment management agencies. The purpose of resource quality objectives in the Act is to establish clear goals relating to the quality of the water resources. Resource quality is important in the context of riparian habitat as resource quality as defined in the Act means the quality of all aspects of a water resource and includes the character and condition of the riparian habitat. In terms of Section 26(4) of the Act, the need for the conservation and protection of riparian habitat must be considered in the determination and promulgation of regulations under the Act.

2.2 Water Use Authorisation Context – Section 21 c) & i) of the National Water Act

The General Authorisation Regulation in terms of Section 21 (c) and (i) water uses (GN509 of 2016, the General Authorisation in terms of Section 39 of the NWA for Water Uses as defined in Section 21 (c) or Section 21(i)) is applicable to a potential water use authorisation requirement for the proposed development.

Section 5 of GN509 states that the General Authorisation applies throughout the Republic of South Africa to the use of water in terms of section 21(c) or (i) of the Act ***within the regulated area of a watercourse***, as defined in the General Authorisation.

The Regulated Area of a watercourse as defined by of GN509 is:
(a) The outer edge of the 1 in 100-year flood line and /or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam;
(b) In the absence of a determined 1 in 100-year flood line or riparian area the area within 100m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench (subject to compliance to section 144 of the Act); or
(c) A 500 m radius from the delineated boundary (extent) of any wetland or pan.

As there are no surface water features located on the site, or within 100m of the site (refer to Section 5), ***the site does not fall within the regulated area of a watercourse.*** Accordingly the development is not subject a Water Use Authorisation as ***no Section 21(c) and (i) water use would be triggered by the proposed development.***

3 Bioregional and National Conservation Planning Context

3.1 National Freshwater Ecosystem Priority Area (NFEPA) Database

The National Freshwater Ecosystem Priority Areas (NFEPA) Database has been analysed in order to determine whether any of the potentially-affected surface water resources on the development site have been classified as being nationally or regionally important.

The NFEPA database is a result of a process to develop cross-sector policy objectives for conserving South Africa's inland water biodiversity, which led to the definition of a national goal for freshwater conservation policy in South Africa: "to conserve a sample of the full diversity of species and the inland water ecosystems in which they occur, as well as the processes which generate and maintain diversity" (Driver et al, 2011). The project provided strategic spatial priorities for conserving South Africa's freshwater ecosystems and supporting sustainable use of water resources. These strategic spatial priorities are known as Freshwater Ecosystem Priority Areas, or FEPAs.

The NFEPA database has designated sub-quaternary catchments of importance, or priority catchments. This catchment approach is derived from a focus on sustainable development, given the current and future pressures on water resources. Protection and utilisation of natural resources need to work hand-in-hand to achieve sustainable development. In the context of water resources management, this means that catchments can be designed to support multiple levels of use, with natural rivers and wetlands that are minimally-used supporting the sustainability of hard-working rivers that often form the economic hub of the catchment. This concept is firmly embedded in the National Water Act and forms the foundation of the water resources classification system (Dollar et al. 2010). Keeping some rivers and wetlands in the catchment in a natural or good condition serves a dual purpose of conserving South Africa's freshwater biodiversity and promoting the sustainable use of water resources in the catchment.

FEPAs have been designated through the NFEPA analysis. These include River FEPAs and Wetland FEPAs. River FEPAs achieve biodiversity targets for river ecosystems and threatened/near-threatened fish species and were identified in rivers that are currently in a good condition (A or B ecological category – i.e. in a condition / state that is natural or near-natural). Their FEPA status indicates that they should remain in a good condition in order to contribute to national biodiversity goals and support sustainable use of water resources.

It is important to note that for River FEPAs, management of the catchment is also important; although FEPA status applies to the actual river reach within such a sub-quaternary catchment, surrounding land and smaller stream networks need to be managed in a way that maintains the good condition (A or B ecological category) of the river reach. These are known as Phase 1 FEPA catchments.

Phase 2 River FEPAs and associated catchments have also been designated. Phase 2 FEPAs were identified in moderately modified rivers (C ecological category), only in cases where it was not possible to meet biodiversity targets for river ecosystems in rivers that were still in good condition (A or B ecological category). River condition of these Phase 2 FEPAs should not be degraded further, as they may in future be considered for rehabilitation once FEPAs in good condition (A or B ecological category) are considered fully rehabilitated and well managed.

FEPAs related to fish sanctuaries and fish support areas have also been created. These are rivers that are essential for protecting threatened and near-threatened freshwater fish species that are indigenous to South Africa and are mapped at the level of the quaternary catchment. Quaternary catchments are designated as Fish Sanctuaries or Fish Support Areas (FSAs).

No FEPA features are located on, or in the immediate vicinity of the development site. The closest surface water feature to the development site that appears on the NFEPA spatial dataset is the Orange River. The reach of the Orange River that is located to the south-west of the development site does not meet the river condition criteria for designation as a River FEPA, as it has been assigned a status of C – moderately modified. However it has been designated as a Fish Support Area and Fish Sanctuary based on the presence of the fish species *Barbus anoplus*. The river would not ordinarily be designated as a fish sanctuary due to its moderately modified condition, but it qualifies as an FSA as it has been identified as a translocation area identified for the threatened fish species. The distance of the development site from the Orange River, and the non-inclusion of any new abstraction of water from the river as part of the development entails that the Orange River would be unlikely to be affected by the proposed development.

3.2 Provincial Bioregional Context – The Northern Cape CBA Dataset

The identification of Critical Biodiversity Areas for the Northern Cape was undertaken using a Systematic Conservation Planning approach. Available data on biodiversity features (incorporating both pattern and process, and covering terrestrial and inland aquatic realms), their condition, current Protected Areas and Conservation Areas, and opportunities and constraints for effective conservation were collated. Priorities from existing plans such as the Namakwa District Biodiversity Plan, the Succulent Karoo Ecosystem Plan, national estuary priorities, and the NFEPA database were incorporated. Targets for terrestrial ecosystems were based on established national targets, while targets used for other features were aligned with those used in other provincial planning processes. Marxan analysis was used to ensure that the required representation of biodiversity features was achieved in a spatially efficient manner which avoided incompatible land uses and activities where possible. The assessment approach and map categories are designed to be compatible with the Guideline Regarding the Determination of Bioregions and the Preparation and Publication of Bioregional Plans. Where possible, all targets are met in the identified set of CBAs (Holness and Oosthuysen, 2016).

The Northern Cape CBA Map identifies biodiversity priority areas, called Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs), which, together with protected areas, are important for the persistence of a viable representative sample of all ecosystem types and species as well as the long-term ecological functioning of e landscape as a whole.

There are no CBAs or ESA designated on, or in the immediate vicinity of the development site. The closest designated CBAs are located approximately 10km to the south-west of the development site along the Orange River corridor. The closest designated ESAs are located approximately 1.4km to the east within the Skurweberg Hills.

4 Physical Environment of the Study Area

4.1 Climate

The study area is located in a semi-arid climatic zone (semi-desert), being located on the boundary between the Great Karoo and the Kalahari semi-desert and receives a mean annual rainfall figure of approximately 215mm (Source: SA Rainfall Atlas Database). There is a relatively strong seasonality in the rainfall figures, indicating that the area falls within the summer rainfall areas within the subcontinent; most of the rainfall occurs in the late summer / autumn between the months of January and April. The scarcity of rainfall and nature of precipitation also entails that rainfall events are episodic in nature, i.e. single rainfall events will contribute a relatively significant portion of rainfall.

4.2 Geology, Macro-geomorphology and Topography

The eastern bank of the Orange River located to the south-west of the development site is characterised by the presence of rocky terrain that rises from an alluvial terrace within the Orange River valley bottom that abuts the channel of the river (this terrace has been subject to intense cultivation). The Orange River corridor is underlain by alluvial sediments of recent geological origin. These sediments are only located in a narrow band along the river.

The entire development site is underlain by siliciclastic rocks of the Kalahari Group, with notable surface outcropping of calcrete. The terrain changes from the incised and more steeply-sloping terrain closer to the Orange River valley to much flatter terrain that is characterised by two prominent landforms – flat calcrete plains and sandy Duneveld. Topographically the site can be divided into two main units – calcrete gravel plains that dominate the southern / south-western half of the site, and sandy flats that grade to Duneveld that characterise the northern-most part od the site. The Duneveld occupies is comprised of sand of wind-blown (aeolian) origin. In the far north-eastern part of the site a number of parallel-running longitudinal dunes that are aligned in a north-south orientation are encountered. The site rises in altitude as one moves north-eastwards (i.e. away from the Orange River Valley).

Although not located near to the development site, areas characterised by a higher lying relief and rockier substrates occur to the south-west of the development site, as well as to the east and north-east (refer to Figure 3 – these are the 'greyer' colours on the aerial photos base as opposed to the red colours of the Kalahari sands). These areas are comprised of more resistant strata of the Brulpan Group, with the area to the south-west being comprised of schists, subordinate quartzite and metalava (greenstones) of the Groblershoop Formation and the areas to the east and north-east comprising of Muscovite quartzite and schist of the Prynsberg Formation. The absence of this geology on the site is very important from a surface water perspective as surface water features are largely absent from the Kalahari Group lithologies and associated landforms, whereas the more incised topography of the Brulpan Group typically contains surface drainage features.

As described above linear sand dunes occur in the north-eastern-most part of the development site. These dunes are comprised of aeolian material, having formed from material eroded from sedimentary deposits that was reworked into dunes during drier periods of the geological past. The dunes that occur widely over the Kalahari region that occupies much of the western interior of the sub-continent are comprised of the unconsolidated sands of the Kalahari Group that cover an area of over 2.5 million km2 (Haddon, 2005). The thickness of these unconsolidated sands varies across the basin, from a few centimetres to over 200m. The dominant landform associated with the sands is the dune fields. Sand dunes throughout the Kalahari Basin are largely stable and are generally classified as relict- or palaeo-forms as dune construction itself is not currently taking place (Haddon, 2005).

The dunes in the South African part of the Kalahari Basin are characterised by partly vegetated linear dunes of 2-15 m in height, dune widths of 150-250 m (Lancaster, 1988, 2000) and are characterised by broad, inter-dune areas which are commonly grassed (Haddon, 2005). These characteristics are present within the study area with a series of dunes aligned in parallel in a broadly northern-southern orientation located in the north-eastern part of the development site. The dunes on the site were typically observed to be relatively low in height, varying between 2-10m. The dunes are typically well-vegetated, with shrubs and grasses located on the dunes themselves and the flat intervening areas between dunes being well grassed. This Duneveld topography has important implications for the occurrence of surface water drainage on the development site as discussed in section 4.3 below.

4.3 Drainage Context

The development site is located within the primary catchment of the Orange (Gariep) River, the largest river in a South African Context. The site is thus located in the Orange River Water Management Area (WMA).

The site is located within the D73D quarternary catchment (refer to Figure 2). This catchment is comprised of a reach of the lower Orange River from Kheis (near Groblershoop) at its upstream end to Lambrechtsdrift (located between Groblershoop and Upington) at its downstream end, as well as a number of ephemeral / episodic watercourses that form tributaries of the Orange. The DHSWS WRiall500 rivers database shows no significant drainage in the vicinity of the development site, with only one watercourse to the east of the Orange River.

When the study area context drainage context is examined, a large-scale absence of drainage features in parts of the wider study area is present (refer to Figure 2). Apart from the Orange which is a large regional river, drainage is largely limited to the wider Orange River valley, especially in the areas to the north and east of the river (in which the study area is located). Drainage only occurs within an area of about 4.5km of the river channel, an area which is largely characterised by rugged, incised topography, Beyond this corridor *no drainage occurs.* Limited surface water drainage occurs in areas characterised by higher-lying, rockier terrain, such as the mountainous terrain (Skurweberg Hills) located to the east and north-east of the site.

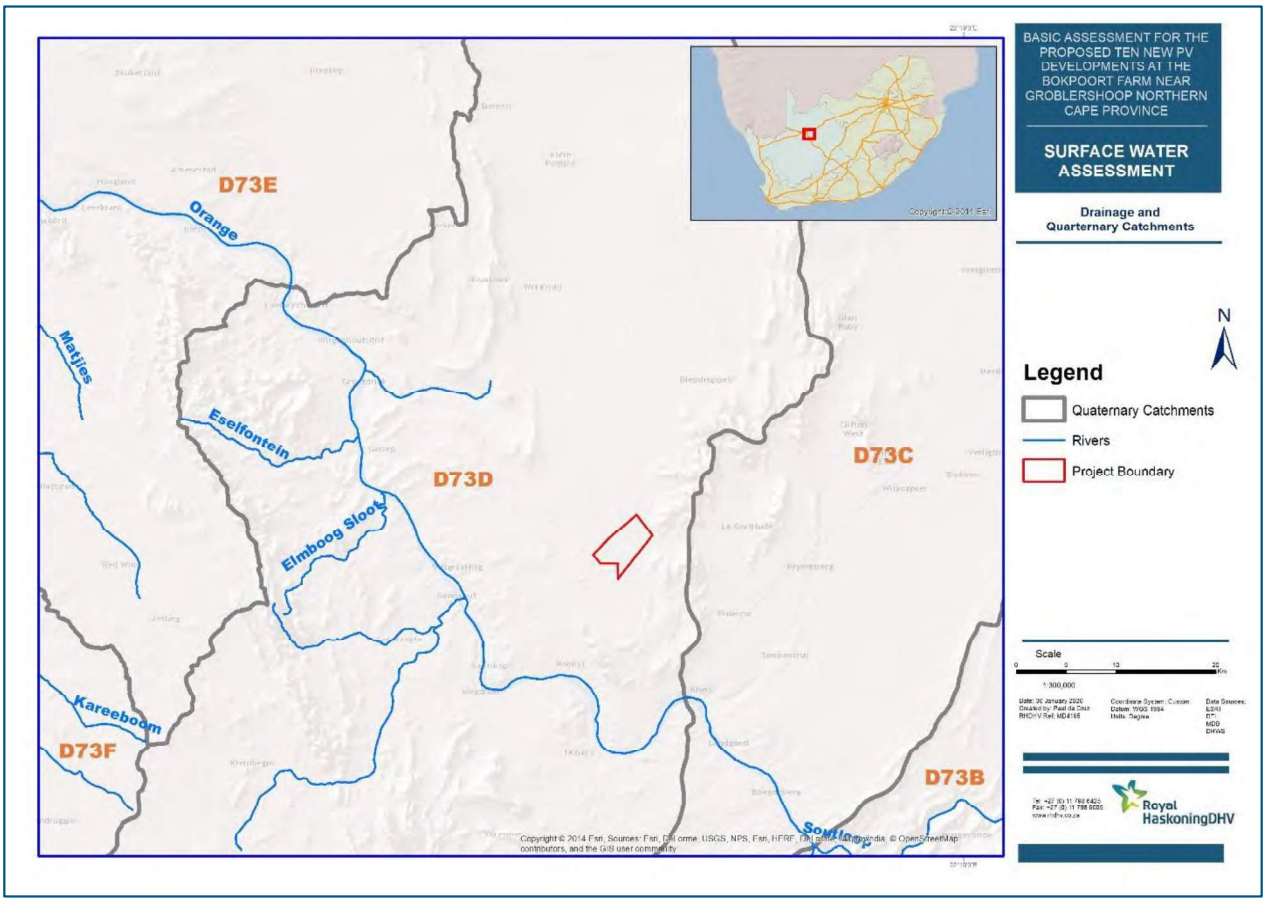

Figure 2 – Quarternary Catchment and Drainage Context

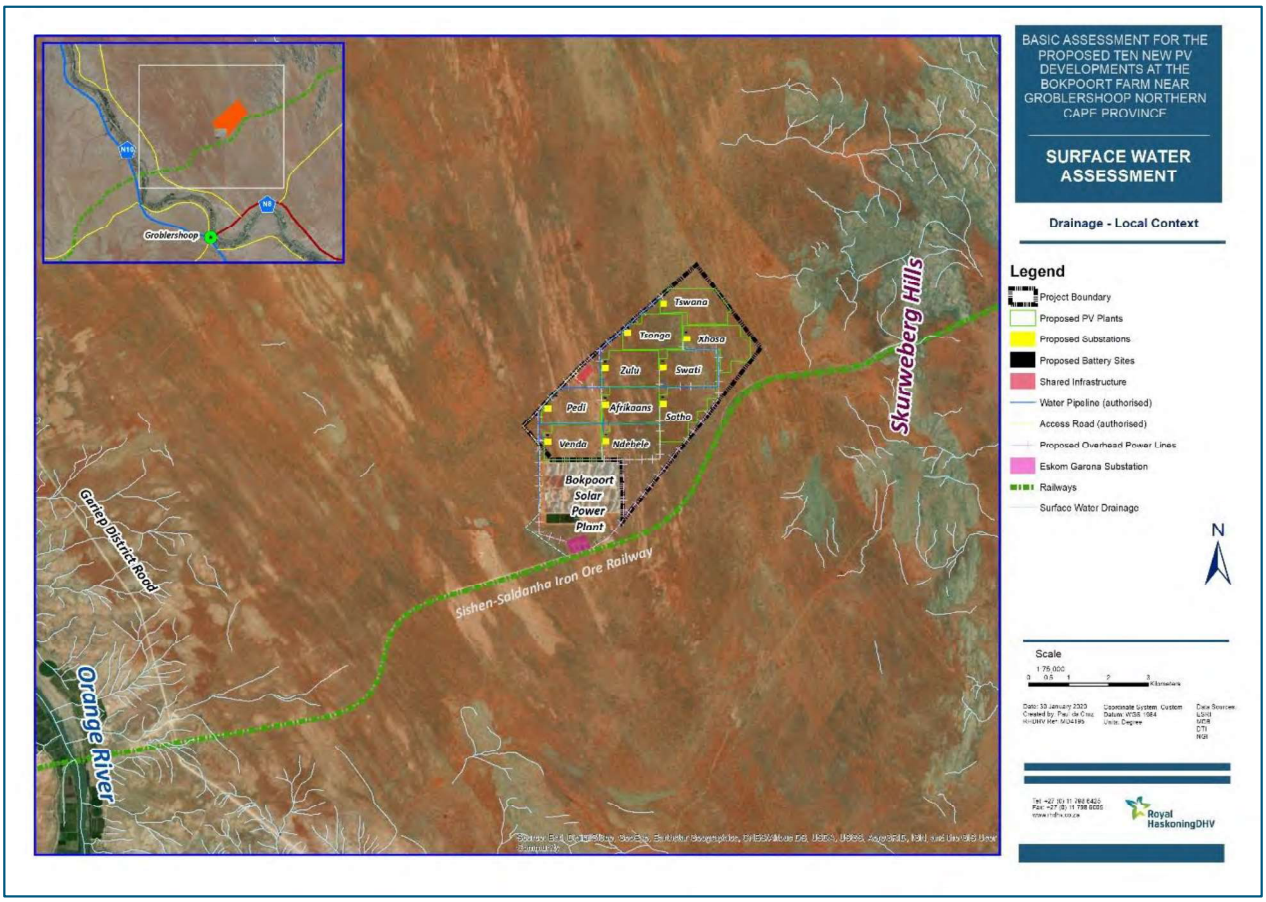

Figure 3 – Local Drainage Context

5 Surface Water Occurrence on the Development Site

The 1:50,000 scale topo-cadastral maps indicate that there are no drainage or surface water features on the development site (refer to Figure 3). A site visit was conducted to confirm this. The site was traversed as far as possible by vehicle.

The site visit confirmed that no surface water features are located on the site of the proposed development. Of the two primary landforms located on the development site, the calcrete gravel plains are extremely flat, with no linear surface water drainage features present. Pans can occur in such very flat terrain where no linear drainage occurs, but there are no pans that occur on the site.

The topography of most remainder of the site, in particular the central parts of the site is similarly very flat, but with a different substrate in the form of red aeolian sands. There is similarly no linear drainage in this part of the site and no pan (a type of wetland that can occur in flat terrain in arid settings) occurrence.

Figure 4 – An example of flat calcrete plains on the development site

The Duneveld that occurs in the far north-eastern quarter of the site is comprised of low, parallel-aligned dunes, with intervening flat areas of sandy substrate covered in a grassy vegetation cover. No surface water drainage was observed in this Duneveld, in spite of the site becoming more sloping, with an increase in altitude to the north-east. The combination of a highly permeable substrate (sandy material) and the presence of parallel-aligned dunes that run roughly perpendicular to the direction of the slope prevents the development of surface drainage features that would under other circumstances be aligned south-westwards.

Figure 5 – Duneveld terrain in the far north-eastern part of the site

The closest surface water features to the development site are located 900m-1km to the east and north-east of the development site's north-eastern boundary where the underlying geology changes and a concomitant change in topography from Duneveld to rocky hills is encountered. In this area, the presence of these watercourses is due to the sloping terrain of the ridge hillslopes which naturally promote surface water flows and accompanying incision. It is important to note that the courses of these watercourses are short, as they drain into the Duneveld and dissipate as they reach the Duneveld topography that lies adjacent to the hilly terrain.

To the south-west of the development site the closest surface water features are located just over 7km distant, being located where the rugged, incised topography that occurs closer to the Orange River valley is first encountered.

5.1 Implications for Development

The absence of any surface water features on the development site entails that no surface water impacts will result due to the proposed development. The closest surface water features are located within a sufficient distance from the site that to ensure that the likelihood of the development impacting these features is very limited. In addition these features are not downstream or downslope of the site, thus making it even less likely that these could be impacted by the proposed development.

Accordingly no legislative process for the authorisation of the proposed development in terms of Section 21 c) & i) of the National Water Act will be required.

In spite of the absence of surface water features on the site, stormwater and pollution controls must be implemented on the development site, in order to ensure that uncontrolled stormwater flows do not cause erosion of the underlying substrate.

6 Conclusion

This study has investigated the occurrence of surface water / freshwater features on the site of a proposed PV development. Due to a number of factors, primarily related to landform, terrain (topography) and underlying geology, there are no surface water features that occur on the site of the proposed development, or within its immediate vicinity. Accordingly the proposed development will not impact surface water features in any way and no legislative water use authorisation processes are required to be undertaken.

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Appendix 1 – Author's CV

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Curriculum Vitae

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Paul offers a varied set of skills and a wide set of experience in different disciplines. He performs the role of an environmental specialist in the disciplines of freshwater (wetland) assessment, visual impact assessment and avifaunal assessment, as well as EIA project management. As the GIS specialist for the Environmental Team he undertakes GIS-based spatial analysis and has developed a GIS-based screening tool for EIA Regulation Listing Notice 3 Activities. Paul also undertakes ECO environmental auditing.

Paul's extensive wetland assessment experience was gained during work undertaken for the Mondi wetlands project and ensuing work in the consulting field in South Africa over 15 years.

He worked in the UK for three years in regulatory and water resources assessment roles for both the Environment Agency in England and SEPA. During this period he gained excellent experience and skills relating to catchment management planning, hydro-ecological risk assessment, water resource regulations and water resources strategies.

Nationality
South African / Portuguese

Years of Experience
18 years

Years with Royal HaskoningDHV
8 years

Qualifications
1998 BA (Hons) Geography and Environmental Studies, University of Witwatersrand, Johannesburg, South Africa

Memberships
Wetland Society of South Africa

Professional experience at RHDHV (selected key projects)

Basic Assessment for the proposed Planning & Design for the Maintenance and/or Upgrade of the Patrol Roads and Fencing on the Borders between RSA, Swaziland & Mozambique – Phases 1& 2

> Start Date: 2017

> Client: National Department of Public Works

Position: BA Project Manager for Phase 1 and Freshwater (Wetland) Specialist for the Phase 1&2 Projects

- Assigned Tasks: Undertook the wetland component of the Freshwater Study for the project (Phases 1&2).
- Managed the Basic Assessment Process for the Phase 1 component (KZN-Mozambique border)
- Provided GIS analysis and mapping support for the Phases 1&2 BA and WULA Processes
- Undertook the Application for Amendment of the Phase 1 Environmental Authorisation (2020)

ESIA for the proposed NEO1 20MW Photovoltaic Power (PV) Generation Development Project in Mafeteng, Lesotho

> Start Date: 2018

> Client: One Power Consortium

Position: Freshwater (Wetland) Specialist

- Assigned Tasks: Undertaking the Freshwater Study for the ESIA
- Compilation of a Post-authorisation wetland rehabilitation plan and monitoring protocol
- Undertaking the Visual Impact Assessment for the ESIA.

EIA for the P166 Bypass Road in Mbombela

> Start Date: 2012

> Client: Endecon Ubuntu (SANRAL)

Position: EIA Project Manager and Specialist

- Assigned Tasks: Managed the EIA, including tasks such as overseeing the public participation process and compiling the EIA Report.
- As a specialist undertook the Visual and Surface Water Specialist Studies

EIA for the Underground Coal Gasification (UCG) Project at the Majuba Power Station, Mpumalanga

> Start Date: 2008

> Client: Eskom Holdings SOC Ltd

Position: Specialist

- Assigned Tasks: Undertook the detailed wetland impact and functional assessments.
- Updating of the visual impact assessment.

Environmental Impact Assessment (EIA) and Waste Management Licence for the Matimba Power Station Ash Disposal Facility, South Africa

> Start Date: 2012

> Client: Eskom Holdings SOC Ltd

Position: Specialist

- Assigned Tasks: Undertook the Visual Specialist Study in support of the EIA
- Undertook the Surface Water Specialist Study for the Water Use Licence.

Basic Assessment for the Proposed Ten New PV Solar Developments at the Bokpoort Farm near Groblershoop, Northern Cape

> Start Date: 2019

> Client: ACWA Power

Position: Specialist

- Undertook the surface water specialist study

EIA for the proposed 100MW Concentrated Solar Power Plant in Groblershoop, South Africa

> Start Date: 2014

> Client: Lereko Metier Capital Growth Fund Manager (Pty) Ltd

Position: Specialist

- Assigned Tasks: Undertook the visual impact assessment study
- Undertook the surface water specialist study

Royal HaskoningDHV

Proposed Forest Park Apartments Residential Development in La Lucia, eThekwini Municipality

> Start Date: 2019
> Client: Penguin Property Investments
Position: Specialist
- Assigned Tasks: Undertook the Freshwater Study (Wetland and Riparian Delineation)

Construction of the LongLake Logistics Park Development, Modderfontein, Johannesburg

> Start Date: 2019
> Client: Fortress Investments
Position: Environmental Control Officer (ECO)
- Assigned Tasks: Undertaking the ECO (environmental auditing) of the construction site for a period of 12 months.

Geometric Improvements to 11 Intersections in the City of Johannesburg

> Start Date: 2019
> Client: Johannesburg Roads Agency (JRA)
Position: Environmental Control Officer (ECO)
- Assigned Tasks: Compiled EMPrs for the Northern and Southern Contract Sites
- Undertook the ECO (environmental auditing) of the intersection upgrade sites.

Development of Precinct Plans for the Port Elizabeth and East London Airports

> Start Date: 2019
> Client: Airports Company South Africa (ACSA)
Position: Specialist
- Assigned Tasks: Undertaking the Surface Water and Terrestrial Ecology Component of the Precinct Planning

Development of Precinct Plans for the Ekurhuleni Metropolitan Municipality

> Start Date: 2017
> Client: Ekurhuleni Metropolitan Municipality
Position: Specialist
- Assigned Tasks: Undertook the Surface Water and Terrestrial Ecology Component of the Precinct Planning

Route Determination for Various K-Route Roads in Gauteng Province

> Start Date: 2017
> Client: Gauteng Department of Roads and Transport
Position: Freshwater Specialist
- Assigned Tasks: Undertaking the Surface Water Component of the Environmental Screening Studies of the various planned routes

Basic Assessment and Water Use Application for decommissioning and replacement of a section of the Firham-Platrand Power Line, Mpumalanga

> Start Date: 2017
> Client: Eskom Holdings SOC Ltd
Position: Specialist
- Assigned Tasks: Undertaking the Freshwater (wetland) study for the BA and WUA processes, including the compilation of a wetland rehab plan and risk assessment

Basic Assessment for the Development of a Battery Storage Site (Substation) near Mount Fletcher, Eastern Cape

> Start Date: 2018
> Client: Eskom Holdings Limited
Position: Freshwater Specialist
- Assigned Tasks: Undertook the Freshwater Study (wetland assessment) for the Project

Basic Assessment and Water Use Application for the new Lydenburg - Merensky 132kV Power Line, South Africa

> Start Date: 2013
> Client: Eskom Holdings SOC Ltd
Position: Specialist
- Assigned Tasks: Undertaking the Surface Water, Avifaunal and Visual Studies for the Basic Assessment

Basic Assessment for the Proposed Waterborne Sewer in Mayflower Village, South Africa

> Start Date: 2014
> Client: Mpumalanga Department of Rural Development
> Position: Specialist
- Assigned Tasks: Undertook the surface water (wetland delineation) specialist study for the Basic Assessment

Royal HaskoningDHV

Basic Environmental Impact Assessment for the Development of Mzinti Feedlot at Nkomazi Local Municipality, South Africa

> Start Date: 2014
> Client: Mpumalanga Department of Rural Development
Position: Specialist
- Assigned Tasks: Undertook the surface water (wetland delineation) specialist study for the Basic Assessment

Basic Assessment for the Eskom 132kV Power Line from Mbumbu Substation to the Proposed Tsakani Substation, Mpumalanga, South Africa

> Start Date: 2014
> Client: Eskom Holdings SOC Ltd
Position: Specialist
- Assigned Tasks: Undertook the visual and surface water specialist studies as part of the Basic Assessment.

Kwameyi-Teekloof Water Supply - Wetland Delineation Study, South Africa

> Start Date: 2014
> Client: Isambulluo Environmental Consultants (Sibgem Management and Consulting Engineering)
Position: Project Manager & Specialist
- Assigned Tasks: Undertook the wetland assessment and delineation study for a proposed bulk water supply project in the Harding area, KZN

Design, Construction & Rehabilitation Work at Rietspruit Dam, Ventersdorp, South Africa

> Start Date: 2014
> Client: Department of Water Affairs and Forestry
Position: Specialist
- Assigned Tasks: Undertook a wetland delineation assessment as part of an environmental screening study

Impendle Bulk Water Supply Investigation, KZN

> Start Date: 2011
> Client: uMgungundlovu District Municipality
> Project Value: R185,000,000.00
Position: Specialist
- Assigned Tasks: Undertook wetland assessments (Wetland Health and Functionality Assessments) in support of the Water Use Licence

75MW CSP project in Bokpoort, South Africa

> Start Date: 2013
> Client: ACWA Power Solafrica Bokpoort CSP Power Plant (Pty) Ltd
Position: Specialist
- Assigned Tasks: Undertook the Surface Water Study for a proposed water pipeline, in support of the BA

Gamma-Kappa 765kV Power Line EIA, South Africa

> Start Date: 2012
> Client: Nzumbulo Heritage Solutions
Position: Surface Water Specialist
- Assigned Tasks: Undertook the Surface Water Study.

Luiperdshoek Basic Assessment (BA) and Water Use Licence Application (WULA) for Eskom, South Africa

> Start Date: 2012
> Client: Eskom Holdings SOC Ltd
Position: Specialist
- Assigned Tasks: Undertook the Avifaunal study in support of the Basic Assessment

Basic Assessment (BA) and Environmental Management Programme Report (EMPR) Amendment for Black Mountain Mine, South Africa

> Start Date: 2012
> Client: Black Mountain Mining (Pty) Ltd
Position: Specialist
- Assigned Tasks: Visual Impact Assessment Specialist Input.

Royal HaskoningDHV

Basic Assessment (BA) for the proposed 23 km 132KV line from Kliphoek to Panbult, South Africa

> Start Date: 2012

> Client: Eskom Holdings SOC Ltd

Position: Specialist

- Assigned Tasks: Undertook the Wetland and Avifauna Specialist Studies

Ekangala Quarry Mining Application and S24G Rectification

> Start Date: 2012

> Client: City of Tshwane Metropolitan Municipality

Position: Specialist

- Assigned Tasks: Undertook the wetland delineation study and compiled the Wetland Rehabilitation Plan

Wetland Assessment Specialist Study for proposed Letaba NDP projects in Limpopo Province

> Start Date: 2012

> Client: Nzumbulo Heritage Solutions

- Assigned Tasks: Undertook the Surface Water Study.

Mooidraai - Smitskloof 132/22kV Environmental Impact Assessment, South Africa

> Start Date: 2012

> Client: Eskom Holdings SOC Ltd

Position: Specialist

- Assigned Tasks: Undertook the Avifaunal Study

EIA for the proposed Upgrade to the Mkuze Airport

> Start Date: 2016

> Client: Umhlosinga Development Agency (KZN Treasury)

Position: Visual Impact Specialist

- Assigned Tasks: Undertook the Visual Impact Assessment for the Project

Royal HaskoningDHV

With its headquarters in Amersfoort, The Netherlands, Royal HaskoningDHV is an independent, international project management, engineering and consultancy service provider. Ranking globally in the top 10 of independently owned, nonlisted companies and top 40 overall, the Company's 6,000 staff provide services across the world from more than 100 offices in over 35 countries.

Our connections

Innovation is a collaborative process, which is why Royal HaskoningDHV works in association with clients, project partners, universities, government agencies, NGOs and many other organisations to develop and introduce new ways of living and working to enhance society together, now and in the future.

Memberships

Royal HaskoningDHV is a member of the recognised engineering and environmental bodies in those countries where it has a permanent office base.

All Royal HaskoningDHV consultants, architects and engineers are members of their individual branch organisations in their various countries.

Integrity

Royal HaskoningDHV is the first and only engineering consultancy with ETHIC Intelligence anti-corruption certificate since 2010.

ETHIC Intelligence
CERTIFICATE ANTI-CORRUPTION COMPLIANCE SYSTEM

royalhaskoningdhv.com

Royal HaskoningDHV
Enhancing Society Together

Peer Review - SAS

Scientific Aquatic Services
Applying science to the real world

29 Arterial Road West, Oriel, Bedfordview, 2007
Tel 011 616 7893
Fax 011 615 6240
www.sasenvironmental.co.za
admin@sasenvgroup.co.za

Name: Stephen van Staden
Date: Tuesday, 05 May 2020
Ref: SAS 219245

Attention: Mr M. Roods

TECHNICAL REVIEW:

SURFACE WATER REPORT FOR THE INCLUSION OF LITHIUM-ION BATTERY ENERGY STORAGE SYSTEM (BESS) AS PART OF THE DEVELOPMENT OF 10 NEW PV PLANTS ON THE FARM BOKPOORT IN THE NORTHERN CAPE PROVINCE

Overview

Based on the review of this study, overall the study is considered objective, comprehensive, well written, concise, well presented and easy to follow. The impact statement is considered accurate. The recommendations presented in the report are appropriate, relevant/necessary, sensible and achievable. The proposed mitigatory measures are considered the best options available. This review provides some guidelines for additional information to consider for inclusion to ensure full compliance with the requirements for the specialist reports in support of the environmental assessment and authorisation process although none of the omitted information is substantive and would alter the outcomes of any interpretation of the article.

Scientific Aquatic Services was requested to undertake a specialist external review of the specialist freshwater assessment, by Mr. P. Da Cruz. The review was focused on the following Objectives:

1. Determining acceptability of the report in relation to the requirements of the National Environmental Management Act (NEMA) (Act no. 107 of 1998) minimum specialist report requirements, which are presented within Appendix 6 of the NEMA: EIA Regulations (2014, as amended).;
2. Assess the document/ report in terms of its fulfilment of the Terms of Reference stated;
3. Consider whether the report is entirely objective;
4. Determining whether the methodology clearly explained and acceptable;
5. Evaluate the appropriateness of the reference literature;
6. Evaluate the validity of the findings and consider whether the report is technically, scientifically and professionally credible (review data evidence);

7. Identify any information gaps, short comings and mitigation measures to address the short comings;
8. Indicate whether the article is well-written and easy to understand and to ensure that the work has adequately assessed the impacts of the proposed development;
9. Discuss the suitability of the mitigation measures and recommendations and Consider whether the recommendations presented are sensible and present the best options; and
10. To provide an independent opinion of the report, whether it is well written and easy to understand and ensure the work meets current requirements/best practice and normal standards of professional practice and competence have been met.

This external review is based on a desktop assessment of the documentation only and no field verification of the results was undertaken. The delineation of the wetlands, and to some degree the characterisation of the wetlands, is thus assumed to be accurate.

A CV presenting the expertise of the peer reviewer has been included as an appendix to this short Memo.

The table below highlights the findings of the review process considering the National Environmental Management Act (NEMA) (Act no. 107 of 1998) minimum specialist report requirements, which are presented within Appendix 6 of the NEMA: EIA Regulations (2014, as amended).

Table 1 Review of Document according to Appendix 6 of the NEMA: EIA Regulations (2014, as amended).

No.	Requirement	Status	Comments
a)	**Details of** -	NA	
(i)	The specialist who prepared the report.	✔	NA
(ii)	The expertise of that specialist to compile a specialist report including a curriculum vitae.	X	The Document Does not present the relevant expertise of the specialist
b)	A declaration that the specialist is independent.	✔	NA
c)	An indication of the scope of, and the purpose for which, the report was prepared.	✔	NA
cA)	An indication of the quality and age of base data used for the specialist report.	✔	NA
cB)	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change.	✔	Existing impacts have not been defined but given the context of the drainage of the area, the historical work undertaken and lack of sensitive watercourses in the area this is not considered a significant omission.
d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment.	X	The date and time of assessment has not been defined but given the context of the drainage of the area and lack of sensitive watercourses in the area this is not considered a significant omission.
e)	A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used.	X	A clear description of the method of assessment has not been defined but given the context of the drainage of the area and lack of sensitive watercourses in the area this is not considered a significant omission.
f)	Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives.	✔	NA
g)	An identification of any areas to be avoided, including buffers.	✔	No watercourses occur in the project area nor near thereto. No buffer map required.
h)	A map superimposing the activity including the associated structure and infrastructure on the environmental sensitivities of the site including areas	✔	NA

No.	Requirement	Status	Comments
	to be avoided, including buffers.		
i)	A description of any assumption made and any uncertainties or gaps in knowledge.	✔	NA
j)	A description the findings and potential implication\s of such findings on the impact of the proposed activity, including identified alternatives on the environment or activities.	✔	Since this is an amendment application, no need for alternatives is deemed necessary.
k)	Any mitigation measures for inclusion in the EMPr.	✔	Numerous relevant and necessary mitigation measures have been presented. Consideration should be given to indicate those to be included in the eEMPr.
l)	Any conditions for inclusion in the environmental authorisation.	✔	NA
m)	Any monitoring requirements for inclusion in the EMPr or environmental authorisation.	✔	No specific monitoring required considering the characteristics of the site.
n)	A reasoned opinion -	✔	NA
(i)	As to whether the proposed activity, activities or portions thereof should be authorised.	✔	NA
(iA)	Regarding the acceptability of the proposed activity or activities.	✔	NA
(ii)	If the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan.	✔	NA
o)	A description of any consultation process that was undertaken during the course of preparing the specialist report.	✔	No Record of interaction is given, however since these amendments to the proposed development are of limited significance, form a freshwater ecological risk point of view and since the impacts of the initial proposed development underwent stakeholder engagement this omission is not deemed significant
p)	A summary and copies of any comments received during any consultation process and where applicable all responses thereto.	✔	No Record of interaction is given, however since these amendments to the proposed development are of limited significance, form a freshwater ecological risk point of view and since the impacts of the initial proposed development underwent stakeholder engagement this omission is not deemed significant
q)	Any other information requested by the competent authority.	✔	No Record of interaction is given, however since these amendments to the proposed development are of limited significance, form a freshwater ecological risk point of view and since the impacts of the initial proposed development underwent stakeholder engagement the lack of clarity on the request for additional information requested is considered irrelevant.

The table below highlights the findings of the review process according to the additional TOR requirements for the reviewer as per the appointment of the reviewer.

Table 1 Review Outcomes of the specialist freshwater resource study prepared

ASSESSMENT CRITERION	COMMENTS
1. Assess the document/ report in terms of its fulfilment of the Terms of Reference set stated.	Assuming the terms of reference was to undertake an appropriate freshwater specialist assessment for the project as defined in the section defining the aims of the study the study fulfilled the terms of reference.
2. Consider whether the report is entirely objective.	The Freshwater study can be considered objective.
3. Determining whether the methodology clearly explained and acceptable.	The method of assessment, including site specific adaptations necessary were very well presented and adequate for the level of study required.
4. Evaluate the appropriateness of the reference literature.	The referenced material is appropriate, sufficient and relevant.
5. Evaluate the validity of the findings and consider whether the report is technically, scientifically and professionally credible (review data evidence).	1. The manner in which the freshwater assessment has been set up is technically scientifically and professionally credible and the information presented, including the mitigation measures can be considered reliable.
2. Identify any information gaps, short comings and mitigation measures to address the short comings.	2. No substantial information gaps have been identified 3. Some recommendations have been presented which would lead to a more complete final product although these have no substantive bearing on the risk posed to the regional watercourses nor the protection thereof.
4. Indicate whether the article is well-written and easy to understand and to ensure that the work has adequately assessed the impacts of the proposed development.	4.The freshwater specialist study is well written, concise and easy to read; and allows for easy assimilation by the reader. The way in which the freshwater specialist study is written will allow the EAP proponent and competent authority to take informed decisions.
5. Discuss the suitability of the mitigation measures and recommendations and Consider whether the recommendations presented are sensible and present the best options.	1. The recommendations presented are appropriate, relevant/necessary, sensible and achievable; and 2. The proposed mitigatory measures are considered the best options available;
3. To provide an independent opinion of the report, whether it is well written and easy to understand and ensure the work meets current requirements/best practice and normal standards of professional practice and competence have been met.	1. Based on the findings of this review it is the opinion of the independent reviewer that: 2. The manner in which the specialist report has been set up is technically scientifically and professionally credible and the results can be relied upon for decision making. 3. The specialist report is well written, concise and easy to read; and allows for easy assimilation by the reader; and 4. The mitigatory measures presented are appropriate, relevant/necessary, sensible and achievable.

SCIENTIFIC AQUATIC SERVICES (SAS) – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF STEPHEN VAN STADEN

PERSONAL DETAILS

Position in Company	Managing member, Ecologist with focus on Freshwater Ecology
Date of Birth	13 July 1979
Nationality	South African
Languages	English, Afrikaans
Joined SAS	2003 (year of establishment)
Other Business	Trustee of the Serenity Property Trust and emerald Management Trust

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Registered Professional Scientist at South African Council for Natural Scientific Professions (SACNASP);
Accredited River Health practitioner by the South African River Health Program (RHP);
Member of the South African Soil Surveyors Association (SASSO);
Member of the Gauteng Wetland Forum;
Member of International Association of Impact Assessors (IAIA) South Africa;
Member pf the Land Rehabilitation Society of South Africa (LaRSSA)

EDUCATION

Qualifications

MSc (Environmental Management) (University of Johannesburg)	2003
BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg)	2001
BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)	2000
Tools for wetland Assessment short course Rhodes University	2016

COUNTRIES OF WORK EXPERIENCE

South Africa – All Provinces
Southern Africa – Lesotho, Botswana, Mozambique, Zimbabwe Zambia
Eastern Africa – Tanzania Mauritius
West Africa – Ghana, Liberia, Angola, Guinea Bissau, Nigeria, Sierra Leone
Central Africa – Democratic Republic of the Congo

PROJECT EXPERIENCE (Over 2500 projects executed with varying degrees of involvement)

1 Mining Coal, Chrome, PGM's, Mineral Sands, Gold, Phosphate, river sand, clay, fluorspar
2 Linear developments
3 Energy Transmission, telecommunication, pipelines, roads
4 Minerals beneficiation
5 Renewable energy (wind and solar)
6 Commercial development
7 Residential development
8 Agriculture
9 Industrial/chemical

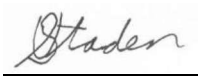
REFERENCES

- Terry Calmeyer (Former Chairperson of IAIA SA)
  Director: ILISO Consulting Environmental Management (Pty) Ltd
  Tel: +27 (0) 11 465 2163
  Email: terryc@icem.co.za

- Alex Pheiffer
  African Environmental Management Operations Manager
  SLR Consulting
  Tel: +27 11 467 0945
  Email: apheiffer@slrconsulting.com

- Marietjie Eksteen
  Managing Director: Jacana Environmental
  Tel: 015 291 4015

Yours faithfully



STEPHEN VAN STADEN

Appendix B5: Ecology

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

	(For official use only)
File Reference Number:	
NEAS Reference Number:	DEA/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

Ecological Basic Impact Assessment of the proposed 200 MW Solar Power Development that will be situated on the Remaining Extent of Farm Bokpoort 390 within the !Kheis Local Municipality (ZF Mgcawu District Municipality) of the Northern Cape Province (excluding birds and bats). Reference Number RHD – BPT – 2020/02

Kindly note the following:

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

Postal address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

Physical address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

SOUTH AFRICAN POLICE SERVICE
COMMUNITY SERVICE CENTRE
2020 -02- 19
WIERDABRUG SAPS

1. SPECIALIST INFORMATION

Specialist Company Name:	Bathusi Environmental Consulting cc			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	Level 4	Percentage Procurement recognition	100%
Specialist name:	Riaan A. J. Robbeson (Pr.Sci.Nat.)			
Specialist Qualifications:	M.Sc. (Plant Ecology)			
Professional affiliation/registration:	South African Council of Natural Scientific Professions (SACNASP) Botanical Scientist, Ecological Scientist (400005/03)			
Physical address:	Balboa Place 9, Eldoglen, Centurion, 0157			
Postal address:	PO Box 77448, Eldoglen, Centurion, 0171			
Postal code:	0171	Cell:		
Telephone:	012 658 5579	Fax:		
E-mail:	riaan@bathusi.org			

2. DECLARATION BY THE SPECIALIST

I, Riaan A. J. Robbeson, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

Bathusi Environmental Consulting cc

Name of Company:

2020 / 02 / 18

Date

SOUTH AFRICAN POLICE SERVICE
COMMUNITY SERVICE CENTRE
2020 -02- 19
WIERDABRUG SAPS
SUID-AFRIKAANSE POLISIEDIENS

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, Riaan A. J. Robbeson, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

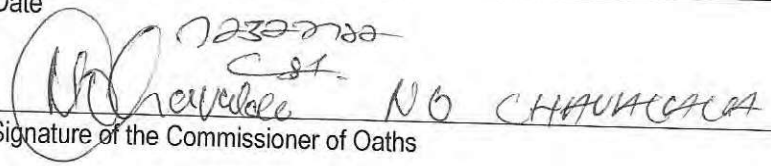
Signature of the Specialist

Bathusi Environmental Consulting cc

Name of Company

2020 / 02 / 18

Date



Signature of the Commissioner of Oaths

2020-02-19

Date

SOUTH AFRICAN POLICE SERVICE
COMMUNITY SERVICE CENTRE
2020 -02- 19
WIERDABRUG SAPS
SUID-AFRIKAANSE POLISIEDIENS

Reference:	RHD - BPT – 2020/02
Version:	2020.02.08.05
Date:	8th February 2020

Cell:	+27 (0)82 3765 933
email:	riaan@bathusi.org
Tel:	+27 (0)12 658 5579

ECOLOGICAL BASIC IMPACT ASSESSMENT OF THE PROPOSED 200 MW SOLAR POWER DEVELOPMENT

THAT WILL BE SITUATED ON:

THE REMAINING EXTENT OF FARM BOKPOORT 390,

WITHIN THE !KHEIS LOCAL MUNICIPALITY (ZF MGCAWU DISTRICT MUNICIPALITY)

OF THE NORTHERN CAPE PROVINCE

{excluding avifauna and bats}

drafted by

B E C

Bathusi Environmental Consulting

this report was this report was prepared for:

Royal HaskoningDHV

Enhancing Society Together

DOCUMENT NAVIGATION

LIST OF TABLES

LIST OF FIGURES

1 PROJECT DETAILS

Table 1: Project details	
Client	Royal HaskoningDHV, on behalf of ACWA Power Energy Africa (Pty) Ltd
Report name	Ecological Basic Impact Assessment of the proposed 200 MW Solar Power Development that will be situated on the Remaining Extent of Farm Bokpoort 390 within the !Kheis Local Municipality (ZF Mgcawu District Municipality) of the Northern Cape Province
BEC Reference Number	RHD – BPT – 2020/02
Report Version	2020.02.08.05
Compiled by	Riaan A. J. Robbeson (Pr.Sci.Nat.), Bathusi Environmental Consulting cc

2 REPORT REFERENCE & CITATION

When used as a reference, or included as an addendum, this report should be cited as:

Bathusi Environmental Consulting cc (2019). Ecological Basic Impact Assessment of the proposed 200 MW Solar Power Development that will be situated on the Remaining Extent of Farm Bokpoort 390 within the !Kheis Local Municipality (ZF Mgcawu District Municipality) of the Northern Cape Province (excluding birds and bats). Reference Number RHD – BPT – 2020/02, Version 2020.02.08.05.

