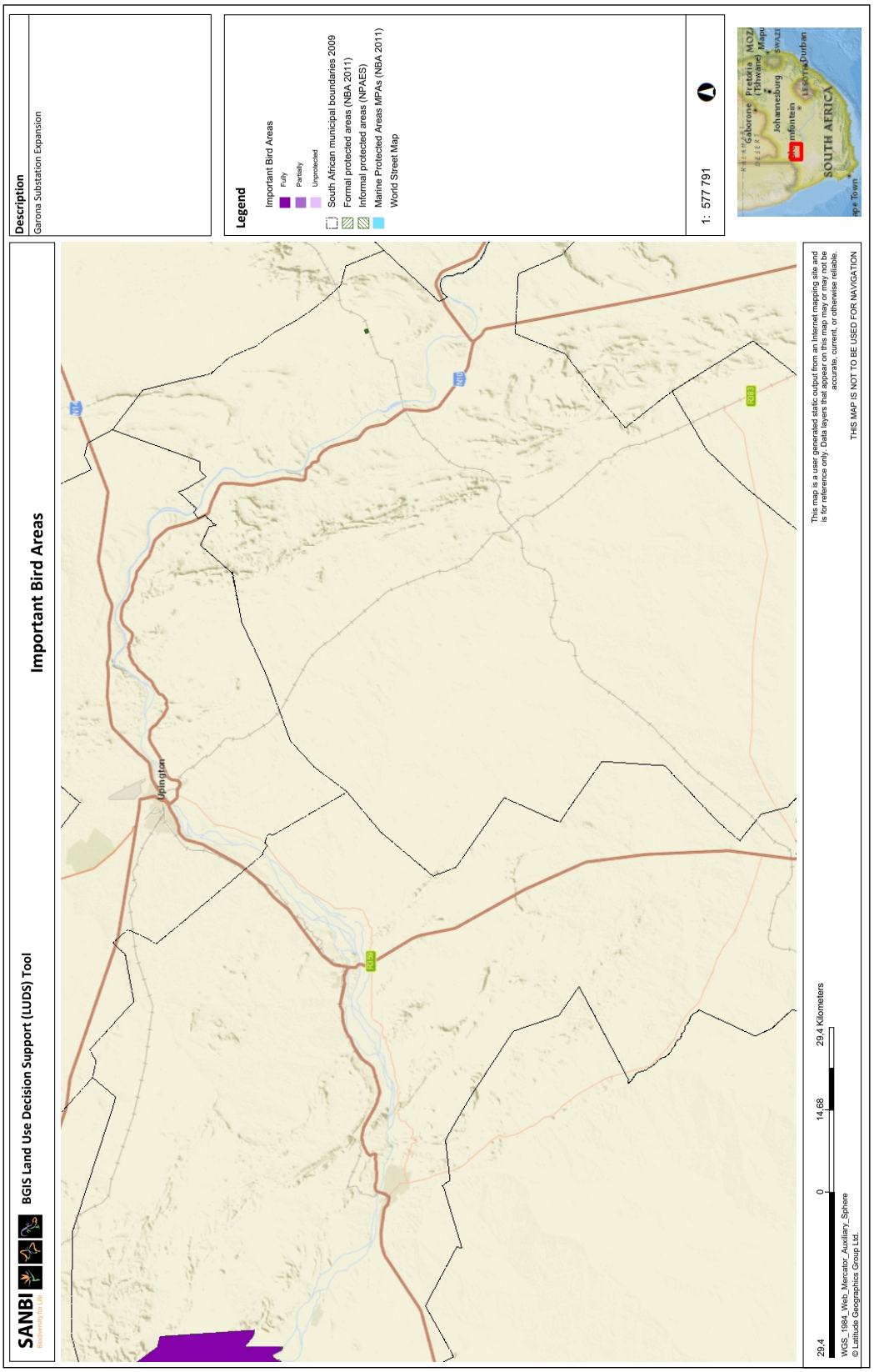
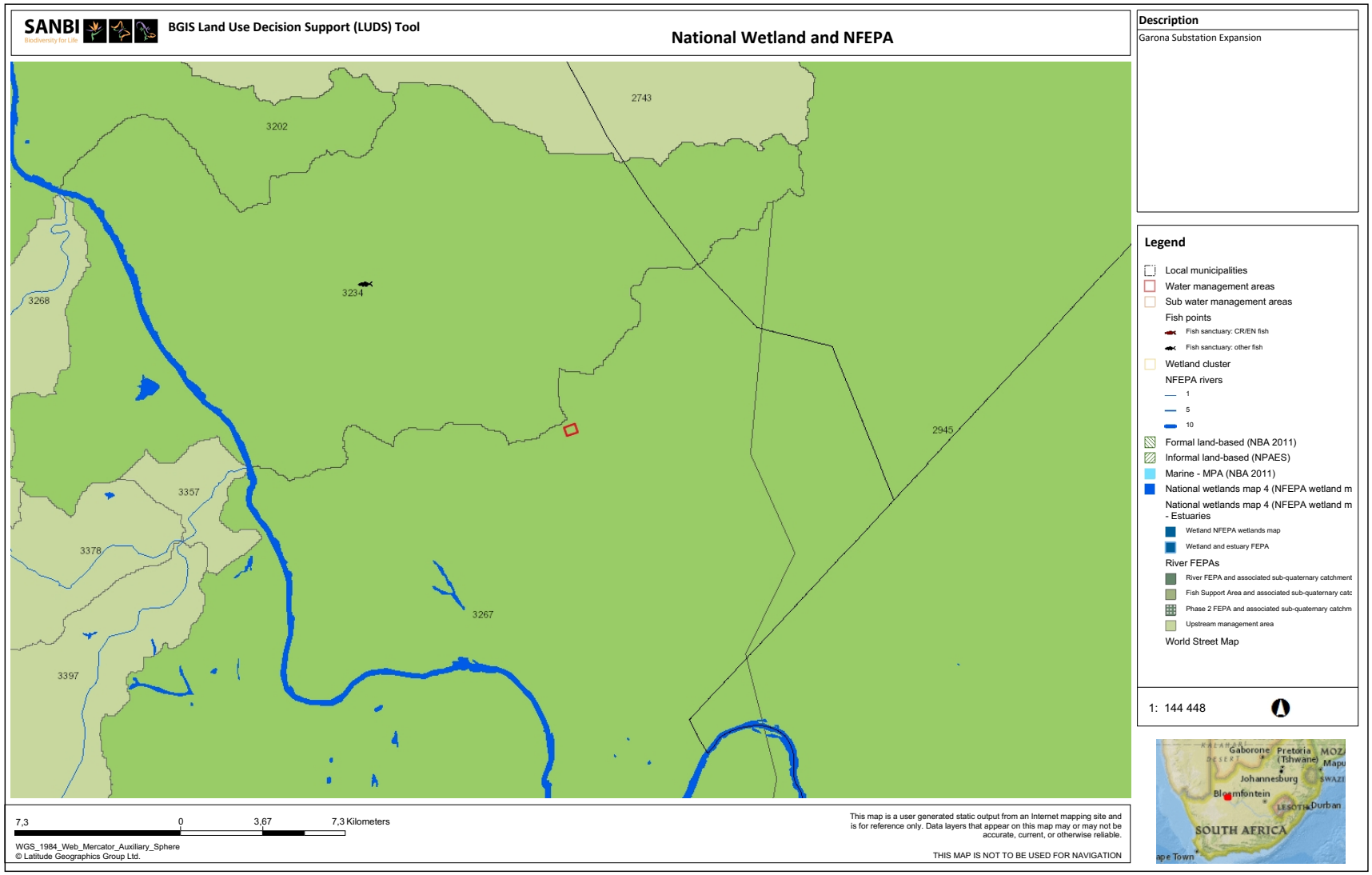
Appendix 2 – Regional conservation planning