3 SPECIALIST INVESTIGATOR[1]

The Natural Scientific Professions Act of 2003 aims to '*provide for the establishment of the South African Council of Natural Scientific Professions (SACNASP), and for the registration of professional, candidate and certified natural scientists; and to provide for matters connected therewith'*. Quoting the Natural Scientific Professions Act of 2003: '*Only a registered person may practice in a consulting capacity*' (20(1) – pg 14).

Table 2: Biodiversity specialists for this project	
Botanical Specialist:	**Riaan Robbeson (Pr.Sci.Nat.)**
Qualification:	M.Sc. (Botany), UP
Affiliation:	South African Council for Natural Scientific Professions
Fields of Expertise:	Botanical Scientist & Ecological Scientist
Registration Number:	*400005/03*

Riaan obtained his B.Sc. degree, with zoology and botany as major subjects in 1990. He committed to post-graduate studies in 1991; ultimately obtaining his M.Sc. degree in Plant Ecology at the University of Pretoria in 1998, while working as a research assistant and team member of the National Grassland Biome Project between 1994 and 1998. In 1999 Riaan established Bathusi Environmental Consulting cc with the objective of conducting ecological studies with a holistic approach and a strong emphasis of the inclusion of faunal disciplines. Towards this objective, the development of working relations with numerous other specialists was, and still remains, a major priority. Inter-disciplinary collaboration on numerous projects enabled Riaan to acquire a working knowledge of these disciplines, including invertebrates, mammals, herpetofauna and birds.

During his career that spans more than 20 years, Riaan has acquired extensive experience in the evaluation of the status and reaction of the natural environment to development, across the ecological spectrum of plants, animals and biophysical attributes of the receiving environment. He has compiled in excess of 400 biodiversity related reports since the start of his career. In addition to pure scientific investigations and ecological investigations (EIA related studies), he has also successfully developed and implemented several biodiversity monitoring programmes on mining areas. In addition to a comprehensive knowledge of the Grassland and Savanna Biomes, Riaan has also successfully contributed to several projects in the Succulent and Nama Karoo biomes.

[1] A CV for the specialist is presented in Section 26

4 PROJECT SYNOPSIS AND BACKGROUND INFORMATION

4.1 BACKGROUND

ACWA Power Energy Africa (Pty) Ltd (hereafter referred to as ACWA Power) applied for several Environmental Authorisations (EA) for the respective phases of the project in 2016. Subsequent to the completion of the CSP development (refer **Figure 1**), ACWA Power is applying to replace a previously authorised (separate) CSP (refer **Figure 2**) with 10 Photo Voltaic plants. Authorisation for 2 PV plants have already been obtained as part of a previous application process, but is subject to slight amendments. The development area is situated on the remaining extent of the Farm Bokpoort 390, which is situated 20 km north-west of the town of Groblershoop within the !Kheis Local Municipality in the ZF Mgcawu District Municipality, Northern Cape Province.

The proposed site is situated within one of South Africa's eight renewable energy development zones, and has therefore been identified as one of the most suitable areas in the country for renewable energy development, in terms of a number of environmental impact, economic and infrastructural factors.

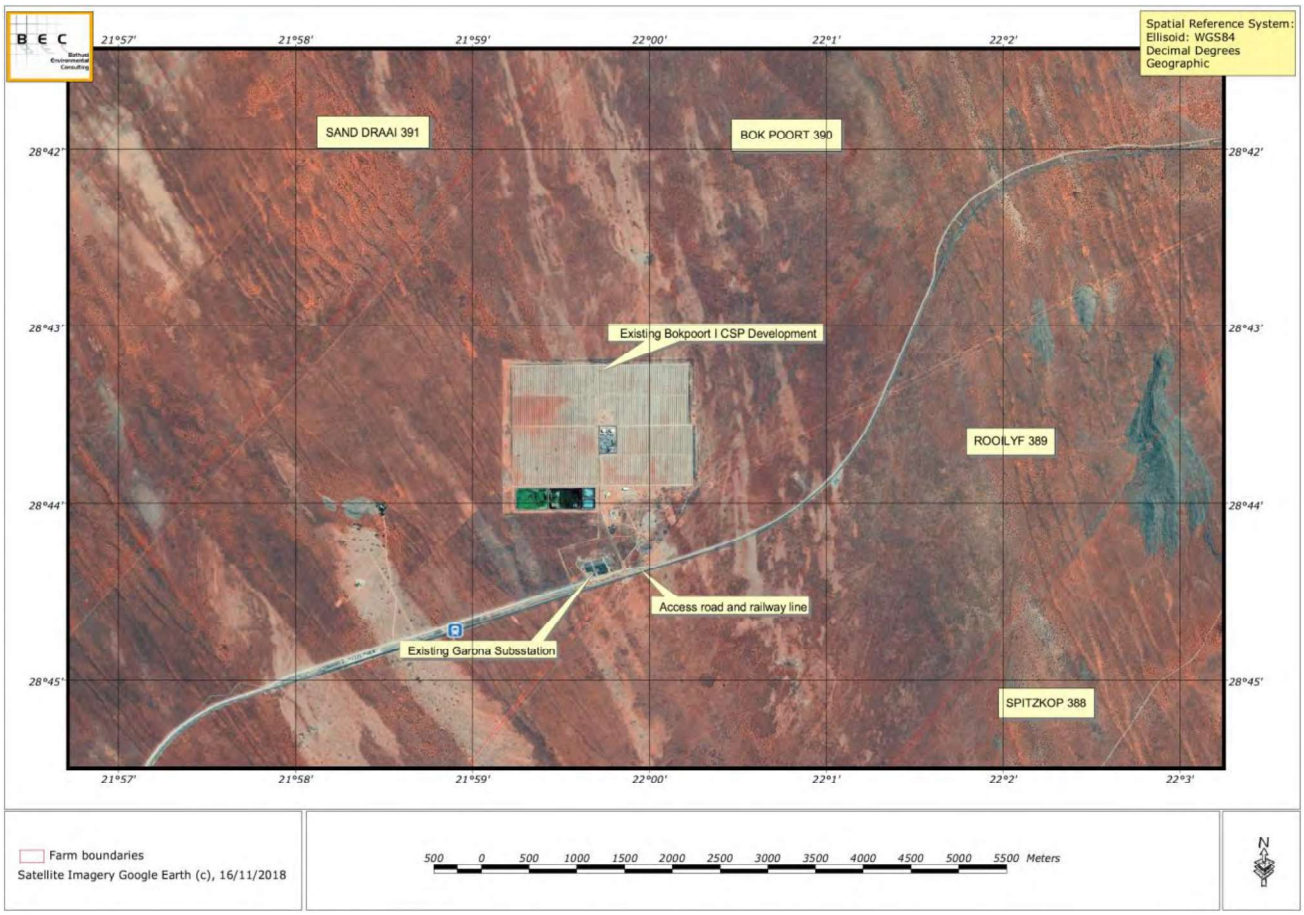


Figure 1: Satellite imagery that reflects the existing status of the site and immediate surrounds, indicating the operational Bokpoort I CSP Development

4.2 AMENDMENTS TO THE DEVELOPMENT

The proposed Bokpoort II development would originally have comprised a combination of Photovoltaic and Concentrated Solar Power Tower technology, including the respective phases Bokpoort II PV1, Bokpoort II PV2 and Bokpoort CSP (refer **Figure 2**). However, to allow for technical advancements and considerations, ACWA Power is now proposing an amendment to the project that will entail the construction of 8 PV plants within the CSP footprint with an output of 200 MW each, instead of the CSP tower. It should be noted that two of the proposed PV Plants (i.e. Ndebele and Xhosa, refer **Figure 3**) have already been authorised; however the authorisation for these two sites did not include the battery

energy storage systems for either of the sites as well as the capacity increase from 75 to 200 MW and will be undergoing a separate BA study (refer **Figure 3**). The total area that will be required for the development will be 1,500 ha.

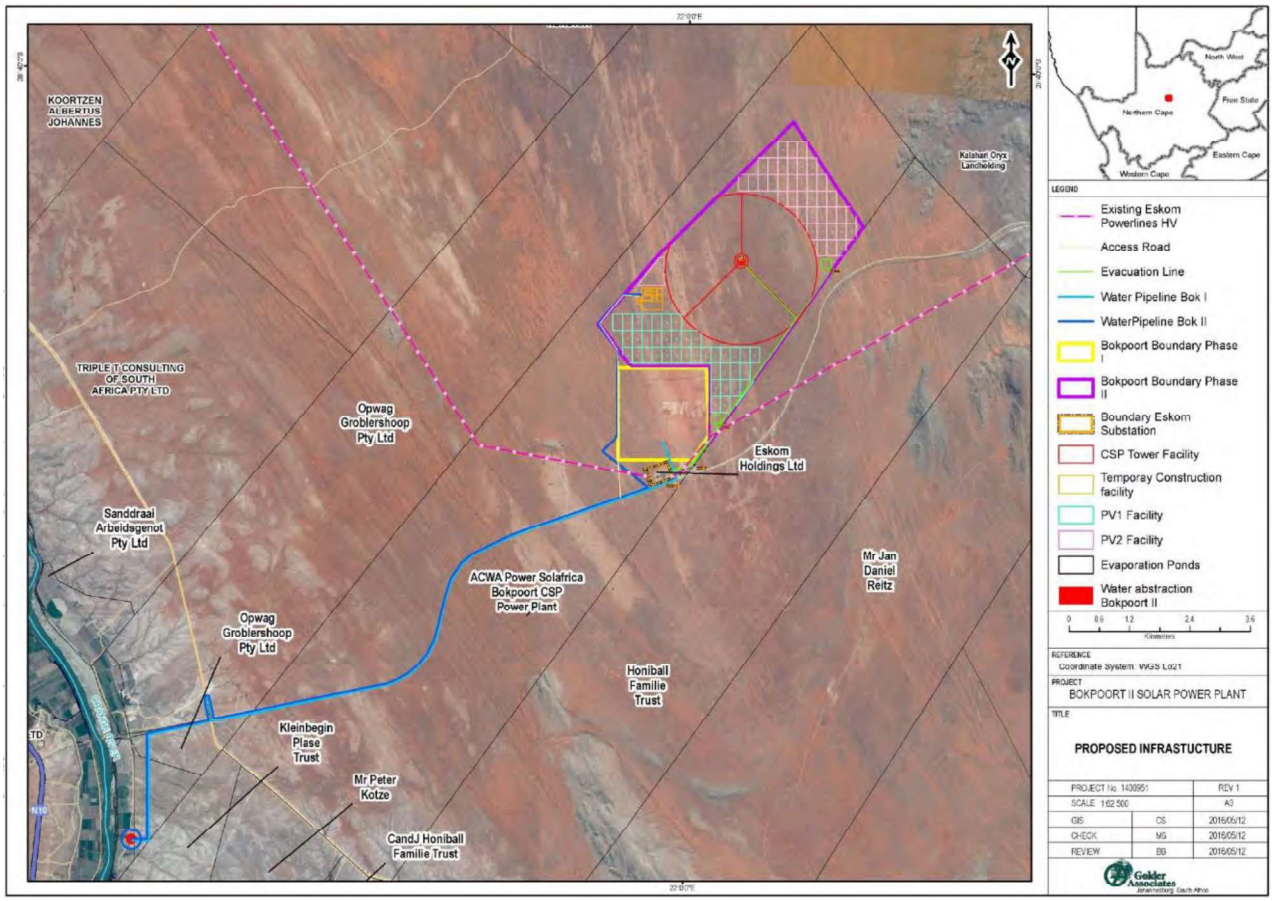


Figure 2: Initial layout of the Bokpoort II PV1, PV2 and CSP development footprint prior to amendment of the application
Image courtesy of Golder Associates

4.3 THE 200 MW PV SOLAR POWER PLANT DESIGN SPECIFICATIONS

The proposed individual 200 MW PV Solar Development will comprise of the following appurtenant infrastructure:

⇒ Solar PV modules that will comprise of monocrystalline PV modules that will be able to deliver up to 200 MW to the Eskom National Grid;

⇒ Inverters that convert direct current (DC) generated by the PV modules into alternating current (AC) to be exported to the electrical grid;

⇒ A transformer that raises the system AC low voltage (LV) to medium voltage (MV). The transformer converts the voltage of the electricity generated by the PV panels to the correct voltage for delivery to Eskom;

⇒ Transformer substation;

⇒ Inclusion of a Battery Energy Storage System (BESS) on all 10 PV sites, with an anticipated storage capacity of 150 MW and a footprint of 16 ha on each of the 10 sites; and

⇒ Instrumentation and control consisting of hardware and software for remote plant monitoring and operation of the facility.

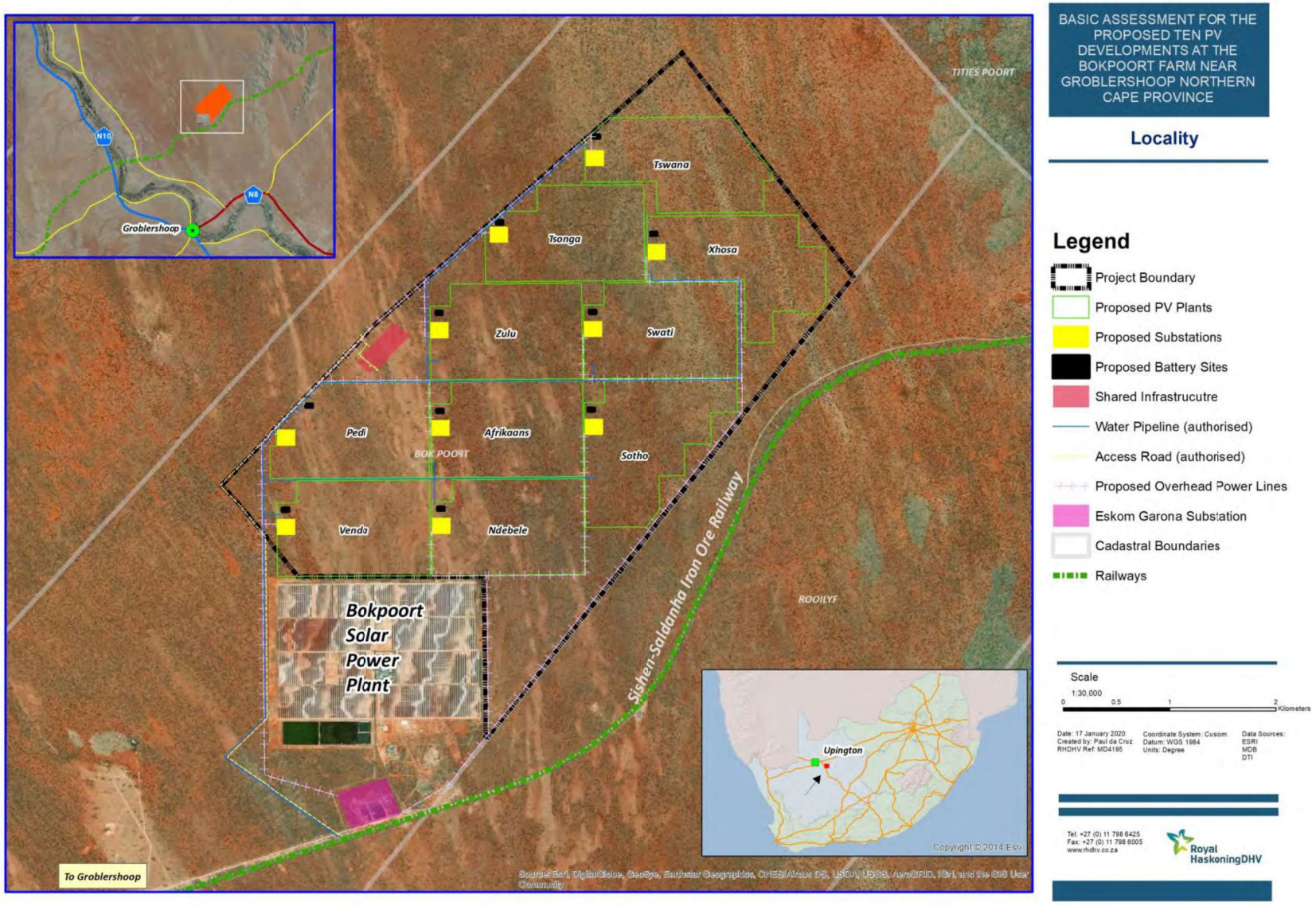


Figure 3: Proposed layout of the 200 MW PV Power Development, indicating the 10 PV footprints and appurtenant infrastructure

Appurtenant infrastructure:

⇒ Mounting structures for the solar panels;
⇒ Cabling between the structures, to be lain underground where practical;
⇒ A new 132 kV overhead power line which will connect the facility to the national grid via Eskom's existing Garona Substation;
⇒ The powerline will be approximately 5 km in length and will be located within a servitude spanning 15.5 meters on both sides. The powerline towers will be 35 meters high; and
⇒ Internal access roads (4 – 6 m wide) will be constructed where necessary, but existing roads will be used as far as possible, with appropriate fencing (approximately 3 m in height).
⇒ Shared infrastructure consisting of buildings, including a workshop area for maintenance, storage (i.e. fuel tanks, etc.), laydown area, parking, warehouse, and offices (previously approved).

Some physical dimensions:

⇒ The proposed total photovoltaic development will cover 1,500 ha in totality (development footprint);
⇒ The proposed solar facility will have the following infrastructure that are important in terms of height:
  - The PV panels disposition over support structures will be maximum 4.5 meters high; and
  - The substation will be 10 meters high;
⇒ The construction laydown area will be 5 ha; and
⇒ The proposed individual solar facility will generate 200 MW.

Battery Energy Storage System:

⇒ Battery power at the point of connection is 150 MW;
⇒ Footprint of each BESS site will be approximately 16 ha, i.e. 400 m x 400 m
⇒ The BESS will store approximately 4,500 m³ of hazardous substance; and
⇒ Water volumes during construction and operational phase will be approximately 22,000 m³.

4.4 THIS ASSESSMENT

Since the inception of the Bokpoort Solar Power Project, several assessments of the ecological and biodiversity receiving environment have been compiled. BEC has been appointed, on behalf of Royal HaskoningDHV, to condense the information from these reports to:

1 present an overview of the ecological receiving environment that will be affected by the proposed PV development, also with reference to recent changes in available information sources; and
2 establish the impact on the biodiversity and ecological receiving environment that are relevant to the amended project.

It should be noted that this report will address aspects of botany and fauna, which include mammals, invertebrates and herpetofauna, but specifically excludes bats (Chiroptera) and avian aspects; these disciplines will be addressed as 'stand-alone' reports by relevant specialists.

Previous reports that are relevant to this particular report and from which information is sourced, include the following documents:

1. Final EIA Report: Proposed 150 MW CSP Tower Development on the Remaining Extent of Farm Bokpoort 390, Northern Cape. Golder Associates. 2016. Report Number: 1400951-301174-15;
2. Final EIA Report: Proposed 75 MW Photovoltaic (PV1) Solar Power Development on the Remaining Extent of Farm Bokpoort 390, Northern Cape. Golder Associates. 2016. Report Number: 1400951-301175-16;

3. Final EIA Report: Proposed 75 MW Photovoltaic (PV2) Solar Power Development on the Remaining Extent of Farm Bokpoort 390, Northern Cape. Golder Associates. 2016. Report Number: 1400951-301175-17;
4. Biodiversity (excluding birds and bats) Baseline and Impact Assessment: Proposed 150 MW CSP Tower Development on the remaining Extent of Farm Bokpoort 390, Northern Cape. Golder Associates. 2016. Report Number: 1400951-300636-14;
5. Biodiversity (excluding birds and bats) Baseline and Impact Assessment: Proposed 75 MW Photovoltaic Solar Development (PV1) on the remaining Extent of Farm Bokpoort 390, Northern Cape. Golder Associates. 2016. Report Number: 1400951-302926-25;
6. Biodiversity (excluding birds and bats) Baseline and Impact Assessment: Proposed 75 MW Photovoltaic Solar Development (PV2) on the remaining Extent of Farm Bokpoort 390, Northern Cape. Golder Associates. 2016. Report Number 1400951-302927-265;
7. Biodiversity Impact Assessment for the proposed Concentrated Solar Thermal Power Plant (Siyanda District, Northern Cape Province) on a portion of the Farm Bokpoort 390. 2010. Bathusi Environmental Consulting cc. Project Reference: SSI-CSP-2011/04; and
8. Protected Species Survey for the proposed Concentrated Solar Thermal Power Plant on a portion of the Farm Bokpoort 390, Siyanda District, Northern Cape Province. 2010. Bathusi Environmental Consulting cc. Project Reference: SSI-HSP-2012/05 (v. 2011.09.08).

It should also be noted that these reports assessed geographical areas that (partially or entirely) include this particular development footprint, and presented professional opinions on anticipated impacts on the receiving environment caused by different processes and activities. While this particular report will extract relevant observations and opinions from these reports, the principal objective is to amend the impact statement to reflect the proposed changes to the nature of the project.

5 EXECUTIVE SUMMARY

5.1 BIOPHYSICAL ENVIRONMENT

The following biophysical attributes of the region are relevant to the biodiversity traits that is exhibited by the site and immediate surrounds:

⇒ The project site is located within a decidedly rural region; livestock agricultural practices, notably sheep farming, constitute the major land use of the region (Lanz, 2016).

⇒ Due to the climatic limitations of the area, the site is totally unsuitable for cultivated crops and the viable agricultural land use is limited to grazing only.

⇒ The geology of the area is generally characterised by metamorphosed sediments and volcanics intruded by granites; it is known as the Namaqualand Metamorphic Province with a aeolian surface which is characteristic of the group (the Gordonia Formation) (Council for Geoscience , 2016).

⇒ The proposed site is situated on red-brown windblown sands of the Gordonia Formation, Kalahari Group.

⇒ Dune ridges occur in the northern portions of the site and are characterised by NNW-SSE orientation.

⇒ Rainfall in the project area is low and generally occurs in late summer and early autumn between January and April with an average between 170 and 240 mm per annum.

⇒ Daily average summer temperatures range between 23°C and 37°C, and winter temperatures ranging between 4°C and 20°C.

⇒ Areas of conservation importance include the Witsand Nature Reserve, which is situated approximately 42 km to the east-northeast of the proposed site (unlikely be affected) and the Lower Gariep Alluvial Vegetation type, comprising the Gariep River, which is considered an Endangered ecosystem, largely due to transformation. While the proposed activity is likely to have a minor influence on this system, any irremediable losses that exacerbate existing impacts are regarded unacceptable.

5.2 KEY RESULTS OF THE ECOLOGICAL ASSESSMENT

The following key results were obtained from the ecological assessments:

⇒ The Study Area is located in a transitional area that includes elements of both the Savanna Biome and the Nama Karoo Biome, more specifically comprising the Kalahari Karroid Shrubland and Gordonia Duneveld ecological types.

⇒ No threatened ecological type is represented in the study area, or occur within the immediate region.

⇒ The SANBI database indicates the presence of only 91 species within the ¼ degree grids in which the study site is located, reflecting a paucity of comprehensive and accurate floristic knowledge of the region.

⇒ The species list that was compiled during the site investigation (BEC, 2010) is considered moderately comprehensive; a total of 112 plant species were identified during the site investigations.

⇒ In spite of a relative homogenous appearance and correlation to the regional types, with the exception of extensive mountain ranges to the north, a relative obvious physiognomic variability is noted in the study area with grassy and calcareous plains alternating with parallel dunes in the northern parts.

⇒ Results of a photo analysis and site investigations revealed the presence of three broad-scale habitat types within the development footprint, namely:

- Calcareous Low Shrub Plains;
- Open Shrub Duneveld; and
- Open Shrub Plains.

⇒ A total of 12 butterfly species were previously recorded in the study area; all species are common and ubiquitous species of the region. Nevertheless, the butterfly species richness is likely a factor of the largely untransformed and non-fragmented nature of the Study Area.

⇒ No amphibian species have been recorded within the study area. Taking cognisance of the absence of surface water within the proposed development footprint, it is regarded unlikely that any amphibian species will occur on site.

⇒ Eight reptile species were observed during the previous baseline studies (BEC, 2010).

⇒ A total of fifty-one (51) mammal species are considered potentially occupants of the study area. Fourteen (14) of these have been confirmed during field studies (RHV, 2014; BEC, 2010).

A review of the local and regional context of the Biodiversity Value that the site exhibit, indicated the following:

⇒ 3 plant species of conservation consideration (protected trees) have been recorded within the site; these trees occur at moderate densities and their removal is subject to permit authorisation (DEFF).

⇒ Several other plant taxa of local importance is known to occur in the site, their removal is subject to a detailed assessment and permit authorisation (NCDENC).

⇒ Several fauna species (excluding birds and bats) are regarded likely to persist within the site, or are known from surrounding localities. Anticipated impacts on these animals have been demonstrated as moderate and the mitigation approach should be dedicated to avoiding direct impacts on these animals.

⇒ Ecosystems of priority conservation concern that are relevant to this study, include the following:

- The rocky outcrop to the north of the study area associated with the Koranna-Langeberg Mountain Bushveld Vegetation type. Apart from exhibiting intact ecological integrity in terms of vegetation community composition, it is an important area in terms of its support of roosting bat species, and is classified as Natural Habitat by IFC; and
- The riparian habitat associated with the Orange River – this area supports the endangered vegetation type Lower Gariep Alluvial Vegetation, and has importance as an ecological corridor through the landscape. In addition, it is an important support area for foraging faunal species, including bats.

⇒ A review of the IFC criteria for natural and modified habitat indicated that only the Rocky outcrops and foothills of the Koranna Mountains to the north of the proposed site is categorised as natural habitat. As a result of persistent and intensive grazing and deterioration, the actual footprint of the development comprises largely modified habitat.

⇒ A review of IFC criteria for Critical Habitat indicated that only the Lower Gariep Alluvial Vegetation unit qualifies as Critical Habitat within the study area, under Criterion 4, and although it is not likely to be directly affected by this project, it is being considered in terms of Cumulative Impacts from the remainder of the project. No area within the development footprint is regarded Critical Habitat.

5.3 Impact Assessment and Significance

The proposed project is likely to result in significant, albeit localised impacts on the ecological receiving environment. Specific project impacts that could occur include:

⇒ Reduction in extent of habitats within the Project footprint;

⇒ Introduction and exacerbation of declared and invasive plant species;

⇒ Loss/disturbance of flora and fauna species of conservation concern;

⇒ Loss/disturbance of other fauna species;

⇒ Reduction in extent of Natural Habitat; and

⇒ Reduction in extent of Critical Habitat; and

⇒ Soil erosion and sediment loading of surface water runoff.

Summary table for the impact significance on the ecological receiving environment (before and after mitigation)		
Nature	*Before Mitigation*	*After Mitigation*
Construction Phase - Loss of extent of modified habitats within the Project footprint (direct impacts on natural vegetation)	50	35
Construction Phase - Introduction/spread of exotic invasive species	52	15
Construction Phase - Loss/disturbance of flora and fauna species of conservation concern	56	36
Construction Phase - Loss/disturbance of other fauna species	55	27
Construction Phase - Reduction in extent of natural habitats, systems of conservation concern	42	18
Construction Phase - Soil erosion and sediment loading of surface water runoff	40	12
Operational Phase - Spread of invasive plant species	52	15
Operational Phase - Direct loss (injury/mortality) of fauna species via roadkill	70	40
Operational Phase - Disturbance of faunal species of conservation concern – site lighting	60	20
Operational Phase - Disturbance of faunal species of conservation concern – barrier to movement	48	36
Decommissioning Phase - Spread of invasive plant species	65	21
Decommissioning Phase - Soil erosion and sediment loading of surface water runoff	39	14

Appurtenant infrastructure that is situated outside the indicated footprint include access roads, the water pipeline and the power line. Natural habitat that will be affected by the required linear infrastructure exhibit similar characteristics to habitat contained within the development footprint. Taking cognisance of the nature of impacts associated with construction and operation of linear infrastructure, the nature and extent of impacts associated with these infrastructures are similar in significance than the principal development footprint, albeit with limited physical extent. As the linear infrastructure is indelibly linked to the PV development, a similar impact significance is therefore estimated, and a similar mitigation approach is recommended.

5.4 CONCLUDING REMARKS

Based on results of the various ecological investigations, it is the considered opinion of the specialist that no specific objection is raised to the proposed PV solar facilities development. Although the proposed activity will result in unavoidable impacts on a local scale, these losses are within an acceptable range and significance level, notably with the application of a comprehensive mitigation approach.

This concluding statement is based on the following key considerations:

⇒ It is recognised that the proposed site is situated within one of South Africa's eight renewable energy development zones, and has therefore been identified as one of the most suitable areas in the country for renewable energy development, in terms of a number of environmental impacts, economic and infrastructural factors;

⇒ Biological and biophysical attributes that characterises the study site are regarded common and are abundantly represented in the wider region;

⇒ A number of protected tree species were recorded on the site and requires legislative authorisation prior to removal;

⇒ No threatened plant or animal species were recorded on the site during the site investigations;

⇒ It is regarded unlikely that any plant or animal species of a threatened status will persist on the site, other than possibly migratory or opportunistic purposes;

- ⇒ No habitat type that were recorded within the site are regarded restricted on a local or wider scale. The site also does not exhibit any significant biophysical feature of rarity or ecological importance;
- ⇒ The loss of natural habitat within the site is not expected to result in significant, or unacceptable, effects of provincial biodiversity conservation patterns or obligations. Similarly, the inclusion of this portion of remaining natural habitat as part of a conservation stewardship will not result in significant gains of conservation efforts on a local or regional scale. Particular reference is made to existing and planned developments in the immediate surrounds (cumulative impacts);
- ⇒ The loss of this portion of natural habitat is also not anticipated to cause severe or unacceptable changes to or disruptions of ecological processes or animal migratory patterns on a local or regional scale;
- ⇒ No impact was identified that would result in significant or unacceptable impacts on the ecological receiving environment;
- ⇒ The application of the recommended mitigation approach is expected to ameliorate anticipated impacts to an acceptable low level.

6 TERMS OF REFERENCE FOR THIS STUDY

The Terms of Reference for this study is perceived as follows:

⇒ Collate and appraise all relevant reports, studies, applications and EMPr documents pertaining to the project;
⇒ Provide a brief overview of the (regional and local scale) biophysical characteristics of the receiving environment;
⇒ Review the regional and local botanical and faunal diversity by means of a desk-top assessment of available historic reports;
⇒ Reflect on the potential presence of conservation important plant and animal species (excluding bats and birds) on the site (DAFF, IUCN, SANBI);
⇒ Establish sensitive biodiversity/ ecological receptors on the site that might be adversely affected by the proposed development;
⇒ Verify/ amend the Impact Statement presented as part of the principal ecological reports that is relevant to the project development footprint and the nature of the proposed development activity;
⇒ Provide a comprehensive mitigation approach and EMPr contributions that will ameliorate anticipated impacts on the ecological environment;
⇒ Provide monitoring recommendations that should be executed as part of the proposed project as part of the construction and operational phases;
⇒ Compile suitable maps, illustrating pertinent aspects; and
⇒ Present all results in a suitable report.

7 APPROACH AND METHODS STATEMENT

This section presents the methods used in this study report to identify any important biodiversity within the Study Area.

The study comprises a desktop appraisal of existing information that included previous baseline reports for the Study Area (DHV 2014a; DHV 2014b; BEC, 2010; Golder, 2016). A review of national and international law, policies, agreements and standards pertaining to biodiversity in South Africa and the Northern Cape Province formed part of the previous assessments, notably the Golder report. These included South African national law and policies, international conventions and treaties. The review of relevant legal documentation (refer Section 21) highlights relevant legislative and policy requirements that must be met in order to fulfil biodiversity protection objectives, and achieve the desired biodiversity outcomes.

7.1 STUDY AREA

The primary effect on biodiversity arising from the Project will be loss of habitat, implying a loss in extent of ecosystems due to site clearance and groundworks. These works are unlikely to be limited to the exact footprint of the CSP tower in isolation, therefore impacts are considered as occurring within the extent of the PV solar facilities boundary.

Previous baseline reports were compiled through a rigorous assessment of a geographical area that include this particular development footprint. Results, discussions and narrative illustrations are used to embellish the account of anticipated impacts on the ecological receiving environment, although some aspects that are not relevant to this development footprint was subsequently omitted.

7.2 DESKTOP REVIEW AND GAP ANALYSIS

A comprehensive review of available information on biodiversity features within the study area was conducted as part of the previous reports and relevant extractions thereof is presented in this report as it relates to changes in the development footprint and activities. The following tasks were undertaken:

⇒ Review of available literature and GIS information on baseline biodiversity conditions within the Study Area, and ecosystem services supplied. Reviewed data included biodiversity baseline data gathered within the Study Area for aspects of the Bokpoort I development (RHDV, 2014a; RHDV, 2014b; BEC, 2010) as well as the reports generated by Golder (2016). Other information that was reviewed included IUCN Red Data lists for the Northern Cape, South Africa and any available information on nearby protected areas; and

⇒ An assessment of available baseline data and information and in order to identify data gaps was conducted, highlighting the additional data required to be gathered as part of the baseline phase, in addition to those already identified in the previous studies.

Sensitive species and habitats and existing threats in the context of the biodiversity within the Study Area were identified through review of background biodiversity and environmental reports relating to the site, available published biodiversity literature, consideration of South Africa's national and Northern Cape's provincial biodiversity legislation and policies, Non-Governmental Organisation (NGO) opinion and guidance documentation, and through application of the expertise of the biodiversity impact assessment team.

7.3 BASELINE DATA GATHERING

No site visit was conducted for this particular report. However, field and site investigations were conducted for historic reports, which is regarded suitable to reflect ecological and biodiversity attributes of the receiving environment. These include:

⇒ Golder Associates conducted limited ground-truthing surveys between 21/09/2015 and 23/09/2015 to ascertain the accuracy of vegetation communities identified in 2010 and 2014, and assess the current extent of use of the Study Area by fauna;

⇒ RHDHV conducted detailed field surveys have been within the Study Area on several occasions (RHDV, 2014a; RHDV, 2014b);

⇒ BEC conducted the principal sampling of the ecological environment, providing species inventories, habitat delineations and descriptions (2010). These surveys also included an evaluation of the likelihood of presence of flora and fauna species of conservation concern within the Study Area that were preliminarily identified as potentially occurring, through habitat suitability assessment; and

7.4 ASSESSMENT OF BIODIVERSITY VALUE

7.4.1 ECOSYSTEMS OF CONSERVATION CONCERN

Habitats were preliminarily defined as being either natural or modified, based on the International Finance Corporation (IFC) approach to assigning value to biodiversity (IFC PS6, 2012). For this impact assessment, natural habitats were defined as those habitats where the key processes, composition, and structure were largely intact, and modified habitats were defined as areas that have been altered by human activity and may contain large portions of non-native plants and animals (e.g. agricultural landscapes).

The ecological integrity of ecosystems and habitats was estimated (based on criteria including species diversity, habitat heterogeneity, presence of habitat linkages, representativeness and resilience) and assigned a subjective class: pristine, near-pristine, slightly-degraded, moderately-degraded, and heavily-degraded.

7.4.2 *Species of Conservation Concern*

Although all species occurring within an area of interest form a component of the overall biodiversity and ecological value, it is neither practicable, nor necessary, to assess potential effects of a project on every species that might be affected. Therefore, species of concern are defined as plant or animal species that require special conservation consideration based on certain characteristics, or one which may be particularly sensitive to project effects.

The following selection criteria were used to identify terrestrial species of concern for the assessment:

a) Threatened and restricted-range/endemic species;
b) Statutory species (protected by national/international legislation, agreements, conventions);
c) 'Specially protected' and 'Protected' species listed on Schedules I and II of the Northern Cape Nature Conservation Act 2009;
d) Species of economic and/or cultural importance;
e) Convention on the International Trade in Endangered Species (CITES)-listed species;
f) Evolutionarily distinct species;
g) Species that play a critical ecological role, represent guilds of species, or capture effects to other species with similar habitat requirements and sensitivities;
h) Vulnerable (VU) species where there is uncertainty regarding the IUCN listing, and the actual status of the species may be critically endangered (CR) or endangered (EN); and
i) Species new or little-known to science.

Predicted effects of the Project on species of conservation concern that were confirmed to be present and/or whose likelihood of presence is 'probable' (or higher) are specifically addressed in the impact assessment.

7.4.3 *Natural, Modified and Critical Habitat*

Natural and modified habitats were mapped using the results of the previous vegetation assessments conducted for the Bokpoort development (BEC, 2010 & RDHV, 2014) to identify existing pressures on habitats within the study area, and assign natural and modified statuses. The determination of natural vs modified status is made based on the level of human-induced disturbance (e.g., presence of invasive species, level of pollution, extent of habitat fragmentation, viability of existing naturally-occurring species assemblages, resemblance of existing ecosystem functionality and structure to historical conditions, degree of other types of habitat degradation, etc.) and the biodiversity values of the site (e.g., threatened species and ecosystems, culturally important biodiversity features, ecological processes necessary for maintaining nearby critical habitats) (IFC 2012).

The potential presence of critical habitat as defined by IFC PS6 was screened through a comparison of the quantitative and qualitative IFC critical habitat determination criteria against the identified biodiversity values supported within the Study Area. This approach provides a high level determination of whether critical habitat exists, and if so, whether it could be impacted by the Project and its area of influence.

7.5 Impact Assessment

The significance of the identified impacts will be determined using the approach outlined below (terminology from the Department of Environmental Affairs and Tourism Guideline document on EIA Regulations, April 1998). This approach incorporates two aspects for assessing the potential significance of impacts, namely probability of occurrence and severity, which are further sub-divided as follows:

Occurrence		Severity	
Probability of occurrence	Duration of occurrence	Scale/ extent of impact	Magnitude (severity) of impact

To assess each of these factors for each impact, the following four ranking scales are used:

Probability	Duration
5 - Definite/ Don't know	5 - Permanent
4 - Highly probable	4 - Long-term
3 - Medium probability	3 - Medium term (8-15 years)
2 - Low probability	2 - Short term (0-7 years)
1 - Improbable	1 - Immediate
0 - None	
Scale	**Magnitude**
5 - International	10 - Very high/ Don't know
4 - National	8 - High
3 - Regional	6 - Moderate
2 - Local	4 - Low
1 - Site only	2 - Minor
0 - None	

Once these factors are ranked for each impact, the significance of the two aspects, occurrence and severity, is assessed using the following formula:

SP (significance points) = (magnitude + duration + scale) x probability

The maximum value is 100 significance points (SP). The impact significance will then be rated as follows:

SP	Significance	Description
SP >75	Indicates high environmental significance	An impact which could influence the decision about whether or not to proceed with the project regardless of any possible mitigation.
SP 30 – 75	Indicates moderate environmental significance	An impact or benefit which is sufficiently important to require management and which could have an influence on the decision unless it is mitigated.
SP <30	Indicates low environmental significance	Impacts with little real effect and which should not have an influence on or require modification of the project design.
+	Positive impact	An impact that constitutes an improvement over pre-project conditions.

8 LIMITATIONS AND ASSUMPTIONS

It is assumed that:

⇒ all observations, identifications, calculations and opinions, as presented in the principal ecological reports (refer Section 4.4) are accurate and correct.

⇒ all drawings, illustrations and documentation presented to the specialist are correct and accurate.

⇒ all information that were sourced for this project are accurate and comprehensive at the time of extraction.

⇒ no field surveys were conducted for this particular report and it comprises a desktop evaluation of existing information that included previous baseline reports for the larger study area. (DHV, 2014a; DHV, 2014b; BEC, 2010) and supplementary studies that were conducted to address identified gaps in the baseline dataset for the project.

9 SITE LOCATION

The project area is located on the north eastern portion of the Remaining Extent of the Farm Bokpoort 390, which is 20 km north-west of the town of Groblershoop within Ward 3 of the !Kheis Local Municipality in the ZF Mgcawu District Municipality, Northern Cape Province. The geographic location of the site is illustrated in **Figure 4**. The proposed PV solar facilities development footprint will comprise of approximately 1 500 ha. The project site is situated approximately 77 km south-east of Upington and the Orange River is located approximately 12 km south-west of the site. A general GPS locality for the middle of the site is S28.7095° and E22.0076°.

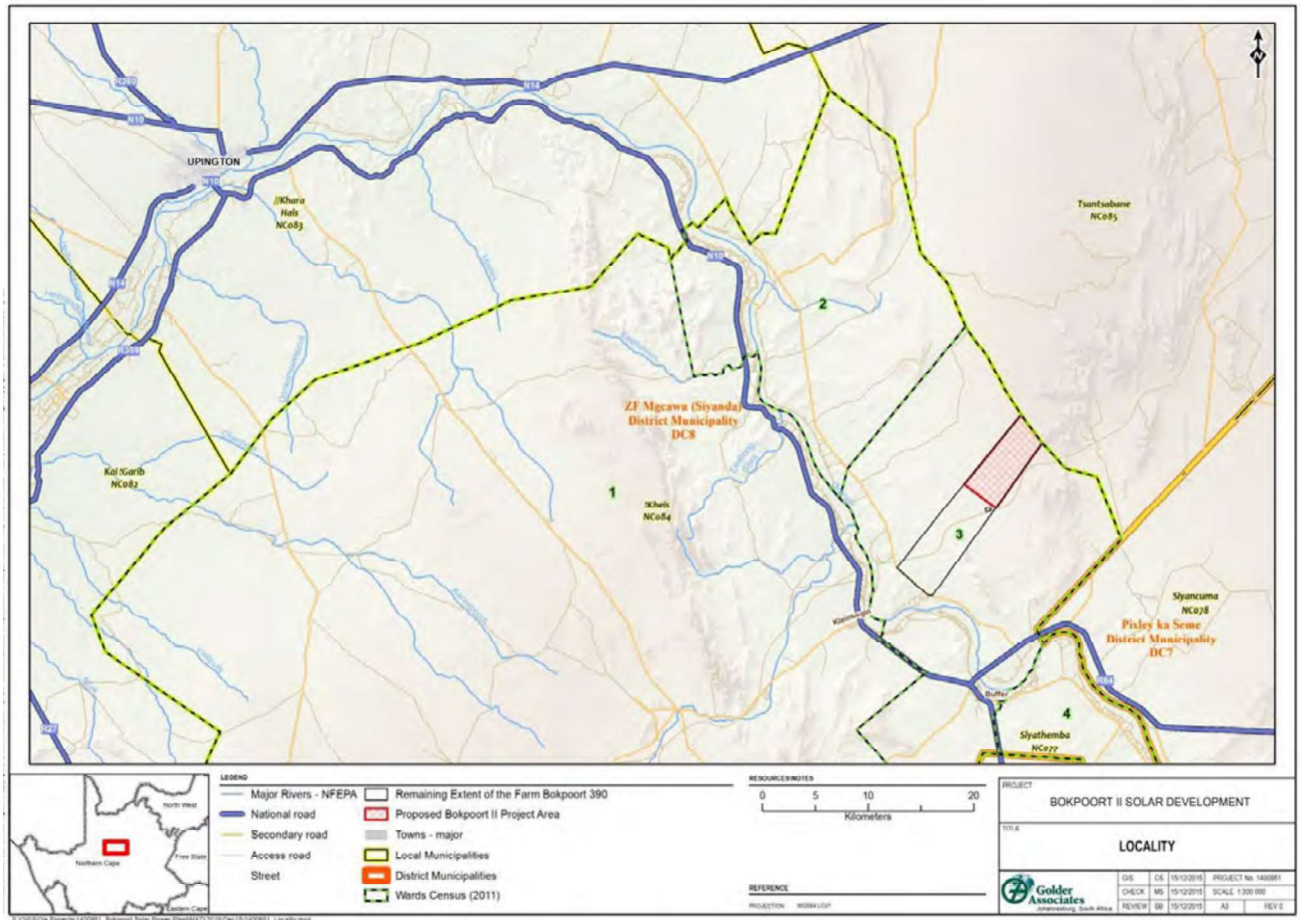


Figure 4: Geographic location of the proposed Bokpoort II: 200 MW PV Power Development

10 LAND COVER & LAND USE OF THE REGION

A brief appraisal of satellite imagery and available information sources indicated that the project site is located within a decidedly rural region. Livestock agricultural practices, notably sheep farming, constitute the most significant land use of the region (Lanz, 2016). The infrastructure on the site is limited to wind pumps, stock watering points and the fencing around the grazing camps. The neighbouring property to the south of the project site has also been developed for solar power generation (industrial) purposes (refer **Section 18.3**). A private game reserve is located to the north of the site. The land use assessment conducted by Lanz (2016) concluded that, due to the climatic limitations of the area, the site is totally unsuitable for cultivated crops and viable agricultural land use is limited to grazing only.

The BGIS information source indicates that the !Kheis Municipality comprises approximately 643 580 ha, of which 10 987 ha has been irreversibly transformed (c. 1.7 %), and 98.3 % remains untransformed. A brief review of available satellite imagery indicated that the immediate region, apart from the existing solar developments, is characterised by a largely untransformed landscape with minor fragmentation from roads and railway lines (refer **Figures 2 and 3**).

11 SOILS & GEOLOGY

The geology of the area is generally characterised by metamorphosed sediments and volcanics intruded by granites; it is known as the Namaqualand Metamorphic Province. The Groblershoop area is spatially situated on the Kalahari Group, which is divided into four formations:

1. At the base is a soft, clay gravel of fluvial origin (the Wessels Formation);
2. Upon this follows calcareous claystone with interlayered gravel (the Budin Formation);
3. This is in turn overlain by clay-containing, calcareous sandstone (the Eden Formation); and
4. Upon the Eden Formation follows the aeolian surface which is characteristic of the group (the Gordonia Formation) (Council for Geoscience , 2016).

The proposed site is situated on red-brown windblown sands of the Gordonia Formation, Kalahari Group. GCS (Pty) Ltd (2010) describes the general geology of the site as comprising mainly red-brown, coarse grained granite gneiss and quartz-muscovite schist, quartzite, quartz-amphibole schist and greenstone of the Groblershoop formation, Brulpan group. Calcrete is also present, especially in the south-eastern part of the area.

Dune ridges occur in the northern portions of the site and are characterised by NNW-SSE orientation. Calcrete outcrops occur approximately 2 km west and southwest from the Garona Substation. An anticlinal structure (upward pointing fold) causes the Groblersdal formation to be elevated in the area to the east of the site where it forms a range of hills known as the Skurweberge (Benedek, F; Roods, M;, February 2011).

12 CLIMATE

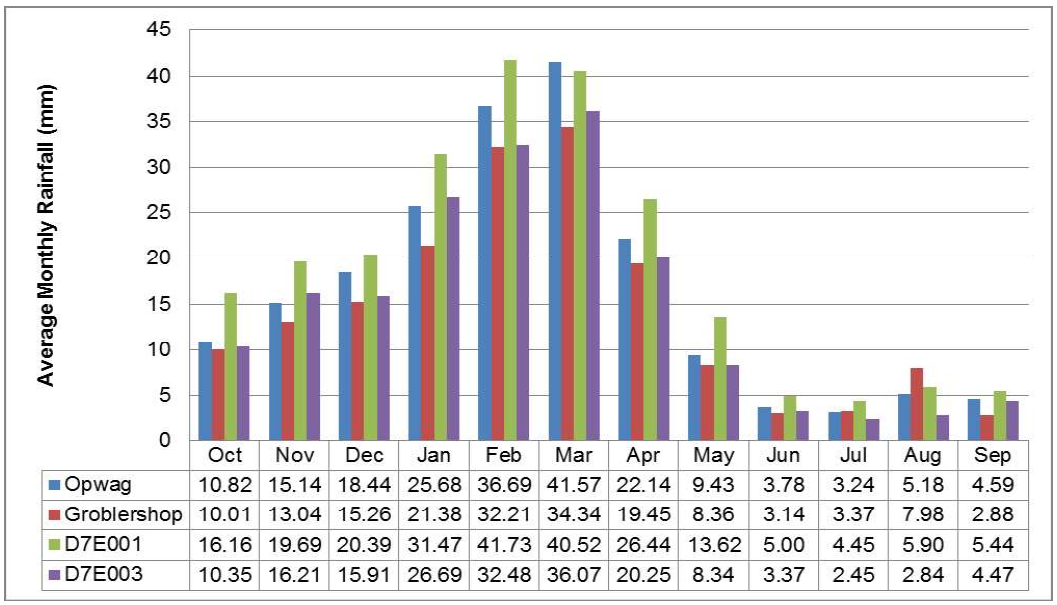
Climate data in the area around the project site was sourced from the Daily Rainfall Extraction Utility (Kunz, 2004) and the Department of Water and Sanitation's website (Department of Water Affairs, 2008).

Rainfall in the project area is scarce and generally occurs in late summer and early autumn between January and April (refer **Figure 5**[2]). Average rainfall in the area varies between 170 and 240 mm per annum (refer **Figure 6**), while evaporation is extremely high, due to the high temperatures, which can reach 35° to 40°C in summer.

Daily average summer temperatures range between 23°C and 37°C with winter temperatures ranging between 4°C and 20°C (refer **Figure 7**).

Based on the evaluation of the meteorological data, done by (Walton & Thompson, November 2010) for the Bokpoort I EIA, winds originate predominantly from the north-north-east (10 % of the time) and north (9 % of the time). Monitoring data recorded from January 2005 to December 2009 indicated that moderate to fast winds was generally recorded over the monitoring period. Calm winds, which are classified as wind speeds less than 0.5 $m.s^{-1}$ occur infrequently (4 % of the time). Moderate to fast winds originate predominantly from the westerly and northerly sectors during the day-time (06:00 – 18:00). During the night-time, winds originate from all sectors with a shift observed to the north-north-east and north-east between 00:00 – 06:00. Winds originate predominantly from the west during the summer months (December, January and February). During autumn (March, April and May), a shift is observed with winds originating predominantly from the north-north-east and north-east. A similar pattern is observed during the winter months (June, July and August). During spring (September, October and November), winds originate from all sectors, with the highest frequency recorded form the westerly sector (Walton & Thompson, November 2010).

[2] Graphs and figures courtesy of Golder Associates



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Opwag	10.82	15.14	18.44	25.68	36.69	41.57	22.14	9.43	3.78	3.24	5.18	4.59
Groblershop	10.01	13.04	15.26	21.38	32.21	34.34	19.45	8.36	3.14	3.37	7.98	2.88
D7E001	16.16	19.69	20.39	31.47	41.73	40.52	26.44	13.62	5.00	4.45	5.90	5.44
D7E003	10.35	16.21	15.91	26.69	32.48	36.07	20.25	8.34	3.37	2.45	2.84	4.47

Figure 5: Monthly rainfall distribution for rainfall stations in the surrounding areas

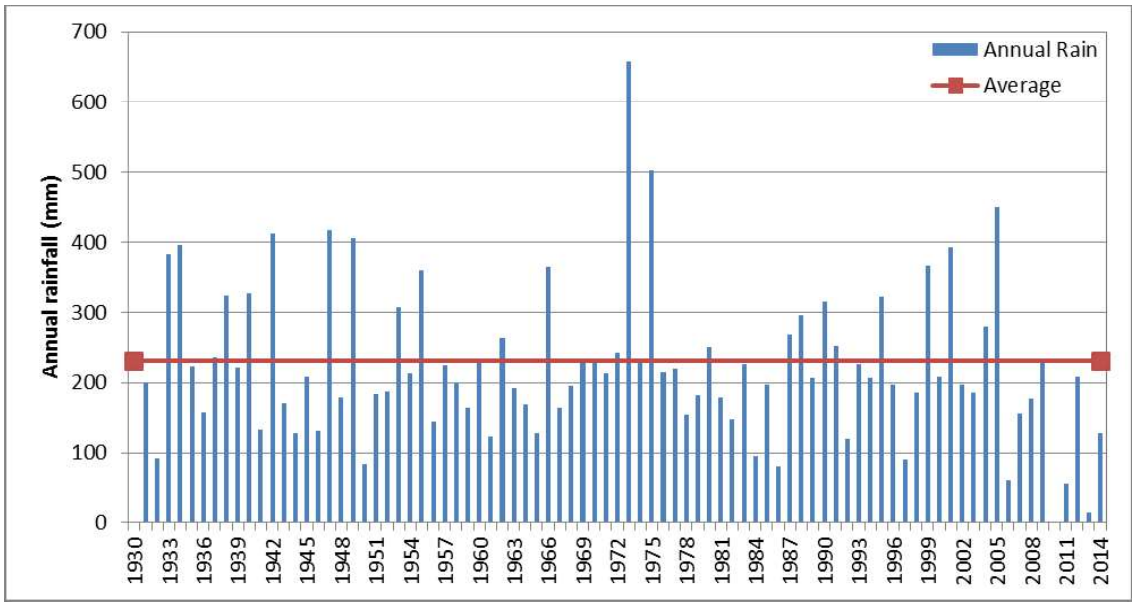


Figure 6: Annual rainfall recorded at the D7E001 (Boegoeberg Dam) station

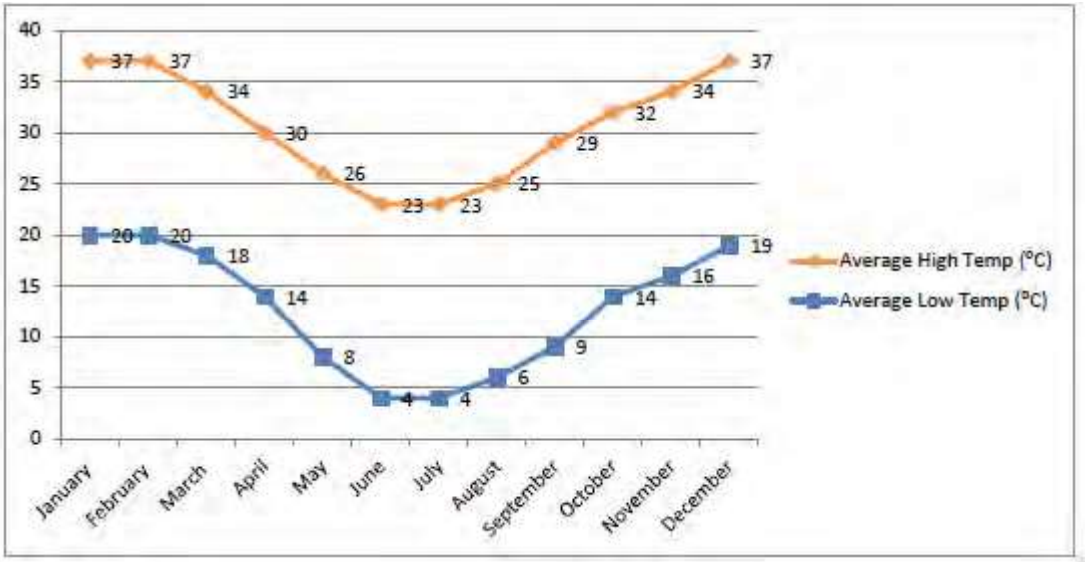


Figure 7: Average temperature (°C) graph for Groblershoop

13 TOPOGRAPHY, RELIEF AND SLOPES

The terrain on the Remaining Extent of the Farm Bokpoort 390 is relatively flat, sloping from 1,110 mamsl in the south-eastern corner to 950 mamsl in the south-western corner over a distance of 5,466 m and from 1,030 mamsl in the northern corner to 955 mamsl in the southern corner over a distance of 6,522 m. The larger surrounding area is characterised by elevated areas, ranging between 1,140 and 1,080 mamsl to the north of the site due to the Korannaberg foothills being located in the extreme northern section of the area. The land slopes gently from the study area towards the Orange River (elevation 860 mamsl) to the south-west over a distance of 12,522 m.

14 PROTECTED AREAS & THREATENED ECOSYSTEMS

The Witsand Nature Reserve is situated approximately 42 km to the east-northeast of the proposed site, but will unlikely be affected as it is adequately buffered by extensive regions of natural habitat as well as the isolated nature of the proposed development (refer **Figure 8**).

The Lower Gariep Alluvial Vegetation type, comprising the Gariep River, is considered an Endangered ecosystem, due to largely due to transformation. Approximately 50 % of the extent of this unit has been used for agricultural cultivation and alluvial diamond mining (Mucina & Rutherford, 2006). Only 6 % is statutorily conserved inside National Parks, and an additional 25 % is targeted for conservation. It is likely that transformation is ongoing in this vegetation unit, although the rate of decline is not known. It is classified as being of High Conservation Value (IFC PS6 GN35). While the proposed activity is likely to have a minor influence on this system, any irremediable losses that exacerbate existing impacts are regarded unacceptable.

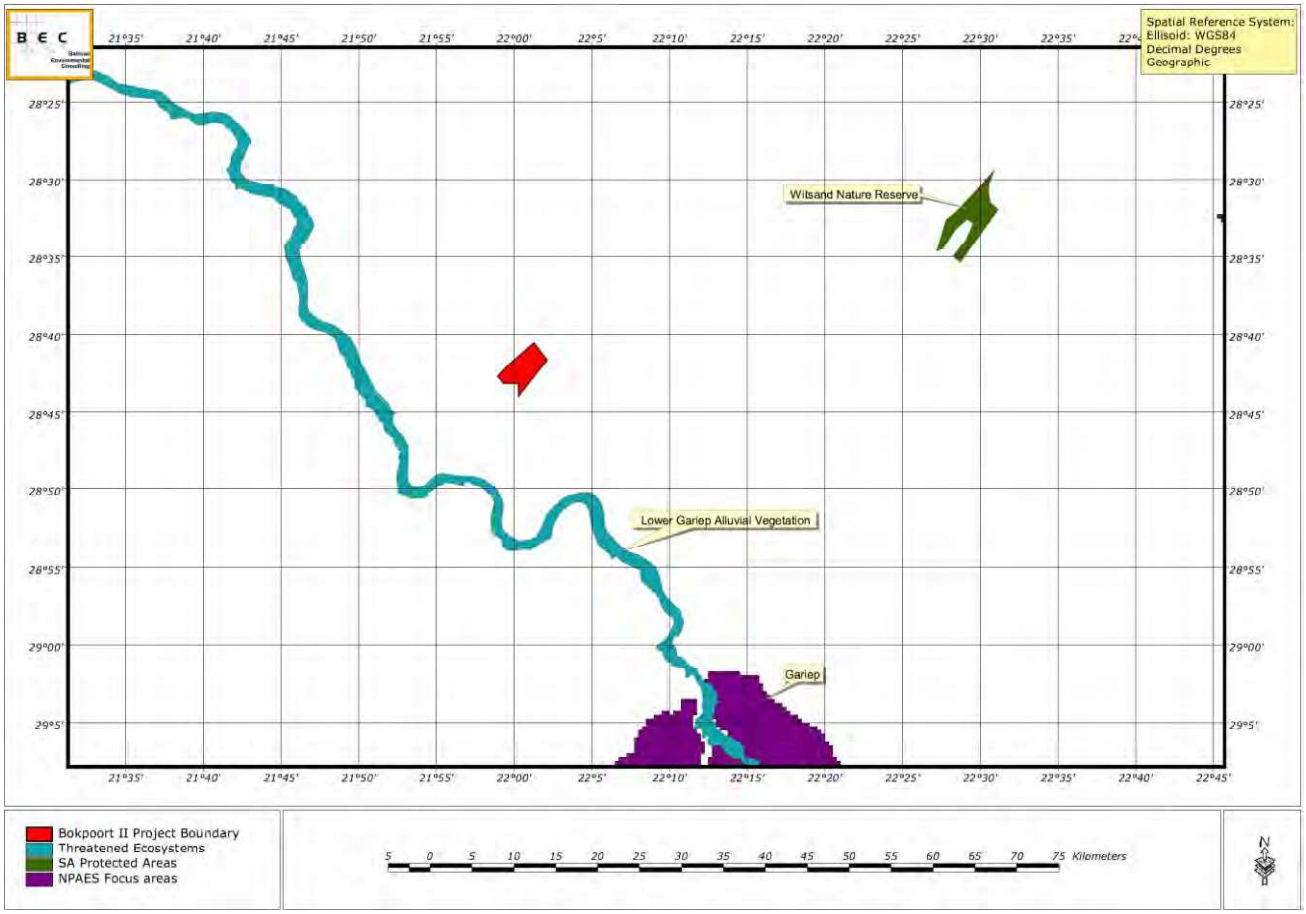


Figure 8: Protected and conservation important areas in relation to the study area

15 BASELINE BIODIVERSITY CHARACTERISATION

15.1 REGIONAL VEGETATION TYPES

The study area is located in a transitional area that includes elements of both the Savanna Biome and the Nama Karoo Biome. The Savanna Biome is defined by the co-dominance of grasses and trees (Sankaran et al. 2005), and is the largest biome in South Africa, covering approximately 35% of the country's land surface (Scholes & Walker 1993). Savannas are described as patch-mosaic landscapes, comprising patches of grassland, scattered trees or closed woodlands, the relative proportions of which vary both spatially and temporally (Bond, 2008). Primary determinants of Savanna composition, structure and functioning include fire, a distinct seasonal climate, substrate type (soils), as well as browsing and grazing by large herbivores (Scholes & Walker 1993; Bond 2008). The Nama Karoo Biome, the second largest biome in Southern Africa, is characterised by plains of dwarf shrubs and grasses, dotted with characteristic 'koppies' (rocky outcrops). It is essentially a grassy, dwarf shrubland; the ratio of grasses to shrubs increases progressively until the Nama Karoo merges with the Savanna Biome (Mucina & Rutherford, 2006).

Two principal natural vegetation types are predicted for the study area (Mucina & Rutherford 2018), namely Kalahari Karroid Shrubland comprising the largest extent of the site and Gordonia Duneveld that is situated in the northern part of the site (refer **Figure 9**).

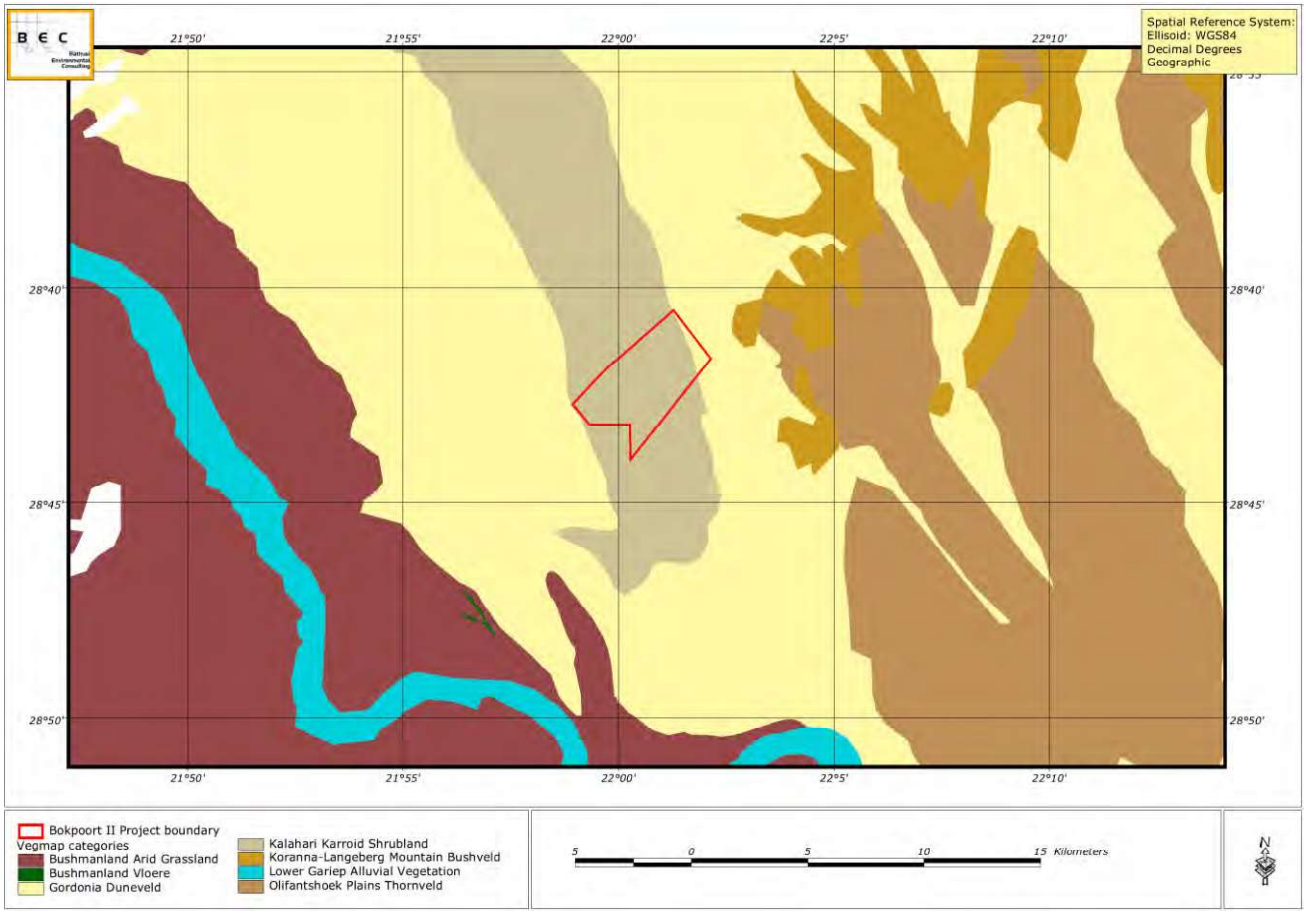


Figure 9: Regional ecological types in spatial relation to the study area

15.1.2 KALAHARI KARROID SHRUBLAND (NKB5)

This vegetation type occurs in the Northern Cape Province, forming part of the Nama Karoo Biome (Bushmanland Bioregion), typically forming belts alternating with belts of Gordonia Duneveld on plains northwest of Upington through Lutzputs and Noenieput to the Rietfontein/ Mier area in the north. Other patches occur around Kakamas and north of Groblershoop. The unit is also found in the neighbouring Namibia. The vegetation and landscape features are typically 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. The geographically important taxon (South-western distribution limit) graminoid *Dinebra retroflexa* is present in this unit.

The conservation status is Least Threatened. Very little of this unit is statutorily conserved in Augrabies Falls National Park. Although only a small area has been transformed many of the belts of this types were preferred routes for early roads, thus promoting the introduction of alien plants (about a quarter of the unit has scattered *Prosopis* species). Vegetation of this mapping unit shows transitional features between the Kalahari proper (Savanna Biome) and the northern Nama-Karoo.

Important taxa that characterise this unit include the following:

Small Trees *Acacia*[3] *mellifera* subsp*. detinens, Parkinsonia africana* and *Boscia foetida* subsp*. foetida.*

Tall shrub *Rhigozum trichotomum*

Epiphytic Semiparasitic shrub - *Tapinanthus oleifolius*

Low Shrubs *Hermannia spinosa, Limeum aethiopicum, Phaeoptilum spinosum, 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* and *Tephrosia dregeana.*

Herbs *Dicoma capensis, Chamaesyce inaequilatera, 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 argutecarinatum, Mollugo cerviana, Monsonia umbellata, Sesamum capense, Tribulus cristatus, T. pterophorus* and *T. terrestris.*

Succulent Herbs *Gisekia africana, G. pharnacioides* and *Trianthema parvifolia.*

Graminoids *Aristida adscensionis, Enneapogon desvauxii, E. scaber, Stipagrostis obtusa, Aristida congesta, Enneapogon cenchroides, Eragrostis annulata, E. homomalla, E. porosa, Schmidtia kalahariensis, Stipagrostis anomala, S. ciliata, S. hochstetteriana, S. uniplumis, Tragus berteronianus* and *T. racemosus.*

It is estimated that the proposed development footprint will comprises approximately 1,601 ha of this ecological type.

15.1.3 GORDONIA DUNEVELD N(SVKD1)

This unit is part of the Savanna Biome (Kalahari Duneveld Bioregion), with vegetation and landscape features comprising characteristically parallel dunes about 3-8 m above the plains. This unit also occurs as a number of loose dune cordons south of the Orange River near Keimoes and between Upington and Putsonderwater. It is typically an open shrubland with ridges of grassland dominated by *Stipagrostis amabilis* on the dune crests and *Acacia haematoxylon* on the dune slopes, also with *A. mellifera* on lower slopes and *Rhigozum trichotomum* in the interdune streets are typical of this unit.

[3] [3] Note: Recently this genus has controversially been split into several genera, with Africa's indigenous *Acacia* now being either *Senegalia* or *Vachellia*. The author, however, do not accept the validity of the new nomenclature and therefore maintains the name *Acacia* in its broad sense.

The conservation status of this unit is regarded Least Threatened with only 14 % statutorily conserved in the Kgalagadi Transfrontier Park. Very little of the area is transformed and erosion is very low.

Biogeographically Important Taxa (Kalahari Endemics) include the tall shrub *Acacia haematoxylon*, the graminoids *Stipagrostis amabilis, Anthephora argentea, Megaloprotrachne albescens* and the herbs *Helichrysum arenicola, Kohautia ramosissima* and *Neuradopsis austro-africana*.

Important taxa include the following:

Small Tree *Acacia mellifera* subsp. *detinens*

Tall Shrubs *Grewia flava* and *Rhigozum trichotomum.*

Low Shrubs *Aptosimum albomarginatum, Monechma incanum* and *Requienia sphaerosperma.*

Succulent Shrubs *Lycium bosciifolium, L. pumilum* and *Talinum caffrum.*

Graminoids *Schmidtia kalahariensis, Brachiaria glomerata, Bulbostylis hispidula, Centropodia glauca, Eragrostis lehmanniana, Stipagrostis ciliata, S. obtusa* and *S. uniplumis.*

Herbs *Hermbstaedtia fleckii, Acanthosicyos naudinianus, Hermannia tomentosa, Limeum arenicolum, L. argute-carinatum, Oxygonum dregeanum* subsp. *canescens* var. *canescens, Sericorema remotiflora, Sesamum triphyllum* and *Tribulus zeyheri.*

It is estimated that the proposed development footprint will comprises approximately 91 ha of this ecological type.

15.2 REGIONAL FLORISTIC DIVERSITY (SANBI, 2010)

The Northern Cape Province is characterised by five biomes. **Table 3** presents the area coverage and proportion of each biome within the Northern Cape Province.

Table 3: Extent of biomes within the Northern Cape Province

Biome	*Area*	*Percentage*
Fynbos	663,527 ha	1.83 %
Grassland	123,837 ha	0.34 %
Nama Karoo	19,593,363 ha	54.05 %
Savanna	10,686,003 ha	29.48 %
Succulent Karoo	5,182,370 ha	14.30 %

The proposed site is mainly located within the Nama Karoo Biome, the second largest biome in southern Africa. It is characterised by plains of dwarf shrubs and grasses, dotted with characteristic koppies. It is essentially a grassy, dwarf shrubland; the ration of grasses to shrubs increase progressively, until the Nama Karoo merges with the Grassland Biome. The species richness of this region is not particularly rich; only 2,147 species are known within this unit. An estimated 386 (18 %) species are endemic and 67 are threatened.

The Savanna Biome, represented in a small north-eastern portion of the site, is known to support more than 5,700 plant species, exceed only by the Fynbos Ecoregion in species richness. The study site is located within the Kalahari variation of the Savanna Biome, which although referred to as a desert, is not a true desert as it does not approximate the extreme aridity of a true desert. This area is densely covered by grasses, shrubs and trees.

The SANBI database indicates the known presence of approximately 5,315 plant species within Northern Cape Province, with only 91 species within the ¼ degree grids in which the study site is located (2821DB, DD, 2822CA). This low diversity reflects a paucity of floristic knowledge of the region. The species diversity of the immediate region comprises a diversity

of growth forms, and is typically dominated by herbs, dwarf shrubs and grasses. Trees and tall shrubs comprise a relative low part of the total, reflecting on the open savanna/ shrubland physiognomy of the region.

15.3 VEGETATION OF THE STUDY AREA

15.3.1 ALPHA DIVERSITY OF THE STUDY AREA

The species list that was compiled during the site investigation (BEC, 2010) is considered moderately comprehensive. A total of 112 plant species were identified during the site investigations (refer **Appendix 1**). The regional setting dictates the physiognomic dominance of the herbaceous component (refer **Table 4**) with 47 forb species (41.9 %) and 24 grass species (21.4 %). Trees and shrubs occur extensively throughout most of the study area (26 species 28.6 %) and apart from *Acacia erioloba* individuals are not particularly physically significant.

Table 4: Growth forms for the study area

Growth Form	*Number*	*Percentage*
Climber	4	3.57%
Forb	47	41.96%
Geophyte	2	1.79%
Grass	24	21.43%
Parasite	1	0.89%
Sedge	1	0.89%
Shrub	20	17.86%
Succulent	7	6.25%
Tree	6	5.36%
Total	**112**	

Taking the setting of the study area into consideration, the species composition of untransformed vegetation types is regarded representative of the regional vegetation. A total of 35 plant families are represented in the study area, dominated by Poaceae (grass family, 24 species, 21.4 %), Fabaceae (16 species, 14.3 %) and Asteraceae (daisy family, 12 species, 10.7 %).

15.3.2 DECLARED INVASIVE SPECIES AND COMMON WEEDS

Table 5 denotes a list of declared alien and invasive species and common weeds that were recorded on the study site during the 2010 site investigation.

Table 5: List of common weeds and declared alien and invasive plant species within the study area

Species Name	Status/ Uses	Common Name
Acacia mellifera	Declared indicator of encroachment, medicinal uses, poison source	Black Thorn (e), Swarthaak (a)
Berkheya species	Weed	--
Flaveria bidentis (L.) Kuntze	Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2016)	Smelter's bush, Smelterbossie (a)
Gomphocarpus fruticosus (L.) Aiton f.	Medicinal uses, common weed	Milkweed (e), Melkbos (a)
Prosopis glandulosa	Declared Invader - Category 1B in EC, FS, NE, WC. Category 3 in NC (NEM:BA, 2004. AIP, 2014)	Honey Mesquite (e), Duitswesdoring (a)
Rhigozum trichotomum	Declared indicator of encroachment	Three Thorn (e), Driedoring (a)

15.3.3 PLANTS WITH TRADITIONAL MEDICINAL USES

Table 6 denotes plant species with traditional medicinal and traditional uses that were recorded within the study site.

Table 6: List of traditional and medicinal uses within the study area

Species Name	*Status/ Uses*	*Common Name*
Acacia erioloba	Declining Status, Protected Tree (National Forest Act, 1998), edible parts, medicinal uses, firewood	Camel Thorn (e), Kameeldoring (a)
Acacia mellifera	Declared indicator of encroachment, medicinal uses, poison source	Black Thorn (e), Swarthaak (a)
Adenium oleifolium	Poisonous parts	Sand Quick (e)
Aptosimum procumbens	Medicinal uses (sheep)	
Boscia albitrunca (Burch.) Gilg & Gilg-Ben.	Protected Tree (National Forest Act, 1998), important fodder, traditional uses, traditional medicinal uses	Sheperd's Tree (e), Witgat (a), Matoppie (a), Mohlopi (ns)
Cadaba aphylla (Thunb.) Wild	Medicinal properties, potentially poisonous	Desert Spray (e), Bobbejaanarm (a)
Ceratotheca triloba (Bernh.) Hook.f.	Medicinal properties	Wild Foxglove (e), Vingerhoedblom (a)
Croton gratissimus	Medicinal uses, larval food for *Charaxes candiope candiope*	Lavender fever-berry (e), Laventelkoorsbessie (a)
Dicoma capensis	Medicinal uses	Koorsbossie (a)
Gomphocarpus fruticosus (L.) Aiton f.	Medicinal uses, common weed	Milkweed (e), Melkbos (a)
Grewia flava DC.	Edible parts, weaving, traditional uses, declared indicator of encroachment	Velvet Raisin (e), Fluweelrosyntjiebos (a)
Kleinia longiflora DC.	Traditional uses	Sjambokbos (a)
Momordica balsamina L.	Edible parts, medicinal uses	Balsam Pear (e), Laloentjie (a), Balsam Peer (a)
Monechma genistifolium subsp. *australe*	Medicinal uses	Medicinal uses, traditional uses
Pergularia daemia	Medicinal uses	Bobbejaankambro (a), Kgaba
Plinthus sericeus	None	--
Senna italica	Medicinal uses	Wild senna (e), Elandsertjie (a)
Solanum supinum Dunal	Medicinal uses	
Tribulus terrestris L.	Medicinal uses	Common Dubbeltjie (e), Gewone Dubbeltjie (a)
Tribulus zeyheri	Medicinal uses, grazed but potentially poisonous	Devil-thorn Weed (e), Dubbeltjiedoring (a)
Ziziphus mucronata Willd. subsp. *mucronata*	Edible parts, traditional medicinal uses, traditional uses	Buffalo-thorn (e), Blinkblaar-wag-'n-bietjie (a)

15.4 BROAD-SCALE HABITAT TYPES

In spite of a relative homogenous appearance and high correlation to the regional types, with the exception of extensive mountain ranges to the north, a relative obvious physiognomic variability is noted in the study area with plains alternating with parallel dunes in the northern parts. It is highly likely that various smaller phytosociological differences are present within each of the identified habitat types, but for the purpose of this assessment, the observed ecological units are considered similar in major phytosociological, physiognomic and biophysical attributes. Many plant species occur across all of the habitat types, but many of the differences between units are ascribed purely on the basis of terrain morphology, soil characteristics or changes in the dominance and structure of the plant species. Surface water and rainfall in this part of the Kalahari is scarce and, together with substrate, is a major driving force of vegetation development. Results of the photo analysis and site investigations (BEC, 2010) revealed the presence of the following habitat types within the development footprint (refer Figure 10):

⇒ Calcareous Low Shrub Plains;

⇒ Open Shrub Duneveld;

⇒ Open Shrub Plains;

The extent and coverage of habitat types within the study area is presented in Table 7.

Table 7: Extent of habitat types within the study area

Habitat Type	*Extent (ha)*	*Percentage*
Calcareous Low Shrub Plains	494.8 ha	34.2 %
Open Shrub Duneveld	288.0 ha	19.9 %
Open Shrub Plains	664.6 ha	45.9 %

15.4.1 CALCAREOUS LOW SHRUB PLAINS

The topography of these areas are characterised by relative flat or slightly undulating plains where the substrate comprises whitish calcareous and compact sandy soils (grey to brown, not red). The vegetation is characterised by low shrubs and grasses; tall shrubs and trees are generally absent from this unit, or occur at extremely low intervals. Prominent species (refer Table 8) include the grasses *Enneapogon desvauxii, Eragrostis obtusa, Eragrostis truncata, Fingerhuthia africana, Stipagrostis ciliata*, the shrub *Salsola etoshensis* and the forbs *Pentzia calcarea, Eriocephalus spinescens, Monechma genistifolium* subsp. *australe, Geigeria* species. The shrubs *Rhigozum trichotomum* and *Lycium horridum* were observed in this unit.

The status of these areas appears to be relative degraded due to grazing pressure from sheep and other livestock; a moderate ecological integrity status is therefore ascribed.

Table 8: Plant taxa recorded within the Calcareous Low Shrub Plains unit

Species Name	*Growth Form*	*Family*
Acacia erioloba	Tree	Fabaceae
Acacia haematoxylon	Tree	Fabaceae
Acacia mellifera	Shrub	Fabaceae
Anthephora pubescens	Grass	Poaceae
Aptosimum procumbens	Forb	Scrophulariaceae
Aristida congesta subsp. *congesta*	Grass	Poaceae
Aristida stipitata	Grass	Poaceae
Asparagus laricinus	Shrub	Liliaceae
Asparagus species	Shrub	Liliaceae
Acacia mellifera	Shrub	Fabaceae
Adenium oleifolium	Succulent	Apocynaceae
Aristida congesta subsp. *congesta*	Grass	Poaceae
Barleria species	Forb	Acanthaceae
Boscia albitrunca	Tree	Capparaceae
Cenchrus ciliaris	Grass	Poaceae
Chrysocoma obtusata	Forb	Asteraceae
Enneapogon desvauxii	Grass	Poaceae
Eragrostis obtusa	Grass	Poaceae
Eragrostis truncata	Grass	Poaceae
Eriocephalus spinescens	Forb	Asteraceae
Fingerhuthia africana	Grass	Poaceae
Geigeria species	Forb	Asteraceae
Lycium bosciifolium	Shrub	Solanaceae
Lycium horridum	Shrub	Solanaceae
Monechma genistifolium subsp. *australe*	Forb	Acanthaceae
Nerine laticoma	Geophyte	Amaryllidaceae
Pentzia calcarea	Forb	Asteraceae
Rhigozum trichotomum	Shrub	Bignoniaceae

Table 8: Plant taxa recorded within the Calcareous Low Shrub Plains unit		
Species Name	*Growth Form*	*Family*
Salsola etoshensis	Shrub	Chenopodiaceae
Salsola tuberculatiformis	Shrub	Chenopodiaceae
Schmidtia kalihariensis	Grass	Poaceae
Setaria verticillata	Grass	Poaceae
Stipagrostis ciliata	Grass	Poaceae
Stipagrostis obtusa	Grass	Poaceae
Tribulus zeyheri	Forb	Zygophyllaceae
Ziziphus mucronata	Tree	Rhamnaceae

15.4.2 Open Shrub Duneveld

The major physiognomic attribute of this unit is the presence of low dunes with characteristic crests, slopes and streets with a floristic composition that largely conforms to an open tree savanna. Each of these units could be described as a variation of this unit on the basis of distinctive habitat attributes and species composition, but for the purpose of this investigation, they are considered holistically as they always occur in association with each other.

The physiognomy conforms to an open tree savanna. Dominant species (refer **Table 9**) include the tree *Acacia mellifera* and the grass *Schmidtia kalahariensis*. Other prominent woody species are *Acacia haematoxylon, Parkinsonia africana, Rhigozum trichotomum, Boscia albitrunca* and *Acacia erioloba* and occasionally *Lycium bosciifolium*. Besides *Schmidtia kalahariensis,* the grass layer is characterised by *Eragrostis lehmanniana, Centropodia glauca, Stipagrostis amabilis, Brachiaria glomerata Stipagrostis obtusa* and *S. ciliata*. Herbs that are found in this unit include *Hermannia tomentosa, Hermbstaedtia fleckii, Requienia sphaerosperma, Dicoma capensis, Momordica balsamina* and the climber *Pergularia daemia*. The species composition of this unit is indicated in Table 8.

The presence of the grass species *Schmidtia kalihariensis* is generally accepted as an indicator of high utilisation pressure. This habitat type is representative of the Gordonia Duneveld vegetation type (Mucina & Rutherford, 2006) and is in a relative good condition. During subsequent visits, it appeared to be moderately degraded due to livestock grazing pressure. A moderate ecological integrity status and moderate-high sensitivity is therefore ascribed to this unit due to the association with dune habitat.

Table 9: Plant taxa recorded in the Open Shrub Duneveld unit		
Species Name	*Growth Form*	*Family*
Acacia erioloba	Tree	Fabaceae
Acacia haematoxylon	Tree	Fabaceae
Acacia mellifera	Shrub	Fabaceae
Anthephora pubescens	Grass	Poaceae
Aptosimum procumbens	Forb	Scrophulariaceae
Aristida congesta subsp. *congesta*	Grass	Poaceae
Aristida stipitata	Grass	Poaceae
Asparagus laricinus	Shrub	Liliaceae
Asparagus species	Shrub	Liliaceae
Boscia albitrunca	Tree	Capparaceae
Brachiaria glomerata	Grass	Poaceae
Bulbostylis hispidula	Sedge	Cyperaceae
Centropodia glauca	Grass	Poaceae
Chascanum pumilum	Forb	Verbenaceae
Citrullus lanatus	Climber	Cucurbitaceae
Cleome angustifolia	Forb	Capparaceae
Cleome gynandra	Forb	Capparaceae
Commelina species	Forb	Commelinaceae
Crotalaria spartioides	Shrub	Fabaceae
Cucumis africanus	Forb	Cucurbitaceae

Table 9: Plant taxa recorded in the Open Shrub Duneveld unit		
Species Name	*Growth Form*	*Family*
Dicoma capensis	Forb	Asteraceae
Eragrostis lehmanniana	Grass	Poaceae
Eragrostis species	Grass	Poaceae
Eragrostis trichophora	Grass	Poaceae
Heliotropium ciliatum	Forb	Boraginaceae
Hermannia tomentosa	Forb	Sterculiaceae
Hermbstaedtia fleckii	Forb	Amaranthaceae
Hermbstaedtia odorata	Forb	Amaranthaceae
Hirpicium gazanioides	Forb	Asteraceae
Indigofera alternans	Forb	Fabaceae
Indigofera charlieriana var. *charlieriana*	Forb	Fabaceae
Lebeckia linearifolia	Shrub	Fabaceae
Leucas capensis	Forb	Lamiaceae
Limeum fenestratum	Forb	Aizoaceae
Limeum sulcatum	Forb	Aizoaceae
Limeum viscosum	Forb	Aizoaceae
Lycium bosciifolium	Shrub	Solanaceae
Lycium species	Shrub	Solanaceae
Momordica balsamina	Climber	Cucurbitaceae
Monechma incanum	Shrub	Acanthaceae
Nolletia arenosa	Forb	Asteraceae
Oxalis semiloba	Geophyte	Oxalidaceae
Oxygonum dregeanum	Forb	Polygonaceae
Parkinsonia africana	Tree	Fabaceae
Pergularia daemia	Climber	Asclepiadaceae
Plinthus sericeus	Shrub	Aizoaceae
Requienia sphaerosperma	Forb	Fabaceae
Rhigozum trichotomum	Shrub	Bignoniaceae
Rhynchosia species	Forb	Fabaceae
Schmidtia kalihariensis	Grass	Poaceae
Senna italica	Forb	Fabaceae
Stipagrostis amabilis	Grass	Poaceae
Stipagrostis ciliata	Grass	Poaceae
Stipagrostis obtusa	Grass	Poaceae
Tapinanthus oleifolius	Parasite	Loranthaceae
Tribulus terrestris	Forb	Zygophyllaceae
Tribulus zeyheri	Forb	Zygophyllaceae

15.4.3 Open Shrub Plains

This habitat type comprises the largest part of the study area. Biophysical attributes include open plains (flat or slightly undulating) with high shrubs and scattered trees on deep sandy, red soils or gravel plains and a well-developed herbaceous layer.

The species diversity is relative low; only 24 species (refer Table 10) were observed during the survey period. Prominent tall woody species in this undulating landscape are *Acacia erioloba, A. mellifera, Parkinsonia africana, Grewia flava* and *Boscia albitrunca*. Low shrubs include *Lebeckia linearifolia, Lycium bosciifolium, Rhigozum trichotomum* and *Salsola etoshensis.* Conspicuous grass species include *Schmidtia kalahariensis*, *Eragrostis lehmanniana* and *Stipagrostis ciliata*. Prominent forb species include *Monechma genistifolium* subsp. *genistifolium* and *Indigofera* species.

This habitat type is representative of the regional vegetation type Kalahari Karroid Shrubland (Mucina & Rutherford, 2006), which typically forms bands alternating with bands of Gordonia Duneveld. Due to similar grazing pressures in this vegetation community, a moderate floristic status is ascribed to this unit.

Table 10: Plant taxa recorded in the Open Shrub Plains unit		
Species Name	*Growth Form*	*Family*
Acacia erioloba	*Tree*	*Fabaceae*
Acacia mellifera	*Shrub*	*Fabaceae*
Asparagus species	*Shrub*	*Liliaceae*
Blepharis species	Forb	Acanthaceae
Boscia albitrunca	Tree	Capparaceae
Bulbostylis hispidula	Sedge	Cyperaceae
Cenchrus ciliaris	Grass	Poaceae
Eragrostis lehmanniana	Grass	Poaceae
Euphorbia species	Succulent	Euphorbiaceae
Grewia flava	Shrub	Tiliaceae
Indigofera species	Forb	Fabaceae
Lebeckia linearifolia	Shrub	Fabaceae
Limeum viscosum	Forb	Aizoaceae
Lycium bosciifolium	Shrub	Solanaceae
Monechma genistifolium subsp. *australe*	Forb	Acanthaceae
Parkinsonia africana	Tree	Fabaceae
Pergularia daemia	Climber	Asclepiadaceae
Plinthus sericeus	Shrub	Aizoaceae
Rhigozum trichotomum	Shrub	Bignoniaceae
Salsola etoshensis	Shrub	Chenopodiaceae
Schmidtia kalihariensis	Grass	Poaceae
Stipagrostis ciliata	Grass	Poaceae
Stipagrostis obtusa	Grass	Poaceae
Tapinanthus oleifolius	Parasite	Loranthaceae

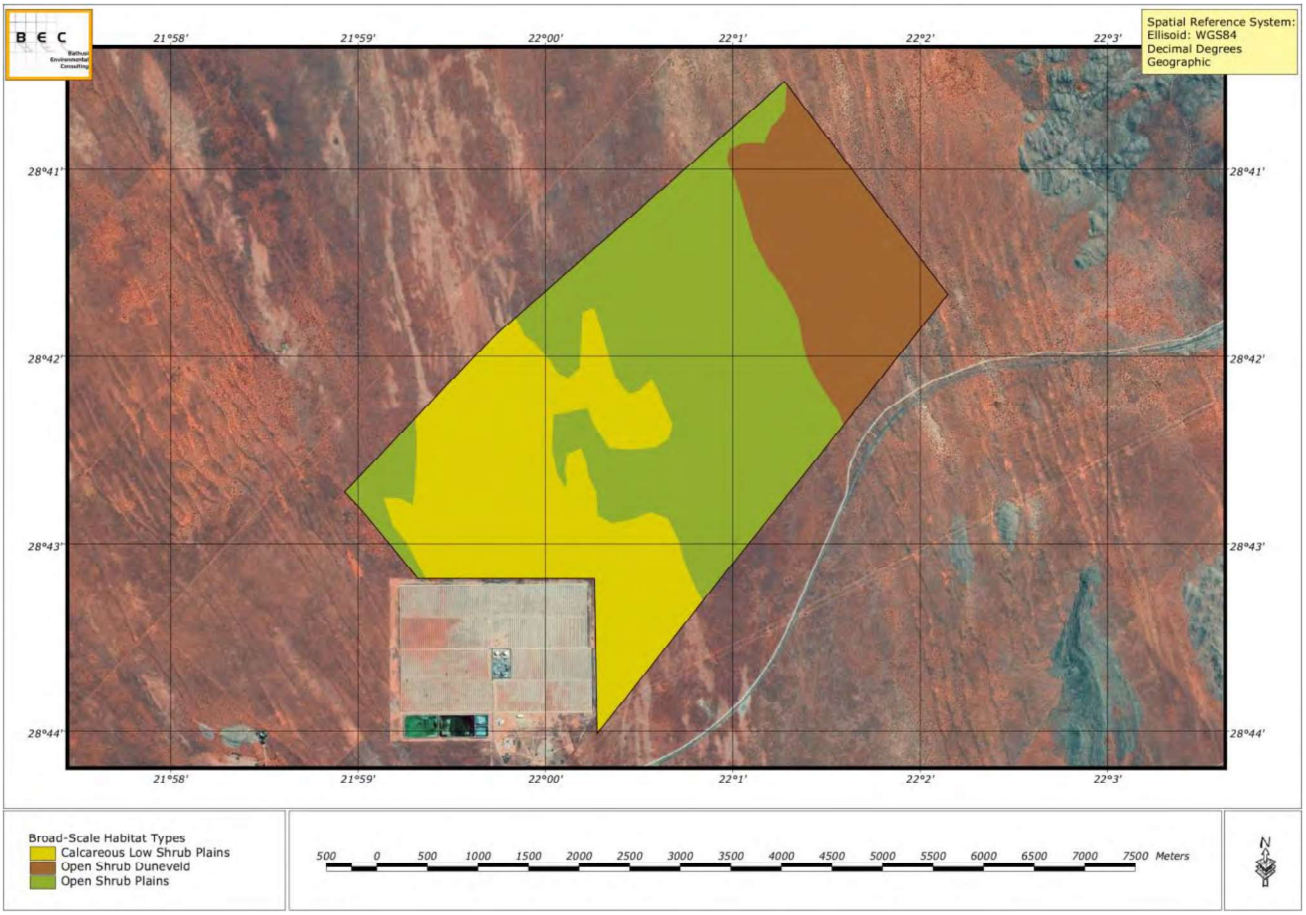


Figure 10: Broad-scale habitat types of the study area

Example of Open shrub duneveld habitat

Example of Open shrub duneveld habitat

Example of Opens shrub plains habitat

Example of Calcareous low shrub plains

Example of rocky habitat terrain (Critical habitat) to the north of the study area

Opens shrub plains habitat

Figure 11: Collage of images depicting habitat conditions of the broad-scale habitat types

16 FAUNAL ATTRIBUTES OT HE STUDY AREA

Please note that aspects pertaining to avifauna and bats are excluded from this assessment as it is presented as 'stand-alone' reports.

16.1 INVERTEBRATES

Invertebrate species previously recorded within the Study Area (BEC, 2010) were restricted to butterflies only (refer Table 11). All species are common and ubiquitous species of the region, nevertheless the butterfly species richness is likely a factor of the largely untransformed and non-fragmented nature of the Study Area.

The invertebrates observed in the study area during the field investigation attested to a healthy, functioning ecosystem on the microhabitat as well as source-sink population dynamics scales. A total of 12 butterflies were observed in the study area; most of these species are common and widespread; if not in Southern Africa then in the drier western regions of the subcontinent. It is highly likely that many other species will complement the observed assemblage of butterflies should the study be repeated in early summer (the only flight time of some Lepidoptera groups, notably Lycaenidae). The drier western regions of South Africa have significantly fewer butterflies than the wetter east; consequently, the number of species observed during the field survey (given timing of the survey as well geographic location of the study area) confirms the untransformed and un-fragmented nature of the study area.

Table 11: Butterfly species recorded in the study area (BEC, 2010)

Biological Name	*English Name*	*Status*
Belenois aurota	Brown-veined White	Least Threatened
Catopsilla florella	African Migrant	Least Threatened
Cigaritis phanes	Silvery Bar	Least Threatened
Colotis eris	Banded Gold Tip	Least Threatened
Colotis lais	Kalahari Orange Tip	Least Threatened
Danaus chryssipus	African Monarch	Least Threatened
Junonia hierta	Yellow Pansy	Least Threatened
Pinacopteryx eriphia	Zebra White	Least Threatened
Spialia diomus	Common Sandman	Least Threatened
Zintha hintza	Hintza Blue	Least Threatened
Zizeeria knysna	Sooty Blue	Least Threatened
Zizula hylax	Gaika Blue	Least Threatened

Two invertebrate species of conservation concern (that have not yet been observed) could potentially occur within the Study Area, these and their likelihood of presence based on habitat suitability are summarised in Table 12.

Table 12: Butterfly species of conservation concern recorded in the region of the study area (BEC, 2010)

Species	*Common name*	*Conservation Status (IUCN)*	*Comment, PoO*
Alfredectes browni	Brown's Shieldback	DD	Possible – This katydid species is understudied, being known only from three specimens, but occurs in a wide range of habitats from grasses along highly disturbed roadsides, to low trees, to high elevation fynbos vegetation so could occur within the Study Area (Bazelet & Naskrecki, 2014).