SANBI
Biodiversity for Life
BGIS Land Use Decision Support (LUDS) Tool
National Wetland and NFEPA
2743
3202
3234
3268
2945
3357
3378
3267
3397
Description
Garona Substation Expansion
Legend
Local municipalities
Water management areas
Sub water management areas
Fish points
Fish sanctuary: CR/EN fish
Fish sanctuary: other fish
Wetland cluster
NFEPA rivers
1
5
10
Formal land-based (NBA 2011)
Informal land-based (NPAES)
Marine - MPA (NBA 2011)
National wetlands map 4 (NFEPA wetland m
National wetlands map 4 (NFEPA wetland m - Estuaries
Wetland NFEPA wetlands map
Wetland and estuary FEPA
River FEPAs
River FEPA and associated sub-quaternary catchment
Fish Support Area and associated sub-quaternary catc
Phase 2 FEPA and associated sub-quaternary catchm
Upstream management area
World Street Map
1: 144 448
Gaborone
Pretoria (Tshwane)
Johannesburg
Bloemfontein
Durban
LESOTHO
SOUTH AFRICA
7,3
0
3,67
7,3 Kilometers
WGS_1984_Web_Mercator_Auxiliary_Sphere
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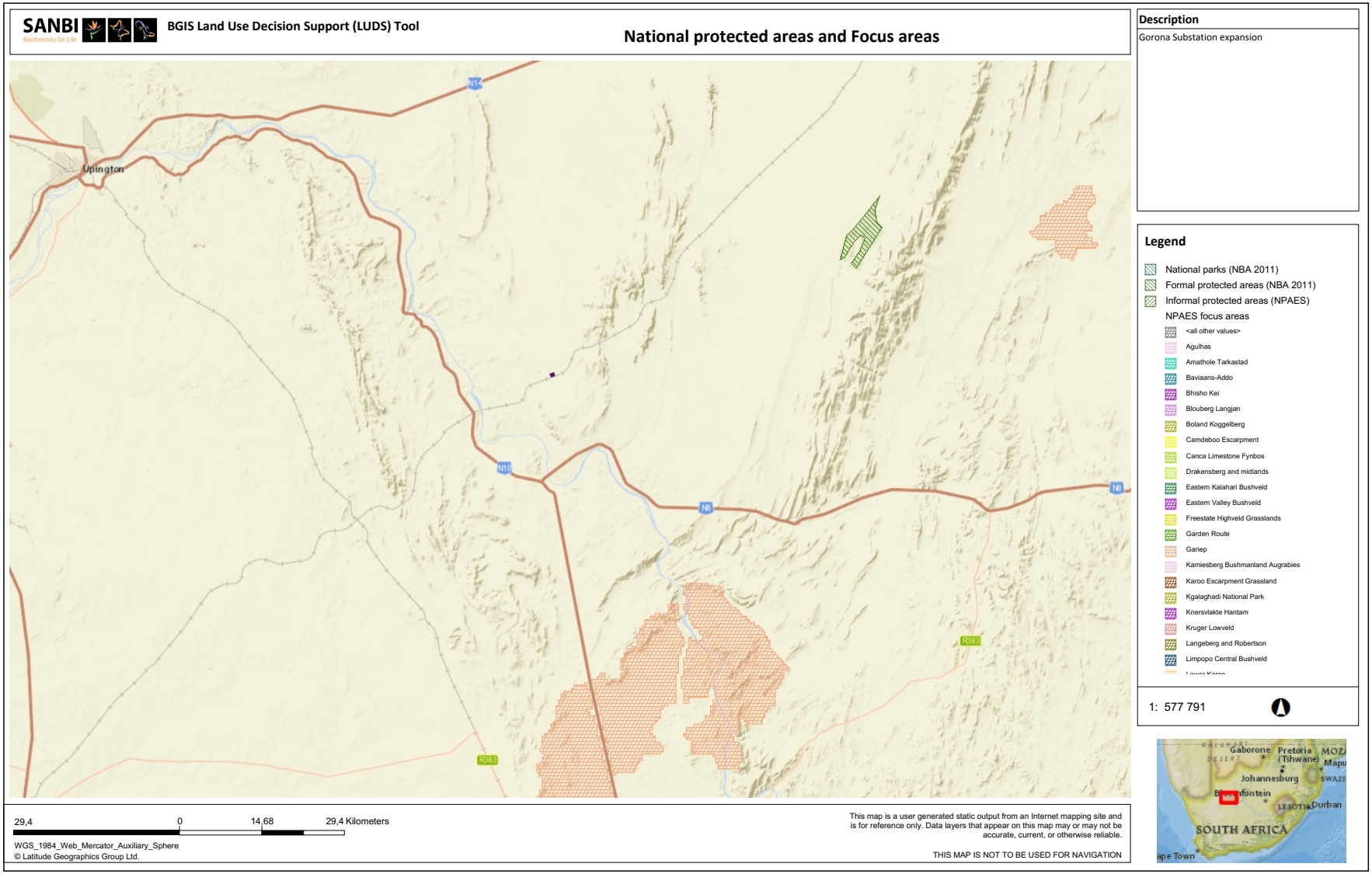
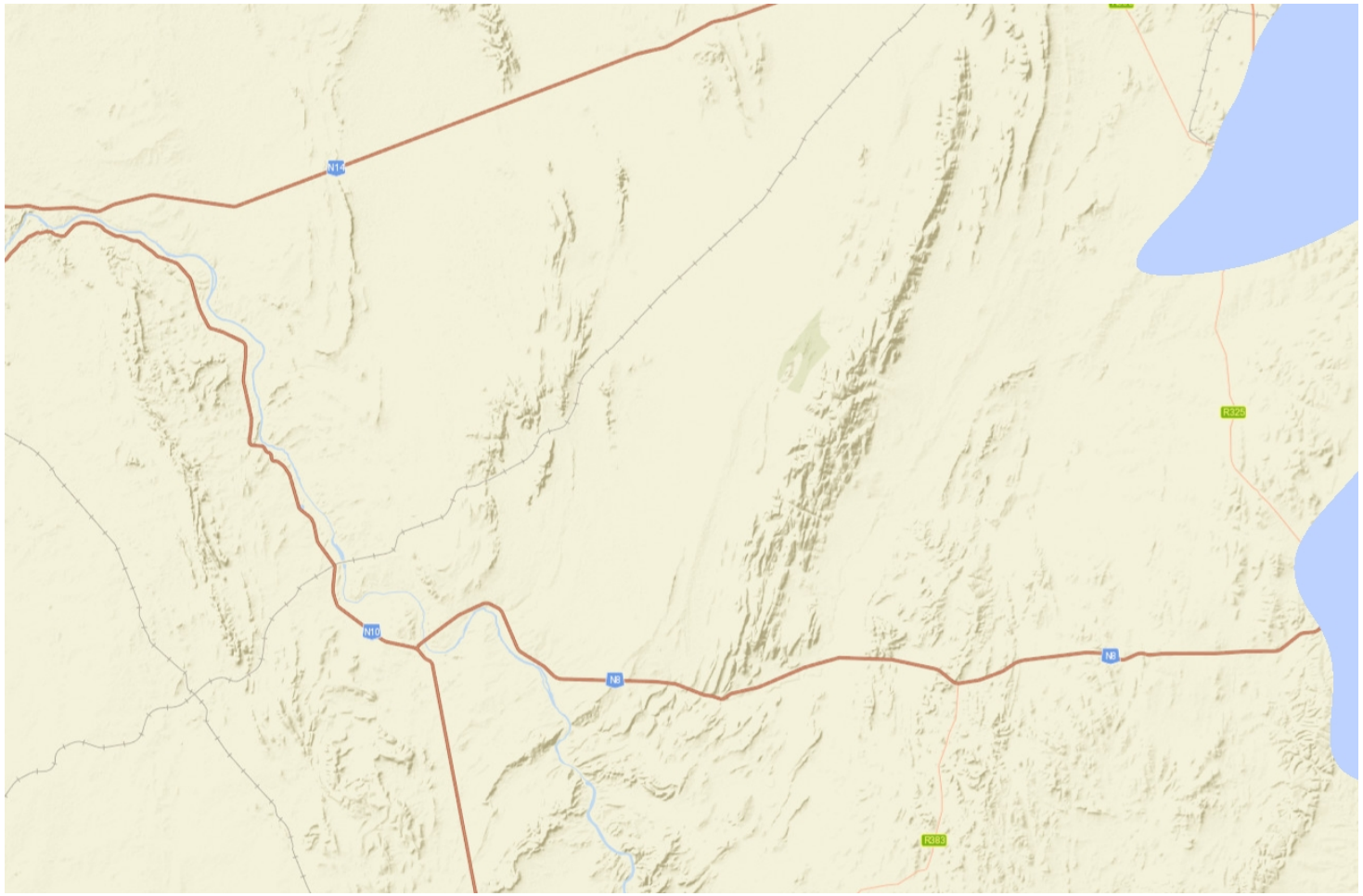

SANBI
Biodiversity for Life
BGIS Land Use Decision Support (LUDS) Tool
National protected areas and Focus areas
Upington
N14
N10
N8
R383
Description
Gorona Substation expansion
Legend
National parks (NBA 2011)
Formal protected areas (NBA 2011)
Informal protected areas (NPAES)
NPAES focus areas
<all other values>
Agulhas
Amathole Tarkastad
Baviaans-Addo
Bhisho Kei
Blouberg Langjan
Boland Koggelberg
Camdeboo Escarpment
Canca Limestone Fynbos
Drakensberg and midlands
Eastern Kalahari Bushveld
Eastern Valley Bushveld
Freestate Highveld Grasslands
Garden Route
Gariep
Kamiesberg Bushmanland Augrabies
Karoo Escarpment Grassland
Kgalaghadi National Park
Knersvlakte Hantam
Kruger Lowveld
Langeberg and Robertson
Limpopo Central Bushveld
1: 577 791
29,4 0 14,68 29,4 Kilometers
WGS_1984_Web_Mercator_Auxiliary_Sphere
© Latitude Geographics Group Ltd.
This map is a user generated static output from an Internet mapping site and is for reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable.
THIS MAP IS NOT TO BE USED FOR NAVIGATION
Gaborone
Pretoria (Tshwane)
Johannesburg
Durban
SOUTH AFRICA
Cape Town

SANBI Biodiversity for Life

BGIS Land Use Decision Support (LUDS) Tool

Strategic Water Source area



Description

Gorona Substation expansion

Legend

SWSA_geo
- Ground water
- Surface water
- Overlap between GW and SW

World Street Map
- Addo Biodiversity Conservation Plan
- Cape Winelands DMA Biodiversity Assessme
- Cape Town Biodiversity Network
- Centralkaroo Biodiversity Assessment
- Eastern Cape Biodiversity Conservation Plar
- FSP Bergrivier
- FSP Breede Valley
- FSP Cederberg
- FSP Hessequa
- FSP Langeberg
- FSP Matzikama
- FSP Mossel Bay
- FSP Saldanha Bay
- FSP Witzenberg
- Garden Route Biodiversity Sector Plan
- Gauteng C Plan
- KwaZulu-Natal Systematic conservation Plar
- Little Karoo Biodiversity Assessment
- Mpumalanga Biodiversity Conservation Plan
- Municipal Summaries Free State
- Municipal Summaries Limpopo

1: 577 791

29,4 0 14,68 29,4 Kilometers

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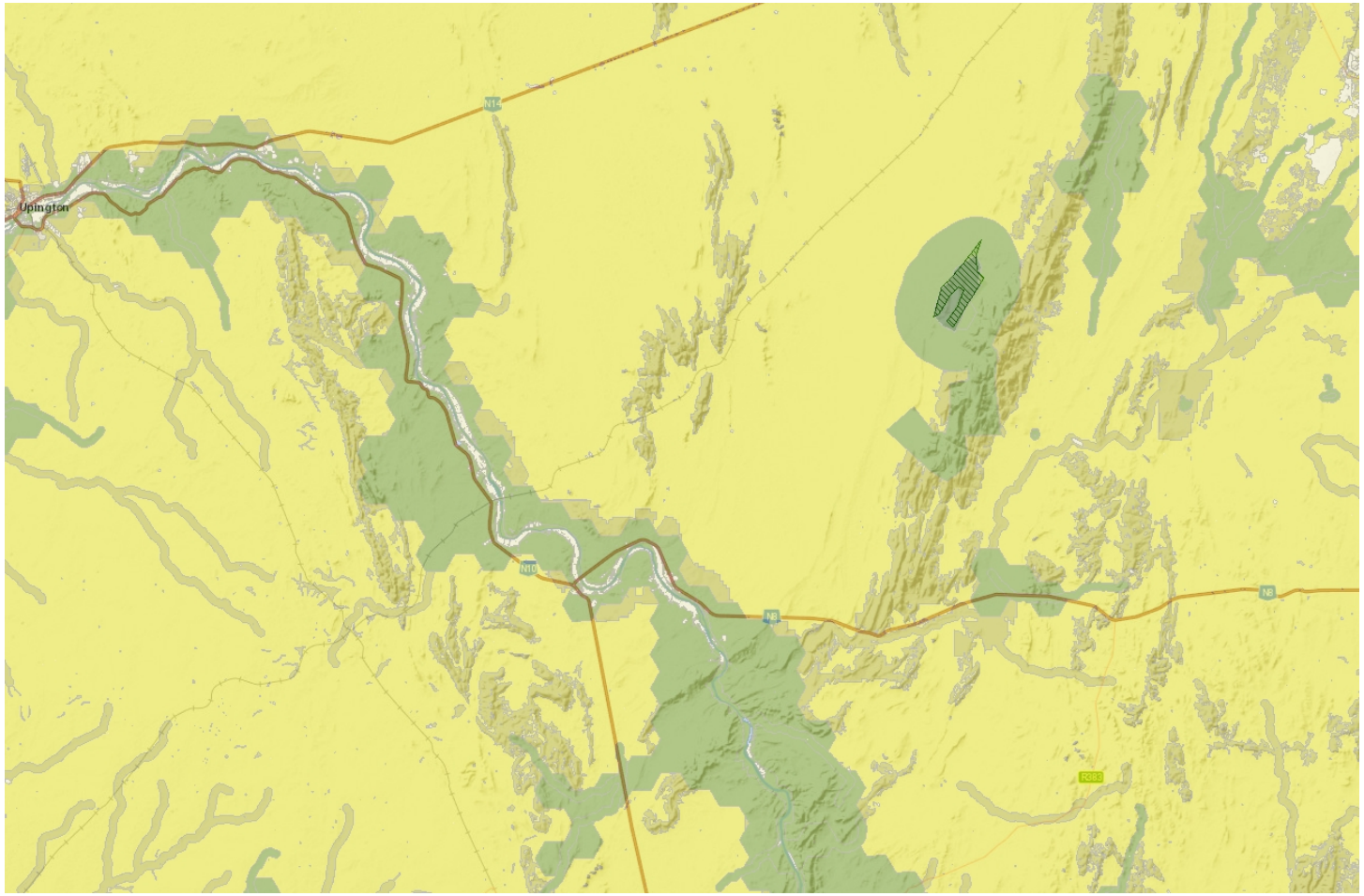
This map is a user generated static output from an Internet mapping site and is for reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable.