Table 12: Butterfly species of conservation concern recorded in the region of the study area (BEC, 2010)			
Species	*Common name*	*Conservation Status (IUCN)*	*Comment, PoO*
Lepidochrysops penningtoni	Pennington's Blue	DD	**Unlikely** – Considerable uncertainty exists around this species' taxonomy and distribution and it is likely that the species will fall into the category of Least Concern with further information as it occupies remote habitats and does not face any major threats. Its strongly seasonal appearance has probably led to it being under-recorded (Larsen, 2011). It is thought to be endemic to the Northern Cape; however, it prefers vegetation consisting of Mesembryanthemum species and other low shrubs (succulent Karoo) (Pringle *et al.,* 1994), which has not been recorded within the Study Area.

16.2 HERPETOFAUNA – AMPHIBIANS AND REPTILES

16.2.1 AMPHIBIANS

No amphibian species have been recorded within the study area or in the immediate surrounds of the study site. Taking cognisance of the absence of surface water within the proposed development footprint, it is regarded unlikely that any of these species will occur on site; however, some frog species are expected to occur in the vicinity of the abstraction point in the Orange River (refer **Table 13**).

Table 13: Amphibian species likely to occur in the vicinity of the abstraction point on the Orange River				
Scientific Name	*Common Name*	*Conservation Status*		
		IUCN - Regional Status (2004)	NEMBA TOPS List (2013)	Northern Cape - Protected Species (2009)
Amietophrynus gutturalis	Guttural Toad	-	-	Protected
Amietophrynus rangeri	Raucous Toad	-	-	Protected
Amietophrynus poweri	Western Olive Toad	-	-	Protected
Vandijkophrynus gariepensis	Karoo Toad	-	-	Protected
Xenopus laevis	Common Platanna	-	-	Protected
Amietia angolensis	Common River Frog	-	-	Protected
Cacosternum boettgeri	Common Caco	-	-	Protected
Pyxicephalus adspersus	Giant Bullfrog	Near Threatened	-	Specially Protected
Tomopterna cryptotis	Tremolo Sand Frog	-	-	Protected
Tomopterna tandyi	Tandy's Sand Frog	-	-	Protected
Source: Distributions = du Preez & Carruthers (2009); Conservation Status = Minter et al. (2004), NEMBA ToPS List (2013) & (Northern Cape Nature Conservation Act 2009)				

16.2.2 REPTILES

Eight reptile species were observed during the previous baseline fieldwork (BEC, 2010); confirmed species (shown in **bold**) as well as other species whose distributions overlap with the Study Area and therefore could potentially occur are listed in **Table 14**.

Table 14: Reptile species likely to occur in the vicinity of the study area				
Scientific Name	*Common Name*	*Conservation Status*		
		NEMBA TOPS List (2013)	*Northern Cape - Protected Species (2009)*	*Endemic Status*
Agama aculeata	Western Ground Agama	-	-	-
Agama anchietae	Anchiea's Agama	-	-	-
Agama atra	**Southern Rock Agama**	**-**	**-**	**Near Endemic**
Monopeltis infuscata	Dusky Worm Lizard	-	-	-
Monopeltis mauricei	Mairice's Worm Lizard	-	-	-
Dasypeltis scabra	Rhombic Egg-eater	-	Protected	-

Telescopus beetzii	Beetz's Tiger Snake	-	-	-
Karusasaurus polyzonus	Southern Karusa Lizard	-	Specially Protected	Near Endemic
Aspidelaps lubricus	Coral Shield Cobra	-	-	-
Naja nigricincta woodi	Black Spitting Cobra	-	-	-
Naja nivea	**Cape Cobra**	**-**	**-**	**-**
Chondrodactylus angulifer	Common Giant Gecko	-	-	-
Chondrodactylus bibronii	Bibron's Gecko	-	-	-
Chondrodactylus turneri	Turner's Gecko	-	-	-
Colopus wahlbergii furcifer	Striped Ground Gecko	-	-	-
Lygodactylus bradfieldi	Bradfield's Dwarf Gecko	-	-	-
Pachydactylus capensis	Cape Gecko	Protected	-	-
Pachydactylus latirostris	Quartz Gecko	Protected	-	-
Pachydactylus montanus	Namaqua Mountain Gecko	Protected	-	-
Pachydactylus punctatus	Speckled Gecko	Protected	-	-
Pachydactylus purcelli	Purcell's Gecko	Protected	-	-
Pachydactylus rugosus	Common Rough Gecko	Protected	-	-
Ptenopus garrulus	**Common Barking Gecko**	**-**	**-**	**-**
Ptenopus garrulus maculatus	Spotted Barking Gecko	-	-	-
Cordylosaurus subtessellatus	Dwarf Plated Lizard	-	-	-
Heliobolus lugubris	Bushveld Lizard	-	Protected	-
Meroles suborbitalis	Spotted Desert Lizard	-	Protected	-
Nucras tessellata	Western Sandveld Lizard	-	Protected	-
Pedioplanis inornata	Plain Sand Lizard	-	Protected	-
Pedioplanis laticeps	Karoo Sand Lizard	-	Protected	Endemic
Pedioplanis lineoocellata	**Spotted Sand Lizard**	**-**	**Protected**	**-**
Pedioplanis namaquensis	Namaqua Sand Lizard	-	Protected	-
Boaedon capensis	Common House Snake	-	-	-
Dipsina multimaculata	Dwarf Beaked Snake	-	-	-
Lycophidion capense	Cape Wolf Snake	-	Protected	-
Prosymna bivittata	Two-striped Shovelsnout	-	Protected	-
Prosymna frontalis	Southwestern Shovel-snout	-	Protected	-
Psammophis notostictus	Karoo Sand Snake	-	-	-
Psammophis trinasalis	Four-marked Sand Snake	-	-	-
Pseudaspis cana	Mole Snake	-	Protected	-
Xenocalamus bicolor	Bicoloured Quillsnouted Snake	-	-	-
Acontias kgalagadi	Kgalagadi Legless Skink	-	-	-
Acontias lineatus	Striped Dwarf Legless Skink	-	-	-
Trachylepis sparsa	Karasburg Tree Skink	-	-	-
Trachylepis spilogaster	Kalahari Tree Skink	-	-	-
Trachylepis striata	**Striped Skink**	**-**	**-**	**-**
Trachylepis sulcata	Western Rock Skink	-	-	-
Trachylepis variegata	Variegated Skink	-	-	-
Psammobates oculifer	**Serrated tent Tortoise**	**-**	**Protected**	**-**
Psammobates tentorius	Tent Tortoise	-	Protected	-
Stigmochelys pardalis	Leopard Tortoise	-	Protected	-
Rhinotyphlops lalandei	Delalande's Beaked Blind Snake	-	-	-
Rhinotyphlops schinzi	Schinz's Beaked Blind Snake	-	-	-
Varanus albigularis	Rock Monitor	-	Protected	-
Varanus niloticus	Water Monitor	-	-	-
Bitis arietans	**Puff Adder**	**-**	**-**	**-**
Bitis caudalis	Horned Adder	Protected	-	-

16.2.3 MAMMALS (EXCLUDING BIRDS AND BATS)

A total of fifty-one (51) mammal species are considered potentially occupants of the study area. Fourteen (14) of these have been confirmed during field studies (RHV, 2014; BEC, 2010). These and details of their conservation status/level of protection afforded to them are listed on **Table 15**; species that have been confirmed present during fieldwork are highlighted in **bold** text. The bat and avifaunal baseline descriptions and impact assessments are provided in a separate report.

Table 15: Mammal taxa of the region, with Probability of Occurrence

Scientific Name	*Common Name*	*Conservation Status*			*Probability of Occurrence*
		IUCN - Regional status	NEMBA TOPS List	Northern Cape NCA	
Antidorcas marsupialis	Springbok			Protected	Unlikely – largely restricted to private reserves and protected areas (IUCN SSC Antelope Specialist Group. 2008).
Oreotragus Oreotragus	Klipsringer		Protected	Protected	Unlikely – no suitable rocky/ mountainous terrain is present within the study area.
Raphicerus campestris	Steenbok			Protected	Probable - occur widely in drier savannas, grasslands and scrublands and show a particular preference for heavily grazed areas (IUCN SSC Antelope Specialist Group. 2008b).
Sylvicapra grimmia	Common Duiker			Protected	Probable – widespread and common.
Tragelaphus strepsiceros	Kudu			Protected	Unlikely due to limited scrub/ woodland cover available within the study area.
Canis mesomelas	**Black-backed Jackal**				**Confirmed (BEC, 2010).**
Otocyon megalotis	**Bat-eared Fox**		**Protected**	**Specially Protected**	**Confirmed (BEC, 2010).**
Vulpes chama	Cape Fox		Protected	Specially Protected	Probable - associate with open country, including grassland, grassland with scattered thickets, and lightly wooded areas, particularly in the dry Karoo regions, the Kalahari and the fringes of the Namib Desert (Hoffman, 2014).
Papio ursinus	Chacma Baboon				Possible – although Chacma Baboon are common and widespread, few foraging/ watering opportunities are available within the Study Area.
Cercopithecus pygerythrus	Vervet Monkey				Possible – although Vervet Monkey are common and widespread, few foraging/ watering opportunities are available within the Study Area
Caracal caracal	**Caracal**				**Confirmed (BEC, 2010)**

Table 15: Mammal taxa of the region, with Probability of Occurrence

Scientific Name	*Common Name*	*Conservation Status*			*Probability of Occurrence*
		IUCN - Regional status	NEMBA TOPS List	Northern Cape NCA	
Felis nigripes	Black-footed Cat		Protected	Specially Protected	Possible – it is a specialist of open, short grass areas with an abundance of small rodents and ground-roosting birds. It inhabits dry, open savanna, grasslands and Karoo semi-desert with sparse shrub and tree cover (Sliwa, 2008), which are a feature of the Study Area
Felis sylvestris	African wild cat			Specially Protected	Possible – wide habitat tolerance (Stuart & Stuart, 2007)
Atilax paludinosus	**Water Mongoose**			**Protected**	**Confirmed (DHV, 2014)**
Cynictis penicillata	**Yellow Mongoose**			**Protected**	**Confirmed (BEC, 2010)**
Galerella sanguinea	**Slender Mongoose**			**Protected**	**Confirmed (BEC, 2010)**
Galerella pulverulenta	Small Grey Mongoose			Protected	Probable – very wide habitat tolerance includes open scrub (Stuart & Stuart, 2007)
Suricata suricatta	Suricate			Protected	Probable – its preferred habitat is arid, open country, characterised by short grasses and sparse woody growth, which characterises the Study Area
Parahyaena brunnea	Brown Hyena	Near Threatened	Protected	Specially Protected	Probable – inhabits dry areas, generally with annual rainfall less than 100 mm, particularly along the coast, in semidesert, open scrub and open woodland savanna
Hystrix africaeaustralis	**Porcupine**				**Confirmed (BEC, 2010)**
Lepus capensis	**Cape Hare**			**Protected**	**Confirmed (DHV, 2014)**
Lepus saxatilis	**Scrub Hare**			**Protected**	**Confirmed (BEC, 2010)**
Macroscelides proboscideus	Karoo Round-eared Sengi			Protected	Probable – a habitat specialist, which occupies gravel plains (Rathbun & Smit-Robinson, 2015a) such as those present within the Study Area associated with the Kalahari Karroid Shrubland vegetation type
Elephantulus rupestris	Western Rock Sengi			Protected	Possible – occupies arid habitats including dry savanna and shrubland, and is typically associated with rocky ridges, outcrops or koppies (Rathbun & Smit- Robinson, 2015b)
Elephantulus intufi	Bushveld Sengi	Data Deficient		Protected	Unlikely – prefers very arid terrain and semi-desert (Rathbun, 2015)
Manis temminckii	Ground Pangolin	Vulnerable	Vulnerable	Specially Protected	Unlikely - inhabits mainly savanna woodland in lowlying regions with moderate to dense scrub, and is not present in arid areas or deserts (Pietersen et al., 2014)
Aethomys chrysophilus	Red Rock Rat			Protected	Unlikely – typically a savanna species (Agwanda et al., 2008)
Desmodillus auricularis	Cape Shorttailed Gerbil			Protected	Probable - inhabits arid gravel plains and areas of hardened sand (Coetzee, 2008)

Table 15: Mammal taxa of the region, with Probability of Occurrence

Scientific Name	*Common Name*	*Conservation Status*			*Probability of Occurrence*
		IUCN - Regional status	NEMBA TOPS List	Northern Cape NCA	
Gerbillurus paeba	Hairy-footed Gerbil			Protected	Probable – found in sandy ground or sandy alluvium with a grass, scrub or light woodland cover (Coetzee & Griffin, 2008a)
Malacothrix typica	Large-eared Mouse			Protected	Possible - inhabits a wide range of habitats including dry savanna (Coetzee & Griffin, 2008b))
Myomyscus verreauxii	Verreaux's White-footed Rat			Protected	Unlikely – found in fynbos vegetation (van der Straeten, 2008)
Aethomys namaquensis	Namaqua Rock Rat			Protected	Probable – present in most habitat types Mus musculus House Mouse - - - Unlikely – no inhabited areas within the Study Area
Mus musculus	House Mouse				Unlikely - no inhabited areas within study area
Parotomys brantsii	Brant's Whistling			Protected	Possible – restricted to consolidated sands in semidesert (Coetzee, 2008b)
Parotomys littledalei	Littledale's Whistling Rat	Near Threatened		Protected	Possible – occurs in shrubland (Coetzee & Griffin, 2008c)
Rhabdomys pumilio	Striped Mouse			Protected	Unlikely – prefers agricultural lands and houses (Coetzee & van der Straeten, 2008)
Saccostomus campestris	Pouched Mouse				Unlikely – associated with savanna woodland (Corti et al., 2008)
Tatera brantsii	Highveld Gerbil	Data Deficient		Protected	Probable - associated with open areas, or plains, in subtropical and wooded grasslands on consolidated sands (Griffin & Coetzee, 2008)
Tatera leucogaster	Bushveld Gerbil			Protected	Unlikely – more typically associated with bushland and grasslands (Coetzee, 2008c)
Aonyx capensis	Cape Clawless Otter		Protected	Protected	Confirmed (DHV, 2014)
Ictonyx striatus	**Striped Polecat**	**Data Deficient**		**Specially Protected**	**Confirmed (BEC, 2010)**
Mellivora capensis	**Honey Badger**	**Near Threatened**		**Specially Protected**	**Confirmed (BEC, 2010)**
Graphiurus ocularis	Spectacled Dormouse				Unlikely - associated with the sandstone formations of the Cape (Coetzee et al., 2008)
Orycteropus afer	**Aardvark**		**Protected**		**Confirmed (BEC, 2010)**
Pedetes capensis	**Springhare**				**Confirmed (BEC, 2010)**
Procavia capensis	Rock Hyrax			Protected	Unlikely - typically associated with rocky outcrops, cliffs or boulders which are not a feature of Study Area
Proteles cristatus	Aardwolf			Specially Protected	Probable - prime habitat is open, grassy plains, being entirely absent from forests or pure desert (Green, 2015)
Xerus inauris	Ground Squirrel				Probable – occurs widely throughout arid parts of Southern Africa

Table 15: Mammal taxa of the region, with Probability of Occurrence

Scientific Name	*Common Name*	*Conservation Status*			*Probability of Occurrence*
		IUCN - Regional status	NEMBA TOPS List	Northern Cape NCA	
Crocidura cyanea	Reddish-grey Musk Shrew	Data Deficient		Protected	Unlikely – occurs in montane grasslands and temperatesub-tropical forests (Baxter et al., 2008)
Genetta Small-spotted	Genet				Unlikely – prefers wooded habitat

Source: Distributions = Stuart & Stuart (2007);Conservation Status = Friedmann & Daly (2004), NEMBA ToPS List (2013) & (Northern Cape Nature Conservation Act 2009)

Slender mongoose

Rock monitor

Cape fox

Agama species

Figure 12: Collage of images depicting various animals recorded in 2010

17 ASSESSMENT OF BIODIVERSITY VALUE

Species and ecosystems of concern identified as key issues for impact assessment are summarised in the sections that follow.

17.1 SPECIES OF CONSERVATION CONSIDERATION

17.1.1 FLORA

The following plant taxa of conservation consideration were recorded within the site (BEC, 2010), or are considered likely to be present based on habitat association and know regional distribution patterns:

Table 16: Conservation important flora species for the region

Species	*Family*	*Threat status*
Acacia erioloba	Fabaceae	Protected Tree (National Forest Act, 1998)
Acacia haematoxylon	Fabaceae	Protected Tree (National Forest Act, 1998)
Anthephora argentea	Poaceae	Regionally important (Vegmap)
Boscia albitrunca	Capparaceae	Protected Tree (National Forest Act, 1998)
Helichrysum arenicola	Asteraceae	Regionally important (Vegmap)
Megaloprotrachne albescens	Poaceae	Regionally important (Vegmap)
Neuradopsis asutro- africana	Neuradaceae	Regionally important (Vegmap)
Stipagrostis amabilis	Poaceae	Kalahari endemic

17.1.2 FAUNA

Table 17: Fauna species of conservation consideration recorded*/ potentially occurring in the study area

Species Name	*Common Name*	*Conservation Status*	*Habitat Association*
Invertebrates			
Alfredectes browni	Brown's Shieldback	IUCN - Data Deficient	Disturbed roadsides, open shrub duneveld, open shrub plains, calcareous low shrub plains throughout Bokpoort II footprint
Herpetofauna			
Pedioplanis lineoocellata	Spotted Sand Lizard	NCNCA 2009 - Protected	Commonly associated with open ground and scattered rock fragments, such as the calcareous low shrub plains in the Study Area (Figure 9)
Psammobates oculifer	Serrated tent Tortoise	NCNCA 2009 - Protected	Open shrub duneveld, open shrub plains, calcareous low shrub plains throughout Bokpoort II footprint
Varanus albigularis	Rock Monitor	NCNCA 2009 - Protected	Open shrub duneveld, open shrub plains, calcareous low shrub plains throughout Bokpoort II footprint; riparian vegetation at water abstraction point
Mammals			
Raphicerus campestris	Steenbok	NCNCA 2009 - Protected	Open shrub duneveld, open shrub plains, calcareous low shrub plains
Sylvicapra grimmia	Common Duiker	NCNCA 2009 - Protected	Open shrub duneveld, open shrub plains, riparian vegetation
**Otocyon megalotis*	Bat-eared Fox	NCNCA 2009 - Protected	Open shrub duneveld, open shrub plains, calcareous low shrub plains throughout Bokpoort II footprint
Vulpes chama	Cape Fox	NCNCA 2009 – Specially Protected, NEMBA	Open shrub duneveld, open shrub plains, calcareous low shrub plains throughout Bokpoort II footprint
Felis nigripes	Black-footed Cat	NCNCA 2009 – Specially Protected, NEMBA	Open shrub duneveld, open shrub plains, calcareous low shrub plains throughout Bokpoort II footprint
**Cynictis penicillata*	Yellow Mongoose	NCNCA 2009 - Protected	Open shrub duneveld, open shrub plains, calcareous low shrub plains throughout Bokpoort II footprint
**Galerella sanguinea*	Slender Mongoose	NCNCA 2009 - Protected	Open shrub duneveld, open shrub plains, calcareous low shrub plains throughout Bokpoort II footprint

Galerella pulverulenta	Small Grey Mongoose	NCNCA 2009 - Protected	Open shrub duneveld, open shrub plains, calcareous low shrub plains throughout Bokpoort II footprint; riparian vegetation at water abstraction point
Suricata suricatta	Suricate	NCNCA 2009 - Protected	Open shrub duneveld, open shrub plains, calcareous low shrub plains throughout Bokpoort II footprint
**Lepus capensis*	Cape Hare	NCNCA 2009 - Protected	Open shrub duneveld, open shrub plains, calcareous low shrub plains throughout Bokpoort II footprint
**Lepus saxatilis*	Scrub Hare	NCNCA 2009 - Protected	Open shrub duneveld, open shrub plains, calcareous low shrub plains throughout Bokpoort II footprint
Macroscelides proboscideus	Karoo Roundeared Sengi	NCNCA 2009 - Protected	A habitat specialist, which occupies gravel plains such as those present within the Study Area associated with the Kalahari Karroid Shrubland vegetation type; this coincides with the open shrub plains, calcareous low shrub plains throughout Bokpoort II footprint
Desmodillus auricularis	Cape Shorttailed Sengi	NCNCA 2009 - Protected	Open shrub duneveld, open shrub plains, calcareous low shrub plains throughout Bokpoort II footprint
Aethomys namaquensis	Namaqua Rock Rat	NCNCA 2009 - Protected	Open shrub duneveld, open shrub plains, calcareous low shrub plains throughout Bokpoort II footprint
Tatera brantsii	Highveld Gerbil	NCNCA 2009 - Protected	Open shrub duneveld, open shrub plains, calcareous low shrub plains throughout Bokpoort II footprint
**Ictonyx striatus*	Striped Polecat	NCNCA 2009 – Specially Protected; Data Deficient	Open shrub duneveld, open shrub plains, calcareous low shrub plains throughout Bokpoort II footprint; riparian vegetation at water abstraction point
**Mellivora capensis*	Honey Badger	NCNCA 2009 – Specially Protected; Near Threatened	Open shrub duneveld, open shrub plains, calcareous low shrub plains throughout Bokpoort II footprint; riparian vegetation at water abstraction point
**Orycteropus afer*	Aardvark	NCNCA 2009 – Specially Protected, NEMBA	Open shrub duneveld, open shrub plains, calcareous low shrub plains throughout Bokpoort II footprint
Proteles cristatus	Aardwolf	NCNCA 2009 - Protected	Open shrub duneveld, open shrub plains in northern region of Bokpoort II footprint

17.2 ECOSYSTEMS OF CONSERVATION VALUE

The ecosystems of priority conservation concern include those identified by NEMBA as endangered, those considered to be of pristine ecological integrity, and those considered important for their support of species of conservation concern.

Therefore, the ecosystems of priority conservation concern for impact assessment include the following:

⇒ The rocky outcrop to the north of the study area associated with the Koranna-Langeberg Mountain Bushveld Vegetation type. Apart from exhibiting intact ecological integrity in terms of vegetation community composition, it is an important area in terms of its support of roosting bat species, and is classified as Natural Habitat by IFC; and

⇒ The riparian habitat associated with the Orange River – this area supports the endangered vegetation type Lower Gariep Alluvial Vegetation, and has importance as an ecological corridor through the landscape. In addition, it is an important support area for foraging faunal species, including bats.

17.3 NATURAL AND MODIFIED HABITATS

Natural and modified habitat was mapped using the baseline data provided in the previously conducted vegetation assessments (BEC, 2010; EnviRoss 2014). The vegetation types and associated IFC habitat categories are outlined on Table 18 and illustrated in Figure 13.

Table 18: Natural and modified habitat types (IFC Criteria)

Broad-scale habitat type	*IFC Natural/ Modified*	*Comment*
Calcareous low shrub plains	Modified	Considered relatively degraded due to livestock grazing pressure.
Open shrub plains	Modified	Considered relatively degraded due to livestock grazing pressure.
Open shrub duneveld	Modified	Although previously found to be representative of the Gordonia Duneveld type (BEC, 2010), this unit was found to be degraded due to persistent livestock grazing since then
Rocky outcrop/foothills	Natural	Assessed as being in pristine condition.
Transformed areas	Modified	Areas already transformed through vegetation clearance and construction activity are considered modified.

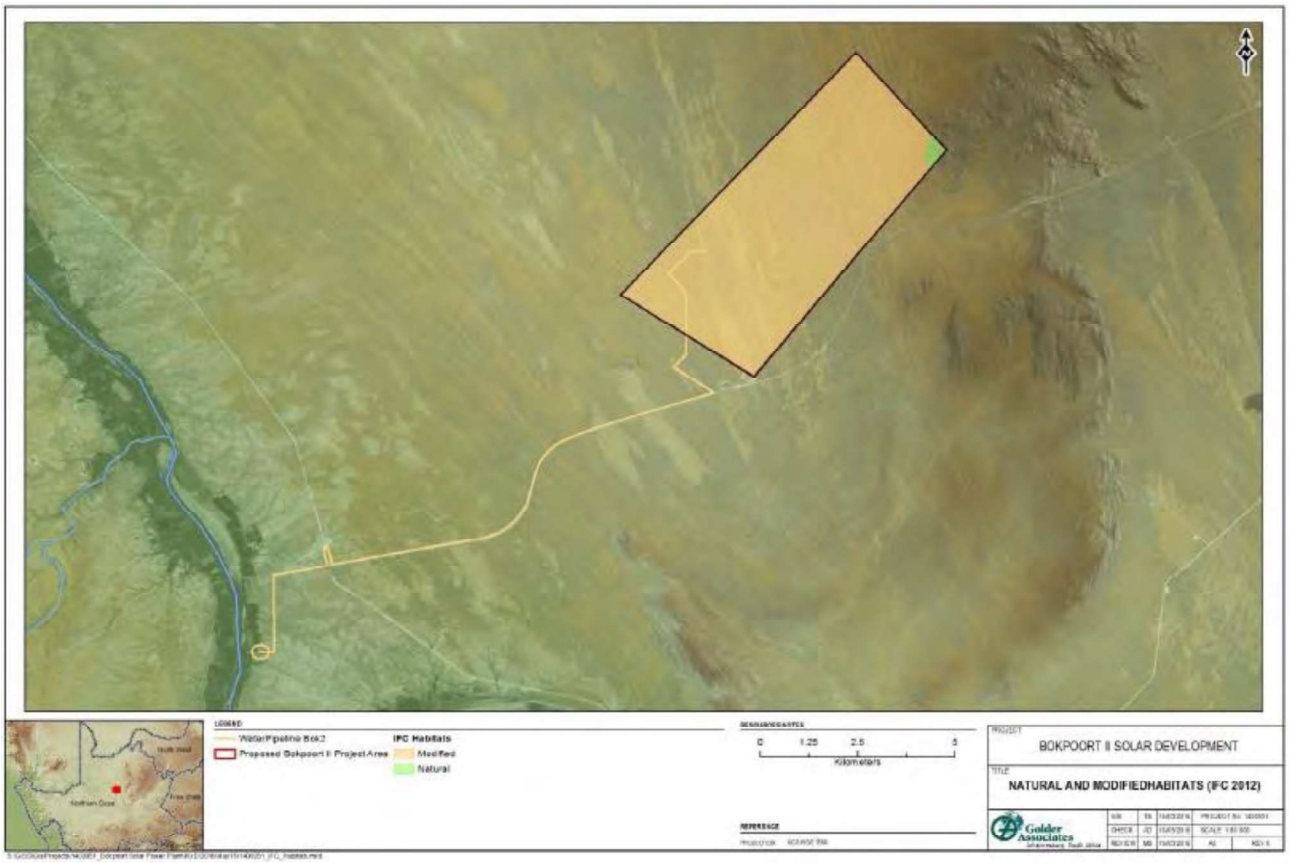


Figure 13: Illustration of modified vs remaining natural habitat according to IFC Criteria

17.4 CRITICAL HABITAT

Critical habitat designation, typically, should be determined on a case-by-case basis according to the concepts of irreplaceability and vulnerability (IFC 2012b). Hence, when applying this guidance, it is often possible to identify critical habitat using the five primary criteria provided by the IFC (2012a), that is:

1) Habitat of significant importance to critically endangered and/or endangered species.
2) Habitat of significant importance to endemic and/or restricted-range species.
3) Habitat supporting globally significant concentrations of migratory species and/or congregatory species.
4) Highly threatened and/or unique ecosystems.
5) Areas associated with key evolutionary processes.

The biodiversity features of the study area are screened against the first three (quantitative) critical habitat determination criteria on Table 19 overleaf.

Criteria 4 and 5, and other qualitative criteria, are addressed on Table 20.

In summary, the Lower Gariep Alluvial Vegetation unit qualifies as Critical Habitat within the Study Area, under Criterion 4; and although it is not likely to be directly affected by this project, it is being considered in terms of Cumulative Impacts from the remainder of the project. Through a process of constant monitoring and dedicated mitigative actions (avoid, minimise, mitigate, offset), the project must ensure that no direct effects on any adjacent areas of Lower Gariep Alluvial Vegetation will occur that is directly associated with the development and associated activities; appropriate steps must be taken to ensure no net loss of this vegetation unit.

Table 19: Screening of quantitative critical habitat criteria against Study Area biodiversity features

Criteria	*Tier 1 Critical Habitat requirement*	*Study area*	*Tier 2 Critical Habitat requirement*	*Study area*
1. Critically Endangered (CR)/Endangered (EN) Species	a) Habitat required to sustain ≥10% of the global population of a CR or EN species/subspecies here there are known, regular occurrences of the species and where that habitat could be considered a discrete management unit for that species. b) Habitat with known, regular occurrences of CR or EN species where that habitat is one of 10 or fewer discrete management	No CR/EN species confirmed or expected present within the Study Area.	c) Habitat that supports the regular occurrence of a single individual of a CR species and/or habitat containing regionally-important concentrations of a Red-listed EN species where that habitat could be considered a discrete management unit for that species/ subspecies. d) Habitat of significant importance to CR or EN species that are wide-ranging and/or whose population distribution is not well understood and where the loss of such a habitat could potentially impact the long-term survivability of the species. e) As appropriate, habitat containing nationally/ regionally important concentrations of an EN, CR	No CR/EN species confirmed or expected present within the Study Area.
2. Endemic/ Restricted Range Species	a) Habitat known to sustain ≥95% of the global population of an endemic or restricted-range species, where that habitat could be considered a discrete management unit for that species (e.g., a single-site endemic).	Some flora and fauna species of regional conservation interest occur, however none can be considered restricted range as defined by IFC3, and even if that were the case, no habitat on site supports ≥95% of the global population of any species.	b) Habitat known to sustain ≥1% but <95% of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species, where data are available	Two Kalahari endemic plant species have been recorded within the Study Area; however it is highly unlikely that these species occur at a scale which would represent ≥1% of the global population of the species, given the size of the extent of occurrence (the Kalahari region) compared to the size of the Study Area.
3. Migratory/ Congregatory Species	a) Habitat known to sustain, on a cyclical or otherwise regular basis, ≥95% of the global population of a migratory or congregatory species at any point of the species' lifecycle where that habitat could be considered a discrete management unit for that species.	Migratory/congregatory species confirmed/ considered likely present within the Study Area include the bat species, however these are crevice/bark roosting species which typically congregate in small numbers (<20 and often individually) and therefore do not fit the ≥95% of the global population criteria	b) Habitat known to sustain, on a cyclical or otherwise regular basis, ≥1% but <95% of the global population of a migratory or congregatory species at any point of the species' lifecycle and where that habitat could be considered a discrete management unit for that species, where adequate data are available and/or based on expert judgment. c) For birds, habitat that meets BirdLife International's Criterion A4 for congregations and/or Ramsar Criteria 5 or 6 for Identifying Wetlands of International Importance. d) For species with large but clumped distributions, a provisional threshold is set at ≥5% of the global population for both terrestrial and marine species. e) Source sites that contribute ≥1% of the global population of recruits.	The expected numbers of populations of any congregatory bat species encountered in the Study Area is not expected to constitute ≥1% of the global population (see Golder Associates Africa, 2016). For birds, see Specialist Ornithology Preconstruction Monitoring report (ARCUS, 2016).

The remaining qualitative critical habitat criteria outlined in PS6 are addressed in the context of the study area in **Table 20**.

Table 20: Qualitative critical habitat determination criteria in the context of the Study Area

Criteria	*Study area context*
4. Highly threatened or unique ecosystems, i.e. those ecosystems: i. that are at risk of significantly decreasing in area or quality; ii. with a small spatial extent; and/or ii. (iii) containing unique assemblages of species including assemblages or concentrations of biome-restricted species	The Lower Gariep Alluvial Vegetation type is considered Endangered, due to largely due to transformation of approximately 50 % of its extent for agricultural cultivation and via alluvial diamond mining (Mucina & Rutherford, 2006). About 6 % is statutorily conserved inside National Parks, and an additional 25 % is targeted for conservation. It is likely that transformation is ongoing in this vegetation unit, although the rate of decline is not known. It is classified as being of High Conservation Value (IFC PS6 GN35), as it is considered to be an Endangered ecosystem. As an endangered ecosystem that has suffered at least a 50 % loss to transformation, and given that the rate of current loss is unknown, this vegetation unit qualifies as critical habitat under Criterion 4 highly threatened ecosystems, as it is an area of high conservation value that may be at risk of significantly decreasing in area or quality (IFC PS6 GN90). The abstraction point is located within the mapped area of this vegetation unit; however this area is already transformed by agricultural cultivation, and as a result of the construction of the existing abstraction point, and no longer supports natural vegetation; therefore the area where the abstraction pipeline is proposed is classified as modified habitat. Although not likely to be directly affected by the proposed development, it is considered in terms of Cumulative Impacts associated with the rest of the project.
5. Key Evolutionary Processes	Examples of habitat triggering this criterion are peat-forming wetlands which develop over the course of millennia, or islands where new species have developed as a result of isolation. No key evolutionary processes are associated with the Study Area.
6. Areas required for seasonal refugia for critically endangered (CR) and/or endangered (EN) species	No significant numbers of CR or EN species confirmed/expected within the Study Area.
7. Ecosystems of known special significance to critically endangered or endangered species for climate adaptation purposes	No significant numbers of CR or EN species confirmed/expected within the Study Area.
8. Concentrations of vulnerable (VU) species in cases where there is uncertainty regarding the listing, and the actual status of the species may be critically endangered or endangered	No such species confirmed/expected within the Study Area.
9. Areas of primary/old-growth/pristine forests and/or other areas with especially high levels of species diversity	None present within the Study Area.
10. Landscape and ecological processes (for example, water catchments, areas critical to erosion control, disturbance regimes) required for maintaining critical habitat	No such landscapes/ecosystems occur within the Study Area.

Table 20: Qualitative critical habitat determination criteria in the context of the Study Area	
Criteria	*Study area context*
11. Habitat necessary for the survival of keystone species; that is, species that act as ecosystem engineers and drive ecosystem process an functions e.g. elephants in their role as ecosystem engineers	No such species confirmed/expected to occur within the Study Area.
12. Areas of high scientific value, such as those containing concentrations of species new and/or little known to science	None identified within the Study Area.
13. An area of known high concentrations of natural resources exploited by local people	Apart from livestock grazing, no natural resource harvest/use by local people has been observed within the Study Area.
14. Areas that meet the criteria of the IUCN's Protected Area Management Categories Ia, Ib and II, although areas that meet criteria for Management Categories III-VI may also qualify depending on the biodiversity values inherent to those sites	None present within/in close proximity the Study Area.
15. Key Biodiversity Areas (KBAs), which encompass inter alia Ramsar Sites, Important Bird Areas, Important Plant Areas (IPA) and Alliance for Zero Extinction Sites	None present within/in close proximity the Study Area.
16. Areas determined to be irreplaceable or of high priority/significance based on systematic conservation planning techniques carried out at the landscape and/or regional scale by governmental bodies, recognized academic institutions and/or other relevant qualified organizations (including internationally recognized NGOs)	None present within/in close proximity the Study Area.
17. High Conservation Value (HCV) areas	None present within/in close proximity the Study Area.

18 BIODIVERSITY IMPACT ASSESSMENT

18.1 PREDICTED IMPACTS

Potential impacts of the Project on biodiversity were identified, taking cognisance of those already outlined in the Scoping Report (Golder Associates, 2016) and the previous terrestrial biodiversity impact assessments for the proposed Project footprint (RHDV, 2014b; BEC, 2010). The predicted impacts on biodiversity for the construction, operational and closure phases of this Project are outlined in the following sections.

18.1.1 IDENTIFIED IMPACTS FOR THE CONSTRUCTION PHASE

The main impact on biodiversity during the construction phase arises from changes in land cover due to the proposed construction of the Project and all associated infrastructure, resulting in direct impacts on the extent and composition of vegetation communities and associated faunal groups. Specific project impacts that could occur include:

⇒ Reduction in extent of habitats within the Project footprint;
⇒ Introduction and exacerbation of declared and invasive plant species;
⇒ Loss/disturbance of flora and fauna species of conservation concern;
⇒ Loss/disturbance of other fauna species;
⇒ Reduction in extent of Natural Habitat; and
⇒ Reduction in extent of Critical Habitat; and
⇒ Soil erosion and sediment loading of surface water runoff.

18.1.2 IDENTIFIED IMPACTS FOR THE OPERATIONAL PHASE

Predicted impacts on biodiversity during the operational phase of the Project relate to disturbance to resident fauna species as a result of the presence of the photovoltaic facility, and contamination risks for the Orange River. The specific operational impacts that are anticipated include:

⇒ Spread of invasive species; and
⇒ Disturbance of resident faunal species caused by ongoing operation and maintenance activities at the facility (e.g. security lighting at night, security patrols of the boundary throughout the day) (human-animal conflict situations;

18.1.3 IDENTIFIED IMPACTS FOR THE DECOMMISSIONING/CLOSURE PHASE

Predicted impacts on biodiversity and ecosystem services during the decommissioning and closure phase of the Project include the following:

⇒ Spread of invasive species;
⇒ Soil erosion and loss/disturbance of ecosystems of conservation concern.

18.2 IMPACT ASSESSMENT FOR PROJECT PHASES

The Project components and activities potentially affecting biodiversity are broken down by Phase and assessed individually as follows.

18.2.1 CONSTRUCTION PHASE IMPACTS

Predicted impacts on biodiversity during the construction phase of the Project relate to vegetation clearance within the photovoltaic plant development footprint, resulting in direct effects on species and ecosystems of conservation concern, indirect effects on ecosystem integrity due to dust and sediment generation causing contamination of surface water systems. The impact assessment matrix summarises construction-phase related impacts to biodiversity (Table 14); specific impacts are discussed in the paragraphs that follow.

Loss of extent of modified habitats within the Project footprint

Site clearance within the footprint of the photovoltaic plant and associated panels will result in a combined loss of approximately 1 500 ha of existing vegetation within the study area, including calcareous low shrub plains, open shrub plains and open shrub duneveld. These vegetation communities (although largely natural) were considered to be comparatively deteriorated as a result of persistent livestock grazing pressure, and were ascribed a moderate ecological integrity status.

The magnitude of loss of these habitats is considered low in the context of the expansive area covered by the regional Kalahari Karroid shrubland vegetation type which supports similar habitat types and vegetation communities. The loss will be for the duration of the Project until such a time as the photovoltaic plant is decommissioned and the site rehabilitated, so will be long-term in duration. This impact is largely restricted to the development footprint (areas subjected to surface clearance); the overall impact significance is therefore considered moderate, notably as a result of the spatial restriction t moderate ecological sensitivity areas.

The anticipated magnitude of impacts, despite being largely irremediable, could be reduced to minor, and the overall impact significance to low, through the application of the recommended mitigation measures that restrict the exacerbation of this impact to surrounding areas.

Introduction/spread of exotic invasive species

Exotic invasive species have been recorded within the Study Area; vegetation clearance works in advance of construction may create conditions that are favourable for the establishment and spread of these species to neighbouring areas, and even further afield if earth movements take place. The impact magnitude could be high as exotic species are capable of rapidly spreading throughout a locality; and the duration is considered permanent as many exotic species are costly and difficult to eradicate, particularly when these species have become established in an area.

The probability of this occurring is considered medium, given that some (few) declared invasive species have already been recorded within the Study Area. The overall impact significance is considered moderate prior to mitigation. The application of the recommended mitigation measures reduces the potential magnitude and extent of effects, leaving an impact of low significance post- mitigation.

Loss/disturbance of flora and fauna species of conservation concern

Vegetation clearance for construction of the proposed PV solar facilities will result in the loss/disturbance of habitat for species of conservation concern, notably so for flora species, but also for fauna species such as Bat-Eared Fox and Cape Fox, whose prey species inhabit the vegetation within the Study Area for foraging and shelter. Construction activities could cause fatalities to individuals of slow-moving or burrowing species of conservation concern which may not be able to escape oncoming machinery e.g. Suricate, Karoo Round-eared Sengi, Cape Short-tailed Gerbil, and Highveld Gerbil. In addition, indirect effects due to the presence of people and heavy machinery may impact faunal species of conservation concern in the wider landscape. High fatality figures are typical for Bat-eared fox and Cape fox that are particularly susceptible as they are nocturnal species that frequent and utilise roads during the night.

The potential impact of loss/disturbance of species of conservation concern is assessed as high, due to the confirmed presence of several species of conservation concern, and the predicted presence of several others. Anticipated impacts can be reduced to low significance, provided that the recommended mitigation measures are applied; specifically the appointment of an Environmental Control Officer for the duration of construction, and additional targeted surveys in for resting areas/dens of mammal species of conservation concern that are known to be present within the Study Area, such as Honey Badger, Aardvark, Striped Polecat, and Bat-eared Fox, directly in advance of clearance works. Strict control of

vehicle movement, notably during nocturnal periods, in addition to reduced speeds, will assist in limiting accidental fatalities.

Loss/disturbance of other fauna species

Vegetation clearance could result in direct impacts including mortality and injury of other fauna. This is considered to be an impact of moderate significance – although species may not be of specific conservation concern, they contribute to the overall regional biodiversity and ecological integrity of the Study Area.

Provided that the recommended mitigation measures are put in place, the predicted impact can be reduced to one of low significance.

Reduction in extent of natural habitats

Natural habitat within the Study Area consists of the rocky outcrop to the north of the Study Area. The magnitude of predicted effects on this habitat are considered to potentially be of moderate significance, as although only a small area of habitat would be affected in the context of the total area of those habitat types, the good-pristine ecological integrity assigned to these areas and its classification as Natural Habitat (IFC, 2012) increases the biodiversity value of these habitats. The IFC requires no net loss of Natural Habitats, therefore provided that the application of the recommended mitigation measures is adhered to, i.e. avoidance of any construction works or vegetation clearance in this habitat, the predicted effects can be reduced to low significance.

Soil erosion and sediment loading of surface water runoff

Dust is expected to be generated during construction activities and earthworks; dust can suppress photosynthesis and affect the growth rates of some plant species. This can have knock-on effects on the ability of vegetation communities to support wildlife; it can also affect the quality of riparian and wetland habitats through changes in water chemistry. In addition, the clearance of the vegetation on site is expected to create conditions more conducive to soil erosion as a result of wind and storm water runoff, which can also contribute to sedimentation of surface water systems. The impact significance is predicted to be medium prior to mitigation, due to the limited extent and duration of predicted effects which would be greatest during seasonal rains.

With the application of recommended mitigation measures, the duration, extent and probability of impact can all be reduced; reducing the resulting impact to one of low environmental significance post-mitigation.

Nature	Loss of extent of modified habitats within the Project footprint (direct impacts on natural vegetation)	
	Before Mitigation	*After Mitigation*
Probability	5 (Definite)	5 (Definite)
Duration	5 (Permanent)	4 (Long-term)
Scale	1 (Site only)	1 (Site only)
Magnitude	4 (Low)	2 (Minor)
Significance	**50 (Moderate)**	**35 (Moderate)**
Nature	Introduction/spread of exotic invasive species	
	Before Mitigation	*After Mitigation*
Probability	4 (Highly probable)	3 (Medium probability)
Duration	5 (Permanent)	2 (Short-term)
Scale	2 (Local)	1 (Site only)
Magnitude	6 (Moderate)	2 (Minor)
Significance	**52 (Moderate)**	**15 (Low)**

Nature	Loss/disturbance of flora and fauna species of conservation concern	
	Before Mitigation	*After Mitigation*
Probability	4 (Highly probable)	4 (Highly probable)
Duration	4 (Long-term)	4 (Long-term)
Scale	2 (Local)	1 (Site only)
Magnitude	8 (High)	4 (Low)
Significance	56 (Moderate)	36 (Moderate)
Nature	Loss/disturbance of other fauna species	
	Before Mitigation	*After Mitigation*
Probability	5 (Definite)	3 (Medium probability)
Duration	4 (Long-term)	4 (Long-term)
Scale	1 (Site only)	1 (Site only)
Magnitude	6 (Moderate)	4 (Low)
Significance	55 (Moderate)	27 (Low)
Nature	Reduction in extent of natural habitats, systems of conservation concern	
	Before Mitigation	*After Mitigation*
Probability	3 (Medium probability)	2 Low probability)
Duration	5 (Permanent)	5 (Permanent)
Scale	1 (Site only)	0 (None)
Magnitude	8 (High)	4 (Low)
Significance	42 (Moderate)	18 (Low)
Nature	Soil erosion and sediment loading of surface water runoff	
	Before Mitigation	*After Mitigation*
Probability	4 (Highly probable)	2 Low probability)
Duration	4 (Long-term)	2 (Short-term)
Scale	2 (Local)	2 (Local)
Magnitude	4 (Low)	2 (Minor)
Significance	40 (Moderate)	12 (Low)

18.2.2 Operation Phase Impacts

Predicted operational phase impacts relate to disturbance to resident fauna species as a result of the presence of the photovoltaic plant, and contamination risks for the Orange River. The impact assessment matrix summarises operation phase-related impacts to biodiversity; specific impacts are discussed in the following paragraphs.

Spread of invasive plant species

The spread of invasive species, particularly invasive plant propagules by heavy machinery and earth works could cause an impact of high environmental significance, depending on the invasive plant species that occur in the area. The application of effective mitigation measures is critical in ensuring an impact of low environmental significance post-mitigation.

Direct loss (injury/mortality) of fauna species via roadkill

Increased vehicular traffic in the study area during the operation of the photovoltaic plant is likely to result in increased incidences of road kill, particularly at night. Magnitude in this case refers to the number of wildlife road deaths, which is considered to be potentially high. The impact would be long-term and would affect wildlife on a local scale with an estimated high probability of occurrence, resulting in an impact of moderate significance.

Although the application of mitigation measures would reduce the number of road kill deaths (magnitude) and the probability of vehicle-animal collisions happening, the impact remains one of moderate significance post-mitigation.

Disturbance of faunal species of conservation concern – site lighting

Based on observations of the Bokpoort I facility made during the field work conducted in September 2015, the Bokpoort II facility will be well-lit at night. In addition, frequent security patrols of the boundary throughout the day were observed. These, together with on-going operation and maintenance activities at the facility, are expected to cause disturbance to faunal species of conservation concern in surrounding areas, particularly at night time. The magnitude of the effects is expected to be moderate given the extent of lighting observed at the existing facility. The predicted impact is thus considered to be of moderate significance prior to mitigation.

Once the recommended mitigation measures are applied, the magnitude of effects on bats and the probability of effects on other faunal species (some of the more adaptable fauna species e.g. foxes may become accustomed to a certain level of disturbance over time) can be reduced, reducing the significance of the overall impact to low.

Disturbance of faunal species of conservation concern – barrier to movement

Security fencing on the perimeter of the development compound will present a barrier to movement for mammal species of conservation concern such as Aardvark, Bat-eared Fox and Honey Badger, as well as larger reptiles. This may reduce mammal movement capability through the landscape, forcing affected species to make longer, more energetically-expensive journeys to get around the fenced areas. The magnitude of potential effects is considered moderate, as no direct mortality or injury to species of conservation concern is anticipated. The effects would be long-term, occur at a local scale and have a moderate likelihood of occurrence, given the relatively sparse mammal population within the study area. The overall significance of impact is considered to be moderate. It is difficult to mitigate the presence of the security fence during the lifetime of the Project; effects would only be reduced following closure and decommissioning.

Therefore, the potential impacts remain of moderate significance for the lifetime of the Project.