THIS MAP IS NOT TO BE USED FOR NAVIGATION

SANBI Biodiversity for Life

BGIS Land Use Decision Support (LUDS) Tool

Critical biodiversity areas



Description

Gorona Substation Expansion

Legend

- Northern Cape Critical Biodiversity Areas 20
- Critical Biodiversity Area One
- Critical Biodiversity Area Two
- Ecological Support Area
- Other Natural Areas
- Protected Area
- Formal protected areas (NBA 2011)
- Informal protected areas (NPAES)
- Marine Protected Areas MPAs (NBA 2011)
- World Street Map
- Addo Biodiversity Conservation Plan
- Cape Winelands DMA Biodiversity Assessm
- Cape Town Biodiversity Network
- Centralkaroo Biodiversity Assessment
- Eastern Cape Biodiversity Conservation Plar
- FSP Bergrivier
- FSP Breede Valley
- FSP Cederberg
- FSP Hessequa
- FSP Langeberg
- FSP Matzikama
- FSP Mossel Bay
- FSP Saldanha Bay
- FSP Witzenberg
- Garden Route Biodiversity Sector Plan
- Gauteng C Plan

1: 577 791

29,4 0 14,68 29,4 Kilometers

WGS_1984_Web_Mercator_Auxiliary_Sphere

This map is a user generated static output from an Internet mapping site and is for reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable.

THIS MAP IS NOT TO BE USED FOR NAVIGATION

Appendix 3 – Details of Specialist

ABRIDGED CURRICULUM VITA

NATALIE VIVIENNE BIRCH

Date of birth: 21 August 1972

QUALIFICATIONS

BSc (Rhodes University) – Botany and Zoology

BSc (Hons) Wildlife Management, Pretoria University

PhD (Rhodes University)

PHD DISSERTATION

Vegetation potential of natural rangelands in the mid Fish River Valley. Towards a sustainable and acceptable management system.

RESEARCH INTERESTS

My academic interests cover various areas dealing with ecological functioning, and wildlife management, with a special interest in the functioning and management of arid and semi arid rangelands.

ACADEMIC AWARD

Awarded a medal in 2001 by the Grassland Society of Southern Africa for: Outstanding Student in Range and Forage Science

PROFESSIONAL EXPERIENCE

1999 – 2000	Eastern Cape Parks Board	Ecologist
2000 -2002	Coastal & Environmental Services	Consultant
2003 – present	Ecological Management Services	Owner/Consultant

I am a founding member of Ecological Management Services, which is based in Kimberley, and we specialise in ecological management and impact assessment. Although we are based in Kimberley we cover most of South Africa and have projects in the Eastern Cape, Free State, North West Province, Northern Cape and Gauteng. We have undertaken impact assessments for various types of developments including urban and rural developments, agricultural developments, as well as developments within the mining sector. We also provide specialist input to various types of projects and have formulated biodiversity offset studies required to off set impacts from large developments.

A selection of recent work is as follows:

- Department of Agriculture Northern Cape—Hopetown Piggery
- Department of Agriculture Northern Cape—Phillipstown Piggery

- Department of Agriculture Northern Cape—Chikiana Piggery
- Department of Agriculture Northern Cape—De Aar Hydroponics
- Sidi Parani—Fertilizer granulation plant in Christiana
- Tiva Enviro Services - Biodiversity study for De Aar Hospital
- Ghaap Ostrich Abattoir—Biodiversity Study
- Amakhala Nature Reserve—Development of lodge facilities
- IG van der Merwe Trust—Residential development, Douglas
- Valrena Trust—Residential development along Vaal River
- Idstone Pty Ltd—Development of irrigation ground for seed potatoes production
- Tiaan Trust—Development of irrigation ground
- C F Scholtz & Seuns - Development of irrigation ground for growing of crops
- Kosie Smith Trust - Development of irrigation ground for growing seed potatoes
- Bakgat Trust—Development of irrigation ground for growing of crops
- Mount Carmel (pty) Ltd—Development of irrigation ground for growing of crops
- Koppieskraal Plase Rietrivier Beperk—Development of irrigation ground for seed potatoes production
- Genade Boerdery (PTY) Ltd—Development of irrigation ground for growing of crops
- Santarose Investments (Pty) Ltd - Development of irrigation ground for seed potatoes production
- Valrena Trust—Development of irrigation ground for growing of crops
- Middledrift Dairy Trust—Establishment of Dairy
- Eliweni Wildlife (Pty) Ltd - Lodge Development on Amakhala Nature Reserve
- Idstone Pty Ltd—Development of irrigation ground for the growing of seed potatoes
- Trisa Trust—Development of irrigation ground for the growing of seed potatoes
- GWK Pty Ltd—Development of irrigation pivots and vineyards
- Blair Athol Golf course development
- Rolfontein Nature Reserve lodge development
- SLR—Ecological Specialist survey for Kudumane Mine
- Biodiversity offset plan—UMK mine
- Biodiversity Action Plan for UMK mine
- Biodiversity offset Kudumane Mine
- IDC—Ecological Management & Business Plan: Siyancuma Women in Game Initiative
- Swanvest 123 Pty Ltd—Wolverfontein Breeding Facility
- De Beers—Ecological Evaluation and Management Plan for Kleinsee Game Farm
- Kalahari Oryx Game Reserve—Risk Assessment introduction of Lion
- Department of Land Affairs—Ecological Management and Business plan for Thwane Commonage
- Mauricedale Game Ranch—Paardefontein Specialist Vegetation Survey
- Santrosa Investments Pty Ltd—Olie Rivier Game Farm HA
- Manzi Safaris Habitat Assessment
- Thuru Lodge—Risk Assessment & Habitat Analysis
- Dugmore brothers—Habitat assessment Hartebeesthoek
- Schutte Boerdery Trust—Habitat Assessment Glenfrere
- F G. Taljaard—Habitat Assessment Namakwari Game Reserve
- Rivierfront Wild - Doornfontein Habitat Assessment
- Sjibbolet Trust—Hartsvalley Habitat Assessment
- Raltefontein Habitat Assessment
- Kalahari Oryx Game Reserve—Specialist Vegetation survey

PROFESSIONAL ASSOCIATIONS

Grassland Society of Southern Africa

South African Council for Natural scientific Professions Registration number 400117/05

RESEARCH PUBLICATIONS

Evans, N.V., Avis, A.M. and Palmer, A.R. 1997. Changes to the vegetation of the mid-Fish River valley, Eastern Cape South Africa, in response to land-use, as revealed by a direct gradient analysis. *African Journal of Range & Forage science*, **14**(2): 68-74.