Nature	Spread of invasive plant species	
	Before Mitigation	*After Mitigation*
Probability	4 (Highly probable)	3 (Medium probability)
Duration	5 (Permanent)	2 (Short-term)
Scale	2 (Local)	1 (Site only)
Magnitude	6 (Moderate)	2 (Minor)
Significance	52 (Moderate)	15 (Low)
Nature	Direct loss (injury/mortality) of fauna species via roadkill	
	Before Mitigation	*After Mitigation*
Probability	5 (Definite)	4 (Highly probable)
Duration	4 (Long-term)	4 (Long-term)
Scale	2 (Local)	2 (Local)
Magnitude	8 (High)	4 (Low)
Significance	70 (Moderate)	40 (Moderate)
Nature	Disturbance of faunal species of conservation concern – site lighting	
	Before Mitigation	*After Mitigation*
Probability	5 (Definite)	2 Low probability)
Duration	4 (Long-term)	4 (Long-term)
Scale	2 (Local)	2 (Local)
Magnitude	6 (Moderate)	4 (Low)
Significance	60 (Moderate)	20 (Low)

Nature	Disturbance of faunal species of conservation concern – barrier to movement	
	Before Mitigation	*After Mitigation*
Probability	4 (Highly probable)	3 (Medium probability)
Duration	4 (Long-term)	4 (Long-term)
Scale	2 (Local)	2 (Local)
Magnitude	6 (Moderate)	6 (Moderate)
Significance	48 (Moderate)	36 (Moderate)

18.2.3 CLOSURE/DECOMMISSIONING PHASE

Predicted impacts on biodiversity during the decommissioning and closure phase of the project relate to the spread of invasive species as a result of large-scale ground works, and contamination of surface water systems with resultant effects on aquatic species of conservation concern; in particular frogs and fish of conservation concern.

Spread of invasive plant species

The spread of invasive species, particularly invasive plant propagules by heavy machinery and earth works could cause an impact of high environmental significance, depending on the invasive plant species that occur in the area. The application of effective mitigation measures is critical in ensuring an impact of low environmental significance post-mitigation.

Soil erosion and sediment loading of surface water runoff

Relics of the operational and decommissioning phases of the project could potentially cause unintended changes in surface water run-off that might cause and contribute to conditions that are conducive for soil erosion. Similarly, poorly vegetated areas might be subjected to wind, which will contribute to surface erosion. The impact significance is predicted to be medium prior to mitigation, due to the limited extent and duration of predicted effects which would be greatest during seasonal rains.

With the application of recommended mitigation measures, the duration, extent and probability of impact can all be reduced; reducing the resulting impact to one of low environmental significance post-mitigation.

Nature	Spread of invasive plant species	
	Before Mitigation	*After Mitigation*
Probability	5 (Definite)	3 (Medium probability)
Duration	4 (Long-term)	2 (Short-term)
Scale	3 (Regional)	1 (Site only)
Magnitude	6 (Moderate)	4 (Low)
Significance	65 (Moderate)	21 (Low)

Nature	Soil erosion and sediment loading of surface water runoff	
	Before Mitigation	*After Mitigation*
Probability	3 (Medium probability)	1 (Improbable)
Duration	5 (Permanent)	5 (Permanent)
Scale	2 (Local)	3 (Regional)
Magnitude	6 (Moderate)	6 (Moderate)
Significance	39 (Moderate)	14 (Low)

18.3 CUMULATIVE IMPACTS

The Project is located adjacent to the existing Bokpoort I development. In addition, the proposed SolAfrica Sanddraai 75 MW PV Project in !Kheis LM is situated on the farm directly adjacent to the Project, and the proposed Kheis Solar Park 1 PV project is located in similar habitat approximately 20 km north of the Project (refer **Figure 14**).

Potential residual (post-mitigation) impacts of the Bokpoort II PV Project that may contribute to the cumulative effects of other proposed and permitted solar developments in the region relate to potential indirect impacts on fauna and exacerbation of the loss of remaining areas of natural habitat. The Project may contribute to cumulative impacts on fauna through increased incidences of road kill as a result of increased vehicular traffic and the creation of a barrier to normal movement of medium-large mammals and reptiles due to the physical barrier that will be created by the site security fencing. Incremental losses of remaining areas of natural (untransformed) habitat is anticipated due to the continual increase of human/ industrial related activities on a regional scale.

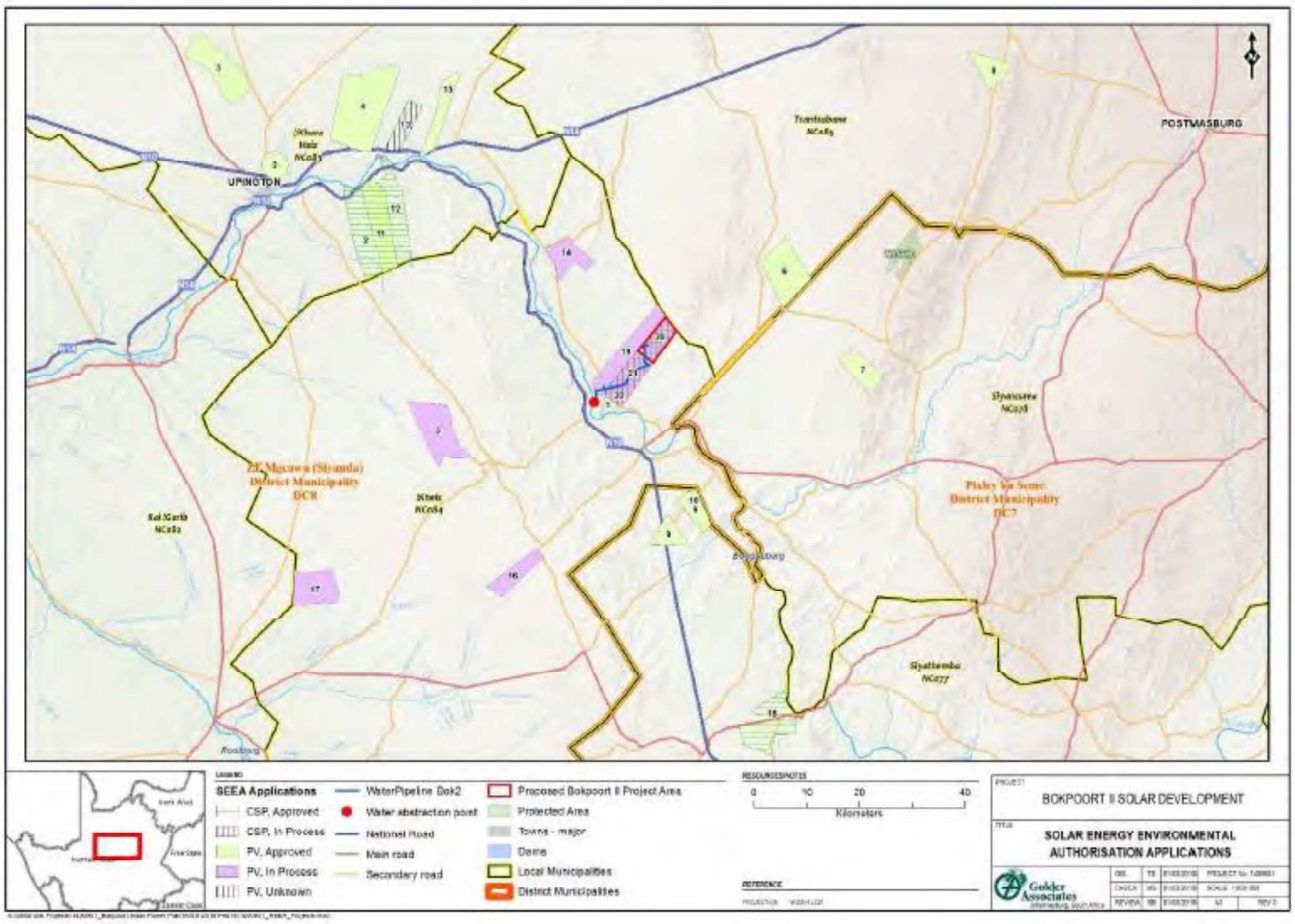


Figure 14: Proposed and authorised solar developments that may contribute to cumulative impacts

18.4 IMPACT SUMMARY (DEVELOPMENT FOOTPRINT)

Summary table for the impact significance on the ecological receiving environment (before and after mitigation)		
Nature	*Before Mitigation*	*After Mitigation*
Construction Phase - Loss of extent of modified habitats within the Project footprint (direct impacts on natural vegetation)	50	35
Construction Phase - Introduction/spread of exotic invasive species	52	15
Construction Phase - Loss/disturbance of flora and fauna species of conservation concern	56	36
Construction Phase - Loss/disturbance of other fauna species	55	27
Construction Phase - Reduction in extent of natural habitats, systems of conservation concern	42	18
Construction Phase - Soil erosion and sediment loading of surface water runoff	40	12
Operational Phase - Spread of invasive plant species	52	15
Operational Phase - Direct loss (injury/mortality) of fauna species via roadkill	70	40
Operational Phase - Disturbance of faunal species of conservation concern – site lighting	60	20
Operational Phase - Disturbance of faunal species of conservation concern – barrier to movement	48	36
Decommissioning Phase - Spread of invasive plant species	65	21
Decommissioning Phase - Soil erosion and sediment loading of surface water runoff	39	14

18.4.1 LINEAR INFRASTRUCTURE SERVITUDE (ACCESS ROAD, WATER PIPELINE AND POWER LINE)

The servitude that will contain the linear infrastructure are spatially placed outside, albeit directly adjacent to, the proposed development footprint (refer **Figure 3**), notably the power line (south and east), access road (south) and the water pipeline (south). The placement of the linear infrastructure in a single 'servitude' will minimize impacts on the natural environment. Furthermore, as the linear infrastructure is also placed directly adjacent to the existing CSP footprint, potential impacts upon the natural receiving environment is further limited.

Natural habitat that will be affected by the linear infrastructure exhibit similar characteristics to those contained within the development footprint (refer **Section 15.4**). Taking cognisance of the nature of impacts associated with construction and operation of linear infrastructure, the nature and extent of impacts associated with these infrastructures are similar in significance than the principal development footprint, albeit with limited physical extent. As the linear infrastructure is indelibly linked to the PV development, a similar impact significance is therefore estimated, and a similar mitigation approach is recommended.

19 RECOMMENDED MITIGATION APPROACH

19.1 MITIGATION HIERARCHY BACKGROUND

Mitigation aims to eliminate or reduce negative biodiversity impacts. Mitigation options should generally be considered in the following order of preference:

1. Avoidance of impacts altogether;
2. Reduction of impacts where unavoidable;
3. Restoration of habitats to their original state;
4. Relocation of affected species or habitats; or
5. Compensation for any residual, unavoidable damage.

The mitigation of negative impacts on biodiversity and ecosystem services is a legal requirement for authorisation purposes and must take on different forms, depending on the significance of the impact and the area being affected. Mitigation requires proactive planning that is enabled by following the mitigation hierarchy, illustrated in **Figure 15**. Its application, is intended to strive to first avoid disturbance of ecosystems and loss of biodiversity, and where this cannot be avoided altogether, to minimise, rehabilitate, and then finally offset any remaining significant residual negative impacts on biodiversity, where:

Avoiding or preventing impacts – refers to considering options in project location, siting, scale, layout, technology and phasing to avoid impacts on biodiversity, associated ecosystem services, and people. This is the best option but is not always possible if development/ construction is to take place. However, there are areas where the environmental and social constraints are too high, and development should not take place. Such areas are best identified early in the development life cycle, so that impacts can be avoided, and authorisations refused. In the case of areas where environmental constraints might be limiting, this includes some ecosystems, habitats, ecological corridors, or areas that provide essential ecosystem services and are of such significant conservation value or importance that their loss cannot be compensated for (i.e. there is no substitute). In such areas, it is unlikely to be possible or appropriate to rely on the latter steps in the mitigation hierarchy (e.g. rehabilitating or offsetting impacts) to provide effective remedy for impacts on biodiversity or ecosystem services. Information about the location of many such areas is available, often making it possible to avoid them.

Reduction of impacts where unavoidable – refers to considering alternatives in the project location, siting, scale, layout, technology and phasing that would minimise impacts on biodiversity and ecosystem services. Even in areas where the environmental and social constraints are not particularly high for development to proceed/take place every effort should still be made to minimise impacts.

Restoration of habitats to their original state – refers to the rehabilitation of areas where impacts were unavoidable, and measures are taken to return impacted areas to a condition ecologically similar to their 'pre-development natural state' or an agreed land use after closure. Although rehabilitation is important and necessary, unfortunately even with significant resources and effort, rehabilitation is a limited process that usually falls short of replicating the diversity and complexity of a natural system. Instead, rehabilitation helps to restore some resemblance of ecological functioning in an impacted landscape, to avoid on-going negative impacts, and/or to provide some sort of aesthetic fix for a landscape. Rehabilitation should occur concurrently or progressively with the proposed activity, and/or on cessation of the activity.

Relocation of affected species or habitat – refers to the physical translocation of affected individuals within the footprint, or adjacent areas, where unavoidable and devastating effects are likely to occur. The translocation of individuals is generally subject to permitting requirements and should be based on a like-for like habitat, taking cognisance of potential impacts such as genetic populations, geographic isolation, etc. The relocation of habitat is generally in severely selective events where small, isolated and biologically significant habitat can be realistically relocated and

reproduced outside the affected footprint. This approach can also be augmented by propagation of certain species.

Offset impacts/ Compensation for any residual, unavoidable damage –refers to compensating for remaining and unavoidable negative effects on biodiversity. When every effort has been made to minimise and then rehabilitate remaining impacts to a degree of no net loss of biodiversity against biodiversity targets, biodiversity offsets can provide a mechanism to compensate for significant residual negative impacts on biodiversity.

The mitigation hierarchy is inherently proactive, requiring the on-going and iterative consideration of alternatives of project location, footprint siting, scale, layout, technology and phasing until the proposed development best 'suits' and can be accommodated without significant negative impacts in the receiving environment. In cases where the receiving environment cannot support the development (e.g. there is insufficient water) or where the project will eradicate unique biodiversity, the development may not be feasible; the earlier the developing company knows of these risks, and can plan to avoid them, the better. In cases where biodiversity impacts are likely to be severe, the guiding principle should therefore be to "anticipate and prevent" rather than "assess and repair".

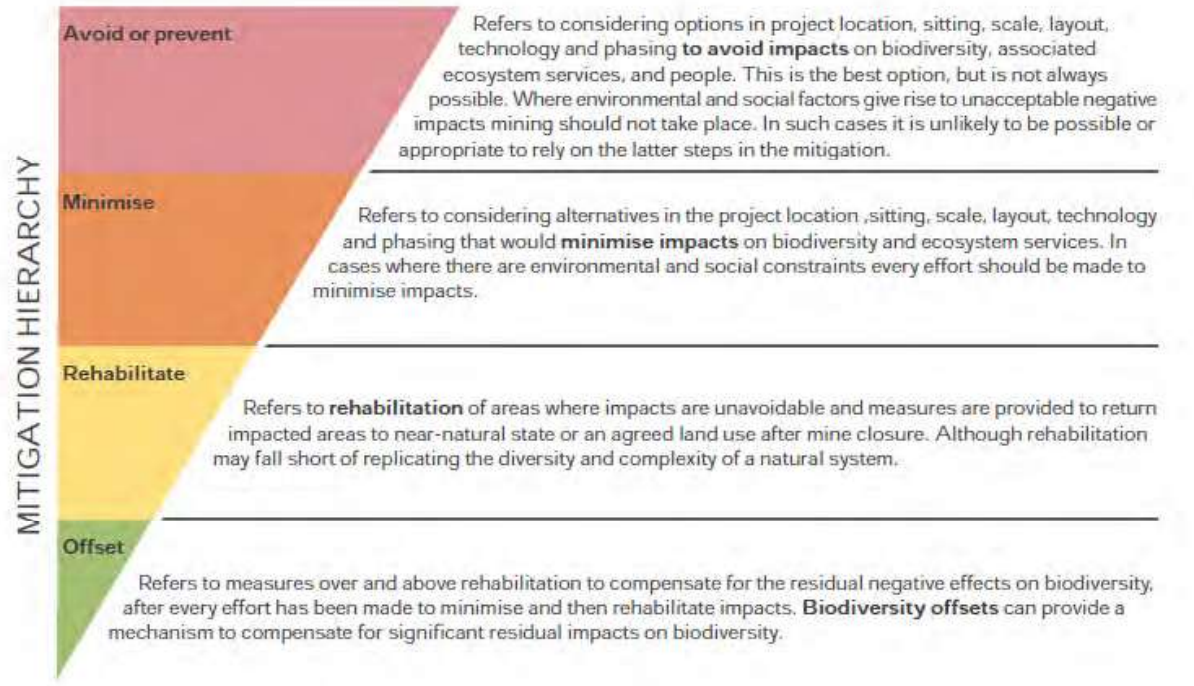


Figure 15: Mitigation hierarchy for dealing with negative impacts on biodiversity

The mitigation approach should be contained and elaborated in the Environmental Management Plan for the activity, notably for the construction phase, and should be regarded as a 'Living Document' that will be amended and updated as new information becomes available. The project should consider minimal disturbance and hazards to the surrounding natural environment. The proposed list of mitigation measures are not considered exhaustive and should be updated where additional or unprecedented impacts are noted during construction and operational phases, i.e. the document should be perceived as a 'living' document that addresses impacts, threats and issues as it becomes evident.

19.2 THE "NO-GO' OPTION

The 'No-Go' option is not regarded an appropriate recommendation for this development, based on the following key considerations:

1. The proposed development site comprises of limited natural savanna and Nama Karoo Biome habitat (Modified habitat, IFC PS6);

2. Natural habitat on the site does not exhibit any aspect of high biological or biodiversity sensitivity and was found to be in a moderately deteriorated condition;
3. Despite the presence of numerous protected tree species on the site, the loss of these species is not anticipated to trigger an exacerbation in the conservation status of any of these species; these species are abundantly encountered in the immediate surrounds;
4. No threatened plant or animal, or population, is anticipated to be affected by the proposed development; and
5. The implementation of a dedicated mitigation approach is anticipated to ameliorate expected and likely impacts to an acceptable level.

19.3 SUPPLEMENTING MITIGATION MEASURES

19.3.1 CONSTRUCTION AND SITE-CLEARANCE PHASE

Mitigation Measure 1 - An Environmental Officer (EO) shall be appointed prior to construction. The appointed Environmental Officer for the project should have an appropriate, not necessarily detailed, knowledge of ecological and biodiversity aspects of the site, surrounds and the general region. Responsibilities should include, but not necessarily be limited to:

a) Ensuring authorisation conditions, guidance of activities, planning and reporting;
b) Identifying species of concern and general flora and fauna species on the site and surrounds;
c) Establish communication with the ecologist/ suitable ecologist as soon as possible to communicate relevant project details and direct any questions in cases of uncertainties;
d) Supervise clearance and construction works;
e) Stop construction activities where necessary (e.g. a breeding/resting site of a species of conservation concern is discovered) so that the appropriate conservation measures can be undertaken.

Mitigation Measure 2 - The Project shall ensure that valid permits are obtained for the removal, destruction and/or transplant of protected and conservation important plant species from the development site:

a) Prior to site clearance, conduct a detailed 'walkthrough' of the proposed site to ascertain the number, abundance and physical conditions of all protected (NFA, 1998) tree species to assist with permit application (DAFF); and
b) Prior to site clearance, conduct a detailed 'walkthrough' of the proposed site to ascertain the number, abundance and physical conditions of all protected plant species (NCNCA, 2009) to assist with permit application (NCDENC).
c) Prior to site clearance, conduct targeted searches for less mobile animal species of conservation concern with high probability of occurring within the Project footprint (i.e. small mammals, medium mammals that may have dens/resting places/ roosts, burrows, etc. within the footprint) to allow relocation to take place where necessary, and avoid mortalities of these species;

Mitigation Measure 3 - Where possible, collection of propagules, including seeds, cuttings and seedlings of floral species of conservation concern, should be conducted to preserve genetic diversity and retain these species for specific conservation efforts. Where possible, these species should be replanted in areas of the study area that are proposed for rehabilitation. Specific plans for this should be outlined in a Biodiversity Management/Action Plan for the Project.

Mitigation Measure 4 - Under no circumstances shall any natural area on neighbouring properties (outside the approved development footprint) be impacted, degraded, cleared, or affected in any manner. The construction of a semi-permanent fence, which will prevent vehicle and personnel access to adjacent areas) shall be constructed.

Mitigation Measure 5 - Due to the type of development, the type and nature of fencing/ demarcation should not attempt to facilitate free movement of smaller/ medium-sized animals as this could lead to unwanted presence (and accidental killing) of animals within the development site.

Mitigation Measure 6 - The use of electric fences (particularly on ground level) is discouraged. Top wire strands should be grounded to avoid electrocution of perching birds.

Mitigation Measure 7 - No surface disturbance or vegetation clearance should occur in the rocky outcrop that consists of Natural Habitat as defined by IFC. This habitat, plus a 250 m buffer, should be demarcated and no construction activity should occur within the demarcated zone;

Mitigation Measure 8 - Areas proposed for vegetation clearance should be clearly marked and no heavy vehicles should travel beyond the marked works zone;

Mitigation Measure 9 - The retention of a vegetated buffer zone between the edge of the proposed infrastructure footprint and the outer boundary of the facility, within which the existing vegetation is retained, is recommended. This will reduce disturbance associated with construction activity (presence of people and heavy machinery, disturbance of faunal species of conservation concern), and will also contribute to the conservation of natural vegetation within the project boundary.

Mitigation Measure 10 - Cleared vegetation and debris that has not been utilised must be collected and disposed of at a suitable waste disposal site. Under no circumstances may it be burned on site.

Mitigation Measure 11 - No painting or marking of rocks or vegetation to identify locality or other information shall be allowed, as it will disfigure the natural setting. Marking shall be done by steel stakes with tags, if required. All temporary markings will be removed upon completion of the construction.

Mitigation Measure 12 - Collection of branches, wood (dead or alive), shrubs or any vegetation for fire making purposes is strictly prohibited.

Mitigation Measure 13 - Absolutely no animals may be hunted, trapped, snared or killed for any purpose whatsoever. Nests shall be protected, and no eggs shall be collected.

Mitigation Measure 14 - Develop and implement an Alien and Invasive Management Programme (flora and fauna). The aim of this programme should include (*inter alia*) the identification, control and eradication of invasive and exotic animals and plants from the site and immediate surrounds. The Environmental Officer shall compile relevant action plans to deal with the presence of alien and invasive species.

Mitigation Measure 15 - No domestic pets of any kind, with specific reference to feral cats, should be allowed on the development.

Mitigation Measure 16 - Site induction for contractors and workers should include a familiarization with all aspects relating to environmental components of the project, as well as potentially occurring dangerous animals of the area and the correct actions to take when encountering dangerous species, notably snakes and scorpions.

Mitigation Measure 17 - A competent person must be appointed to safely handle and remove any dangerous animal from the construction site.

Mitigation Measure 18 - Establish operational procedures for eventualities in dealing with snakebites.

Mitigation Measure 19 - Prevent all open fires on site.

Mitigation Measure 20 - The irresponsible use of welding equipment, oxy-acetylene torches and other naked flames, which could result in veld fires, or constitute a hazard should be guided by safe practice guidelines.

Mitigation Measure 21 - The burning of general waste material is not to be allowed.

Mitigation Measure 22 - Provide demarcated fire-safe zones, facilities and suitable fire control measures;

Mitigation Measure 23 - Develop an effective waste management plan to limit the exposure of natural biota to waste, creating artificial refuge areas, or providing access and food to opportunistic species, including feral cats, mongoose, Suricate, mice, rats, etc. Waste management should aim to develop a zero residual strategy whereby waste materials are immediately removed from site to an approved, central waste management facility. This also refers to on-site ablution facilities, temporary camps, and storage / laydown areas.

Mitigation Measure 24 - Prevent contamination of surrounding, natural habitat from any source of pollution, notably from hydrocarbon spillages, runoff end contamination from transformed areas. Ducts that facilitate

water flow underneath roads shall be kept clear of litter, debris and shall not be used to dispose of chemicals, unwanted effluent, etc.;

Mitigation Measure 25 - Traffic speed limits of a maximum of 40km/h should be imposed for all construction vehicles on all site rods and site access roads to reduce accidental animal road fatalities;

Mitigation Measure 26 - Minimize the use of floodlight and high intensity lighting during the night. Where unavoidable, lights should be mounted as low as possible and fully shielded where possible. Beams should be directed only to areas where it is needed (avoid peripheral light);

Mitigation Measure 27 - Use light bulbs that produces long wavelengths (ambers and reds).

19.3.2 OPERATIONAL PHASE

Mitigation Measure 1 - Absolutely no animals may be hunted, trapped, snared or killed for any purpose whatsoever. Nests shall be protected, and no eggs shall be collected. A periodic (weekly) monitoring survey of all fences shall be conducted to identify and remove snares when observed.

Mitigation Measure 2 - Nests of birds observed within infrastructure shall be discouraged during times when no breeding is taking place. If breeding takes place, the nests shall be removed when the chicks have left the nests.

Mitigation Measure 3 - Continue the Alien and Invasive Management Programme of declared and invasive plant species. The Environmental Manager shall compile relevant action plans to deal with the presence of alien and invasive species.

Mitigation Measure 4 - No domestic pets of any kind, with specific reference to feral cats and dogs, should be allowed on the development site, with specific reference to administrative offices and buildings.

Mitigation Measure 5 - The persistence of opportunistic animal species within the development footprint and appurtenant infrastructure should be monitored and discouraged.

Mitigation Measure 6 - Site induction for contractors and personnel should include a familiarization with all aspects relating to environmental components of the project, as well as potentially occurring dangerous animals of the area and the correct actions to take when encountering dangerous species, notably snakes and scorpions.

Mitigation Measure 7 - A competent person must be appointed to safely handle and remove any dangerous animal from the operational site.

Mitigation Measure 8 - Establish operational procedures for eventualities in dealing with snakebites.

Mitigation Measure 9 - Traffic speed limits of a maximum of 40 km/h should be imposed for all construction vehicles on all site rods and site access roads to reduce accidental animal road fatalities;

Mitigation Measure 10 - Information signs regarding animals that may crossroads, notably during nocturnal periods, should be erected at selected localities. Monitoring of road conditions will inform of sites where burrows are observed;

Mitigation Measure 11 - Develop an effective waste management plan to limit the exposure of natural biota to waste, creating artificial refuge areas, or providing access and food to opportunistic species, including feral cats, mongoose, Suricate, mice, rats, etc. Waste management should aim to develop a zero residual strategy whereby waste materials are immediately removed from site to an approved, central waste management facility. This also refers to on-site ablution facilities, temporary camps, and storage / laydown areas.

Mitigation Measure 12 - Prevent contamination of surrounding, natural habitat from any source of pollution, notably from hydrocarbon spillages, runoff end contamination from transformed areas. Ducts that facilitate water flow underneath roads shall be kept clear of litter, debris and shall not be used to dispose of chemicals, unwanted effluent, etc.;

Mitigation Measure 13 - Minimize the use of floodlight and high intensity lighting during the night. Where unavoidable, lights should be mounted as low as possible and fully shielded where possible. Beams should be directed only to areas where it is needed (avoid peripheral light);

Mitigation Measure 14 - Use light bulbs that produces long wavelengths (ambers and reds).

19.3.3 DECOMMISSIONING AND REHABILITATION PHASE

Mitigation Measure 1 - The use of locally indigenous plant species for landscaping and rehabilitation purposes is strongly recommended. In particular, the retention of trees (notably protected trees) should be assessed as part of the rehabilitation aspect.

Mitigation Measure 2 - Under no circumstances shall exotic and invasive plants be used for landscaping purposes.

Mitigation Measure 3 - An invasive species management plan for rehabilitation works should be developed. This will include the identification of target areas for invasive species control, and species-specific eradication methods and measures that will need to be enacted; and

Mitigation Measure 4 - Restoration/rehabilitation of the Project footprint must include consideration of compatible measures for biodiversity enhancement. Such measures should include planting of native species vegetation using the plants/propagules maintained since construction phase and demarcation of rehabilitated areas as conservation areas only i.e. no livestock grazing should take place in these areas.

19.3.4 SUGGESTED BIODIVERSITY MONITORING PROTOCOL

Constant and periodic monitoring of the following aspects are recommended:

Vegetation – the continuation of the AIP species management plan during all stages of the development. This should be developed by a qualified ecologist, implemented by the Environmental Manager. Ongoing monitoring should be conducted by the ECO and periodic monitoring (annual) by a qualified ecologist to ascertain the efficacy of the programme.

Vegetation – monitoring of rehabilitation success and management should be conducted after commencement of rehabilitation activities. Seasonal inspections of rehabilitation areas should be conducted by the ECO, based on criteria from the rehabilitation plan.

Vegetation and land use - an annual monitoring protocol shall be executed to assess the status and impacts of the development on areas of remaining natural habitat in the immediate surrounds of the development footprint. This shall include reference to botanical and faunal observations and diversity patterns and will advise the Project on adverse actions and effects of the Project outside the approved footprint.

Fauna – ongoing monitoring of the presence of animals within the site and immediate surrounds, including roads, shall be conducted by the ECO for the project. Voluntary contributions from personnel, by means of observations and photographic evidence is encouraged, with reference to a cautionary approach to potentially dangerous animals.

Fauna – a register shall be created for all observations relating to the ecological receiving environment.

20 CONCLUDING STATEMENT AND PROFESSIONAL OPINION

It is a regulatory requirement that the specialist provides a professional opinion in regards to the proposed development.

The various assessment of the ecological receiving environment that were accessed to compile this report revealed a moderate, at best, ecological sensitivity of remaining and untransformed portions of the site. The photovoltaic plant development will potentially affect biodiversity in three main ways; loss in extent of vegetation communities and loss and associated disturbance of species of conservation concern during construction; effects on fauna species of conservation concern as a result of site lighting, security fencing and increased road traffic during operation, and the spread of invasive species and potential contamination of remaining natural (surrounding) ecosystems during closure. Biological attributes of the site exhibit typical diversity and status of natural spaces in the region of the site, which is ultimately characterised by limited and low intensity, albeit long-term, anthropogenic impacts that have caused a moderate decline in the status and natural diversity. Despite a moderate to high correlation with regional ecological types, only a moderate diversity was recorded on the site, which provides an indication of the relentless nature of existing impacts, and surrounding developments.

A review of the anticipated impacts associated with this type of development on the ecological environment indicates that none of the anticipated impacts can be highlighted or construed to represent an unacceptable or severe threat to sensitive biological or biodiversity components within the study area and wider region. Ecological attributes and characteristics and biological components that were recorded on the site during the brief survey period are regarded common and typical of the larger region and are not restricted to the site, i.e. no plant or animal species or habitat type will be affected in such a manner that the conservation status (local, regional, global) will be affected adversely. Although several species of conservation concern have been recorded within the study area, no species were recorded that would trigger 'Critical Habitat' as defined by IFC. As with any type of anthropogenic development, the decimation of natural habitat is an unfortunate result and the reduction in the local abundance of animals and plants represent natural and anticipated consequences.

The Concluding Statement is based on the following key considerations:

⇒ It is recognised that the proposed site is situated within one of South Africa's eight renewable energy development zones, and has therefore been identified as one of the most suitable areas in the country for renewable energy development, in terms of a number of environmental impacts, economic and infrastructural factors;

⇒ Biological and biophysical attributes that characterises the study site are regarded common and are abundantly represented in the wider region;

⇒ A high number of protected tree species were recorded on the site and requires legislative authorisation prior to removal;

⇒ No threatened plant or animal species were recorded on the site during the site investigation;

⇒ It is regarded unlikely that any plant or animal species of a threatened status will persist on the site, other than possibly migratory or opportunistic purposes;

⇒ No habitat type that were recorded within the site are regarded restricted on a local or wider scale. The site also does not exhibit any significant biophysical feature of rarity or ecological importance;

⇒ The loss of natural habitat within the site is not expected to result in significant, or unacceptable, effects of provincial biodiversity conservation patterns or obligations. Similarly, the inclusion of this portion of remaining natural habitat as part of a conservation stewardship will not result in significant gains of conservation efforts on a local or regional scale. Particular reference is made to existing and planned developments in the immediate surrounds (cumulative impacts);

⇒ The loss of this portion of natural habitat is also not anticipated to cause severe or unacceptable changes to or disruptions of ecological processes or animal migratory patterns on a local or regional scale;

⇒ No impact was identified that would result in significant or unacceptable impacts on the ecological receiving environment;

⇒ The application of the recommended mitigation approach is expected to ameliorate anticipated impacts to an acceptable low level.

It is therefore the considered opinion of the specialist, based on results of the various ecological investigations, that no specific objection is raised to the proposed development. Although the proposed activity will result in unavoidable impacts on a local scale, these losses are within an acceptable range and significance.

APPENDIX 1: LIST OF PLANT SPECIES RECORDED WITHIN THE STUDY AREA

** denotes declared AIP species

Species Name	Family	Growth Form	Status/ Uses	Common Name
Acacia erioloba[4]	**Fabaceae**	**Tree**	**Protected Tree (National Forest Act, 1998), edible parts, medicinal uses, firewood**	**Camel Thorn (e), Kameeldoring (a)**
Acacia haematoxylon	**Fabaceae**	**Tree**	**Kalahari Endemic, Protected Tree (National Forest Act, 1998)**	**Grey Camel (e), Vaalkameel (a)**
Acacia mellifera	Fabaceae	Shrub	Declared indicator of encroachment, medicinal uses, poison source	Black Thorn (e), Swarthaak (a)
Adenium oleifolium	Apocynaceae	Succulent	Poisonous parts	Sand Quick (e)
Aloe claviflora	Asphodelaceae	Succulent	None	Kraalaalwyn (a)
Anacampseros albidiflora	Portulacaceae	Succulent	None	
Anacampseros ustulata	Portulacaceae	Succulent	Food preparation	
Anthephora pubescens	Poaceae	Grass	High grazing potential. Decreaser species	Wool grass (e), Borseltjiegras (a)
Aptosimum lineare Marloth & Engl.	Scrophulariaceae	Forb	None	--
Aptosimum procumbens	Scrophulariaceae	Forb	Medicinal uses (sheep)	
Aristida congesta subsp. *congesta*	Poaceae	Grass	Poor grazing potential, indicator of poor habitat, Increaser IIC	Tassel Three-awn (e), Katstertsteekgras (a)
Aristida species	Poaceae	Grass	None	--
Aristida stipitata	Poaceae	Grass	Poor grazing potential, indicator of poor habitat, Increaser IIC	Long-awned Three-awn (e), Langnaaldsteekgras (a)
Asparagus laricinus Burch.	Asparagaceae	Shrub	Edible parts	Cluster-leaved Asparagus (e), Bergkatbos (a)
Asparagus species	Asparagaceae	Shrub	None	Wild Asparagus (e), Katbos (a)
Barleria species	Acanthaceae	Forb	None	--
Berkheya species	Asteraceae	Forb	Weed	--
Blepharis species	Acanthaceae	Forb	None	--
Boscia albitrunca **(Burch.) Gilg & Gilg-Ben.**	**Capparaceae**	**Tree**	**Protected Tree (National Forest Act, 1998), important fodder, traditional uses, traditional medicinal uses**	**Sheperd's Tree (e), Witgat (a), Matoppie (a), Mohlopi (ns)**
Brachiaria glomerata	Poaceae	Grass	None	
Bulbostylis hispidula (Vahl) R.W.Haines subsp. *pyriformis* (Lye) R.W.Haines	Cyperaceae	Forb	None	--
Cadaba aphylla (Thunb.) Wild	Capparaceae	Succulent	Medicinal properties, potentially poisonous	Desert Spray (e), Bobbejaanarm (a)
Cenchrus ciliaris L.	Poaceae	Grass	Palatable grazing species, Decreaser	Blue Buffalo Grass (e), Bloubuffelgras (a)
Centropodia glauca	Poaceae	Grass	Palatable grazing species, Decreaser	

[4] [4] Note: Recently this genus has controversially been split into several genera, with Africa's indigenous *Acacia* now being either *Senegalia* or *Vachellia*. The author, however, do not accept the validity of the new nomenclature and therefore maintains the name *Acacia* in its broad sense.

Species Name	Family	Growth Form	Status/ Uses	Common Name
Ceratotheca triloba (Bernh.) Hook.f.	Pedaliaceae	Forb	Medicinal properties	Wild Foxglove (e), Vingerhoedblom (a)
Chascanum pumilum	Verbenaceae	Forb	None	--
Chrysocoma obtusata	Asteraceae	Forb	None	
Citrullus lanatus	Cucurbitaceae	Climber	Edible parts	Tsamma Melon (e), Tsamma (a), Bitterwaatlemoen (a) (Tsamma is the Khoisan word for 'speckled water')
Cleome angustifolia	Capparaceae	Forb	None	Yellow mouse-whiskers (e), Peultjiesbos
Cleome gynandra	Capparaceae	Forb	Edible parts	African Cabbage (e), Oorpeultjie (a)
Commelina species	Commelinaceae	Forb	None	Dayflower (e)
Crotalaria spartioides	Fabaceae	Shrub	None	
Croton gratissimus	Euphorbiaceae	Shrub	Medicinal uses, larval food for *Charaxes candiope candiope*	Lavender fever-berry (e), Laventelkoorsbessie (a)
Cucumis africanus L.f.	Cucurbitaceae	Forb	Edible parts	Wild Cucumber (e), Wildekomkommertjie (a)
Cymbopogon pospischilii	Poaceae	Grass	Aromatic grass, unpalatable, Increaser I	Narrow-leaved Turpentine Grass (e), Smalblaarterpentyngras (a)
Dicoma capensis	Asteraceae	Forb	Medicinal uses	Koorsbossie (a)
Digitaria eriantha Steud.	Poaceae	Grass	Weaving, palatable grazing grass, Decreaser	Finger grass (e), Finger gras (a)
Enneapogon desvauxii	Poaceae	Grass	Moderate grazing potential	Eight-day Grass (e), Haasgras (a)
Enneapogon scoparius Stapf	Poaceae	Grass	Moderate grazing potential, Increaser IIB	Bottlebrush grass (e), Kalkgras (a)
Eragrostis lehmanniana Nees var. *lehmanniana*	Poaceae	Grass	Indicator of overgrazing, valuable grazing grass,	Lehman Love Grass (e), Lehmann-eragrostis (a), Knietjiesgras (a)
Eragrostis obtusa	Poaceae	Grass	Indicator of poor habitat conditions and historic overgrazing	Dew Grass (e), Douvatgras (a)
Eragrostis porosa	Poaceae	Grass	None	
Eragrostis species	Poaceae	Grass	None	--
Eragrostis trichophora Coss. & Durieu	Poaceae	Grass	Moderate grazing potential	Hairy Love Grass (e), Harige Pluimgras (a)
Eragrostis truncata	Poaceae	Grass	None	
Eriocephalus spinescens	Asteraceae	Forb	None	Doringkapokbos (a)
Euphorbia species	Euphorbiaceae	Succulent	None	--
Felicia species	Asteraceae	Forb	None	--
Fingerhuthia africana Lehm.	Poaceae	Grass	Moderate grazing potential, Decreaser	Thimble grass (e), Vingerhoedgras (a)
Flaveria bidentis (L.) Kuntze**	Asteraceae	Forb	Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2016)	Smelter's bush, Smelterbossie (a)
Geigeria ornativa O.Hoffm.	Asteraceae	Forb	Potentially poisonous, indicator of poor habitat conditions	Vermeerbos (a)
Geigeria species	Asteraceae	Forb	None	--
Gomphocarpus fruticosus (L.) Aiton f.	Apocynaceae	Shrub	Medicinal uses, common weed	Milkweed (e), Melkbos (a)

Species Name	Family	Growth Form	Status/ Uses	Common Name
Grewia flava DC.	Malvaceae	Shrub	Edible parts, weaving, traditional uses, declared indicator of encroachment	Velvet Raisin (e), Fluweelrosyntjiebos (a)
Heliotropium ciliatum Kaplan	Boraginaceae	Forb	None	Kalahari String-of-stars (e), Vergeet-my-nietjie (a)
Hermannia tomentosa (Turcz.) Schinz ex Engl.	Malvaceae	Shrub	None	Lusernbos (a)
Hermbstaedtia fleckii	Amaranthaceae	Forb	None	
Hermbstaedtia odorata	Amaranthaceae	Forb	None	Rooiaarkatstert (a)
Hirpicium gazanioides	Asteraceae	Forb	None	
Hoffmannseggia burchellii subsp. *burchellii*	Fabaceae	Forb	None	= Pomaria burchellii (DC.) B.B.Simpson & G.P.Lewis subsp. burchellii
Indigofera alternans	Fabaceae	Forb	None	Skaap-ertjie (a), Springbokopslag (a)
Indigofera charlieriana var. *charlieriana*	Fabaceae	Forb	None	
Indigofera species	Fabaceae	Forb	None	--
Kleinia longiflora DC.	Asteraceae	Succulent	Traditional uses	Sjambokbos (a)
Kyphocarpa angustifolia (Moq.) Lopr.	Amaranthaceae	Forb	None	Silky Burweed (e)
Lebeckia linearifolia	Fabaceae	Shrub	None	
Leucas capensis (Benth.) Engl.	Lamiaceae	Forb	None	
Leucosphaera bainesii	Amaranthaceae	Shrub	None	
Limeum fenestratum (Fenzl) Heimerl var. *fenestratum*	Molluginaceae	Forb	None	Lintblommetjie (a)
Limeum sulcatum	Molluginaceae	Forb	None	Klosaarbossie (a)
Limeum viscosum	Molluginaceae	Forb	None	Klosaarbossie (a)
Lycium bosciifolium	Solanaceae	Shrub	None	Slapkriedoring (a)
Lycium horridum	Solanaceae	Shrub	None	Slangbessie (a), Boksdoring (a)
Lycium species	Solanaceae	Shrub	None	--
Melinis repens	Poaceae	Grass	Poor grazing potential, Increaser IIC	Natal Red Top (e), Natal-rooipluim (a)
Momordica balsamina L.	Cucurbitaceae	Climber	Edible parts, medicinal uses	Balsam Pear (e), Laloentjie (a), Balsam Peer (a)
Monechma divaricatum (Nees) C.B.Clarke	Acanthaceae	Forb	None	Wild lucern (e), Wilde Lusern (a)
Monechma genistifolium subsp. *australe*	Acanthaceae	Forb	Medicinal uses	Medicinal uses, traditional uses
Monechma incanum	Acanthaceae	Shrub	Palatable grazing	
Monsonia angustifolia E.Mey. ex A.Rich.	Geraniaceae	Forb	None	Crane's Bill (e), Angelbossie (a)
Nerine laticoma	Amaryllidaceae	Geophyte	None	Gifbol (a), Vleilelie (a), Misrybol (a)
Nolletia arenosa	Asteraceae	Forb	South-western Kalahari endemic	
Oxalis semiloba Sond.	Oxalidaceae	Geophyte	Edible parts	Transvaal Sorrel (e), Transvaal Suring (a)
Oxygonum dregeanum	Polygonaceae	Forb	None	--
Parkinsonia africana	Fabaceae	Tree	Grazing potential, edible parts	Green-hair thorn (e), Groenhaardoring (a)

Species Name	Family	Growth Form	Status/ Uses	Common Name
Pentarrhinum insipidum E.Mey.	Apocynaceae	Climber	Edible parts, Non-endemic	African Heartvine (e), Donkieperske (a)
Pentzia calcarea	Asteraceae	Forb	None	Meerkatkaroo (a)
Pergularia daemia	Apocynaceae	Climber	Medicinal uses	Bobbejaankambro (a), Kgaba
Plinthus sericeus	Aizoaceae	Shrub	None	--
Plumbago zeylanica L.	Plumabaginaceae	Shrub	None	
*Prosopis glandulosa***	Fabaceae	Tree	Declared Invader - Category 1B in EC, FS, NE, WC. Category 3 in NC (NEM:BA, 2004. AIP, 2014)	Honey Mesquite (e), Duitswesdoring (a)
Ptycholobium biflorum	Fabaceae	Forb	None	--
Requinea sphaerosperma	Fabaceae	Forb	None	--
Rhigozum trichotomum	Bignoniaceae	Shrub	Declared indicator of encroachment	Three Thorn (e), Driedoring (a)
Rhynchosia species	Fabaceae	Forb	None	--
Salsola etoshensis	Chenopodiaceae	Shrub	None	
Salsola tuberculatiformis	Chenopodiaceae	Shrub	None	
Schmidtia kalihariensis	Poaceae	Grass	Moderate grazing potential, indicator of overgrazing & drought, Increaser IIC	Sour Grass (e), Suurgras (a)
Searsia burchelli	Anacardiaceae	Shrub	Edible parts	
Searsia species	Anacardiaceae	Shrub	None	--
Senna italica	Fabaceae	Forb	Medicinal uses	Wild senna (e), Elandsertjie (a)
Setaria verticillata (L.) P.Beauv.	Poaceae	Grass	Edible parts, palatable grazing	Bur Britle Grass (e), Klitsgras (a)
Solanum supinum Dunal	Solanaceae	Dwarf shrub	Medicinal uses	
Stipagrostis amabilis	**Poaceae**	**Grass**	**Kalahari endemic, weaving**	**Dune bushman grass (e), Duinsteekriet (a)**
Stipagrostis ciliata (Desf.) De Winter var. *capensis* (Trin. & Rupr.) De Winter	Poaceae	Grass	Palatable grazing, Decreaser	Tall Bushman Grass (e), Langbeenboesmangras (a)
Stipagrostis obtusa	Poaceae	Grass	Palatable grazing, Decreaser	Small Bushman Grass (e), Kortbeenboesmangras (a)
Tapinanthus oleifolius	Loranthaceae	Parasite	None	Mistletoe (e), Voëlent (a), Vuurhoutjies (a)
Tephrosia species	Fabaceae	Forb	None	--
Thesium species	Santalaceae	Forb	None	--
Tribulus terrestris L.	Zygophyllaceae	Forb	Medicinal uses	Common Dubbeltjie (e), Gewone Dubbeltjie (a)
Tribulus zeyheri	Zygophyllaceae	Forb	Medicinal uses, grazed but potentially poisonous	Devil-thorn Weed (e), Dubbeltjiedoring (a)
Ziziphus mucronata Willd. subsp. *mucronata*	Rhamnaceae	Tree	Edible parts, traditional medicinal uses, traditional uses	Buffalo-thorn (e), Blinkblaar-wag-'n-bietjie (a)

APPENDIX 2: LIST OF PROTECTED TREE SPECIES UNDER THE NATIONAL FOREST ACT, 1998 (ACT NO. 84 OF 1998)

Binomial name	*Common Name (English)*	*National Tree Number*
Acacia erioloba	**Camel thorn**	**168**
Acacia haematoxylon	**Grey camel thorn**	**169**
Adansonia digitata	Baobab	467
Afzelia quanzensis	Pod mahogany	207
Balanites maughamii subsp. *maughamii*	Torchwood	251
Barringtonia racemosa	Powder-puff tree	524
Boscia albitrunca	**Shepherd's tree**	**122**
Brachystegia spiciformis	Msasa	198.1
Breonadia salicina	Matumi	684
Bruguiera gymnorrhiza	Black mangrove	527
Cassipourea swaziensis	Swazi onionwood	531.1
Catha edulis	Bushman's tea	404
Ceriops tagal	Indian mangrove	525
Cleistanthus schlechteri var. *schlechteri*	False tamboti	320
Colubrina nicholsonii	Pondo weeping thorn	453.8
Combretum imberbe	Leadwood	539
Curtisia dentata	Assegai	570
Elaeodendron transvaalensis	Bushveld saffron	416
Erythrophysa transvaalensis	Bushveld red balloon	436.2
Euclea pseudebenus	Ebony guarri	598
Ficus trichopoda	Swamp fig	54
Leucadendron argenteum	Silver tree	77
Lumnitzera racemosa var. *racemosa*	Tonga mangrove	552
Lydenburgia abotti	Pondo bushman'sTea	407
Lydenburgia cassinoides	Sekhukhunibushman's tea	406
Mimusops caffra	Coastal red milkwood	583
Newtonia hildebrandtii var. *hildebrandtii*	Lebombo wattle	191
Ocotea bullata	Stinkwood	118
Ozoroa namaquensis	Gariep resin tree	373.2
Philenoptera violacea	Apple-leaf	238
Pittosporum viridiflorum	Cheesewood	139
Podocarpus elongates	Breede River yellowwood	15
Podocarpus falcatus	Outeniqua yellowwood	16
Podocarpus henkelii	Henkel's yellowwood	17
Podocarpus latifolius	Real yellowwood	18
Protea comptonii	Saddleback sugarbush	88
Protea curvata	Serpentine sugarbush	88.1
Prunus africana	Red stinkwood	147
Pterocarpus angolensis	Wild teak	236
Rhizophora mucronata	Red mangrove	526
Sclerocarya birrea subsp. *caffra*	Marula	360
Securidaca longepedunculata	Violet tree	303
Sideroxylon inerme subsp. *inerme*	White milkwood	579
Tephrosia pondoensis	Pondo poison pea	226.1
Warburgia salutaris	Pepper-bark tree	488
Widdringtonia cedarbergensis	Clanwilliam cedar	19
Widdringtonia schwarzii	Willowmore cedar	21

21 LEGISLATIVE AND POLICY CONTEXT

21.1 APPLICABLE SOUTH AFRICAN LEGISLATION AND POLICY

This report is written in accordance with the terms of reference for specialist investigations to be conducted during the impact assessment phase, as set out in the NEMA EIA Regulations 2014. In addition, the biodiversity-related legislative instruments and policies discussed in the following sections are addressed in this report.

21.1.1 NATIONAL ENVIRONMENTAL MANAGEMENT ACT: BIODIVERSITY ACT (2004)

The over-arching government policy on natural resource conservation in South Africa is provided for in the National Environmental Management Act: Biodiversity Act (Act No. 10 of 2004). The relevant constitutional provisions in the Act include the following:

⇒ Chapter 3 - Biodiversity Planning and Monitoring: Provides for integrated and co-ordinated biodiversity planning, including the National Biodiversity Framework (see below); Bioregional plans, Biodiversity management plans and agreements, monitoring of the conservation status of various components of South Africa's biodiversity, and promotion of research on biodiversity conservation including the sustainable use, protection and conservation of indigenous biological resources; and

⇒ Chapter 4 - Threatened or Protected Ecosystems and Species: Provides for the protection of ecosystems and species that are threatened or in need of protection; gives effect to South Africa's obligations under international agreements regulating trade in endangered species; and ensures that utilisation of biodiversity is managed in an ecologically sustainable way.

Project Relevance

The Project must demonstrate that it has taken appropriate measures to avoid/minimise any potential impacts on biodiversity within the Study Area, and where necessary, implement an invasive species management plan as part of the mitigation actions for potential effects on biodiversity within the Study Area. In addition, it should avoid significant effects on areas identified as Endangered within the Study Area, such as those linked to the riparian zone of the Orange River.

21.1.2 SOUTH AFRICA'S NATIONAL BIODIVERSITY FRAMEWORK (2008)

South Africa's National Biodiversity Framework (NBF) is a requirement of the National Environmental Management Act: Biodiversity Act, 2004. The NBF is informed by the National Biodiversity Strategy and Action Plan (NBSAP) and the National Spatial Biodiversity Assessment (NSBA), and provides a framework for implementation of the conservation and development objectives of the NBSAP and the NSBA.

Project Relevance

The NBF defines five major pressures on South Africa's biodiversity, including loss and degradation of natural habitat, spread of invasive alien species, over-harvesting of species, over-abstraction of water and climate change. Solar power is an industrial sector whose activities could contribute substantially to over-abstraction of water and invasive species introduction and spread through site clearance and earthworks prior to construction. The Project must therefore demonstrate that it has taken appropriate measures to avoid/minimise any potential impacts on baseline water quality and quantity in the Orange River, and where necessary, implement an invasive species management plan as part of the mitigation actions for potential effects on vegetation communities within the Study Area.

21.1.3 South Africa's National Biodiversity Strategy and Action Plan (2005)

The NBSAP is a long-term (20 year) strategy for the conservation and sustainable use of South Africa's biodiversity. The overall goal of the NBSAP is to conserve and manage terrestrial and aquatic biodiversity to ensure sustainable and equitable benefits to the people of South Africa. It identifies five Strategic Objectives (SO) required to achieve that goal, of which SO1, SO3 and SO5 directly relate to biodiversity management and conservation:

⇒ SO1: An enabling policy and legislative framework integrates biodiversity management objectives into the economy;

⇒ SO3: Integrated terrestrial and aquatic management across the country minimises the impacts of threatening processes on biodiversity, enhances ecosystem services and improves social and economic security; and

⇒ SO5: A network of conservation areas conserves a representative sample of biodiversity and maintains key ecological process across the landscape.

The NBSAP is a useful policy guide for addressing South Africa's concerns in biodiversity conservation and the utilisation of its components, as well as for implementation of the requirements of the Convention on Biological Diversity.

Project Relevance

The NBSAP promotes integrated terrestrial and aquatic management in order to minimise the impacts of threatening processes on biodiversity, enhance ecosystem services and improve social and economic security, sustainable use of biological resources, and maintenance of a network of conservation areas to conserve a representative sample of biodiversity and maintain key ecological process across the landscape. Through appropriate biodiversity survey, impact assessment and management, the Project can contribute to achieving the National biodiversity conservation aims outlined in the NBSAP.

21.1.4 National Spatial Biodiversity Assessment (2004)

The NSBA was the first comprehensive spatial assessment of biodiversity throughout South Africa, intended to inform policies and plans of both public and private-sector bodies with reference to biodiversity issues. It focusses on mainstreaming biodiversity priorities throughout the economy and making links between biodiversity and socio-economic development; with the intention of enabling these to reinforce each other so that conserving biodiversity strengthens the economy and contributes to social development.

Project Relevance

The spatial assessment generated several map products including terrestrial ecosystem status, priority conservation areas and protected areas. These maps will be viewed in the context of the Project to determine any potential impacts the Project may have on terrestrial and riparian ecosystems and ensuing effects on ecosystem service supply by those systems.

21.1.5 Northern Cape Nature Conservation Act (2009)

The Northern Cape Nature Conservation Act (NCNCA, 2009) provides for the sustainable utilisation of wild animals, aquatic biota and plants, and the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), to which South Africa is a signatory. Schedule 1 to the act lists 'specially protected animals' and Schedule 2 lists 'protected animals' for which certain activities are restricted. The main difference between 'specially protected' and 'protected species' is that 'protected' species can be 'possessed' without a specific permit, and hunting is allowed under certain conditions (permits, seasons, bag limits), whereas 'specially protected' species cannot be possessed or hunted except under exceptional circumstances.

21.1.6 NATIONAL FOREST ACT (ACT NO 84 OF 1998)

According the Act (National Forests Act (Act no 84 of 1998)), the Minister may declare a tree, group of trees, woodland or a species of trees as protected. The prohibitions 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 National Forest Act:

⇒ Promotes the sustainable management and development of forests for the benefit of all;
⇒ Creates the conditions necessary to restructure forestry in State Forests;
⇒ Provide special measures for the protection of certain forests and protected trees;
⇒ Promotes the sustainable use of forests for environmental, economic, educational, recreational, cultural, health and spiritual purposes; and
⇒ Promotes community forestry.

Project Relevance

The known presence of protected tree species within the proposed footprint requires legislative compliance through the completion and submission of permit application for the removal of these trees from the footprint. The Project will need to demonstrate alignment with this Act.

21.2 CONVENTIONS AND INTERNATIONAL AGREEMENTS

South Africa is a signatory to the following international conventions and agreements:

⇒ Convention on Biological Diversity: Under the convention, each contracting party is expected to develop national strategies, plans or programs for the conservation and sustainable use of Biological diversity;
⇒ Convention on International Trade in Endangered Species (CITES);
⇒ Convention on the Conservation of Migratory Species of Wild Animals, (the Bonn Convention):
⇒ South Africa is a Contracting Party to the African-Eurasian Water-bird Agreement (AEWA).
⇒ Convention on Wetlands of International Importance (the Ramsar Convention); and
⇒ UNESCO World Heritage Commission.

Project Relevance

The Project will need to demonstrate alignment with the provisions of the conventions and agreements in order to satisfy Government obligations as a signatory to these. This can be achieved through identifying biodiversity value of the Study Area, and in particular restricting impacts on CITES-listed species, migratory species and wetlands by ensuring that internationally recognised practices for the protection, field-based study, and documentation of these biodiversity components are implemented throughout the ESIA and the lifetime of the Project.

21.3 IFC PERFORMANCE STANDARDS 2012

At the project financing level, the assessment and management of biodiversity is largely dealt with in Performance Standard 6 - Biodiversity Conservation and Sustainable Management of Living Natural Resources (IFC, 2012); the PS is briefly summarised as follows.

PS 6 – Biodiversity Conservation and Sustainable Management of Living Natural Resources

Performance Standard 6 (PS6), and the associated Guidance Note (GN6) relates to:

⇒ The protection and conservation of biodiversity;
⇒ Maintenance of ecosystem services; and
⇒ Sustainable management of living natural resources.

The requirements set out in PS6 have been guided by the Convention on Biological Diversity. PS6's main priority is that the Project should seek to avoid impacts on biodiversity and ecosystem services. When avoidance of impacts is not possible, measures to minimise impacts and restore biodiversity and ecosystem services should be implemented.

However, when a project occurs in critical habitat supporting exceptional biodiversity value, a net gain in biodiversity value is required.

PS6 sets specific biodiversity protection and conservation standards relating to potential project impact. The specific requirements that may apply to this Project are summarised below according to the PS6 categories:

⇒ Modified Habitat: Areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area's primary ecological functions and species composition. PS6 relates to areas of modified habitat that have significant biodiversity value, and requires that impacts on such biodiversity must be minimised, and mitigation measures implemented as appropriate;

⇒ Natural Habitat: Viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition. In such areas, the conservation outcome required by PS6 is no-net-loss of biodiversity value achieved using biodiversity offsets;

⇒ Critical Habitat: Areas with high biodiversity value, including (i) habitat of significant importance to Critically Endangered and/or Endangered species; (ii) habitat of significant importance to endemic and/or restricted-range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregatory species; (iv) highly threatened and/or unique ecosystems; and/or (v) areas associated with key evolutionary processes. When a project occurs in critical habitat, a net gain in biodiversity value is required by PS6. This is achievable through appropriate biodiversity offsets;

⇒ Legally Protected Areas: Such areas often have high biodiversity value; when this is the case these areas are likely to qualify as critical habitat and, as such, the conservation outcome required by PS6 is also a net gain in biodiversity value, as well as obtaining the relevant legal permits, following standard governmental regulatory procedures, and engagement of affected communities and other stakeholders;

⇒ Invasive Alien Species: The development project should not intentionally introduce any new alien species (unless carried out within the appropriate regulatory permits) and should not deliberately introduce any alien species with a high risk of invasive behaviour under any circumstance. The project should implement measures to avoid the potential for accidental or unintended introductions; and

⇒ Management of Ecosystem Services: Where a project is likely to adversely impact ecosystem services, an ecosystem service review to identify priority ecosystem services is required. For a full assessment of ecosystem services within the Study Area, see Golder Associates (2016).

Project Relevance

In the case of its direct investments (including project and corporate finance provided through financial intermediaries), the IFC requires its clients to apply the Performance Standards to manage environmental and social risks and impacts so that development opportunities are enhanced. Together, the Performance Standards establish standards that the Project is to meet throughout the life of an investment by IFC. As stated above, Performance Standard 6 requires that Projects seek to avoid impacts on biodiversity and ecosystem services. When avoidance of impacts is not possible, measures to minimise impacts and restore biodiversity and ecosystem services should be implemented. Therefore, in order to secure Project funding from IFC or associated lending institutions, the Project must demonstrate that it is in compliance with the requirements of PS 6.

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23 DECLARATION OF INDEPENDENCE

I, the undersigned, acting in a capacity as specialist biodiversity consultants, declare that:

- ⇒ I acted as independent specialist consultant conducting these biodiversity assessments and preparing the results and reports;
- ⇒ As professional and active members, I consider myself bound to the rules and ethics of the South African Council for Natural Scientific Professions (SACNASP);
- ⇒ Neither I in my personal capacity, nor Bathusi Environmental Consulting cc (BEC), are subsidiaries, legally or financially, of either Mills & Otten Environmental Consultants, or the Client;
- ⇒ At the time of completing this report, I did not have any interest, hidden or otherwise, in the proposed development or activity as outlined in this document, other than fair financial compensation for work performed in a professional capacity as specified by the 2014 National Environmental Management Act (No 107 of 1998) Regulations GNR 983 and GNR 986, as amended in 2017;
- ⇒ Neither I in my personal capacity, nor BEC, shall be affected in any manner by the outcome of the environmental process of which this report and biodiversity assessments form part of, other than being part of the general public;
- ⇒ I do not necessarily object to or endorse the proposed development, but aim to present facts and recommendations based on scientific data and relevant professional experience;
- ⇒ I do not have any influence over decisions made by the governing authorities;
- ⇒ I undertake to disclose, to the competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the Environmental Impact Assessment Regulations, 2005; and
- ⇒ Upon request, I shall provide the competent authority with access to all information at our disposal regarding the study/ application, whether such information is favourable to the applicant or not.

Should I consider myself in conflict with any of the above declarations, I shall formally submit a Notice of Withdrawal to all relevant parties and register as an Interested and Affected Party.

Riaan A. J. Robbeson (Pr.Sci.Nat.)
on behalf of Bathusi Environmental Consulting cc (CK1999/052182/23)
8th February 2020

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25 INDEMNITY & LIMITATIONS OF THIS PROJECT AND REPORT

⇒ Findings, results, observations, conclusions and recommendations presented in this report are based on the authors' best scientific and professional knowledge as well as the interpretation of information available to him at the time of compiling this report.

⇒ Due care and diligence was exercised by the author in rendering services, preparing this document and executing his responsibilities as an ecologist.

⇒ Results presented in this report are based on a snapshot investigation of the study area and not on detailed and long-term investigations of all environmental attributes and the varying degrees of biological diversity that may be present in the study area. Specifically, no discipline-specific, long-term and scientific survey methods were employed in the collation of data from the site. Although as much as possible data was obtained from opportunistic observations and a detailed walk-through of the entire site during the brief survey period, these (EIA) surveys are customarily limited by budgetary and time constraints – results presented in this report need to be interpreted with these limitations in mind.

⇒ Notably, rare and endemic species normally do not occur in great densities and, because of customary limitations in the search and identification of Red Listed species, the detailed investigation of these species was not possible. Results are ultimately based on estimations and specialist interpretation of imperfect data.

⇒ To obtain a comprehensive understanding of the dynamics of ecological associations in an area, as well as the status of endemic, rare or threatened species in an area, ecological surveys should consider investigations at different time scales (across seasons/ years) and through replication.

⇒ This report should always be considered in its entirety. Reading and representing portions of the report in isolation could lead to incorrect conclusions and assumptions. In case of any uncertainty, the authors should be contacted to clarify any viewpoints, recommendations and/ or results.

⇒ It is emphasised that information, as presented in this document, only have bearing on the site as indicated on accompanying maps. This information cannot be applied to any other area, however similar in appearance or any other aspect, without proper investigation.

⇒ Furthermore, additional information may become known during a later stage of the process or development. The authors therefore reserve the right to modify aspects of the report, including findings and recommendations, should new information become available from ongoing research or additional work performed in the immediate region of this specific site, or any forthcoming information pertaining to this investigation after the submission of this report.

⇒ Neither BEC (the company), neither the Mr. Robbeson (the specialist/ ecologist that conducted the surveys and compiled the report) will accept any liability for conclusions, suggestions, limitations and recommendations made in good faith, based on available information, or based on data that was obtained from surveys of a brief nature.

⇒ The client, by accepting this document and submitting it as part of the application procedure, indemnifies BEC, its members, consultants and/or specialist investigators against all actions, claims, demands, losses, liabilities, costs, damages and expenses arising from, or in connection with, services rendered, directly or indirectly by BEC and by the use of the information contained in this document.

26 CURRICULUM VITAE OF RIAAN A. J. ROBBESON (PR.SCI.NAT.)

Date of Birth: 13th April 1969
Nationality: South African
Address: PO Box 77448, Eldoglen, 0171
Cellular Contact: +27 (0)82 3765 933
Telephone Contact: +27 (0)12 658 5579
Email: riaan@bathusi.org

Consulting experience: 22 years
Name of Firm: Bathusi Environmental Consulting cc
Position: Member, Specialist Investigator (Ecology and Botany)
Years with BEC: 20 years
Profession: Environmental Scientist, Ecologist, Botanist

Education

DEGREE / DIPLOMA	FIELD	INSTITUTION
B.Sc.	Botany and Zoology (major subjects), Geography, Chemistry, Genetics	University of Pretoria (1987 – 1991)
B.Sc. (Hons)	Botany	University of Pretoria (1992)
M.Sc.	Plant Ecology	University of Pretoria (1994 – 1998)
Visual Basic Programming	Programming	Unischool (University of Pretoria), 1999

Affiliations

CLASS	PROFESSIONAL SOCIETY	YEAR OF REGISTRATION
Pr.Sci.Nat.	South African Council of Natural Scientific Professions (SACNASP) (Ecological Scientist & Botanical Scientist, Reg no: 400005/03)	2003

Key Attributes

Riaan has been always been a passionate ecologist. Since a very young age his interest in ecology and his natural love and understanding of the natural environment has guided him towards a lifelong commitment to a profession in the natural sciences. After obtaining his B.Sc. degree, with zoology and botany as major subjects in 1990, he committed to post-graduate studies, ultimately obtaining his Masters degree in Plant Ecology at the University of Pretoria in 1998, while working as a research assistant and team member of the National Grassland Biome Project between 1994 and 1998. His involvement in specialist environmental studies followed naturally after graduation in 1998, and he has since been passionately involved in numerous ecological studies with the main emphasis on botanical assessments as part of environmental applications.

Between 1997 and 1999 Riaan was a co-founder of EkoInfo cc and contributed to the general management and consulting responsibilities. In 1999 Riaan, as the sole member, established Bathusi Environmental Consulting cc with the objective of conducting ecological studies with a holistic approach and a strong emphasis of the inclusion of faunal disciplines. Towards this objective, the development of working relations with numerous other specialists was, and still remains, a major priority. Inter-disciplinary collaboration on numerous projects enabled Riaan to acquire a working knowledge of these disciplines, including invertebrates, mammals, herpetofauna and birds.

During his career that spans 20 years, Riaan has acquired extensive experience in the evaluation of the status and reaction of the natural environment to development, across the ecological spectrum of plants, animals and biophysical attributes of the receiving environment. In addition to pure scientific investigations and ecological investigations, he has also successfully developed and implemented several biodiversity monitoring programmes on mining areas. In addition to a vast knowledge of the Grassland and Savanna Biomes, Riaan also utilises every possible opportunity to expand his knowledge of other biomes of southern Africa; he also contributed to international projects in Botswana, Lesotho and Mozambique. Riaan displays an enthusiastic, always willing and 'can do' approach to projects and is able to work either as part of a team environment, or in isolation.

Apart from being committed to his professional career, other personal interests of Riaan include wildlife and sports photography, birding (currently at 506 species), and a life-long passion for sport. He is the holder of five Comrades bronze medals between 2005 and 2010. He is also a frequent competitor in ultra-endurance mountain bike events across South Africa and socially plays golf and squash.

Relevant Computer Skills

⇒ MS Word
⇒ MS Excel
⇒ MS Access
⇒ GIS Arcview 3.2 (a)
⇒ Google Earth
⇒ Adobe Photoshop CS & Lightroom 2.6
⇒ Visual Basic Programming

Employment Record

POSITION	COMPANY	JOB DESCRIPTION	DURATION
Research Assistant	University of Pretoria	Botanical surveys, plant identifications, data capturing, data analysis, report compilation, phytosociological descriptions, Post graduate Masters Publications	1994 - 1998
Member	EkoInfo cc	Project acquisition, site investigations, data analysis, report compilation, GIS mapping, selected peer review for publications and specialist reports	1995 - 1999
Member	Bathusi Environmental Consulting	Project acquisition, project management, site investigations, data analysis, report compilation, GIS mapping, selected peer review for publications and specialist reports, financial administration	1999 - present

Experience & Project Contributions

The development of accurate and comprehensive biodiversity studies that forms an integral part of successful environmental applications for a wide range of clients represents a major focus of BEC. To achieve this objective Riaan is committed to effective acquisition of projects, involvement and management of other specialist investigators as well as the ecological integration and interpretation of biodiversity data and reports to present a holistic overview of the ecological receiving environment.

Riaan has contributed to more than 400 environmental projects and reports that include a range of specialist fields, including biodiversity impact assessments and scoping reports, biodiversity Fatal Flaw assessments, environmental audits, ecological screening assessments, botanical assessments, vegetation sampling, classification, description and mapping, the development and implementation of environmental monitoring programmes, Red Data flora assessments, invasive species management programmes, compilation of Environmental Management Programme Reports, etc.

The range of clients that are assisted by BEC include environmental companies, private developers, mining houses (gold, diamond, iron, coal, sand), parastatals, traditional coal-energy producers, alternative energy producers (coal-fired, UCG, solar), property developers, etc.

Languages

English: RWS - Excellent
Afrikaans: RWS – Excellent

Selected Reports and Projects

The following projects are presented as a brief selection of the contributions to more than 400 projects and reports between 1999 and 2019.

⇒ **Biodiversity Impact Assessments (EIAs):**

- Terrestrial Biodiversity (flora, fauna, avifauna) Impact Assessments of the proposed NEO 1 20MW Solar PV Plant that will be situated in the Mafeteng District of the Kingdom of Lesotho. 2018. For Royal HaskoningDHV. In collaboration with Pachnoda Consulting and Ecocheck Environmental Services.
- Terrestrial Biodiversity (flora, fauna, avifauna) Impact Assessments for the proposed Mutsho Power Project near Makhado, Limpopo Province. 2018. For Savannah Environmental. In collaboration with Pachnoda Consulting and Ecocheck Environmental Services.
- Biodiversity Impact Assessment and development of the biodiversity EMP for the proposed Kalkaar Solar Project in the Northern Cape Province. 2014. For SLR Consulting on behalf of SolarReserve, South Africa.
- Terrestrial biodiversity Impact Assessments of the proposed Tshivhaso Power Station near Lephalale in the Limpopo Province (Savanna Environmental). 2016. For Savannah Environmental. In collaboration with Pachnoda Consulting and Ecocheck Environmental Services.
- Terrestrial biodiversity Impact Assessments of the proposed expansion of the existing Kao Diamond Mine in the Kingdom of Lesotho (EIMS). 2016. For Savannah Environmental. For Environmental Impact Management Services (EIMS). In collaboration with Ecocheck Environmental Services.
- Biodiversity Impact Assessments of the Medupi Power Station near Lephalale in the Limpopo Province. 2006. For Royal HaskoningDHV, previously Bohlweki Environmental. In collaboration with Ecocheck Environmental Services.
- Impact Assessment for a proposed holiday destination in the Okavango Delta in the Republic of Botswana (@Land Landscape Architects). 1997. In collaboration with Ekotrust cc.
- Terrestrial Impact Assessment for a proposed hunting concession in the Okavango Delta in the Republic of Botswana (Ekotrust). 1997.
- Terrestrial Biodiversity Impact Assessment for the GOPE Diamond Mine in the Central Kalahari Game Reserve in the Republic of Botswana. 2008. For Marsh Vikela. In collaboration with Ecocheck Environmental Services.
- Botanical Assessments for the proposed expansion of a holiday destination in Mozambique (EkoInfo cc). 2005. In collaboration with EkoInfo cc and Ecocheck Environmental Services.
- Terrestrial biodiversity Impact Assessments of the proposed Steelpoort Pumped Storage Scheme. 2007. For Royal HaskoningDHV, previously Bohlweki Environmental. In collaboration with Ecocheck Environmental Services.

⇒ **Biodiversity Scoping Assessments:**

- Terrestrial Biodiversity (flora, fauna, avifauna) Scoping Assessments of the proposed NEO 1 20MW Solar PV Plant that will be situated in the Mafeteng District of the Kingdom of Lesotho. 2018. For Royal HaskoningDHV. In collaboration with Pachnoda Consulting and Ecocheck Environmental Services.
- Terrestrial Biodiversity (flora, fauna, avifauna) Scoping Assessments for the proposed Mutsho Power Project near Makhado, Limpopo Province. 2018. For Savannah Environmental. In collaboration with Pachnoda Consulting and Ecocheck Environmental Services.

⇒ **Biodiversity Screening Assessments:**

- Ecological Screening Assessments of 14 K-Routes for the Gauteng Province Department of Roads and Transport as part of the road expansion project. 2018. For Royal HaskoningDHV. In collaboration with Feathers Environmental Services.
- Terrestrial biodiversity screening assessment of the proposed Enviroblast Titanobel development in Gauteng Province. 2016. For Mills & Otten Environmental Consultants.
- Ecological Screening Assessment of the proposed Waterberg Heavy Haul railway project. 2015. For Royal HaskoningDHV

⇒ **Environmental Management Programme Reports (EMPR's):**

- Development of an Environmental Management Report for the Alkantpan Runway as part of the Copperton Wind Energy Project in the Northern Cape Province (fauna and avifauna). For Terramanzi Group. 2019. In collaboration with Pachnoda Consulting and Ecocheck Environmental Services.
- Development of Animal Conflict Resolution approach for the Alkantpan Runway as part of the Copperton Wind Energy Project in the Northern Cape Province (fauna and avifauna). For Terramanzi Group. 2019. In collaboration with Pachnoda Consulting and Ecocheck Environmental Services.

- Development of Biodiversity Action Programme report for the Matla Mine in the Mpumalanga Province. 2014. For Groundwater Consulting Services (GCS). In collaboration with Pachnoda Consulting and Ecocheck Environmental Services.
- Development of an Environmental Management Programme for the proposed Aspen Lakes residential development in Gauteng Province. 2014. For Mills & Otten Environmental Consultants.
- Development of Off-Site Mitigations recommendations for the proposed Majuba Power Station Ashing Expansion Project in the Mpumalanga Province. 2014. For Eskom. In collaboration with Ecocheck Environmental Services.
- Environmental Management Programme for the Vygeboom Power Line. 2019. For Royal HaskoningDHV (previously SSI).

⇒ Biological/ Biodiversity Monitoring Reports:

- Deployment of a biological monitoring programme to ascertain the breeding status of Grey-headed Gulls at the proposed Zenprop Skymall Property near O.R. Tambo International Airport in Gauteng Province. 2017. For Mills and Otten Environmental Consulting cc. In collaboration with Pachnoda Consulting.
- Development and deployment of a biennial faunal monitoring programme for the Letšeng Diamond Mine in the Kingdom of Lesotho (Letšeng Diamonds). Since 2015, ongoing. For Letšeng Diamonds. In collaboration with Pachnoda Consulting, Ecocheck Environmental Services and Enviro-Insight.
- Development and deployment of biodiversity monitoring programme at the Woestalleen Colliery properties in the Mpumalanga Province (Woestalleen Colliery, NuCoal). 1997 – 2008. In collaboration with EkoInfo cc.
- Floristic monitoring surveys within the Blesbokspruit river in the Gauteng Province to determine the effect of acid mine drainage. In collaboration with EkoInfo cc.
- Development and implementation of a biodiversity monitoring programme for the Ghaghoo Diamond Mine in Botswana. 2013. For VDDB Engineers, Marsh Vikela, Ghagoo Diamond Mine. In collaboration with Ecocheck Environmental Services.

⇒ Biodiversity Basic Assessment Reports:

- Terrestrial biodiversity Basic Assessment report for the proposed Etna – Trade powerline in the Gauteng Province (Eskom). 2016. In collaboration with Ecocheck Environmental Services.
- Ecological Basic Assessment of the proposed expansion of the Rietspruit Dam near Ventersdorp in the North-West Province. 2015. For Royal HaskoningDHV.

⇒ Species at Risk Assessments and Studies:

- Ecological status of the (Near Threatened) *Trachyandra erythrorrhiza* community in Esther Park from 2011 (ongoing) as part of compliance for the Bombela Concession Company. 2018. For Bombela Concession Company.
- Final walkdown and marking of protected tree species within the Thabametsi Power Project development footprint, the Medupi-Thabametsi 400 kV line, the Matimba-Thabametsi 400kV Line and the Thabametsi 33 kV line. 2018. For Savannah Environmental. In collaboration with Feathers Environmental Services and Ecocheck Environmental Services.
- Medicinal plants survey on a portion of the Farm Vlakfontein 30-IR in the Gauteng Province. 2017. For Mills & Otten Environmental Consultants.
- Final walkdown and marking of protected tree species within the Masa – Selomo 400 kV lines in the Limpopo Province. 2016. For Babcock International. In collaboration with Ecocheck Environmental Services.
- Search and rescue operation of medicinal plants at the proposed Vorna Valley development in Midrand, Gauteng Province. 2016. For Abland Developers.
- Protected species survey for the proposed water facility expansion at Giyani in the Limpopo Province. 2015. For EIMS.
- Red Data flora investigation for the proposed Irene Development within the Gauteng Province. 2004. For Mills & Otten Environmental Consultants.

⇒ Alien and Invasive Species Management Programmes:

- Development of a management plan for invasive fauna species at the Duvha Power Station in Gauteng Province. 2018. For Eskom. In collaboration with Ecocheck Environmental Services.
- Development of a management plan for alien and invasive plants at the Duvha Power Station in Mpumalanga Province. 2017. For Eskom.
- Development of a management plan for alien and invasive plants at the Majuba Power Station in Mpumalanga Province. 2017. For Eskom.
- Development of a management plan for alien and invasive plant at the Mercedes Benz (South Africa) Plant in Centurion, Gauteng Province. 2017. For Ingen Engineers.

- Survey of alien and invasive plant species for Exxaro Mining Properties in the Mpumalanga Province. 2018. For Ulwando.

⇒ Biodiversity Sensitivity Analysis:

- Sensitivity analysis for the proposed Mogale X (Doornbosch 308) development in Gauteng Province. 2016. For Greenergy.

⇒ Ecological Baseline Assessments and Descriptions:

- Baseline ecological assessment of the Mothae Diamond Mine in the Kingdom of Lesotho. 2017. For Sustain Consulting, Mothae Diamond Mine. In collaboration with Ecocheck Environmental Services.
- Baseline assessment of the proposed Tshwane Freight Terminal in the Gauteng Province. 2016
- Botanical assessments for the proposed Mmamabula Power Lines in the Republic of Botswana. 2006. For EkoInfo cc.
- Botanical surveys in the Tswalu Desert Reserve. 1997. For Ekotrust.
- Ecological Baseline Assessment of the proposed Golwe Development near Vhuri Vhuri in the Limpopo Province. 2007. For AgriDev Consultants. In collaboration with Ecocheck Environmental Services.

⇒ Biodiversity Risk Assessments:

- Risk assessment for the Sappi Enstra Mill in the Gauteng Province. 2016. For WSP Group.
- Assessment of potential damage to trees adjacent to ATC tower infrastructure in Lyttelton and Waterkloof in the Gauteng Province. 2015. For ATC.

⇒ Research, interpretation, analysis of aerial photographs and other:

- Sitting member of the Environmental Monitoring Committee (EMC) for Medupi Power Station (Eskom). 2007 – 2019. For Eskom (Medupi).
- Peer review of the biodiversity impact assessment report for the National Road 3: Keeversfontein to Warden expansion. 2014. For Cave Klapwijk & Associates.
- Development and deployment of provincial floristic surveys to correlate remote sensing vegetation degradation patterns in the Gauteng Province. 1999. For ISCW. In collaboration with EkoInfo cc.
- Development and deployment of provincial floristic surveys to correlate remote sensing vegetation degradation patterns in the Mpumalanga Province (ISCW). 1999. For ISCW. In collaboration with EkoInfo cc.
- Determination of the effect of uncontrolled fires in selected areas within the Sabi Sands Reserve as part of insurance claims. 2001. For Deneys Reitz Attorneys. In collaboration with EkoInfo cc.
- Determination of the impact of Quelea control actions in wetlands on the vegetation in selected wetland regions in the Free State Province. 2000. For ISCW. In collaboration with EkoInfo cc.
- Establishing wind and visual breaks through planting of trees at selected properties of Woestalleen Colliery in the Mpumalanga Province. 2002. For Woestalleen Colliery. In collaboration with EkoInfo cc.
- Ground truthing of landcover mapping procedures within the Gauteng Province. 2004. For SEF.
- Herpetological assessment of the proposed Moruladal Development in the Gauteng Province. 2004. For Mills & Otten Environmental Consultants.
- Assessment of Bushbabies at the proposed Wittkoppen Ext 112 in the Gauteng Province. 2004. For Mills & Otten Environmental Consultants. In collaboration with Ecocheck Environmental Services cc.
- Avifaunal surveys for the proposed H2 Power Plant Development near Bronkhorstspruit in the Mpumalanga Province. 2017. For Feathers Environmental Services.

⇒ Green Certification

- Ecological Green Building Certification for the proposed Woodmead Development in Gauteng Province. 2018. For Mills & Otten Environmental Consultants.

⇒ GIS and related

- Mapping and GIS digitising of maps for the National VEGMAP project. 2000. For Ecotrust.

Selected Reference Contact List

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Babcock South Africa	Donovan Fredrighi	011 739 8200	donovan.fedrighi@babcock.co.za
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Eskom (Medupi Power Station)	Emile Marell	082 560 4618	MarellEm@eskom.co.za
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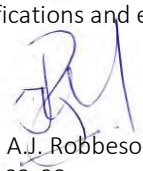
TerraManzi	Kelly Armstrong	021 701 5228	kelly@terramanzi.co.za
Ulwando	Charles Verster	082 653 6081	charles@ulwando.co.za
WSP Group/ Lidwala Consulting	Ashlea Strong	011 361 1300	Ashlea.Strong@WSPGroup.co.za

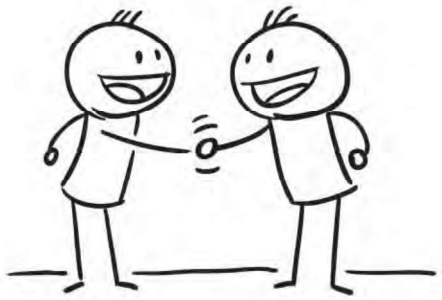
** please note that this list represents an abridged selection of companies, additional contact details can be provided upon request*

Certification

I, the undersigned, certify that to the best of my knowledge and belief, the above data correctly describe me, my qualifications and experience.



Riaan A.J. Robbeson (Pr.Sci.Nat.)
2020-02-08



Contact us, let us help you!

082 3765 933
riaan@bathusi.org
012 658 5579

Appendix B6: Avifauna

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

	(For official use only)
File Reference Number:	
NEAS Reference Number:	DEA/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

BOKPOORT II SOLAR FACILITY

Kindly note the following:

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

Postal address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

Physical address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

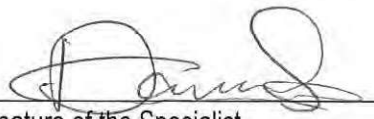
1. SPECIALIST INFORMATION

Specialist Company Name:	ARCUS CONSULTANCY SERVICES SOUTH AFRICA (PTY) LIMITED			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	100
Specialist name:	OWEN RHYS DAVIES			
Specialist Qualifications:	PhD ZOOLOGY (ORNITHOLOGY)			
Professional affiliation/registration:	SOUTH AFRICAN COUNCIL FOR NATURAL SCIENTIFIC PROFESSIONS SACNASP REG. N° 117555			
Physical address:	OFFICE 607 CUBE WORKSPACE ICON BUILDING HANS STRIJDOM AVE			
Postal address:	AS ABOVE			
Postal code:	8001	Cell:	+27 72 558 0080	
Telephone:	+27 21 412 1529	Fax:		
E-mail:	OWEND@ARCUSCONSULTING.CO.ZA			

2. DECLARATION BY THE SPECIALIST

I, OWEN RHYS DAVIES, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.



Signature of the Specialist

ARCUS CONSULTANCY SERVICES SOUTH AFRICA (PTY) LTD

Name of Company:

2020-02-19

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, OWEN RHYS DAVIES, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

ARCUS CONSULTANCY SERVICES SOUTH AFRICA (PTY) LTD

Name of Company

2020-02-19

Date

Rosedene Fillies
Commissioner of Oaths
Practising Attorney SA
ENSafrica
1 North Wharf Square
Loop Street Cape Town 8001

Signature of the Commissioner of Oaths

2020-02-19

Date

AVIFAUNAL SPECIALIST AMENDMENT REPORT FOR THE PROPOSED BOKPOORT II SOLAR FACILITY

On behalf of

Royal HaskoningDHV (Pty) Ltd

December 2019

Prepared By:

Arcus Consultancy Services South Africa (Pty) Limited

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1 INTRODUCTION

ACWA Power Energy Africa (Pty) Ltd (ACWA) obtained three Environmental Authorisations in 2016 for 2 x 75MW photovoltaic (PV) facilities (PV 1 and PV 2) as well as a 150MW concentrated solar power (CSP) tower facility near Groblershoop, Northern Cape Province. However, ACWA Power now propose to amend the project description and apply for authorisation of 8 x 200MW PV components and associated infrastructure, including battery storage (16 ha), access routes, substation, water pipeline connection, 132kV overhead powerline and shared infrastructure consisting of buildings, including a workshop area for maintenance, storage (i.e. fuel tanks, etc.), laydown area, parking, warehouse, and offices (previously approved) on the same site as the CSP development (Figures 1, 2 and 3). Previously, approval for 2 of the 10 PV facilities was obtained, PV 1 (Ndebele) and PV 2 (Xhosa), however the proposal for these two sites did not include the battery energy storage system for either of the sites or the capacity increase from 75 to 200MW and will therefore undergo a separate basic assessment study.

The site is within one of South Africa's eight renewable energy development zones, and has therefore been identified as one of the most suitable areas in the country for renewable energy development, in terms of a number of environmental impact, economic and infrastructural factors.

Arcus Consultancy Services South Africa (Pty) Ltd (Arcus) were appointed to provide avifaunal specialist input in the form of a specialist Impact Assessment Report for the initial development as well as 12 months of pre-construction avifaunal monitoring, the results of which advised the initial impact assessment. Royal HaskoningDHV (Pty) Ltd (RHDHV) have appointed Arcus to provide an update to the specialist Impact Assessment Report to reflect changes associated with the proposed amendment.

1.1 Terms of Reference

The report has been carried out under the following terms of references and provides:

- An assessment of all impacts related to the proposed amendment;
- Advantages and disadvantages associated with the amendment;
- An updated description of the avifaunal baseline, including a description of avifaunal microhabitats available on the project site;
- Identification of information gaps and limitations; and
- A comparative assessment of the potential predicted impacts to avifauna as well as a significance rating before and after the amendment, and associated mitigation measures.

1.2 Assumptions and Limitations

The SABAP1 data covers the period 1986-1997. Bird distribution patterns can change regularly according to availability of food and nesting substrate. (For a full discussion of potential limitations in the SABAP1 data, see Harrison et al. 1997[1]).

The two post-construction studies on impacts of solar energy facilities in the Northern Cape, South Africa have increased the confidence of impact assessments for birds in the area, but these studies were limited in that they only covered a period of three-months each.

The overall environmental impacts of solar energy facilities remain relatively poorly understood as do the specific impacts of these facilities on habitat destruction and fragmentation particularly with reference to birds.

[1]Harrison, J.A., Allan, D.G., Underhill, L.G., Herremans, M., Tree, A.J., Parker, V & Brown, C.J. (eds). 1997. The atlas of southern African birds. Vol. 1&2. BirdLife South Africa: Johannesburg.

While sampling effort was as recommended in the solar guidelines, to achieve statistically powerful results it would need to be increased beyond practical possibilities. The data was therefore analysed at a relatively basic level and interpreted using a precautionary approach.

Relatively dry, drought conditions were experienced during the year of monitoring, and the study was therefore not able to consider the effects of inter-annual variation in avifauna, for example following a good rain season.

2 METHODOLOGY

2.1 Literature Review

The overall environmental impacts of solar energy developments globally remain poorly understood as do the specific impacts of these plants on birds[2]. This is particularly true in a southern African context, however some studies[3,4] have recently been conducted on the impact of solar energy developments on birds in the Northern Cape. These studies have assisted to improve the confidence in the avifaunal impact assessment.

2.2 Defining the Baseline

The baseline avifaunal environment for the broader project area was defined utilising a desk based study and informed by the results of the 12 month pre-construction monitoring programme, which included vantage point surveys, walked transects, drive transects and focal site records (Figure 2) over four seasonal site visits (winter, spring, summer and autumn) and was completed in April 2016. An additional two day site visit was conducted in early December 2019 to assess the environmental status quo as it pertains to avifauna. This information was examined to determine the potential location, abundance and behaviour of avifauna which may be sensitive to the proposed development, and to understand their conservation status and sensitivity.

2.2.1 Sources of information

- Bird distribution data of the Southern African Bird Atlas Project (SABAP1; Harrison *et al*. 1997) and Southern African Bird Atlas Project 2 (SABAP2) obtained from the Avian Demography Unit of the University of Cape Town;
- Co-ordinated Water-bird Count (CWAC) project (Taylor *et al*. 1999);
- The Important Bird Areas (IBA) of southern Africa project (Marnewick *et al*. 2015);
- Avifaunal Impact Assessment Report for the neighbouring Bokpoort I project (van Rooyen, UNDATED);
- The impact of a 'trough' Concentrated Solar Power facility on birds and other animals in the Northern Cape, South Africa (Jeal 2017, MSc thesis conducted on Bokpoort I);
- Publically available satellite imagery;
- Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland (Taylor *et al*. 2015); and
- Avifaunal Impact Assessment Report: Bokpoort II Solar Farm (Arcus 2016).

[2]Jenkins, A.R., Ralston-Paton, S., & Smit-Robinson, H.A. 2017. Birds and Solar Energy Best Practice Guidelines. BirdLife South Africa.

[3]Visser, I. 2016. The impact of South Africa's largest photovoltaic solar energy facility on birds in the Northern Cape, South Africa. Percy FitzPatrick Institute of African Ornithology, University of Cape Town. MSc. Thesis.

[4]Jeal, C. 2017. The impact of a 'trough' Concentrated Solar Power facility on birds and other animals in the Northern Cape, South Africa. Percy FitzPatrick Institute of African Ornithology, University of Cape Town. MSc. Thesis.

2.3 Identification and Rating of Potential Impacts

After collation of the baseline data from the sources of information listed above the potential impacts of the project were identified, for both the construction and operational phases. This was done by reviewing existing literature and data available (both locally and internationally) on the potential impacts of solar energy facilities on avifauna and considering the potential avifaunal community on the project site. The Birds and Solar Energy Best Practice Guidelines (2017) for assessing and monitoring the impact of solar power generating facilities on birds in southern Africa were also considered in the compilation of this report. A significance rating and impact assessment has been done for each impact using set criteria (Appendix I) and impact tables in the following sections below. The impact tables include essential mitigation measures for each of the significance ('With Mitigation') is given for each impact, assuming correct implementation of the mitigations. Cumulative impacts for solar projects within a 50 km radius of the project site (Table 1) were assessed according to the same methodology.

Table 1. Solar Energy Projects within a 50 km radius of the project site[5].

No.	Approx. Distance from Bokpoort II (km)	DEA Reference Number	Applicant	Technology	Capacity (MW)	Status
1	Adjacent	Operational	Operational	Solar CSP	50	Operational
2	1	14/12/16/3/3/2/640	Scatec Solar (Pty) Ltd	Solar PV	86	In Process
3	10	14/12/16/3/3/2/738	Solafrica Photovoltaic Energy (Pty) Ltd	Solar PV	75	In Process
4	10	12/12/20/1920	Solafrica Thermal Energy Pty Ltd	Solar CSP	50	Approved
5	20	14/12/16/3/3/2/906	Marang Solar Farm (Pty) Ltd	Solar PV	unknown	In Process
6	20	14/12/16/3/3/2/907	Marang Solar Farm (Pty) Ltd	Solar PV	unknown	In Process
7	21	14/12/16/3/3/2/571/AM1	Gestamp Asetym Solar South Africa (Pty) Ltd	Solar PV	75	Approved
8	25	14/12/16/3/3/1/909	Siyathemba Solar One (Pty) Ltd	No Technology	unknown	Approved
9	27	12/12/20/2583	To Review	Solar PV	75	Approved
10	29	14/12/16/3/3/1/658	To Review	Solar PV	19	Approved
11	36	12/12/20/2647/48	To Review	Solar PV	225	Approved
12	39	12/12/20/2198	Vanguard Solar Pty Ltd	Solar PV	50	In Process
13	41	14/12/16/3/3/2/625	Ansolgenix (Pty) Ltd	No Technology	unknown	In Process
14	42	14/12/16/3/3/2/299	FG Emvelo Energy (Pty) Ltd	Solar CSP	100	Approved
15	42	14/12/16/3/3/2/639/1	Tewa Isitha Solar 2 (Pty) Ltd	Solar PV	75	Approved
16	47	14/12/16/3/3/2/905	FG Emvelo (Pty) Ltd	Solar CSP	150	Approved

3 LITERATURE REVIEW

The two broad types of utility scale solar energy facilities are PV and CSP, with each having different impacts on birds[2]. CSP facilities incorporating the use of large reflective surfaces such as heliostats or parabolic troughs introduce the risk of collision-related trauma and those technologies which focus solar energy onto a central tower expose passing birds to the risk of being singed or incinerated in the area of concentrated solar flux[1]. Water

[5]Renewable Energy EIA Application Database. Department of Environmental Affairs. 17 October 2019.

utilisation and wastewater management at CSP facilities are potential sources of impact by either draining local reserves or attracting species in naturally dry habitats[6].

The displacement or exclusion of species and changes to species composition through habitat removal, destruction or modification are potentially the most significant impacts of both types of utility scale solar energy facilities on birds[3]. CSP facilities typically have a higher level of habitat loss compared to PV facilities as vegetation is more intensively managed to reduce the fire risk from high temperatures associated with concentrated sunlight[4].

While there is presently no clear pattern in the types of birds negatively affected by solar energy facilities[1], a study on the impact of a photovoltaic solar energy facility on birds was however conducted on the nearby 96 MW Jasper PV solar facility in the Northern Cape Province[3]. The Jasper PV solar facility promoted the regrowth of natural vegetation such as grasses and forbs below the solar arrays to mitigate the total loss of natural habitat in the development area[4]. The removal of shrubland/woodland and the promotion of grasses and forbs below the panels resulted in an associated shift from an avifaunal community preferring shrubland/woodland to one dominated by open country and grassland species[3]. Shrubland/woodland species were therefore threatened by the land-use changes associated with the PV development, while open country and grassland and generalist species were favoured[3]. The study concluded that PV developments could potentially offset some of the widespread loss among open habitat species due to bush encroachment, which has led to increases in shrub-dependent species at the expense of open country and grassland birds[3].

Collision-related trauma and fatalities are associated with both broad types of solar energy facilities, however PV technology theoretically presents a lower risk of collisions to large bodied, high-flying or soaring species such as Verreaux's Eagle, Martial Eagle and Ludwig's Bustard compared to the initially proposed CSP development due to the absence of a central receiving tower. In terms of small birds, no bird collisions with mirror fields were recorded during a three-month fatality study in the neighbouring CSP (trough) facility (Bokpoort I) while seven fatalities associated with solar panels were recorded at the Jasper PV facility during a three-month fatality study[3]. The difference has been attributed to the lack of vegetation/habitat and the lower number of birds utilising the extensively cleared and managed area at the Bokpoort I CSP facility compared to the revegetated area within the Jasper PV facility[4].

The advantages of the proposed amendment to utilise PV technology on the project site instead of CSP tower technology include:

- The absence of concentrated solar flux, thereby avoiding fatalities associated with singing or incineration;
- Reduced collision risk for high-flying or soaring species due to the absence of a central receiving tower;
- Lower water requirements, thereby reducing the potential risk of depleting local reserves in an arid area;
- Lower wastewater production, thereby reducing the attractant effect of larger evaporation ponds; and
- A greater opportunity to promote the regrowth of natural vegetation below the panels to mitigate the total area of habitat loss and potentially offset the local effects of bush-encroachment.

[6]Hernandez, R.R., Easter, S.B., Murphy-Mariscal, M.L., Maestre, E.T., Tavassoli, M., Allen, E.B., Barrows, C.W., Belnap, J., Ochoa-Hueso, Ravi, S. & Allen, M.F. 2014. Environmental impacts of utility-scale solar energy. Renewable & Sustainable Energy Reviews 29: 766-779.