Birch N.V., Avis, A.M. and Palmer, A.R. (1999) The Effect Of Land-Use On The Vegetation Communities Along A Topo-Moisture Gradient In The Mid-Fish River Valley, South Africa. *African Journal of Range & Forage science*, **16**(1): 1-8

Birch, N.V., Avis, A.M. and Palmer, A.R. 1999. Changes to the vegetation communities of natural rangelands in response to land-use in the mid-Fish River valley, South Africa. *People and Rangelands Building the Future* (Eds D. Eldridge & D. Freudenberger) pp.319-320 vol 1. Proceeding of the VI International Rangeland Congress, Townsville, Queensland, Australia

Offset Feasibility Investigation

Ecological Management Services

Ecological Management Services

DRAFT

BIODIVERSITY OFFSET FEASIBILITY INVESTIGATION FOR THE ACWA POWER BOKPOORT SOLAR PROJECT NEAR GROBLERSHOOP NORTHERN CAPE

Prepared by Dr N. Birch *Pri.Sci.Nat*
Ecological Management Services
P.O. Box 110470
Hadison Park
Kimberley
8306

For
ENVIRONMENTAL IMPACT MANAGEMENT SERVICES (PROPRIETARY) LIMITED

May 2021

DECLARATION OF INDEPENDENCE

I, Natalie Birch, as duly authorized representative of Ecological Management Services (EMS), hereby confirm my independence, as well as that of the EMS as a specialist and declare that I do not have any interest, be it business, financial, personal or other, in any proposed activity, application or appeal in respect of which I was appointed as an Independent specialist, other than fair remuneration for work performed.

Natalie Birch Pr. Sci. Nat 400117/05

EXECUTIVE SUMMARY

Bokpoort CSP is a greenfield Independent Power Project (IPP) which is an integral part of South Africa's renewable IPP program. The site is located within one of South Africa's eight renewable energy development zones, 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 Bokpoort project was initiated 10 years ago, with the planning for Bokpoort I, which covers just over 250ha and consists of a solar field of parallel rows of parabolic troughs, a power block, a thermal-energy storage system as well as a pipeline and abstraction point. Construction commenced in 2013, and the plant synchronized for the first time on the South African Grid in November 2015, after a construction period of 29 months. Subsequent to this an additional application was submitted for Bokpoort II, which consists of 10 Photo Voltaic plants and associated infrastructure which will cover 1500ha.

The area contains floral species of conservation concern most notably *Boscia albitrunca*, which is protected under the National Forest Act (Act 84 of 1998). Owing to the presence of species of conservation concern permit applications were made to allow for the removal of these species during the construction phase of Bokpoort I. One of the conditions stipulated in the tree removal license that was issued, was the requirement for the developer to implement a Biodiversity offset. This was supposed to have been concluded by the expiry date of the relevant license (31 December 2015).

A number of biodiversity options were put forward by the developer, however no formal arrangement has as yet been agreed upon by the DENC and Forestry with the developer for the required offset. In the meanwhile an application for the development of Bokpoort II has been submitted and additional permit applications will be required to remove additional species of conservation concern.

In order to move forward with this development the offset requirements need to be quantified for both Bokpoort I and Bokpoort II. Only once the size of the required offset has been calculated can a suitable offset option be determined. When the offset option has been approved then an implementation plan can be drawn up to facilitate the initiation of the offset.

Residual impacts are impacts that remain after mitigation and management measures have been implemented. It is only if there is an occurrence of unavoidable and residual impacts should an offset be considered.

Four of the impacts to the biodiversity listed in the EIA are assessed to show a moderated negative significance after mitigation, ie moderate residual impacts, these are

- Loss of habitats
- Loss/disturbance of flora and fauna species of conservation concern
- Direct loss (injury/mortality) of fauna species via roadkill

- Disturbance of faunal species of conservation concern – barrier to movement

The EIA however states 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 recorded on the site 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.

The EIA does nevertheless state that the high number of protected tree species recorded on the site would require legislative authorisation prior to removal

The walk-through surveys and the permit applications confirmed the following protected floral species would be lost as a result of the development

Species	Conservation Status	Bokpoort I		Bokpoort II	Total for permit applications
		Permit application	Removal register	Walk through survey	
Boscia albitrunca	LC	975	478	4350	5325
Vachelliai haematoxylon	LC	135	107	653	788
Vachellia erioloba	LC	45	31	394	439
Aloe claviflora	LC	2290	183*	552	2842
Euphorbia sp	LC	125	31*	5	130
Acanthopsis hoffmannseggiana	DDT	-	-	2607	-
Hoodia gordonii	DDD	-	-	4	4
Ruschia divaricata	LC	-	-	252	252

*Plants were relocated not destroyed

In terms of the definition for critical habitats as described by IFC's Performance Standard 6 (PS6) the following synthesis of site characteristics and the critical habitat criteria can be provided.

(i) Habitat of significant importance to Critically Endangered and/or Endangered species;

There are no Critically Endangered or Endangered, floral or faunal species located on or in the immediate vicinity of the site. This criterion is not triggered for the site.

(ii) Habitat of significant importance to endemic and/or restricted-range species;

The study area falls within the Griqualand West Centre of Endemism. Although the site occurs in a center of endemism, none of the floral SCC that occur within the study site are endemic to South Africa, and only one of the plants, *Vachellia haematxylon* occurs only in the Northern Cape, the other species all occur in at least one other province. *Vachellia haematoxylon* is the only species that may trigger this criterion, it does however occur in a number of other vegetation types across the Northern Cape and therefore it is unlikely that the development of the small area of duneveld for this project would trigger this criterion for this site.

There are however two plant species that are categorized as data deficient which means there is insufficient information on the species at present to estimate population status but they are both considered to be widespread. No SCC reptiles or mammals that occur on site are endemic to South Africa, although the scrub hare is endemic to Southern Africa

(iii) Habitat supporting globally significant concentrations of migratory species and/or congregatory

There are no migratory or congregatory species which are known to gather at the site. As such, the site is not considered important for any such species and this criterion is not triggered.

(iv) Highly threatened and/or unique ecosystems;

The National Biodiversity Assessment (NBA) is released every seven years and provides an assessment of South Africa's biodiversity and ecosystems. The current National Biodiversity Assessment (NBA) is the 2018 assessment. Ecosystem types are categorised as critically endangered (CR), endangered (EN), vulnerable (VU) or least concerned (LC), based on the proportion of each ecosystem type that remains in good ecological condition relative to a series of thresholds. Ecosystem protection level tells us whether ecosystems are adequately protected or under-protected. Ecosystem types are categorised as not protected, poorly protected, moderately protected or well protected, based on the proportion of each ecosystem type that occurs within a protected area recognised in the Protected Areas Act.

Ecosystem status is based on the percentage of original area remaining untransformed (in relation to the biodiversity target and a threshold for ecosystem functioning. Biodiversity target refers to the percentage of the original areas required to capture 75% of the species occurring in each vegetation type. The targets are aimed only at species conservation, and ecological processes are not considered. No significant disruption of ecosystem functioning is assumed in *least concerned* vegetation units, which still have more than 80% of their original extent untransformed.

According to the vegetation classification of Mucina & Rutherford (2006, BGIS vegetation map updated 2018), there are two vegetation types present within the CSP field (Bokpoort I) and the PV plants (Bokpoort II) –Kalahari Karroid Shrubland and Gordonia Duneveld. The pipeline and water abstraction point for Bokpoort I runs through Bushmanland Arid Grassland and the Lower Gariep Alluvial vegetation types.

The Kalahari Karroid Shrubland is listed as Least Concerned (NBA 2018). It is not well conserved, and its target is set at 21%. The Gordonia duneveld is listed as Least Concerned (NBA 2018). It is considered to be moderately protected with 14.8% formally conserved, the target is set at 16%. The Bushmanland Arid Grassland is listed as Least Concerned (NBA 2018) it is not well protected with 0.5% formally conserved and its target is set at 21%.

The Lower Gariep Alluvial is listed as Least Concerned (NBA 2018), however this vegetation type was listed as Endangered in the 2011 biodiversity assessment. There are ecosystem types which, based on the new land cover data, are in a lower threat category than the 2011 NEMBA assessment. In some cases this represents an improved understanding of the extent of natural habitat remaining, and in others it may be

that the new land cover data is over estimating the extent of natural habitat, therefore it is recommended that these ecosystems are investigated further and supplementary assessments should be undertaken to substantiate the change in threat category. As an endangered ecosystem this vegetation unit qualifies as critical habitat under Criterion 4. However, the abstraction point is located in an area that is already transformed by agricultural cultivation, and an existing abstraction point, and no longer supports natural vegetation; thus the area where the abstraction pipeline was placed is classified as modified habitat, and therefore cannot trigger this criterion.

The study area does not fall within a Freshwater Ecosystem Priority Area (FEPA) but it does fall within a fish support area. The study area does not overlap with any Important Bird Areas, or protected areas. In addition, the site is homogeneous and there are no unique or rare habitats or ecosystems within or in close proximity to the site, this criterion is not triggered at the site.

(v) Areas associated with key evolutionary processes.

The area around the Bokpoort site is not classified as a CBA, indicating that it has not been identified as being important for the maintenance of landscape connectivity and ecological processes. However parts of the pipeline and the abstraction point traverses a CBA, the presence of a CBA is considered to represent Critical Habitat for key Evolutionary Processes.

The quantum of biodiversity offsets in South Africa uses a basic ratio derived from a target which is in turn linked to the status of residually affected ecosystems. Multipliers are then applied to this basic ratio dependent on the onsite conditions, the affected biodiversity and the risks associated with the project. Ecosystem status is generally used to determine the basic offset ratio.

The Bokpoort CSP field and PV project area does not contain any Critically Endangered, Endangered or Vulnerable Ecosystems. All habitat types within this area are listed as Least Threatened. For Least threatened ecosystem offsets are not generally required. The abstraction point and some of the pipeline area however traverses an area classified as a CBA, the presence of a Critical Biodiversity Areas does trigger a requirement for an offset. The basic offset ratio for a CBA 1 is set at a ratio of 30:1 and up to 20:1 for a CBA 2.

Of particular concern is the substantial amount of *Boscia albitrunca* that will be lost as a result of this development. Offsets related to threatened species are usually not determined using an offset ratio but is guided by specific information on the species to inform an appropriate size and type of offset. However, very little research has been done on *Boscia albitrunca*, and thus questions remain on species occurrence (historical and current range), what its conservation status is and its population dynamics. Setting targets for species to determine an appropriate offset is not a simple task as it depends on many factors including the type of distribution data available as well as the taxa under consideration. Ideally species targets should be population level targets. In the absence of this information to set conservation targets for species, one can revert to the ecosystem data to facilitate setting these offset ratios. One would then need to consider

the ecosystem targets for the Kalahari Karroid shrubland and the Gordonia Duneveld in which this species occurs in the study area to determine offset ratios.

The required percentage of remaining habitat needed to meet the target is set at 21% for the Kalahari Karroid Shrubland and 16% for Gordonia Duneveld. A revised conservation target for this exercise could include the initial national target plus a buffer to ensure that no species within the habitat becomes endangered. A Basic Offset Ratio can then be assigned by reading it off against its corresponding target on the "No-Net- Loss up to a Target" graph. For example an adjusted target set at 50% for the Kalahari Karroid Shrubland would result in basic offset ratio of 1:1.

Offset ratios are subject to other influences which act as additional multipliers to the basic offset ratio. These multiplier factors include;

Risks and uncertainties – the basic offset ratio can be multiplied to accommodate uncertainty regarding impacts, the multiplier is determined by the amount of risk or uncertainty of an impact occurring. For instance, in habitats where a complete loss of relevant species due to vegetation clearing (such as under the PV plants) will occur uncertainty is not relevant in these cases and an additional multiplier will not be required.

Condition of habitat – this multiplier caters for differences in condition of the habitat impacted. If the habitat within a development area is significantly better than in the surrounding area then an additional multiplier would be applicable. For this project the condition of the habitat within the development area is not better than the surrounding areas. The area surrounding the abstraction point and the pipeline has been disturbed and most of the natural vegetation has been removed. The abstraction point is within an existing agricultural development, the pipeline for the most part runs along a railway line and gravel road, thus is considered to be more disturbed than the surrounding area. The property where the CSP plant and PV plants will be located is comparable in condition to the surrounding area. There are signs of over utilization on the property but it is not significantly different to the habitat in the immediate surrounds, thus an additional multiplier for habitat condition is not applicable, for any of the ecosystem units affected by the development.

Biodiversity priority – This multiplier recognizes biodiversity priority. It may also be necessary to cater for special habitats, or areas that contain a large number of protected species. In areas where a significant amount of threatened and/or protected species occur and will be lost an additional multiplier is required to account for this loss. This multiplier is relevant within the project development area where large numbers of SCC, most notably *Boscia albitrunca* will be lost from the site

The multipliers can then be applied to the basic offset ratio to obtain a final offset ratio, which is then multiplied by the area of disturbance within each ecosystem, to give the required offset area for the project.

The offset summary table is provided below

	Vegetation type	Conservation status	Conservation target NBA 2018	Critical Biodiversity Area	Residual loss (Ha)	Final Ratio	Offset required (Ha)
Bokpoort I	Kalahari Karroid Shrubland	Least Concerned	21%	NA	179,19803	2	358,39606
	Gordonia duneveld	Least Concerned	16%	NA	79,44154	1,5	119,16231
	Bushmanland arid grassland	Least Concerned	21%	CBA2	5,49305	20	109,861
	Lower Gariep Alluvial	LC/ Endangered	31%	CBA1	0,43401	30	13,0203
Bokpoort II	Kalahari Karroid Shrubland	Least Concerned	24%	NA	1243,12	2	2486,24
	Gordonia duneveld	Least Concerned	16%	NA	256,88	1,5	385,32
					1764,56663		**3471,99967**

The term 'No Net Loss' (NNL) is defined as the outcome of an offset where there would be no loss of a vegetation type, habitat or feature beyond the scientifically established conservation target for that feature. However, in the absence of regional fine scale mapping, the determination of No Net Loss is not possible at species level. No net loss of protected trees cannot be adequately tested as the extent of the resource is not known and has not been mapped or quantified. However as the vegetation types have been mapped and conservation targets set, it can be assumed that provision is made for a budget to ensure that the biodiversity values of that species, or habitat or feature, is maintained in the long term.

Internationally biodiversity offsets are currently used in reference to both like-for-like exchange for land, trading up to a higher conservation value habitat, and activities such as funding of biodiversity research, provision of financing for protected areas or support for capacity building in government agencies.