The disadvantages of the proposed amendment are less significant in terms of avifaunal impact. With reflective surfaces potentially covering a larger area with PV technology compared to the gaps that exist between heliostat arrays used with CSP tower technology the 'lake effect' may be greater with the proposed amendment. The 'lake effect' hypothesizes that man-made reflective surfaces such as PV panels reflect horizontally polarised light similar to water, which is the primary source of horizontally polarized light[4]. This effect is thought to act as an 'ecological trap' attracting insects and birds mistaking the PV panels for a lake but studies have been unable to substantiate or refute this potential impact[4]. The use of PV technology instead of CSP technology could increase the number of small bird mortalities occurring on the site, especially if the regrowth of natural vegetation is promoted between the solar panels. This would however be a function of improved habitat availability and utilisation by birds when compared to an extensively managed and cleared area associated with a CSP facility and should therefore not be considered a net-negative if mitigation is implemented with the proposed amendment.

4 BASELINE ENVIRONMENT

4.1 Vegetation, Land Use and Bird Micro-habitats

The project site is situated in the arid Northern Cape Province, within the Nama Karoo Biome. The most prominent vegetation type on the project site is Kalahari Karroid Shrubland, while elements of Gordonia Duneveld are present[7] (Figure 3). Other vegetation types present in the broader project area include Olifantshoek Plains Thornveld and Koranna-Langeberg Mountain Bushveld. Land use in the project site is predominantly stock farming. In the broader project area, there is also game farming/ranching, while agricultural activities (e.g. vineyards) are present in the Orange River Valley. The site visit in December 2019 confirmed that the main vegetation types and avifaunal micro-habitats that were originally identified in the initial avifaunal impact assessment report (Arcus 2016) remain largely unchanged. The micro-habitats include scattered kraals, reservoirs and associated water troughs for livestock farming, thornveld/scrubland, open grassy scrubland, gravel plains, and duneveld.

4.2 Avifaunal Community

The SABAP1 data was collected between 1986 and 1997 and, although somewhat outdated, is one of the best long term data sets on bird distribution and abundance available in South Africa at present. The project site is situated within the quarter degree squares 2821DB and 2822CA (Figures 1 and 2), each quarter degree square had eight and ten cards of reporting data respectively and these data remained unchanged since the initial impact assessment (Arcus 2016). A total of 117 species were recorded including six endemic or near-endemic species and five species with a regional Red Data Status (Appendix II). SABAP2 is part of an ongoing study by the Animal Demography Unit (ADU) based at the University of Cape Town. SABAP2 data was examined for the pentads (which are roughly 8 km x 8 km squares, and are smaller than the squares used in SABAP1). Several additional observation cards had been submitted from the area and surrounds since the initial bird impact assessment was conducted. The pentads examined for this report were 2845_2205, 2845_2200, 2845_2155, 2845_2150, 2840_2205, 2840_2200 2840_2155, 2840_2150, 2835_2205, 2835_2200 and 2835_2155 (Figures 1 and 2). These data combined with extensive walk transects conducted in the area by Jeal[4], and the initial 12 months of pre-construction monitoring conducted by Arcus result in a combined total of 190 bird species recorded from the area. This includes nine endemic or near-endemic species and 11 species with a regional Red Data Status (Appendix III).

[7]Mucina & Rutherford. 2006. The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

The initial Bird Impact Assessment Report (Arcus 2016) detailed the locations of three Verreaux's Eagle and one Martial Eagle nests (Figure 3). These sites were revisited by the avifaunal specialist in December 2019 to confirm their status. The three Verreaux's Eagle nests are close together and located approximately 4 km to the east of the project site and represent a primary nest and two alternative nests from a pair of Verreaux's Eagle. The pair of Verreaux's Eagle were observed perched next to the identified nesting site and these nests can be considered to still be active. The Martial Eagle nest, located approximately 1.55 km from the project site appeared to no longer be active during the December 2019 site visit. In 2015 the nest consisted of a stick structure placed on top of a sociable weaver nest in a transmission line tower with a lot of white-wash below. During the December 2019 site visit almost no stick structure remained, no new sticks had been added and significantly less white-wash was present below, therefore it appeared as if the nest had not been re-used for a few seasons. Martial Eagles exhibit strong fidelity to nesting sites[8] but a breeding pair may alternate breeding attempts between multiple nests in their breeding territory[9], which range in size from 100 – 800 km^2 in South Africa[10]. Martial Eagle was not recorded in the project area over three months of monitoring by Jeal (2017), nor has it been recorded in the project area or immediate surrounds by the SABAP2 project. The project area therefore many not constitute an important foraging area for these birds.

5 AVIFAUNAL SENSITIVITY ZONES

5.1 High Sensitivity Zones

High sensitivity zones were related to the identified eagle nest sites in the broader study area. These include a 3 km circular area around the Verreaux's Eagle primary and alternative nest sites and a 1.5 km circular area around the previously used, but currently inactive Martial Eagle nest site. As some areas within these buffers are already altered and disturbed (e.g. by existing transmission lines, roads and a major railway line), other project infrastructure (e.g. PV panels, battery storage, pipelines and power lines) are allowed within the buffer areas if all the mitigations recommended are implemented.

5.2 Medium Sensitivity Zones

Medium Sensitivity Zones are areas identified on the project site that are currently important for avifauna, and/or support important species and/or support high abundances of birds at certain times. Two such types of zones were identified associated with gravel plains (which support important species such as coursers and bustards) and artificial water points. These areas are not sufficiently sensitive so as to preclude development and it is understood that should the project proceed these areas within the project site will be completely destroyed/removed. This has been taken into account when conducting the impact assessment for habitat destruction and disturbance.

5.3 Undetermined Sensitivity Zones

Undetermined Sensitivity Zones are all the remaining areas of the project site not buffered in Figure 3 or related to the features discussed above. These areas show no obvious avifaunal features, patterns or sensitivities and are preferred for infrastructure placement.

[8]Herholdt, J.J., Mendelsohn J.M. 1995. Survival and nest-site fidelity in the Martial Eagle in the Kalahari Gemsbok National Park, South Africa. J. Afr. Raptor Biol. 10:33-34.

[9]Machange, R.W., A.R. Jenkins, and Navarro, R.A. 2005. Eagles as indicators of ecosystem health: is the distribution of Martial Eagle nests in the Karoo, South Africa, influenced by variations in land-use and rangeland quality? Journal of Arid Environments 63(1): 223 – 243.

[10]Hockey, P.A.R., Dean, W.R.J. and Ryan, P.G. (eds). 2005. Roberts - Birds of southern Africa, VIIth ed. The Trustees of the John Voelcker Bird Book Fund, Cape Town.

However, considering the general avifauna of the area and broader project area, it is likely that these zones are in fact of moderate sensitivity.

6 AVIFAUNAL IMPACT ASSESSMENT

Considering all the bird baseline data, resulted in the identification of a set of focal species. The focal species for the impact assessment were determined to be: Verreaux's Eagle, Lappet-faced Vulture, Cape Eagle-Owl, Lanner Falcon, Martial Eagle, Pygmy Falcon, Pale-chanting Goshawk, Greater Kestrel, Kori Bustard, Ludwig's Bustard, Northern Black Korhaan, Burchell's Courser, Eastern Clapper Lark, Fawn-coloured Lark, Black-eared Sparrow-Lark, Black-headed Canary, Sociable Weaver, Namaqua Sandgrouse, Rock Martin, Barn Swallow, and Namaqua Dove. By considering focal species we are not ignoring other birds, as in most cases these focal species serve as surrogates for other species, examples being Martial Eagle for Booted Eagle and Northern Black Korhaan for Karoo Korhaan.

6.1 Identification and rating of Potential Impacts

The following key potential impacts on avifauna, arising from the proposed project's construction and operational phases have been identified. The mitigations that were applicable to the original authorisation for CSP technology are no longer required, the following mitigations measures must be implemented for the proposed amendment.

6.1.1 Construction Phase

6.1.1.1 Habitat Destruction

As the original authorisation and the proposed amendment are located on the same footprint they both impose a risk to birds through habitat destruction as clearing activities during the construction phase will remove vegetation and therefore habitat that birds require for breeding, foraging and roosting. The proposed amendment may reduce the duration of total habitat loss compared to the original authorisation if rehabilitation of natural vegetation underneath the solar panels is implemented. This would provide habitat, albeit modified, for at least some important bird species such as coursers and francolins. The original authorisation obtained a significance score of 70 (Moderate) without mitigation and 65 (Moderate) with mitigation. The duration of the impact is reduced with the proposed amendment after mitigation is implemented, resulting in a significance score of 60 (Moderate).

Potential Impact: The removal and/or destruction and/or alteration of habitat used by birds, may impact on the foraging and/or breeding success of certain species, and will lead to numerous birds being displaced from the projects site, and needing to find suitable available habitat elsewhere. Habitat loss may effect, and be more significant for important terrestrial species such as coursers, korhaans and bustards. Raptors (e.g. Martial Eagle, Black-chested Snake-Eagle and Pale Chanting Goshawk) may also be effected to a lesser degree, through the loss of potential hunting habitat.							
Proposed Amendment							
	Magnitude	**Duration**	**Scale**	**Probability**	**Significance**	**Status**	**Confidence**
Without Mitigation	8	4	2	5	70 (Moderate)	Negative	Medium
With Mitigation	8	3	1	5	60 (Moderate)	Negative	Medium
Can the impact be reversed?			Partially (If suitably re-habilitated after construction).				
Will impact cause irreplaceable loss or resources?			Possibly.				
Can impact be avoided, managed or mitigated?			Unlikely. The entire project site is likely to be disturbed and cleared of vegetation. The mitigation measures below may help reduce the duration of total habitat loss.				

Required mitigation measures to reduce residual risk or enhance opportunities:

- A site specific environmental management programme (EMPr) must be implemented, which gives appropriate and detailed description of how construction activities must be conducted to reduce unnecessary destruction of habitat;
- All contractors are to adhere to the EMPr and should apply good environmental practice during construction;
- High traffic areas and buildings such as offices, batching plants, storage areas etc. should, where possible be situated in areas that are already disturbed;
- Existing roads and farm tracks should be used where possible;
- The minimum footprint areas of infrastructure should be used wherever possible, including road widths and lengths;
- No off-road driving;
- Environmental Control Officer (ECO) to oversee activities and ensure that the EMPr is implemented and enforced; and
- Following construction, rehabilitation of areas underneath the solar panels and those disturbed by the temporary contractor's facility must be undertaken and to this end a habitat restoration plan is to be developed by a specialist and included within the EMPr.

6.1.1.2 Disturbance and Displacement

Both the original authorisation and the proposed amendment impose a risk of temporary or permanent disturbance and displacement of birds due to construction activities. The significance rating of this impact before mitigation was 48 (Moderate) and was reduced to 30 (Moderate) after mitigation in the original authorisation, these ratings remained unchanged with the proposed amendment.

Potential Impact: Birds are disturbed and displaced from the project site and surrounding areas due to construction activities and associated noise etc. Particularly at risk are sensitive species breeding on and around the site or regularly utilizing the project site for foraging/hunting e.g. eagles, korhaans, coursers and bustards.

Proposed Amendment							
	Magnitude	**Duration**	**Scale**	**Probability**	**Significance**	**Status**	**Confidence**
Without Mitigation	8	2	2	4	48 (Moderate)	Negative	Medium
With Mitigation	6	2	2	3	30 (Moderate)	Negative	Medium

Can the impact be reversed?	Yes.
Will impact cause irreplaceable loss or resources?	No.
Can impact be avoided, managed or mitigated?	Partially. The mitigation measures below may help to keep the impact to a practical minimum.

Required mitigation measures to reduce residual risk or enhance opportunities:

- A site specific EMPr must be implemented, which gives appropriate and detailed description of how construction activities must be conducted;
- All contractors are to adhere to the EMPr and should apply good environmental practice during construction;
- ECO to oversee activities and ensure that the site specific EMPr is implemented and enforced;
- The appointed ECO must be trained by an avifaunal specialist to identify the potential Red Data species as well as the signs that indicate possible breeding by these species;
- The ECO must then, during audits/site visits, make a concerted effort to look out for such breeding activities of Red Data species, and such efforts may include the training of construction staff (e.g. in Toolbox talks) to identify Red Data species, followed by regular questioning of staff as to the regular whereabouts on site of these species;
- If any of the Red Data species are confirmed to be breeding (e.g. if a nest site is found), construction activities within 500 m of the breeding site must cease, and an avifaunal specialist is

to be contacted immediately for further assessment of the situation and instruction on how to proceed;
- Prior to construction, an avifaunal specialist should conduct a site walkthrough, covering the final road, pipeline and power line routes as well as the temporary contractors facility, to identify any nests/breeding/roosting activity of sensitive species, as well as any additional sensitive habitats;
- The results of which may inform the final construction schedule in close proximity to that specific area, including abbreviating construction time, scheduling activities around avian breeding and/or movement schedules, and lowering levels of associated noise;
- No construction activities or staff are permitted within 1.5 km of the identified Martial Eagle nest buffer; and
- A construction phase bird monitoring programme must be implemented by a bird specialist, to document potential impacts on key species such as korhaans, bustards and eagles, and must include the ongoing monitoring of the active Verreaux's Eagle and Martial eagle nest sites.

6.1.2 Operational Phase

6.1.2.1 Disturbance and Displacement

Both the original authorisation and the proposed amendment impose a risk of disturbance and displacement of birds due to ongoing operational and maintenance activities. The significance rating of this impact before mitigation was 56 (Moderate) and was reduced to 24 (Low) after mitigation in the original authorisation, these ratings remained unchanged with the proposed amendment.

Potential Impact: Birds are disturbed and displaced from the project site and surrounding areas, or from the grid connection servitude and surrounding areas, due ongoing operational and maintenance activities. Particularly at risk are sensitive species breeding or foraging/hunting in close proximity to the activities, for example raptors that may nest on the new powerline tower being disturbed by power line and servitude maintenance.

Proposed Amendment							
	Magnitude	**Duration**	**Scale**	**Probability**	**Significance**	**Status**	**Confidence**
Without Mitigation	8	4	2	4	56 (Moderate)	Negative	Medium
With Mitigation	6	4	2	2	24 (Low)	Negative	Medium

Can the impact be reversed?	Yes.
Will impact cause irreplaceable loss or resources?	No.
Can impact be avoided, managed or mitigated?	Partially. The mitigation measures below may help to keep the impact to a practical minimum.

Required mitigation measures to reduce residual risk or enhance opportunities:

- A site specific operational EMPr must be implemented, which gives appropriate and detailed description of how operational and maintenance activities must be conducted to reduce unnecessary disturbance.
- All contractors are to adhere to the environmental management programme and should apply good environmental practice during all operations.
- The on-site operational facilities manager (or a suitably appointed Environmental Manager) must be trained by an avifaunal specialist to identify the potential Red Data species as well as the signs that indicate possibly breeding by these species.
- If a priority species or Red Data species is found to be breeding (e.g. a nest site is located) on or within 2 km of the operational facility (or the grid connection servitude), the nest/breeding site must not be disturbed and the avifaunal specialist must be contacted for further instruction.
- The on-site operational facilities manager (or a suitably appointed Environmental Manager) must conduct inspections every two months of the grid connection line, and all existing transmission line pylons within 2 km of the project site boundary to locate possible nesting raptors.
- Any such nests must not be disturbed and should be reported to the avifaunal specialist for further instruction.
- Operational phase bird monitoring, in line with the solar guidelines, must be implemented.
- No operational activities or staff are permitted within 1.5 km of the identified Martial Eagle nest.

6.1.2.2 Burning

This potential impact is restricted to CSP technologies and poses a significant risk to birds especially at CSP tower facilities as described for the original authorisation. Bird mortalities from burning were recorded in the USA at the Ivanpah CSP project where mortalities of falcons, hawks, warbles and sparrows (as well as other species) were found and a follow on detailed study at the same facility, estimated over 3500 birds to have died in a single year (many from being burnt or singed)[11]. This significant risk is completely avoided by the proposed amendment. The significance rating of this impact before mitigation was 85 (High) and was reduced to 70 (Moderate) after mitigation in the original authorisation, these ratings were zero (Low) with the proposed amendment.

Potential Impact: Large heliostat arrays focus solar flux on a central "power tower", exposing passing birds to the risk of being singed or burnt in the flux beams, particularly as they aggregate close to the receiver. Birds may be burnt in the stand-by focal points.							
Proposed Amendment							
	Magnitude	**Duration**	**Scale**	**Probability**	**Significance**	**Status**	**Confidence**
Without Mitigation	0	N/A	0	0	0 (Low)	Negative	High
With Mitigation	0	N/A	0	0	0 (Low)	Negative	High
Can the impact be reversed?			N/A				
Will impact cause irreplaceable loss or resources?			No.				
Can impact be avoided, managed or mitigated?			This impact is wholly avoided by the proposed amendment.				
Required additional mitigation measures specific to the amendment to reduce residual risk or enhance opportunities: None.							

6.1.2.3 Collision with Infrastructure (Excluding Power Lines)

Both the original authorisation and the proposed amendment impose a risk to birds from collision with reflective structures. The proposed amendment may impose an increased risk of collision for small birds due to an increased area of panels associated with PV technology compared to heliostat arrays of CSP technology and a potentially increased 'lake effect'. The risk of collision for small and medium sized birds may also increase from the proposed amendment if the recommended rehabilitation and regrowth of natural vegetation is implemented underneath the solar panels due to increased use of the area by birds when compared to more intensively managed vegetation generally associated with CSP technology. However, the lack of a central receiving tower in the proposed amendment would reduce the collision risk to high-flying or soaring species such as bustards, eagles and vultures compared to the original authorisation. The collision risk of the proposed amendment should therefore largely be confined to the site itself as the risk to birds commuting at higher altitude across the project site would be low. The significance rating of this impact before mitigation was 70 (Moderate) and was reduced to 52 (Moderate) after mitigation in the original authorisation, these ratings were 55 (Moderate) before mitigation and 27 (Low) after mitigation with the proposed amendment.

Potential Impact: Birds collide with heliostats and/or the PV panels and/or the central receiver tower. Birds may be attracted to the reflective surfaces which may be mistaken for large water bodies and can cause disorientation of flying birds, resulting in injury and/or death.
Proposed Amendment

[11]H.T. Harvey & Associates. 2014. California Valley Solar Ranch Project: Avian and Bat Protection Plan, Sixth Quarterly Postconstruction Fatality Report, 16 November 2013 - 15 February 2014. Unpublished report to HPR II, PLC, California Valley Solar Ranch.

	Magnitude	Duration	Scale	Probability	Significance	Status	Confidence
Without Mitigation	6	4	1	5	55 (Moderate)	Negative	Medium
With Mitigation	4	4	1	3	27 (Low)	Negative	Low
Can the impact be reversed?			No.				
Will impact cause irreplaceable loss or resources?			Yes.				
Can impact be avoided, managed or mitigated?			Partially. The mitigation measures below may help to keep the impact to a practical minimum.				

Required mitigation measures to reduce residual risk or enhance opportunities:

- All artificial water points (e.g. livestock water points and wind pumps) on the project site and within 500 m from the boundary of the project site, must be moved or shut down (if not already removed from the project site during construction) so that birds are not attracted to the project site and immediate surrounding areas.
- All water related infrastructure (e.g. pipes, pumps, reservoirs, toilets, taps etc.) must be regularly (twice weekly) checked for leaks, and repaired immediately.
- Lighting should be kept to a minimum to avoid attracting insects and birds and light sensors/switches should be utilised to keep lights off when not required.
- Lighting fixtures should be hooded and directed downward where possible, to minimize the skyward and horizontal illumination, lighting should be motion activated where possible.
- Careful selection of and modifications to solar facility equipment should be made where possible e.g. white borders could be applied to PV panels to reduce the resemblance of solar arrays to waterbodies.
- Develop and implement an operational monitoring programme for birds in line with applicable solar guidelines, which must include searching for mortalities.
- Frequent and regular review of operational phase monitoring data and results by an avifaunal specialist.
- If unacceptable impacts are observed (in the opinion of the bird specialist and independent review), the specialist should conduct a literature review specific to the impact and provide updated and relevant mitigation options to be implemented.
- As a starting point for the review of possible mitigations, the following may need to be considered: Assess the suitability of using deterrent devices to reduce collision risk, which may include the use of rotating/flashing mirrors, or sound deterrents.

6.1.2.4 Collision with Power Lines

Collisions with large (132 kV or above) power lines are a well-documented threat to birds in southern Africa[12,13] while smaller lines pose a higher threat of electrocution but can still be responsible for collision. Collisions with overhead power lines occur when a flying bird does not see the cables, or is unable to take effective evasive action, and is killed by the impact or impact with the ground. Especially heavy-bodies birds such as bustards, cranes and waterbirds, with limited manoeuvrability are susceptible to this impact[12]. Many of the collision sensitive species are also considered threatened in southern Africa. While many power lines associated with existing infrastructure and railway lines occur in the area, birds may collide with the new over-head power lines, particularly during times of low light or poor visibility. Species that are likely to be affected include Kori Bustard, Ludwig's Bustard, Northern Black Korhaan, Red-crested Korhaan, and Karoo Korhaan.

The proposed amendment potentially has a greater length of overhead power lines compared to the original authorisation and therefore imposes a greater risk of collision for birds. However, attracting insects and therefore insectivores to a PV facility may not pose

[12]van Rooyen, C.S. 2004. The Management of Wildlife Interactions with over-headlines. In The fundamentals and practice of Over-head Line Maintenance (132kV and above), pp217-245. Eskom Technology, Services International, Johannesburg.
[13]Shaw, J.M, Jenkins, A.R., Smallie, J.J & Ryan, P.G. 2010. Modelling power-line collision risk for the Blue Crane *Anthropoids paradiseus* in South Africa. Ibis 152: 590-599

as much of a risk to birds as to a CSP tower facility allowing for the use of ultraviolet lights to illuminate overhead power lines to be investigated. A recent study on the efficacy of pole-mounted near-ultraviolet light Avian Collision Avoidance System (ACAS) in the United States of America reported a 98% decrease in collisions of Sandhill Cranes with a stretch of overhead power line[14]. The significance rating of this impact before mitigation was 90 (High) and was reduced to 42 (Moderate) after mitigation in the original authorisation, these ratings were 90 (High) before mitigation, which was reduced to 24 (Low) after mitigation with the proposed amendment.

Potential Impact: Birds collide with the overhead power lines.

Proposed Amendment

	Magnitude	Duration	Scale	Probability	Significance	Status	Confidence
Without Mitigation	10	4	4	5	90 (High)	Negative	Medium
With Mitigation	6	4	2	2	24 (Low)	Negative	Medium
Can the impact be reversed?			No.				
Will impact cause irreplaceable loss or resources?			Yes.				
Can impact be avoided, managed or mitigated?			Yes. The mitigation measures below may help to keep the impact to a practical minimum.				

Required mitigation measures to reduce residual risk or enhance opportunities:

- Where possible, power lines/cables on the project site should be underground.
- Where possible, the routing of power line infrastructure should avoid Medium or High Sensitivity zones.
- Where possible, grid connection infrastructure should follow existing servitudes such as existing power lines, roads and fences.
- An avifaunal specialist must conduct a site walk through of the final Grid Connection route and pylon positions prior to construction to determine if, and where, bird flight diverters (BFDs) are required.
- Install bird flight diverters as per the instructions of the specialist following the site walkthrough, which may include the need for modified BFDs fitted with solar powered LED lights on certain spans.
- The operational monitoring programme for the associated CSP site must be in line with applicable monitoring guidelines and must include regular (at least monthly) monitoring of the grid connection power line for collision (and electrocution) mortalities.
- Any mortalities should be reported to the Endangered Wildlife Trust (EWT).
- Investigate the applicability of pole-mounted near-ultraviolet light (UV-A; 380–395 nm) Avian Collision Avoidance System (ACAS) on overhead power-lines in addition to bird flight diverters to increase visibility of power lines to birds in low light or poor visibility conditions.

6.1.2.5 Electrocution

Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components[12]. With regard to the grid connection infrastructure, overhead power line infrastructure with a capacity of 132 kV or more do not generally pose a risk of electrocution due to the large size of the clearances between the electrical infrastructure components. Electrocutions are therefore more likely for larger species whose wingspan is able to bridge the gap such as eagles or vultures. Various large raptors (such as Martial Eagle, Verreaux's Eagle and Lappet-faced Vulture), susceptible to electrocution (particularly in the absence of safe and mitigated structures) may occur in the broader project area. Electrocution may also occur within newly

[14]Dwyer, J. F., Pandey, A. K., McHale, L. A., & Harness, R. E. (2019). Near-ultraviolet light reduced Sandhill Crane collisions with a power line by 98%. The Condor, 121(2). doi:10.1093/condor/duz008

constructed substations and battery storage facilities, the proposed amendment imposes a greater risk to birds as new substations, battery storage facilities and power lines are associated with each of the PV facilities. Mitigation measures nevertheless remain effective at reducing the potential risk of electrocution. The significance rating of this impact before mitigation was 72 (Moderate) and was reduced to 24 (Low) after mitigation in the original authorisation, these ratings remained unchanged with the proposed amendment.

Potential Impact: Electrocution of birds perching or attempting to perch on electrical structures.							
Proposed Amendment							
	Magnitude	**Duration**	**Scale**	**Probability**	**Significance**	**Status**	**Confidence**
Without Mitigation	10	4	4	4	72 (Moderate)	Negative	Medium
With Mitigation	6	4	2	2	24 (Low)	Negative	High
Can the impact be reversed?	No.						
Will impact cause irreplaceable loss or resources?	Yes.						
Can impact be avoided, managed or mitigated?	Yes. The mitigation measures below may help to keep the impact to a practical minimum.						
Required mitigation measures to reduce residual risk or enhance opportunities: • Any new power line/s must be of a design that minimizes electrocution risk by using adequately insulated 'bird friendly' monopole structures, with clearances between live components of 2 m or greater and which provide a safe bird perch. • The structures to be constructed must be approved by the Endangered Wildlife Trust's (EWT) Wildlife and Energy Programme or a suitably qualified bird specialist. • The operational monitoring programme for the associated WEF site must be in line with applicable guidelines and must include regular monitoring of the grid connection power line and all new associated substations for electrocution (and collision) mortalities. • Any mortalities should be reported to the EWT. • Prevent birds from nesting in and around substations and battery storage facilities through exclusion covers or spikes.							

6.1.2.6 Water Pollution and Wastewater

The utilisation of dust suppression or cleaning chemicals used on solar panels imposes a risk of contamination of pollution of water resources. The production of wastewater would be lower at the PV facilities proposed by the amendment than at the CSP facility assessed in the original authorisation. The need for artificial evaporation ponds is therefore reduced with the proposed amendment as are the significance scores of the associated risks, including the potential for evaporation ponds attracting birds in an arid environment that could be poisoned or drowned. The significance rating of this impact before mitigation was 39 (Moderate) and was reduced to 20 (Low) after mitigation in the original authorisation. The significance ratings of this impact were 30 (Moderate) before mitigation and 16 (Low) after mitigation for the proposed amendment.

Potential Impact: Pollution of water resources used by birds. Production of wastewater (brine), which can be difficult to manage and treat. Artificial evaporation ponds attract waterbirds, which could be poisoned and/or drown.							
Proposed Amendment							
	Magnitude	**Duration**	**Scale**	**Probability**	**Significance**	**Status**	**Confidence**
Without Mitigation	4	4	2	3	30 (Moderate)	Negative	Low
With Mitigation	2	4	2	2	16 (Low)	Negative	Low
Can the impact be reversed?	Possibly.						
Will impact cause irreplaceable loss or resources?	Unlikely.						

Can impact be avoided, managed or mitigated?	Partially. The mitigation measures below may help to keep the impact to a practical minimum.
Required mitigation measures to reduce residual risk or enhance opportunities: • Ensure that birds do not get in contact with any evaporation ponds that may be required i.e. ponds should be covered with wire mesh or netting to reduce the possibilities of, attracting, drowning, or poisoning birds. • All cleaning products used on the site should be environmentally friendly and bio-degradable. • The operational environmental management programme must include site specific measures for the effective management and treatment of any wastewater to be produced.	

6.1.2.7 Excessive use of Water

Using large amounts of water, may drain/deplete local reserves used by birds in naturally dry habitats. The proposed amendment will reduce the risk of depleting local water reserves as the water use requirements for PV facilities are lower than those of the CSP facility assessed in the original authorisation. The significance rating of this impact before mitigation was 39 (Moderate) and was reduced to 22 (Low) after mitigation in the original authorisation. The significance ratings of this impact were 33 (Moderate) before mitigation and 18 (Low) after mitigation for the proposed amendment.

Potential Impact: Excessive use of water, which may drain local reserves used by birds in naturally dry habitats.							
Proposed Amendment							
	Magnitude	**Duration**	**Scale**	**Probability**	**Significance**	**Status**	**Confidence**
Without Mitigation	4	4	3	3	33 (Moderate)	Negative	Low
With Mitigation	2	4	3	2	18 (Low)	Negative	Low
Can the impact be reversed?			No.				
Will impact cause irreplaceable loss or resources?			Possibly.				
Can impact be avoided, managed or mitigated?			Partially. The additional mitigation measures below may help reduce the effect of water-use on the water table.				
Required additional mitigation measures specific to the amendment to reduce residual risk or enhance opportunities: • Utilise water from sources other than ground-water to clean solar panels as to not deplete local groundwater levels.							

6.1.2.8 Disruption of Bird Movement Patterns

Utility scale solar energy facilities may form a physical barrier to movement of birds across the landscape, and this may alter migration routes and increase distances travelled and energy expenditure or block movement to important areas such as hunting and foraging areas. This potential impact is not yet well understood, is likely to be more significant as a cumulative impact with surrounding developments, is difficult to measure and assess, and therefore mitigation measures are difficult to identify. The 'lake effect' could potentially increase with the proposed amendment, evidence supporting this impact is not strong, however. The proposed amendment may reduce the risk of habitat fragmentation and permeability of the site to some species compared to the original authorisation if habitat rehabilitation and the regrowth of natural vegetation is promoted under the solar panels. This will reduce the open space and area of unsuitable habitat that would have been a barrier to movement across the site at a CSP facility with more intensive vegetation

management. Perimeter fencing must be adequately designed to prevent entrapment of large bodied species attempting to move across the site. The significance rating of this impact before mitigation was 39 (Moderate) and was reduced to 36 (Moderate) after mitigation in the original authorisation. The significance ratings of this impact were 39 (Moderate) before mitigation and 20 (Low) after mitigation for the proposed amendment.

Potential Impact: The development forms a physical barrier to movement of birds across the landscape, alters migration routes and increases distances travelled and energy expenditure for hunting or foraging.							
Proposed Amendment							
	Magnitude	**Duration**	**Scale**	**Probability**	**Significance**	**Status**	**Confidence**
Without Mitigation	6	4	3	3	39 (Moderate)	Negative	Low
With Mitigation	4	4	2	2	20 (Low)	Negative	Medium
Can the impact be reversed?			Unlikely.				
Will impact cause irreplaceable loss or resources?			No				
Can impact be avoided, managed or mitigated?			Partially. The mitigation measures below may help reduce the disruption of bird movement patterns.				

Required mitigation measures to reduce residual risk or enhance opportunities:

- Where not prescribed by technical or local and international requirements, external lighting to be of an intermittent and coloured nature rather than constant white light to reduce the potential impact on the movement patterns of nocturnal species. Habitat rehabilitation and promoting the regrowth of natural vegetation below the solar panels would reduce the barrier effect to some bird species reluctant to cross unsuitable habitat or cleared vegetation, such as francolins.
- Perimeter fencing must be designed to prevent entrapment of large bodied species such as korhaans between fence rows, giving them sufficient space for take-off, i.e. if a double-layer of parallel fencing is used, the gap between the fences should be large enough to allow for large birds to take-off and leave the area. Where this would result in unacceptable compromises to the security of the site, large-bodied birds should be prevented from entering the gaps between parallel fence rows. Perimeter fence design to be done in consultation with an avifaunal specialist.
- Markers or panel gaps on solar panels to break-up reflections and reduce the 'lake effect'.

6.2 Cumulative Impacts

Approximately 16 solar energy projects in various stages of the EIA application process fall within this 50 km radius of the project site (Table 1). Should 50% or more of these projects be constructed the cumulative impact of the residual impacts may have a significance rating of 85 (High). Depending on the type of solar technology employed and the level of mitigation implemented at each of the developments the cumulative impacts may have had a significance rating of 65 (Moderate) after mitigation.

It is difficult to say with high confidence at this stage what the cumulative impact of all the proposed developments will be on birds as the specifics of the final technologies to be utilised at each site, and levels of habitat rehabilitation within the project sites, is unknown.

Nevertheless the proposed amendment would impose a reduced cumulative impact compared to the original authorisation due to the move away from utilising CSP tower technology and the risks associated with it. The cumulative impact of the proposed amendment and the adjacent operational Bokpoort I project would similarly be reduced compared to the original authorisation. The cumulative impact if all the mitigation measures associated with the proposed amendment are followed would have a significance rating of 33 (Moderate).

Potential Impact: The impact of multiple utility scale solar developments in the area has the potential to significantly reduce available habitat for avifauna.							
Proposed Amendment							
	Magnitude	**Duration**	**Scale**	**Probability**	**Significance**	**Status**	**Confidence**
Without Mitigation	10	4	3	5	85 (High)	Negative	Low
With Mitigation	4	4	3	3	33 (Moderate)	Negative	Medium
Can the impact be reversed?			Unlikely.				
Will impact cause irreplaceable loss or resources?			No				
Can impact be avoided, managed or mitigated?			Partially. The cumulative impact can be significantly reduced if the mitigation measures are implemented at all surrounding developments.				
Required mitigation measures to reduce residual risk or enhance opportunities: • Implement the mitigation measures listed above.							

7 CONCLUSION

Based on a the above, the proposed amendment is preferred compared to the original authorisation due to the significantly reduced risk of collision for important high-flying and soaring species such as eagles, bustards and vultures commuting over the site as well as the removal of burning risks associated with CSP tower facilities. The reduced water use and wastewater production and management requirements in the proposed amendment are also preferred in such an arid landscape. The proposed amendment would also allow for additional bird flight deterrent devices to be investigated to reduce the potential impact of collisions with overhead power lines as well as reduced habitat fragmentation and disruption of bird movements across the project site for a number of ground dwelling species.

If temperatures rise in the medium to long term, some species will be living closer to the limits of their thermal tolerances, with species in arid environments expected to be among the first to reach the limits of their thermoregulatory capacities[15]. It is anticipated that much of the Kalahari's avian biodiversity will be lost by the end of the century due to loss of body condition, delayed fledging, reduced fledging size, and outright breeding failure as a result of increased exposure to higher temperatures[16]. PV panels may provide more shaded environments (thermal refugia) for ground dwelling and ground nesting birds near their thermal limits and also offer a certain amount of protection to more open habitat species against bush encroachment[17].

The proposed amendment, if mitigation such as the rehabilitation of natural vegetation under solar panels is implemented, could potentially therefore even provide an

[15]van de Ven, T.M.F.N. 2017. Implications of climate change on the reproductive success of the Southern Yellow-billed Hornbill, *Tockus leucomelas*. PhD Thesis. Percy FitzPatrick Institute of African Ornithology, DST-NRF Centre of Excellence, Department of Biological Sciences, Faculty of Science, University of Cape Town.

[16]Conradie, S.R., Woodborne, S.M., Cunningham, S.J. and McKechnie, A.E. 2019. Chronic, sublethal effects of high temperatures will cause severe declines in southern African arid-zone birds during the 21st century.

[17]Towards a policy on indigenous bush encroachment in South Africa (2019), Department of Environmental Affairs, Pretoria, South Africa.

improvement of the habitat for certain important bird species such as coursers, francolins and other open-country birds by offering shade and grassland in the face of potentially rising temperatures and bush encroachment.

The proposed amendment is therefore recommended over the original authorisation in terms of avian impact and the project may proceed subject to all recommendations (including construction and operational phase monitoring) and proposed mitigations in this report, as well as those applicable in the original authorisation being implemented.

APPENDIX I: IMPACT ASSESMENT METHODOLOGY

The significance of the identified impacts will be determined using the approach outlined below (terminology from the Department of Environmental Affairs and Tourism Guideline document on EIA Regulations, April 1998). This approach incorporates two aspects for assessing the potential significance of impacts, namely occurrence and severity, which are further sub-divided as follows:

Occurrence		**Severity**	
Probability of occurrence	Duration of occurrence	Scale / extent of impact	Magnitude (severity) of impact

To assess each of these factors for each impact, the following four ranking scales are used:

Probability	**Duration**
5 - Definite/don't know	5 - Permanent
4 - Highly probable	4 - Long-term
3 - Medium probability	3 - Medium-term (8-15 years)
2 - Low probability	2 - Short-term (0-7 years) (impact ceases after the operational life of the activity)
1 - Improbable	1 – Immediate
0 - None	
Scale	**Magnitude**
5 - International	10 - Very high/don't know
4 - National	8 - High
3 - Regional	6 - Moderate
2 - Local	4 - Low
1 - Site only	2 - Minor
0 - None	

Once these factors are ranked for each impact, the significance of the two aspects, occurrence and severity, is assessed using the following formula:
SP (significance points) = (magnitude + duration + scale) x probability

The maximum value is 100 significance points (SP). The impact significance will then be rated as follows:

SP >75	**Indicates high environmental significance**	**An impact which could influence the decision about whether or not to proceed with the project regardless of any possible mitigation.**
SP 30 – 75	Indicates moderate environmental significance	An impact or benefit which is sufficiently important to require management and which could have an influence on the decision unless it is mitigated.
SP <30	Indicates low environmental significance	Impacts with little real effect and which should not have an influence on or require modification of the project design.
+	Positive impact	An impact that constitutes an improvement over pre-project conditions

APPENDIX II: RAPTORS, ENDEMIC OR NEAR-ENDEMIC SPECIES RECORDED BY SABAP1 IN THE QUARTER DEGREE SQUARES

Quarter Degree Square			**2821DB**	**2822CA**
Number of cards			*8*	*10*
Number of species			*101*	*61*
Species	**Regional red data status (Taylor *et al.* 2015)**	**Endemic or near-endemic***	**Reporting rate (%) ** **	
Eagle, Verreaux's	VU			20
Eagle, Martial	EN		13	
Vulture, Lappet-faced	EN			10
Vulture, White-backed	EN			10
Falcon, Lanner	VU			30
Eagle, African Fish			13	
Eagle, Booted			13	
Goshawk, Pale Chanting			25	10
Kestrel, Greater				20
Kite, Black-shouldered			25	40
Owl, Spotted Eagle-				10
White-eye, Cape (Pre-split)		x	25	10
Flycatcher, Fairy		x	25	
Flycatcher, Fiscal		x	13	
Warbler, Namaqua		x	25	
Starling, Pied		x		60
Kestrel, Rock				30
Owl, Western Barn			13	
Owlet, Pearl-spotted			25	

*EN = Endangered; VU = Vulnerable. * Endemic or near endemic (i.e. ~70% or more of population in RSA) to South Africa (not southern Africa as in field guides) or endemic to South Africa, Lesotho and Swaziland. Taken from BirdLife South Africa Checklist of Birds in South Africa, 2014.**Reporting rates are percentages of the number of times a species was recorded in the square, divided by the number of times that square was counted. It is important to note that these species were recorded in the entire quarter degree square in each case and may not actually have been recorded on the proposed project area.*

APPENDIX III: BIRDS RECORDED IN THE PROJECT SITE AND IMMEDIATE SURROUNDING AREAS

Alphabetical Name	Red Data	Ende-mism*	Arcus 2016	Jeal 2017	SABAP2 Reporting Rate %**										
					2845_2205	2845_2200	2845_2155	2845_2150	2840_2205	2840_2200	2840_2155	2840_2150	2835_2205	2835_2200	2835_2155
No. of cards					*10*	*4*	*4*	*13*	*10*	*2*	*1*	*7*	*1*	*3*	*1*
No. of species					*92*	*66*	*74*	*122*	*91*	*57*	*45*	*101*	*30*	*65*	*29*
Barbet, Acacia Pied			X	X	42.9	75	100	100	83.3	50	100	60	100	100	100
Barbet, Crested			X				33.3	57.1				40			
Batis, Pririt			X	X	71.4	100	66.7	85.7	100	50	100	40	100	66.7	
Bee-eater, European			X		28.6			57.1	16.7						
Bee-eater, Swallow-tailed			X		28.6	25	33.3	71.4	16.7			20		33.3	
Bee-eater, White-fronted			X				33.3	14.3							
Bishop, Southern Red			X		28.6		66.7	85.7			100	80			100
Bokmakierie			X	X	100	75	100	85.7	100	100	100	40	100	100	100
Brubru					28.6			42.9	33.3	50			100	66.7	
Bulbul, African Red-eyed			X	X	42.9	25	100	100	83.3	100	100	100	100	66.7	
Bunting, Cape			X		28.6	25			100	50				66.7	
Bunting, Cinnamon-breasted			X		14.3				16.7						
Bunting, Golden-breasted			X												
Bunting, Lark-like			X	X	14.3	50		42.9	66.7	100		20	100	100	
Bustard, Kori	NT		X	X	14.3				33.3		100			66.7	100
Bustard, Ludwig's	EN		X												
Buttonquail, Common (Kurrichane)				X	14.3				16.7	50				33.3	
Canary, Black-headed		x	X												

Alphabetical Name	Red Data	Ende-mism*	Arcus 2016	Jeal 2017	SABAP2 Reporting Rate %**										
					2845_2205	2845_2200	2845_2155	2845_2150	2840_2205	2840_2200	2840_2155	2840_2150	2835_2205	2835_2200	2835_2155
Canary, Black-throated			X	X				42.9	16.7			20		33.3	
Canary, White-throated			X		28.6			42.9	33.3	50				33.3	
Canary, Yellow			X	X	42.9	75		100	50	50	100	100	100	66.7	100
Chat, Ant-eating			X	X	57.1	25		42.9	50	50	100	20	100	100	100
Chat, Familiar			X	X			66.7	57.1	50			40			
Chat, Sickle-winged		x	X												
Cisticola, Desert				X			33.3			50				66.7	
Cisticola, Grey-backed			X		57.1	50		14.3	100	50		20		100	
Cisticola, Levaillant's			X					71.4				60			
Cisticola, Zitting								42.9				40			
Coot, Red-knobbed				X											
Cormorant, Reed			X				33.3	42.9				60			
Cormorant, White-breasted			X	X				28.6				40			
Coucal, Burchell's			X					14.3				40			
Courser, Burchell's	VU		X												
Courser, Double-banded	NT		X								100				100
Crombec, Long-billed			X	X	71.4	75	33.3	85.7	100	100	100	20	100	66.7	
Crow, Pied			X	X	71.4	50	33.3	57.1	50		100		100	66.7	100
Cuckoo, Diederik					14.3	25	33.3	42.9	33.3			20			
Cuckoo, Jacobin			X		14.3	25		42.9	33.3						
Darter, African			X				0.0000	57.1				40			
Dove, Cape Turtle			X	X	100	75	100	100	66.7	100	100	40	100	100	100
Dove, Laughing			X	X	42.9	50	100	100	83.3	100	100	100	100	66.7	100
Dove, Namaqua			X	X	71.4	50	33.3	100	83.3	100	100	60		100	

Alphabetical Name	Red Data	Ende-mism*	Arcus 2016	Jeal 2017	SABAP2 Reporting Rate %**										
					2845_2205	2845_2200	2845_2155	2845_2150	2840_2205	2840_2200	2840_2155	2840_2150	2835_2205	2835_2200	2835_2155
Dove, Red-eyed							33.3	71.4				80			
Dove, Rock			X												
Drongo, Fork-tailed					14.3										
Duck, African Black			X									20			
Duck, Yellow-billed								14.3				20			
Eagle, African Fish			X	X			66.7	57.1				40			
Eagle, Black-chested Snake			X												
Eagle, Booted			X												
Eagle, Martial	EN		X												
Eagle, Verreauxs'	VU		X		42.9	25		14.3	16.7	50	100				
Egret, Little			X					28.6							
Egret, Western Cattle			X			25	66.7	57.1	16.7			80			
Eremomela, Yellow-bellied			X	X	28.6	75	66.7	71.4	50	100	100	40		100	100
Falcon, Lanner	VU		X						33.3						
Falcon, Pygmy			X	X	71.4	50		28.6	66.7	50		20		33.3	
Finch, Red-headed			X	X	28.6				83.3	50				66.7	
Finch, Scaly-feathered			X	X	71.4	25			66.7	100	100	20	100	66.7	100
Fiscal, Common			X	X	71.4	50	100	71.4	83.3	100	100	100	100	100	
Flycatcher, Chat				X	57.1	25	66.7	57.1	33.3		100	20		66.7	100
Flycatcher, Fiscal		x	X		14.3		100	100				20			
Goose, Egyptian			X	X	42.9		33.3	57.1	16.7			60			
Goose, Spur-winged			X		14.3			28.6				40			
Goshawk, Pale Chanting			X	X	85.7	25	66.7	28.6	66.7			20		66.7	
Grebe, Little			X	X											

Alphabetical Name	Red Data	Ende-mism*	Arcus 2016	Jeal 2017	SABAP2 Reporting Rate %**										
					2845_2205	2845_2200	2845_2155	2845_2150	2840_2205	2840_2200	2840_2155	2840_2150	2835_2205	2835_2200	2835_2155
Greenshank, Common				X											
Guineafowl, Helmeted			X		14.3		33.3	57.1	16.7			80			
Hamerkop								28.6				20			
Heron, Black-headed			X	X			33.3	28.6				40			
Heron, Goliath			X				33.3	42.9				20			
Heron, Grey			X					42.9				20			
Honeyguide, Lesser					14.3			57.1				20			
Hoopoe, African			X				33.3	42.9	16.7	50		60			
Hornbill, African Grey			X												
Hornbill, Southern Yellow-billed			X												
Ibis, African Sacred			X					28.6				60			
Ibis, Glossy								14.3							
Ibis, Hadeda			X	X	28.6	50	100	71.4				100			
Kestrel, Greater				X	14.3										
Kestrel, Rock			X		14.3	25	33.3		66.7	50				33.3	
Kingfisher, Brown-hooded								42.9							
Kingfisher, Giant			X					42.9							
Kingfisher, Malachite			X	X											
Kingfisher, Pied								42.9							
Kite, Black-shouldered			X									20			
Kite, Yellow-billed			X												
Korhaan, Karoo	NT		X				33.3	85.7				60			
Korhaan, Northern Black			X	X	28.6	25	33.3	85.7	16.7	50	100	20	100	66.7	100

Alphabetical Name	Red Data	Ende-mism*	Arcus 2016	Jeal 2017	SABAP2 Reporting Rate %**										
					2845_2205	2845_2200	2845_2155	2845_2150	2840_2205	2840_2200	2840_2155	2840_2150	2835_2205	2835_2200	2835_2155
Korhaan, Red-crested			X	X	57.1	50			50	50	100			100	100
Lapwing, Blacksmith			X	X				71.4	16.7			40			
Lapwing, Crowned			X				33.3	14.3	66.7		100	40		33.3	100
Lark, Black-eared Sparrow-		x	X												
Lark, Eastern Clapper			X	X	28.6	50		14.3	50	50	100	20		100	100
Lark, Fawn-coloured			X	X	100	100	66.7	57.1	100	100	100	40	100	100	100
Lark, Grey-backed Sparrow			X		14.3			57.1		50		20		33.3	
Lark, Karoo Long-billed							66.7	85.7	16.7	50	100	40			
Lark, Red-capped								14.3							
Lark, Sabota			X	X	28.6		100	85.7		100	100	60		33.3	
Lark, Spike-heeled			X	X	14.3	50	100	42.9	66.7	100	100	60		100	100
Lark, Stark's			X												
Martin, Brown-throated				X		25	66.7	57.1				40			
Martin, Common House								14.3							
Martin, Rock			X	X	71.4	75	66.7	28.6	100	50	100			100	
Mousebird, Red-faced			X		14.3	50	33.3	57.1	33.3	100	100	40	100	33.3	100
Mousebird, White-backed			X	X	42.9	50	66.7	57.1	33.3	100	100	60	100	33.3	100
Myna, Common						25									
Neddicky					14.3	25									
Nightjar, Fiery-necked					14.3				16.7						
Nightjar, Rufous-cheeked					42.9			14.3	16.7			20			