In order to establish what type of offset would be appropriate, a clear and valid purpose for the offset in broader conservation planning terms needs to be investigated. The next step in this offset process is the identification of a suitable offset with input from various stakeholders once this has been achieved a management and implementation plan can be produced for the approved offset.

There have been some attempts to implement a biodiversity offset for this project. A number of offset projects have been proposed by the developer and some contribution to other projects has already been undertaken. However, this was done without any quantification of the required offset, and some of the projects proposed owing to their nature cannot be regarded as offsets. These projects have included;

- The proposal to establish an Aloe garden
- The proposal to establish a seedling programme with Witsand Nature Reserve
- The contribution R150 000 towards the ADU TreeMAP project within the Northern Cape
- The contribution of R59 000 towards the CSP plant bird impact project, in partnership with UCT, Prof Peter Ryan and Birdlife SA
- The contribution of R66 000 towards a Graduate training programme
- The proposal of a tree greening programme for the !Kheis Municipal area
- The proposal of sponsorship of a nature reserve

All offset options must include both Bokpoort I and Bokpoort II, in terms of offset obligations. Once consensus has been reached by the various stakeholders in terms of determining offset size and appropriated offset (ie Like-for-like offset), the next step in the offset process will be the identification of a

suitable offset site. Once this has been achieved a management and implementation plan can be produced for the offset.

ACRONYMS & ABBREVIATIONS

BGIS	Biodiversity Geographical Information System
CBA	Critical Biodiversity Area
CITES	Convention on International Trade in Endangered Species
DAFF	Department of Agriculture, Forestry and Fisheries
DENC	Department of Environment and Nature Conservation
EIA	Environmental Impact Assessment
EWT	Endangered Wildlife Trust
FEPA	Freshwater Ecosystem Priority Areas
GPS	Global Positioning System
GWC	Griqualand West Centre of Endemism
IUCN	International Union for Conservation of Nature
NBA	National Biodiversity Assessment
NCNCA	Northern Cape Nature Conservation Act
NEM:BA	National Environmental Management: Biodiversity Act
NEMA	National Environmental Management Act
NFEPA	National Freshwater Ecosystem Priority Areas assessment
NPAES	National Protected Areas Expansion Strategy
PESEIS	Present Ecological State, Ecological Importance & Ecological Sensitivity
QDS	Quarter Degree Squares
SABAP	South African Bird Atlas Project
IBA	Important Bird and Biodiversity Area
SABIF	South African Biodiversity Information Facility
SANBI	South African National Biodiversity Institute
SARCA	Southern African Reptile Conservation Assessment
SCC	Species of Conservation Concern
SIBIS	SANBI's Integrated Biodiversity Information System
TOPS	Threatened or Protected Species
WMA	Water Management Area

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1. INTRODUCTION

1.1. BIODIVERSITY OFFSETS

Biodiversity offsets are measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development after appropriate prevention and MITIGATION measures have been taken. The goal of biodiversity offsets is to achieve NO NET LOSS and preferably a NET GAIN of biodiversity on the ground with respect to species composition, habitat structure, ecosystem function and people's use and cultural values associated with biodiversity.

Biodiversity loss is usually observed as one or both of: (1) reduced area occupied by species and community types and (2) reduced abundance of species or condition of communities & ecosystems. The likelihood of any biodiversity component persisting – or surviving – in the long term declines with both lower abundance and reduced habitat area. The relationship is far from linear and is highly variable across different biodiversity components. The loss of a species is the fundamental example of an irreversible loss of biodiversity

Priorities for BIODIVERSITY CONSERVATION are influenced by the concepts of IRREPLACEABILITY and VULNERABILITY. Biodiversity components that are highly irreplaceable and highly vulnerable are a top priority for conservation effort. Irreplaceability (or uniqueness) relates to the existence of additional spatial options available for conservation if the biodiversity at a particular site were irreversibly lost. Vulnerability indicates risk of imminent loss and so reflects the loss of conservation opportunities over time. The scientific concept of vulnerability includes a consideration of loss as the result of past, ongoing or future threats, and with irreplaceability, could be considered equivalent to the concept of 'hazard' used in corporate risk assessment. THREAT STATUS (of a species or community type) is a simple but highly integrated indicator of vulnerability.

The main concepts that arise when designing a biodiversity offset, include, when a biodiversity offset should be considered, how it should be measured, how suitable offset locations and activities can be selected, and how the offset should dovetail with an area's biodiversity priorities.

The role of biodiversity offsets is effectively as a 'last resort', after all reasonable measures have been taken first to avoid and minimise the impact of a development project and then to restore biodiversity on-site. Consequently, biodiversity offsets should only be applied to the residual adverse impacts of a project. The application of this mitigation hierarchy, and how far each step should be pursued before turning to the next is one of the key issues for consideration in biodiversity offset design.

When are offsets considered: Offsets tend to be required by a regulator, or considered by a project proponent, when the biodiversity that will be negatively impacted by a project is judged to be 'significant' in terms of its intrinsic or conservation value (e.g. globally threatened or locally endemic species; significant

concentrations or source populations; unique ecological communities), or when its loss is likely to have significant consequences in view of its use value (e.g. high level of dependence on that biodiversity for livelihoods). While the significance of impact on an environment is influenced by the sensitivity of the specific environment (and biodiversity offsets are therefore more likely to be considered in more sensitive environments), environmental sensitivity in itself is not the trigger for an offset. The trigger is whether the residual negative impact on biodiversity is of 'medium', 'medium – high' or 'high' significance

Quantified loss and gain: A feature that distinguishes offsets from other forms of ecological compensation is the requirement to demonstrate 'no net loss' or a 'net gain'. What this means and how to measure it lies at the heart of biodiversity offsetting. It is not always easy to determine what should be measured or accounted for in an offset. Biodiversity in its entirety is impossible to measure, so the process of offset design involves decisions about suitable 'metrics' or 'currencies'. As it is impossible to count every individual in every population of every species, and as no two sites are identical in biodiversity terms, the choice of metrics often involves selecting 'surrogates' or 'proxies' which can be quantified and which can be considered representative of 'overall' biodiversity. The extent to which the selected measures are genuinely representative of biodiversity overall may be difficult to demonstrate. It is also important to consider how similar the biodiversity structure, composition and function at an offset site needs to be to that affected by the development project for no net loss to be achieved. Exchange rules may be used to determine what levels of difference might be acceptable and to show how exchange between different sites will be accounted for in the metrics. Loss and gain also encompasses impacts on people's uses and cultural values associated with biodiversity. There are many possible approaches to designing, selecting and applying metrics appropriate for a given situation.

Habitat is a useful concept for loss / gain calculations, because it lends itself to identification of areas of land and uses these as a PROXY for 'carrying capacity' with respect to individual or multiple species. Most offset methods consider the areas of land available to key species, species populations or communities / assemblages and also the capacity of these areas to support them in a viable condition (generally referred to as 'habitat quality'). In this case, measures of area are generally combined with some measure of quality, health or condition of the habitat,

An offset should deliver CONSERVATION GAINS over and above what is already taking place or planned. A fundamental precept of biodiversity offsets is that they deliver results that would not have happened anyway in the absence of the offset. This means that calculations of loss and gain need to take into consideration the biodiversity BASELINE and trends.

1.2. PROJECT BACKGROUND

Bokpoort CSP is a greenfield Independent Power Project (IPP) which is an integral part of South Africa's renewable IPP program. The 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.