Alphabetical Name	Red Data	Ende-mism*	Arcus 2016	Jeal 2017	SABAP2 Reporting Rate %**										
					2845_2205	2845_2200	2845_2155	2845_2150	2840_2205	2840_2200	2840_2155	2840_2150	2835_2205	2835_2200	2835_2155
Ostrich, Common								42.9						100	
Owl, Cape Eagle-			X												
Owl, Spotted Eagle-					28.6	25			16.7						
Owl, Western Barn				X						50		20			
Owlet, Pearl-spotted			X					14.3							
Penduline-tit, Cape			X		57.1	25			16.7						
Pigeon, Speckled			X	X			33.3	28.6	66.7	50	100	40			
Pipit, African			X				33.3	71.4	16.7			80		33.3	
Pipit, African Rock	NT	x			57.1	25			100	50				66.7	
Pipit, Long-billed					14.3				16.7						
Plover, Grey				X											
Plover, Kittlitz's				X											
Plover, Three-banded			X	X				42.9							
Prinia, Black-chested			X	X	100	75	66.7	100	83.3	100	100	80	100	100	100
Quail, Common					14.3					50		20		33.3	
Quelea, Red-billed			X	X	14.3		33.3	57.1	16.7		100	80		66.7	
Robin, Kalahari Scrub			X	X	100	75		42.9	100	100	100	40	100	100	100
Robin, Karoo Scrub			X	X	28.6	25	33.3	85.7	16.7			80		66.7	
Robin-chat, Cape			X				66.7	57.1				80			
Ruff				X											
Sanderling				X											
Sandgrouse, Burchell's														33.3	
Sandgrouse, Namaqua			X	X	85.7	50	66.7	100	50	100	100	60	100	66.7	100
Sandpiper, Curlew				X											

Alphabetical Name	Red Data	Ende-mism*	Arcus 2016	Jeal 2017	SABAP2 Reporting Rate %**										
					2845_2205	2845_2200	2845_2155	2845_2150	2840_2205	2840_2200	2840_2155	2840_2150	2835_2205	2835_2200	2835_2155
Scimitarbill, Common			X	X	57.1	25			66.7	50	100	40	100	33.3	
Shelduck, South African			X	X				14.3							
Shoveler, Cape				X											
Shrike, Crimson-breasted			X		28.6	25			16.7				100	33.3	
Shrike, Lesser Grey					28.6	25									
Shrike, Red-backed					14.3	25		14.3	33.3						
Sparrow, Cape			X	X	28.6	25	66.7	71.4	66.7	50	100	80		66.7	100
Sparrow, Great			X												
Sparrow, House			X	X	14.3		33.3	57.1	50		100	20			
Sparrow, Southern Grey-headed								57.1	16.7			40			
Sparrow-weaver, White-browed			X	X	57.1	25	100	71.4	100	100	100	80		100	
Starling, Cape Glossy			X		14.3		100	85.7	16.7			40			
Starling, Pale-winged			X		57.1	50			83.3	100				33.3	
Starling, Wattled					14.3		33.3	28.6				20			
Stilt, Black-winged				X				14.3							
Stint, Little				X											
Sunbird, Dusky			X	X	85.7	100	66.7	100	83.3	100	100	40	100	100	100
Swallow, Barn			X		71.4	50	33.3	57.1	83.3			40			
Swallow, Greater Striped							33.3	71.4	66.7			40			
Swallow, South African Cliff		x										20			
Swallow, White-throated			X	X				57.1				80			
Swift, African Palm								14.3				20			

Alphabetical Name	Red Data	Ende-mism*	Arcus 2016	Jeal 2017	SABAP2 Reporting Rate %**										
					2845_2205	2845_2200	2845_2155	2845_2150	2840_2205	2840_2200	2840_2155	2840_2150	2835_2205	2835_2200	2835_2155
Swift, Bradfield's			X					14.3	33.3						
Swift, Common					28.6	25			33.3			20			
Swift, Little			X	X	14.3		66.7	100	33.3	50		40	100		
Swift, White-rumped					57.1	25		42.9	50			20			
Tchagra, Brown-crowned			X	X	57.1	75	33.3	42.9	66.7			20		66.7	
Teal, Cape				X											
Teal, Red-billed				X				28.6							
Tern, Whiskered				X											
Thick-knee, Spotted					28.6				16.7			20			
Thrush, Karoo		x	X				33.3	57.1				60			
Thrush, Short-toed Rock			X	X	14.3				33.3	50					
Tit, Ashy			X		42.9	25	33.3	57.1	100	100	100		100	66.7	
Tit-Babbler, Chestnut-vented			X	X	85.7	75	66.7	85.7	83.3	100	100	20	100	100	100
Tit-Babbler, Layard's		x			28.6	50			100	50					
Turnstone, Ruddy				X											
Vulture, Lappet-faced	EN		X												
Vulture, White-backed	EN												100		
Wagtail, African Pied			X				33.3	42.9							
Wagtail, Cape			X	X			33.3	71.4				80			
Warbler, African Reed								57.1				40			
Warbler, Lesser Swamp								42.9				40			
Warbler, Namaqua		x	X					57.1				60			

Alphabetical Name	Red Data	Ende-mism*	Arcus 2016	Jeal 2017	SABAP2 Reporting Rate %**										
					2845_2205	2845_2200	2845_2155	2845_2150	2840_2205	2840_2200	2840_2155	2840_2150	2835_2205	2835_2200	2835_2155
Warbler, Rufous-eared			X	X	71.4	25	66.7	85.7	33.3	50	100	60		66.7	100
Warbler, Willow								14.3							
Waxbill, Black-faced					28.6		33.3		X					33.3	
Waxbill, Common			X			25	33.3	42.9							
Waxbill, Violet-eared			X	X	14.3									33.3	
Weaver, Sociable			X	X	100	50	100	85.7	100	50	100	60	100	100	100
Weaver, Southern Masked			X	X	14.3	50	100	100	33.3	50	100	80	100	100	
Wheatear, Capped			X		57.1		33.3	14.3	33.3			40			
Wheatear, Mountain			X	X	57.1	50		14.3	100	50				100	
White-eye, Orange River			X			25	100	71.4				80			
Whydah, Pin-tailed							33.3	14.3							
Woodpecker, Cardinal			X					28.6							

SABAP2 data as accessed on 28 November 2019. VU = Vulnerable; NT = Near-threatened. Endemic or near endemic (i.e. ~70% or more of population in RSA) to South Africa (not southern Africa as in field guides) or endemic to South Africa, Lesotho and Swaziland. Taken from BirdLife South Africa Checklist of Birds in South Africa, 2014 **Reporting rates are essentially percentages of the number of times a species was recorded in the pentad, divided by the number of times that pentad was counted. It is important to note that these species were recorded in the entire pentad in each case and may not actually have been recorded on the proposed project area.*

APPENDIX IV: SPECIALIST DESCRIPTION AND CURRICULUM VITAE

Dr Owen Rhys Davies – Owen is a South African Avifauna Specialist and Ecologist who has been involved in avifaunal monitoring activities for renewable energy projects since 2013. He obtained his PhD Zoology (Ornithology) from the Percy FitzPatrick Institute of African Ornithology, a DST-NRF Centre of Excellence at the University of Cape Town. His responsibilities for avifaunal and ecological studies include project management, field surveys and ecological data collection, identification and assessment of environmental impacts, identification of mitigation measures and compilation of specialist reports in accordance with applicable environmental legislation. Owen was involved in the avifaunal pre-construction monitoring for the approved environmental authorisations at the Bokpoort II site and this experience was applied to the assessment of the proposed amendment. Owen is registered as a Professional Natural Scientist (Reg. No. 117555) with the South African Council for Natural Scientific Professions (SACNASP).

CURRICULUM VITAE

Dr Owen Davies Pr. Sci. Nat. (Ecology)

Ecologist

Email:OwenD@arcusconsulting.co.za

Specialisms

- Avifaunal surveys
- Ecological surveys
- Field research
- Data analysis and assessment of ecological data

Summary of Experience

Owen is a Professional Natural Scientist registered with the South African Council for Natural Scientific Professions (SACNASP) and obtained his doctoral degree from the Percy FitzPatrick Institute of African Ornithology, a DST-NRF Centre of Excellence at the University of Cape Town. Owen has been involved in avifaunal monitoring activities for renewable energy projects since 2013. Extensive field research has given Owen experience in the techniques required for conducting biological surveys on a variety of taxa including observations, physical trapping and identification of small terrestrial birds, raptors, bats, small mammals, rodents, snakes, reptiles, scorpions and fish. He is also qualified to conduct observations and acoustic monitoring of marine mammals in the offshore environment. Data collection in a diversity of habitats and ecosystems, combined with formal training in field skills such as off-road driving, enables Owen to conduct ecological surveys across southern Africa. In addition, his skills in data analysis and scientific writing at the PhD level enable him to produce high quality assessments and reports.

Qualifications and Professional Interests

- **University of Cape Town, Percy FitzPatrick Institute of African Ornithology, 2010 to 2015**
  PhD Zoology
- **University of Cape Town, Percy FitzPatrick Institute of African Ornithology, 2008 to 2010**
  MSc Zoology (upgraded to PhD)
- **University of Cape Town, 2007**
  BSc Zoology (Hons)
- **University of Cape Town, 2003 to 2006**
  BSc Zoology
  BSc Botany

Professional History

2015 (July) to present - Avifaunal Specialist, Ecologist, field team leader, Arcus Consultancy Services, Cape Town
2014 to 2015 - Bat monitoring field assistant, Arcus Consultancy Services, Cape Town
2013 to 2015 - Avifaunal observer, Arcus Consultancy Services, Cape Town
2009 to 2013 - Research Assistant (birds) to Dr J. Fuchs (Curator of Birds at the Muséum national d'Histoire naturelle, Paris), throughout South Africa
2007 to 2013 - Research Assistant (birds) to Prof T. M. Crowe (Percy FitzPatrick Institute of African Ornithology, Department of Zoology, University of Cape Town), throughout South Africa
2011 - Research Assistant (birds) to Dr I. Little, Endangered Wildlife Trust, Uganda
2010 - Research Assistant (bats) to Asst. Prof Hassan Salata, Department of Wildlife (South Sudan), Northern Cape
2010 to 2011 - Research Assistant (small mammals) to Dr B. Smit, University of Pretoria, Northern Cape
2010 - Research Assistant to Dr H. Smit-Robinson, Birdlife SA, Western and Northern Cape

CURRICULUM VITAE

Project Experience

- Confidential WEF near Molteno, Northern Cape Province (bird monitoring data analysis and reporting)
- Confidential Grid Connection near De Aar, Northern Cape Province (Avifaunal assessment, Ecological assessment, site-walkthrough, data analysis and reporting)
- Confidential WEF near Yzerfontein, Western Cape Province (Avifaunal assessment, Ecological assessment, site-walkthrough, data analysis and reporting)
- Metsimatala Solar (Field team leader, bird observations, data analysis and reporting in collaboration with specialists)
- Kolkies WEF (Field team leader, bird observations, bat mast commission, data analysis and reporting in collaboration with specialists)
- Karee WEF (Field team leader, bird observations, bat mast commission, data analysis and reporting in collaboration with specialists)
- Gouda WEF (Field team leader, bird observations – post construction)
- Hopefield WEF (Field team leader, bird observations, data analysis and reporting in collaboration with specialists – post construction)
- UmSinde Emoyeni WEF (Bird observations)
- Spitzkop West WEF (Bird observations, bat mast commission)
- Pofadder WEF (Bat mast commission)
- Cookhouse WEF (Bat mast commission and decommission)
- Komsberg WEF (Field team leader, bird observations, bat mast commission, data analysis and reporting in collaboration with specialists)
- Bokpoort Solar (Field team leader, bird observations, data analysis and reporting in collaboration with specialists)

Conferences and Seminars

- Biodiversity Southern Africa Conference, Biological Sciences Department, University of Cape Town, 2 to 6 December 2013
- Southern African Society for Systematic Biology (SASSB) Conference 2012: Systematics in the Era of Integrative Biology, Arniston, Western Cape, 16 to 20 July 2012
- The Willi Hennig Society Annual Meeting XXX Conference for Cladistic Research 2011, Sao Jose do Rio Preto, State of Sao Paulo, Brazil, 29 July to 2 August 2011
- Southern African Society for Systematic Biology (SASSB) Conference 2011: Biodiversity Matters!, Rhodes University, Grahamstown, Eastern Cape, 19 to 21 January 2011
- Zoological Society of Southern Africa (ZSSA) 50th Anniversary conference 2009, Natalia Resort, Illovo Beach, Kwa-Zulu Natal South Coast, 21 to 25 July 2009
- Southern African Society for Systematic Biology (SASSB) 10th Anniversary Conference 2009, Natalia Resort, Illovo Beach, Kwa-Zulu Natal South Coast, 25 to 27 July 2009
- Pan-African Ornithological Congress (PAOC 12) South African Conference 2008: Birds and People – Interaction, Utilisation and Conservation, Goudini Spa, Western Cape, 7 to 12 September 2008

Publications

DAVIES, O.R, JUNKER, K, JANSEN, R, CROWE, T.M. & BOOMKER, J. 2008. Age- and sex-based variation in helminth infection of Helmeted Guineafowl (*Numida meleagris*) with comments on Swainson's Spurfowl (*Pternistis swainsonii*) and Orange River Francolin (*Scleroptila levaillantoides*). South African Journal of Wildlife Research 38 (2): 163-170.

JUNKER, K., DAVIES, O.R., JANSEN, R., CROWE, T.M. & BOOMKER, J. 2008. Nematodes of Swainson's Spurfowl *Pternistis swainsonii* and Orange River Francolin *Scleroptila levaillantoides* from the Free State province, South Africa, with a description of *Tetrameres swainsonii*, sp. nov. (Nematoda: Tetrameridae). Journal of Helminthology 82: 365-371.

Appendix B7: Bats

BAT SPECIALIST AMENDMENT REPORT FOR THE PROPOSED BOKPOORT SOLAR FACILITY, NORTHERN CAPE PROVINCE

On behalf of

Royal HaskoningDHV (Pty) Ltd

April 2020

Prepared By:

Arcus Consultancy Services South Africa (Pty) Limited

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Registered in South Africa No. 2015/416206/07

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1 INTRODUCTION

ACWA Power Energy Africa (Pty) Ltd obtained environmental authorisation for two 75 MW photovoltaic (PV) solar power developments, PV1 and PV2, on Farm Bokpoort (DEA reference numbers 14/12/16/3/3/2/881 and 14/12/16/3/3/2/880, respectively). Environmental authorisation was also acquired for a 150 MW concentrated solar power (CSP) tower development on Farm Bokpoort 390 (DEA reference number 14/12/16/3/3/2/879). The site is located approximately 20 km northwest of Groblershoop within the !Kheis Local Municipality of the Northern Cape Province (Figure 1). ACWA Power are applying to replace the CSP facility with construction of eight photovoltaic plants, on the same site as was previously assessed and authorized for the CSP facility. Previously, approval for 2 PV facilities was obtained, PV 1 (Ndebele) and PV 2 (Xhosa), however the proposal for these two sites did not include the battery energy storage system for either of the sites or the capacity increase from 75 to 200MW.

The amendment application involves the following changes to the development:

- Eight PV facilities, in place of the CSP facility, within the same footprint;
- PV facility associated infrastructure:
  - Battery storage site occupying area of 400 m by 400 m
  - Access routes between PV panels
  - Access road for maintenance of power line
  - Substation
  - Water pipeline connection to main water pipeline
  - 132 kV overhead line and 31 m servitude
  - Shared infrastructure consisting of buildings, including a workshop area for maintenance, storage (i.e. fuel tanks, etc.), laydown area, parking, warehouse, and offices (previously approved).

The site is within one of South Africa's eight renewable energy development zones, and has therefore been identified as one of the most suitable areas in the country for renewable energy development, in terms of a number of environmental impact, economic and infrastructural factors.

1.1 Terms of Reference

This report has been compiled under the following terms of reference and provides:

- An assessment of the advantages and disadvantages of constructing ten PV facilities instead of a CSP facility, as they relate to bats;
- An assessment of the impacts of the proposed ten PV plants and associated infrastructure;
- Measures to manage/mitigate impacts of the proposed amendment.

2 METHODOLOGY

A literature review of the impacts of CSP and PV developments on bats was conducted to assess the advantages and disadvantages of the proposed amendment. The bat impact assessment reports of the initial EIA of the CSP and two PV facilities (presented by Golder Associates, report numbers 1400951-302665-23 and 24, dated April and May 2016) were reviewed. Satellite imagery of the development area was inspected for changes in land use and changes to features that were identified as sensitive in the bat impact assessment reports of the EIA. Impacts of the proposed amendment were assessed and relevant mitigation measures outlined.

The identified impacts were assessed with the approach outlined below extracted from the Golder EIR (terminology from the Department of Environmental Affairs and Tourism Guideline document on EIA Regulations, April 1998). This approach incorporates two aspects for assessing the potential significance of impacts, namely occurrence and severity, which are further sub-divided as follows:

Occurrence		Severity	
Probability of occurrence	Duration of occurrence	Scale/extent of impact	Magnitude (severity) of impact

To assess each of these factors for each impact, the following four ranking scales were used:

Probability	Duration
5 - Definite/don't know	5 - Permanent
4 - Highly probable	4 - Long-term
3 - Medium probability	3 - Medium-term (8 - 15 years)
2 - Low probability	2 - Short-term (0 - 7 years) (impact ceases after the operational life of the activity)
1 - Improbable	1 – Immediate
0 – None	0 - None
Scale	**Magnitude**
5 - International	10 - Very high/don't know
4 - National	8 - High
3 - Regional	6 - Moderate
2 - Local	4 - Low
1 - Site only	2 - Minor
0 - None	0 - None

Once these factors were ranked for each impact, the significance of the two aspects, occurrence and severity, were assessed using the following formula:

SP (significance points) = (magnitude + duration + scale) x probability

The maximum value is 100 significance points (SP). The impact significance is then rated as follows:

SP >75	Indicates high environmental significance	An impact which could influence the decision about whether or not to proceed with the project regardless of any possible mitigation.
SP 30 – 75	Indicates moderate Environmental significance	An impact or benefit which is sufficiently important to require management, and which could have an influence on the decision unless it is mitigated.
SP <30	Indicates low environmental significance	Impacts with little real effect and which should not have an influence on or require modification of the project design.

3 ASSUMPTIONS AND LIMITATIONS

The principle limitation relevant to this study is that there is a lack of empirical data and very few peer reviewed experimental studies that have investigated the impacts of solar facilities, either PV or CSP, on bats. Studies concerning landscape-scale impacts are also not available. Information is particularly lacking in a South African setting. Assumptions are therefore made regarding impacts which are based on bat ecology and described in detail in Section 4.

4 RESULTS

4.1 Review of Impacts of CSP and PV Facilities on Bats

Under laboratory conditions, bats demonstrated drinking behaviour over smooth artificial plates as they confused these surfaces with water sources (Greif and Siemers, 2010). This raised the concern of a risk of bats colliding with smooth PV panels as they may confuse these with water, possibly causing injuries and/or fatalities. Greif et al. (2017) investigated how bats interact with smooth vertical and horizontal surfaces. They confirmed drinking behaviour over smooth horizontal surfaces and found bats mistake smooth vertical surfaces for open flight paths resulting in collision. The risk of injury or fatality by collision was thus with vertical surfaces rather than horizontal. Collision of bats with solar panels has not been investigated and is not confirmed. Given that PV arrays are typically tilted and not oriented vertically, risk of collision with PV panels cannot be inferred from these studies and is typically assumed to be low (Taylor et al. 2019). Additionally, a field experiment recorded bats leaving an area with artificial surfaces when they learnt after a few attempts that drinking from the surfaces was not possible (Russo et al. 2012). If there is a risk of collision, over time bats should learn that PV panels are not water sources and search elsewhere for water. With enough time, collision risk should then be reduced to zero.

PV panels reflect horizontally polarized light and attract polarotactic insects (insects attracted to polarized light) as they perceive the panels to be water sources (Horvath et al. 2010). It may be assumed that the attraction of insects to PV panels would in turn attract insectivorous bats to forage around the panels (Harrison et al. 2017). However, there is no evidence to confirm this attraction or collision by bats while foraging in the area of a PV facility therefore this impact is assumed to be negligible.

Negative environmental impacts of CSP developments include avifaunal deaths from collisions with reflective heliostats and singeing of feathers from flight through concentrated solar flux (Ho 2016). Walston et al. (2016) reported an avian mortality rate of 7 to 21 times greater (relative to power generating capacity) at CSP facilities than PV facilities in South West California. CSP heliostats are highly reflective and concentrate light towards a central receiver, while PV panels are more absorptive than reflective of sunlight. Therefore, there is a risk of heat related injuries or fatalities associated with CSP technology that is less applicable to PV panels (Pimentel et al. 1994). There should be a lower risk of heat related injuries and fatalities for bats than birds as heat is lost through the night, but bats may be attracted to the central CSP receiver for territorial or roosting purposes. The South African Bat Assessment Association (SABAA) website notes that bat fatalities have occurred at CSP facilities in South Africa (no further information of cause or location is provided), and mentions there to be no evidence that PV farms constructed on the ground in fields pose a direct fatality risk to bats.

Drewitt and Langston (2006) identified habitat loss/fragmentation, disturbance, displacement and barrier effect as negative impacts of both CSP and PV developments on avifauna. These impacts are also applicable to bats. The development footprint of the proposed amendment remains the same as was previously approved. Thus, the impact of habitat loss, disturbance, displacement and barrier effect remain the same, irrespective of the technology, as when the development was granted authorization. Although no study has explicitly compared the impacts, the lack of evidence of collision of bats with PV panels, the higher avian mortality rate at CSP facilities and the record of bat deaths at CSP facilities in South Africa may infer a higher fatality risk for CSP than PV developments.

4.2 Review of EIA Bat Impact Assessment Reports and Satellite Imagery

The African straw-coloured fruit bat (*Eidolon helvum*) was not included in the table of bat species potentially occurring within the study area of the EIA report. It has been recorded

within the central plateaus of South Africa and the site is located within this species modelled distribution range as per Monadjem et al. (2010). This omission does not influence the impact assessment of the amendment.

The construction and decommission phase impacts of the two PV developments identified in the bat impact assessment reports were the same as those identified for the CSP facility. The operational phase impacts differed in that the CSP facility had a high pre-mitigation impact significance for injury and mortality due to CSP tower and concentrated heat, while the PV facility had a low pre-mitigation impact significance for injury and mortality of bats due to collision with panels.

Review of the latest publicly available satellite imagery indicates there has been no change in agricultural land use since the environmental authorisation was granted. There is no addition of natural vegetation or natural features that bats would utilize for foraging, roosting or commuting. There has been subsequent development of buildings and a water treatment facility which may have attracted bats to the area as several species utilize buildings for roosting; and the water treatment facility may attract bats for drinking and foraging on insects attracted to the water. The development of PV plants may negatively impact the roosting or foraging activities in the area due to lighting of the facility at night and noise disturbance during construction.

5 BAT IMPACT ASSESSMENT

Potential impacts of construction, operation and decommission of ten PV plants are described and assessed below.

5.1 Construction phase

Negative impacts during the construction phase pertain to the clearance of indigenous vegetation from the development area. The vegetation clearing will cause habitat loss and fragmentation, reducing the foraging habitat available to bats in this area. The natural functioning of the ecosystem of the development footprint will be permanently altered. This impact has a pre-mitigation **moderate** significance rating that is reduced to **low** significance with mitigation measures (Table 1).

Construction activities and lighting of the site may cause disturbance and displacement whereby bats will no longer utilize the area and the bat community in the greater area may be altered. If bats have taken to roosting within the more recently built houses/buildings on site, traffic and construction noise may be a disturbance to them. This impact has a pre-mitigation **moderate** significance rating that is reduced to **low** significance with mitigation measures (Table 1).

Table 1: Construction phase impact rating

Impact	Pre-mitigation						Post-mitigation					
	Magnitude	Duration	Scale	Probability	Rating	Significance	Magnitude	Duration	Scale	Probability	Rating	Significance
Reduction in foraging habitat due to vegetation clearance	6	4	1	5	55	Moderate	2	4	1	4	28	Low

Disturbance and displacement due to construction noise and lighting	6	2	1	4	36	Moderate	4	1	1	4	24	Low

5.2 Operation phase

Operation of ten PV plants will impact the foraging and commuting of bats within and around the development area as the plants have a barrier effect to their normal behaviour and use of the area. Lighting of the plants at night will alter the natural bat community in the area as some species actively forage on insects attracted to light, while other species are deterred from the area by the light. These above-mentioned impacts have a pre-mitigation **moderate** significance rating that is reduced to **low** significance with application of mitigation measures (Table 2).

Collision of bats with PV panels has been assessed as having a **low** pre-mitigation significance rating as bats are not likely to mistake panels as water sources and will typically utilize their established drinking sources. Additionally, bats should learn that the panels are not water sources and leave the area to search for water elsewhere.

Table 2: Operation phase impact rating

Impact	Pre-mitigation						Post-mitigation					
	Magnitude	Duration	Scale	Probability	Rating	Significance	Magnitude	Duration	Scale	Probability	Rating	Significance
Barrier effect of PV plants to normal foraging and commuting behaviours	8	4	1	4	52	Moderate	4	4	1	3	27	Low
Change of bat community utilizing development area due to security lighting	6	4	1	4	44	Moderate	2	4	1	4	28	Low
Collision of bats with PV panels	4	1	1	2	12	Low	4	1	1	1	6	Low

5.3 Decommission phase

The negative impact of disturbance and displacement may result from decommissioning activities due to noise, vehicles moving through the site and additional lighting of the area. This impact has a pre-mitigation **moderate** significance rating that is reduced to **low** significance with mitigation measures (Table 3).

Table 3: Decommission phase impact rating

Impact	Pre-mitigation						Post-mitigation					
	Magnitude	Duration	Scale	Probability	Rating	Significance	Magnitude	Duration	Scale	Probability	Rating	Significance
Disturbance and displacement due to decommission noise and lighting	6	2	1	4	36	Moderate	4	1	1	4	24	Low

6 MITIGATION MEASURES

Mitigation measures to reduce the negative effects of the proposed development on bats, and to restore the affected areas are outlined below. All mitigation measures must be included in the EMPr. In addition, all mitigation measures and sensitive areas identified for bats in the original EIAs for PV1 and PV2, as well as the management plans of these areas, must be adhered to.

6.1 Construction phase

- Vegetation clearance and disturbance of topsoil should be limited to developable areas and minimized as much as possible. Areas to be cleared should be clearly delineated and movement of vehicles should be limited to these areas;
- Upon completion of construction, vegetation rehabilitation should be carried out in areas that were disturbed during construction if the ground surface is no longer in use for the operation of the plants;
- Construction activities should be reduced as much as possible during the night to limit noise and light disturbance to bats;
- If nocturnal lighting is required during construction, it should be directed and limited to work areas to prevent light spillage; and
- If feasible, warm LED bulbs should be used for site lighting to limit the attraction of insects to the light and in turn prevent a shift in the bat community present in the area.

6.2 Operation phase

- Lighting of the site during operation should also be directional and limited to only the necessary areas to prevent light spillage, and warm LED bulbs should be used;
- Searches for bat carcasses on the ground around and beneath the PV panels should be conducted in tandem with searches for bird carcasses. The Environmental Control Officer must freeze bat carcasses and keep a record of the location, date and time of when they were found.

In addition to the above, the current EMPr requires acoustic monitoring for bats. However, this requirement should be removed from the EMPr due to the low impact to bats.

6.3 Decommission phase

- Decommission activities should be reduced as much as possible during the night to limit noise and light disturbance to bats;
- If nocturnal lighting is required during decommission, it should be directed and limited to work areas to prevent light spillage and warm LED bulbs should be used;

- Upon completion of decommission, vegetation rehabilitation should be carried out over the site to re-establish the natural ecosystem functioning of the development footprint and restore the use of the area by bats.

7 CUMULATIVE IMPACT ASSESSMENT

The renewable energy EIA application database map for the second quarter of 2019 (distributed by Department of Environmental Affairs) was used to identify all renewable energy developments within a 50 km radius of the proposed site. The applications listed as 'approved' or 'in process' are:

- Inyanga solar energy project (75 MW) on Farm O'poort 384
- Three 75 MW Arriesfontein photovoltaic solar power plants on the farm Arriesfontein
- Hydropower station at Boegoeberg dam on the Orange River
- Prieska solar power plant within the Siyathemba Municipality (19 MW)
- Marang solar project on the Blauwbospan No. 113
- PV solar energy facility on the farm Kleinbegin (50 MW)
- 150 MW Ilanga CSP facility
- Karoshoek CSP facility in the Khara Hais municipality (100 MW)
- Kheis solar park 1 and 2 PV project on a site south east of Upington
- Tew Isitha solar 1 and solar 2 facilities (75 MW) in the David Kruiper local municipality
- 86 MW PV solar facility on the farm Rooilyf No. 389
- The operational Bokpoort I PV solar plant

The proposed Bokpoort solar facility amendment and above-mentioned developments will primarily negatively impact bats by reducing foraging areas and roosting resources within the greater area. However, the Orange River and its riparian vegetation is a more important source of drinking water and prime foraging grounds for bats than the surrounding areas that the Bokpoort development is located within. It is essential for each facility to apply site specific mitigation measures recommended by relevant specialists to mitigate the cumulative impacts of renewable energy developments in the region. Thus, the proposed Bokpoort solar facility must adhere to the outlined mitigation measures listed in Section 5 of this report to reduce cumulative impacts of development in the greater area. Therefore no impact assessment table is required for cumulative assessment.

8 CONCLUSION

The literature review of the impacts of PV and CSP technologies indicates the proposed Bokpoort amendment of PV plants, instead of a CSP facility, is favourable for bats. The PV plants should have fewer negative impacts on bats. The impact assessment ratings of ten PV plants for the development are all reduced to a low significance impact rating after application of mitigation measures listed in Section 5 of this report. The mitigation measures listed in this report propose changes to the EMPr, specifically the removal for the requirement for acoustic monitoring. Provided the mitigation measures in this report are adhered to, and including those in the original EIAs for PV1 and PV2, the development and operation of the facility can take be undertaken without unacceptable risk to bats.

9 REFERENCES

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Pimentel, D., Rodrigues, G., Wang, T., Abrams, R., Goldberg, K., Staeker, H., Ma, E… Boerke, S. (1994). Renewable energy: economic and environmental issues. *BioScience*, 44, 536-547.

Russo, D., Cistrone, L., & Jones, G. (2012). Sensory ecology of water detection by bats: a field experiment. *PLoS ONE*, 7(10), e48144.

Taylor, R., Conway, J., Gabb, O., & Gillespie, J. (2019). Potential impacts of ground-mounted photovoltaic solar panels. BSG Ecology. Accessed from https://www.bsg-ecology.com/potential-ecological-impacts-ground-mounted-photovoltaic-solar-panels-uk/

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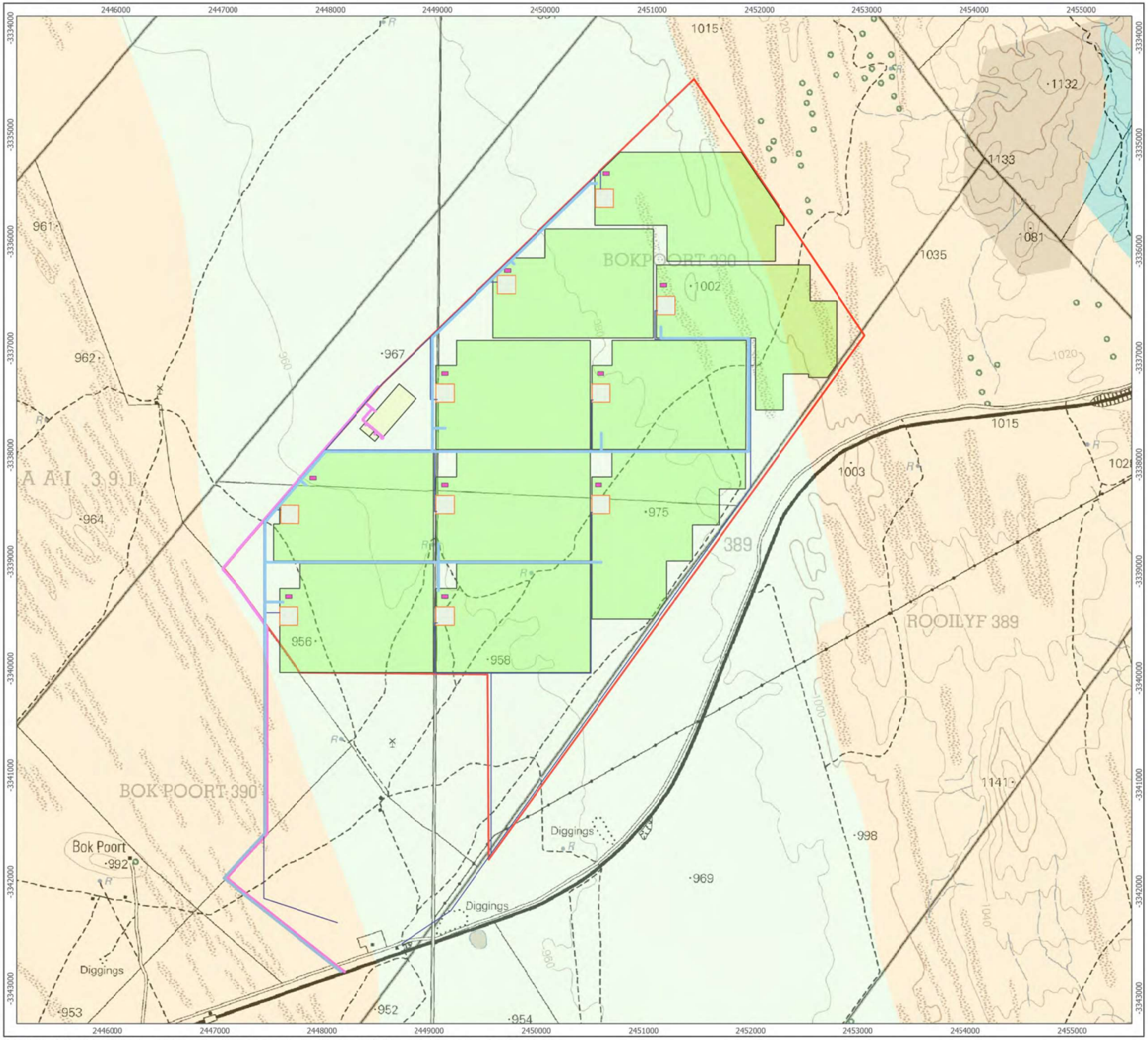
Figures



ARCUS

- Project Boundary
- PV Plants
- Battery Storage
- Proposed Substations
- Temporary Contractors Facility
- Roads
- Overhead Powerlines
- Water Pipeline

Vegetation Types

- Gordonia Duneveld
- Kalahari Karroid Shrubland
- Koranna-Langeberg Mountain Bushveld
- Olifantshoek Plains Thornveld

1:30 000 Scale @ A3

0 1 2 km

NORTH

Produced By: MB	Ref: 3570-REP-0004
Checked By: JA	Date: 2020/04/09

Proposed Layout and Vegetation Types
Figure 1

BOKPOORT II SOLAR FARM BAT SPECIALIST AMENDMENT REPORT

S:\GIS\Projects\Older Projects\3570 Bokpoort Solar Amendment\3570-Bokpoort-Solar-Amendment.aprs\3570_Bokpoort Fig 1 Proposed Layout and Vegetation Types

Appendix 1 – Details of Specialist and Specialist CV

CURRICULUM VITAE

Jonathan Aronson MSc Pr.Sci.Nat

Senior Ecologist

Email:JonathanA@arcusconsulting.co.za

Specialisms

- Ecological Impact Assessments
- Pre-construction and Operational monitoring at wind energy developments
- Data analysis and statistical assessment of ecological data
- GIS mapping and Analysis

Summary of Experience

Jonathan has 12 years of experience studying and researching bats and has presented at the International Bat Research Conference, the Conference of Wildlife and Wind Energy Impacts, and local bat workshops. He has been at the forefront of bats and wind energy research in South Africa and has worked on more than 40 WEF projects in South Africa, Kenya, Mozambique, Zambia and the UK undertaking pre-construction monitoring, operational monitoring, impact assessments and mitigation strategy design. He is a co-author of the Good Practise Guidelines for Surveying Bats at Wind Energy Facilities in South Africa, is the lead author on the operational monitoring guidelines for bats and is a founding member of the South African Bat Assessment Advisory Panel (SABAAP). He has experience managing wind energy facility projects including developing survey strategies, implementing field surveys, data analysis and report writing. He has provided extensive input to Environmental Impact Assessments (EIA) and post-construction Environmental Management Plans (EMP) for bats.

Professional History

2019 to current - Senior Ecologist, Arcus Consultancy Services Ltd, Cape Town
2013 to 2019 - Ecology Specialist, Arcus Consultancy Services Ltd, Cape Town
2011 to 2013 - Director, Gaia Environmental Services Pty (Ltd), Cape Town
2008 to 2008 - Research Assistant, Percy Fitzpatrick Inst. of African Ornithology, Cape Town

Qualifications and Professional Affiliations

- **University of Cape Town, 2009-2010**
  Msc Zoology
- **University of Cape Town, 2007**
  BSc (Hons) Freshwater Biology
- **University of Cape Town, 2003-2006**
  BSc Zoology
- Member of Society for Conservation Biology (2011 to present)
- South African Bat Assessment Advisory Panel (2013 to 2018)
- South African Bat Assessment Association (2019 to present)
- Professional Natural Scientist (Ecological Science) – SACNASP Registration #400238/14

Project Experience

<u>Pre-Construction Bat Monitoring and Environmental Impact Assessments</u>

- Pienaarspoort Wind Energy Facility (ABO Wind renewable energies (Pty) Ltd).
- Nuweveld Wind Energy Facility (Red Cap Energy (Pty) Ltd).
- Banna Ba Phifu Wind Energy Facility (WKN Windcurrent SA (Pty) Ltd).
- Kwagga Wind Energy Facility (ABO Wind renewable energies (Pty) Ltd).
- Wind Farm in Zambia (SLR Consulting).
- Namaacha Wind Farm (Consultec).
- Beck Burn Wind Farm. Post-construction Monitoring. (EDF Energy).
- Paulputs Wind Energy Facility (WKN Windcurrent SA (Pty) Ltd).
- Putsonderwater Wind Energy Facility (WKN Windcurrent SA (Pty) Ltd).
- Zingesele Wind Energy Facility (juwi Renewable Energies (Pty) Ltd).
- Highlands Wind Energy Facility (WKN Windcurrent SA (Pty) Ltd).
- Kap Vley Wind Energy Facility (juwi Renewable Energies (Pty) Ltd).
- Universal and Sonop Wind Energy Faculties (JG Afrika).
- Kolkies and Karee Wind Energy Facility (Mainstream Renewable Power South Africa).
- Komsberg East and West Wind Energy Facility (African Clean Energy Developments Pty Ltd).
- Pofadder Wind Energy Facility (Mainstream Renewable Power South Africa).
- Elliot Wind Energy Facility (Rainmaker Energy).
- Spitskop West Wind Energy Facility (RES Southern Africa/Gestamp).
- Spitskop East Wind Energy Facility (RES Southern Africa).
- Patryshoogte Wind Energy Facility (RES Southern Africa).
- Swartberg Wind Energy Facility (CSIR).
- Clover Valley and Groene Kloof Wing Energy Facility (Western Wind Energy).

CURRICULUM VITAE

Jonathan Aronson MSc Pr.Sci.Nat

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Operational Bat Monitoring Studies

- West Coast One Wind Energy Facility. Post-construction Monitoring (Aurora Wind Power (RF) (Pty) Ltd).
- Fazakerly Waste Water Treatment Works. Post-construction Monitoring. (United Utilities).
- Gouda Wind Energy Facility (Blue Falcon 140 (Rf) Pty Ltd)
- Hopefield Wind Farm (Umoya Energy).

Ecological Surveys

- Killean Wind Farm. Bat acoustic surveys including a driven transect and commissioning of bat detectors for this proposed site in Scotland, UK. (Renewable Energy Systems Ltd).
- Maple Road, Tankersely. Bat acoustic surveys including a walked transect for this proposed site near Barnsley, UK (Rula Developments).

Due Diligence

- Due Diligence of Bat Monitoring at the Excelsior, Golden Valley and Perdekraal Wind Farm (IBIS Consulting).
- Due Diligence of Bat Monitoring at the Copperton Wind Enery Facility (SLR Consulting).
- Due Diligence of Bat Monitoring at the Roggeveld Wind Farm (IBIS Consulting).
- Due Diligence of Bat Monitoring at the Kangas, Excelsior and Golden Valley Wind Farms (ERM).

Amendment Applications

- Ukomeleza Wind Energy Facility (CES - Environmental and social advisory services).
- Great Kei Wind Energy Facility (CES - Environmental and social advisory services).
- Motherwell Wind Energy Facility (CES - Environmental and social advisory services).
- Dassiesridge Wind Energy Facility (CES - Environmental and social advisory services).
- Great Karoo Wind Energy Facility (Savannah Environmental (Pty) Ltd).
- Gunstfontein Wind Energy Facility (Savannah Environmental (Pty) Ltd).
- Komserberg East and West Wind Energy Facilities (Aurecon South Africa (Pty) Ltd).
- Soetwater Wind Energy Facility (Savannah Environmental (Pty) Ltd).
- Karusa Wind Energy Facility (Savannah Environmental (Pty) Ltd).
- Zen Wind Energy Facility (Savannah Environmental (Pty) Ltd).

Peer Review

- Peer Review for Three Bat Monitoring Reports for the Bokpoort II Solar Developments (Golder Associates)
- Peer Review of Operational Monitoring at the Jeffreys Bay Wind Farm, including updating the operational mitigation strategy for bats (Globeleq South Africa Management Services (Pty) Ltd).
- Oyster Bay Wind Energy Facility. Reviewing a pre-construction bat monitoring study and providing input into a stand-alone study (RES Southern Africa).
- Review and design mitigation strategies for bats at the Kinangop Wind Park, Kenya (African Infrastructure Investment Managers).

Feasibility Studies

- Feasibility assessment for four potential wind farms in the Northern Cape (ABO Wind renewable energies (Pty) Ltd).
- Feasibility assessment for four potential wind farms in Mozambique (Ibis Consulting (Pty) Ltd).
- Assessment of the Feasibility of a Wind Farm in the Northern Cape (juwi Renewable Energies (Pty) Ltd).
- Assessment of the Feasibility of a Wind Farm in the Eastern Cape (WKN Windcurrent SA (Pty) Ltd).

Research Projects

- Darling National Demonstration Wind Farm Project. Designed and implemented a research project investigating bat fatality in the Western Cape.

CURRICULUM VITAE

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Publications

- Aronson, J.B., Shackleton, S., and Sikutshwa, L. (2019). Joining the puzzle pieces: reconceptualising ecosystem-based adaptation in South Africa within the current natural resource management and adaptation context. Policy Brief, African Climate and Development Initiative.
- MacEwan, K., **Aronson, J.**, Richardson, E., Taylor, P., Coverdale, B., Jacobs, D., Leeuwner, L., Marais, W., Richards, L. South African Bat Fatality Threshold Guidelines for Operational Wind Energy Facilities – South African Bat Assessment Association (1st Edition).
- **Aronson, J.B.** and Sowler, S. (2016). Mitigation Guidance for Bats at Wind Energy Faculties in South Africa.
- **Aronson, J.B.**, Richardson, E.K., MacEwan, K., Jacobs, D., Marais, W., Aiken, S., Taylor, P., Sowler, S. and Hein, C (2014). South African Good Practise Guidelines for Operational Monitoring for Bats at Wind Energy Facilities (1st Edition).
- Sowler, S. and S. Stoffberg (2014). South African Good Practise Guidelines for Surveying Bats in Wind Energy Facility Developments - Pre-Construction (3rd Edition). Kath Potgieter, K., MacEwan, K., Lötter, C., Marais, M., **Aronson, J.B**., Jordaan, S., Jacobs, D.S, Richardson, K., Taylor, P., Avni, J., Diamond, M., Cohen, L., Dippenaar, S., Pierce, M., Power, J. and Ramalho, R (eds).
- **Aronson, J.B.**, Thomas, A. and Jordaan, S. 2013. Bat fatality at a Wind Energy Facility in the Western Cape, South Africa. *African Bat Conservation News* 31: 9-12.

Workshops, Seminars, Conferences and Courses

- Conference on Wildlife and Wind Energy Impacts, Stirling, August 2019.
- GenEst Carcass Fatality Estimator Workshop, Stirling, August 2019.
- GenEst Carcass Fatality Estimator Workshop, Kirstenbosch Research Centre (KRC), October 2018.
- The Ecosystem Approach and Systems Thinking Course, United Nationals Environment Programme.
- Bats and Wind Energy Workshop, The Waterfront Hotel & Spa, Durban, July 2016.
- Why Carbon Footprinting Makes Business Sense, African Climate and Development Initiative Seminar, September 2016.
- The Age of Sustainable Development Course, The SDG Academy, 2016.
- Planetary Boundaries and Human Opportunities Course, The SDG Academy, 2015.
- Endangered Wildlife Trust (EWT) Bats and Wind Energy Training Course, October 2013.
- Ecological Networks Course, Kirstenbosch Research Centre (KRC), July 2013.
- Social and Economic Network Analysis Course, online via Stanford University, 2013.
- Social Network Analysis Course, online via University of Michigan, 2013.
- Introduction to Complexity Science Course, online via Santa Fe Institute, 2013.
- Introduction to Spatial Analysis using R, Kirstenbosch Research Centre (KRC), May 2013.
- Google Geo Tools for Conservation, University of Cape Town, February 2013.
- Endangered Wildlife Trust (EWT) Bats and Wind Energy Training Course, January 2012.
- 15th International Bat Research Conference, Prague, August 2010.
- Statistical Modelling Workshop for Biologists, University of Cape Town, September 2010.
- ESRI Virtual Campus Online GIS Courses, 2010.
- WAYS/ScholarShip IT Workshop: Remote Sensing and GIS Course, March 2009.

Appendix 2 – Declaration of Interest

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

	(For official use only)
File Reference Number:	
NEAS Reference Number:	DEA/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

Bat Assessment for the Proposed Development of Photovoltaic (PV) Plants on the Remaining Extent of Farm Bokpoort 390, Groblershoop, Northern Cape

Kindly note the following:

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

Postal address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

Physical address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Specialist Company Name:	Arcus Consultancy Services South Africa (Pty) Ltd			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	100%
Specialist name:	Jonathan Aronson			
Specialist Qualifications:	MSc (Zoology)			
Professional affiliation/registration:	SACNASP			
Physical address:	Office 607, Cube Workspace, Long Street cnr Hans Strijdom Avenue, Cape Town			
Postal address:	Office 607, Cube Workspace, Long Street cnr Hans Strijdom Avenue, Cape Town			
Postal code:	8001	Cell:	+27 (0) 79 098 8595	
Telephone:	+27 (0) 21 412 1529	Fax:		
E-mail:	jonathana@arcusconsulting.co.za			

2. DECLARATION BY THE SPECIALIST

I, Jonathan Aronson, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

Arcus Consultancy Services South Africa (Pty) Ltd

Name of Company:

20/05/2020

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, Jonathan Aronson, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

Arcus Consultancy Services South Africa (Pty) Ltd

Name of Company

20/05/2020

Date

Signature of the Commissioner of Oaths

1/06/2020

Date

CERTIFIED TRUE COPY OF THE
ORIGINAL

Malcolm Roods

Commissioner of Oaths
BA(Hons) LLB
(011) 798 6001
PO Box 867, Gallo Manor 2052
21 Woodlands Drive, Woodmead

Appendix B8: Air Quality