The Bokpoort project was initiated 10 years ago, with the planning for Bokpoort I, which covers just over 250 ha and consists of a solar field of parallel rows of parabolic troughs, a power block, a thermal-energy storage system and related infrastructure. Construction commenced in 2013, and the plant synchronised for the first time on the South African Grid in November 2015, after a construction period of 29 months. Subsequent to this an additional application was submitted for Bokpoort II, which consists of 10 Photo Voltaic plants

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.

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 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).

During the construction of the ACWA Power Bokpoort photovoltaic plants, the site will be cleared and all vegetation removed from the site.

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 total photovoltaic development will cover 1,500ha in totality (development footprint).

The area contains a significant amount of species of conservation concern most notably *Boscia albitrunca*. In order to remove SCC permission must be granted in the form of permits. In the Northern Cape, environmental permitting is regulated through a central integrated permit office managed by DENC which regulates both national and provincial requirements. As such an integrated permit application is required for protected species. In addition to this application a separate application in terms of the Foresty Act (Act 84 of 1998) for the protected trees must be submitted to remove or damage any protected trees.

A number of permits were granted by DENC for the first phase of this project Bokpoort I, these included Permit FLORA 114/2/2011 that was issued on 28 August 2012 and was valid from: 28 August 2012 to 28 August 2013. A permit (NCU 2701012) was granted by the Department of Agriculture, Forestry and Fisheries for the removal of protected trees and was valid from 1 November 2012 to 31 December 2015. A condition of this permit was the developer should undertake a biodiversity offset to compensate for the loss of the protected trees.

During clearing activities related to the construction phase of Bokpoort I a number of SCC were rescued from the construction area and relocated.

1.2.1. SCOPE OF THIS REPORT

This report investigates the need for an offset, proposes appropriate metrics and multipliers for an offset, in order to calculate the require offset size for this development, so that suitable offset options can be explored. It has been undertaken in accordance with the Draft National Biodiversity Offset Policy (DEA 2017) and the Business and the Biodiversity Offset Design Handbook (BBOP 2012a).

1.3. OFFSET POLICY FRAMEWORK

1.3.1. INTERNATIONAL GUIDELINES FOR BIODIVERSITY OFFSETS

A biodiversity offset is:
"the measurable conservation outcomes resulting from actions designed to compensate for significant negative residual impacts on biodiversity arising from project development after appropriate prevention and mitigation measures have been taken" (BBOP 2012a)

Biodiversity offsets can encompass spatial patterns of biodiversity and the ecological processes that maintain those patterns, as well as people's use and cultural values associated with that biodiversity (ecosystem services). Our ecosystems create landscapes of aesthetic and natural heritage value; any cultural landscape and associated heritage depends in part on conservation of these natural systems. Impacts on biodiversity and ecosystems affect water resources either in terms of quality or flow, and thus also water users. Likewise, biodiversity offsets – in particular involving riparian and freshwater ecosystems – can be designed to benefit water resources and users in addition to the ecosystem itself.

Offsetting ecosystem service impacts can, however, have undesirable outcomes if the biodiversity or ecological process responsible for the original service is lost due to a development, and the service is effectively replaced with artificial provisions. It is important to ensure that ecosystem service offsets do not compromise or are not traded off for the original biodiversity and/or ecological processes being lost. Moreover, only ecosystem services that flow directly from the biodiversity or ecological process should be considered for offsets, and all ecosystem service offsets should aim to improve those services by enhancing the underlying biodiversity or process.

The most detailed international development of the biodiversity offset concept is outlined in the 2012 Business and Biodiversity Offset Programme (BBOP 2012a). This provides a coherent set of principles, criteria and indicators for offsets, as well as a range of tools and metrics for pursuing defensible offset projects. As far as possible, this study has followed the BBOP approach, except in one or two technical details which flow from the specific regulatory context and biodiversity planning and assessment tools used in South Africa.

1.3.2. LEGAL AND POLICY FRAMEWORK FOR BIODIVERSITY OFFSETS IN SA

Legislation

The Constitution of South Africa requires that development be 'ecologically sustainable'. The principles in the National Environmental Management Act 107 of 1998 (NEMA) state that the environment is held in public trust for the people, and must be protected as the 'people's common heritage'. The principles point to the need to conserve biodiversity and ecological integrity and, where impacts on biodiversity and disturbance to ecosystems cannot be altogether avoided, they must be minimized and remedied. Further, the principles reflect the 'mitigation hierarchy', and state that the party who causes environmental damage is responsible for 'paying' or remedying that damage. Finally, the NEMA principles advocate a 'risk-averse and cautious approach' where we are uncertain about the consequences of our actions. Environmental management principles in the National Environment Management Act of 1998 (NEMA), which apply to all authorities whose decisions affect the environment and to private and public sector developers, enable the inclusion of biodiversity offsetting as a condition of authorisation. They include the 'polluter pays' principle, and the need to remedy adverse effects on biodiversity and ecosystems after avoidance and minimization. Both NEMA and the National Water Act 36 of 1998 (NWA) provide the competent authority with the discretion to impose any condition necessary for the protection of the environment/water resource, whilst the latter specifically authorises the lodging of financial guarantees for any required mitigation actions. The NEMA Environmental Impact Assessment (EIA) regulations list activities that are subject to environmental assessment. The significance of residual impacts triggers the need for offsets, which are required to address impacts on biodiversity predicted to be of 'medium' to 'high' significance. Impacts of 'very high' significance that may result in loss of irreplaceable biodiversity are considered unacceptable.

In terms of the National Environmental Management Biodiversity Act 10 of 2004 (Biodiversity Act), the State has trusteeship of the country's biodiversity and must 'manage, conserve and sustain' South Africa's

biodiversity and its components and genetic resources. The Biodiversity Act provides for the listing of threatened or protected species and ecosystems, and for the publishing of Bioregional Plans, thus identifying our priority biodiversity areas. In addition, this information signals the probable significance of impacts where the species or ecosystems are adversely affected by any proposed development.

The National Environmental Management Protected Areas Act 57 of 2003 (Protected Areas Act) provides for a range of options to protect an area, and point to the most secure statutory options to achieve this. Any of the four categories of protected area can be declared on privately owned land at the request, or with the consent, of the landowner(s). The Act provides for the involvement of parties other than organs of State in the declaration and management of protected areas as the primary tool to safeguard the nation's biodiversity assets, enabling offset management arrangements. Both the National Framework for Sustainable Development in South Africa (2008) and the National Strategy for Sustainable Development (2010) highlight the value of biodiversity to society, its importance in sustaining our life support systems and livelihoods, and the range of benefits to people of healthy, functioning ecosystems.

The National Biodiversity Framework (NBF, 2009) notes that biodiversity offsets are already being implemented to some extent in South Africa, but with little consistency. The Department of Agriculture, Forestry and Fisheries (DAFF, undated) has produced "Principles and Guidelines for control of development affecting natural forests" which includes biodiversity offsets and sets out the steps to be taken and aspects to be addressed. Both the Western Cape and KwaZulu-Natal have issued guidelines for Biodiversity Offsets, and other provinces are developing their own. Biodiversity Offsets are being called for by regulators in all provinces in South Africa.

National Offsets framework

A draft National Biodiversity Offsets Policy Framework has been developed by the Department of Environmental Affairs (DEA) (DEA 2017). This policy encompasses the following principles as a departure point for biodiversity offset development:

1. The Ecosystem Approach

The implementation of biodiversity offsets recognises the ecosystem approach (as opposed to a species approach) to biodiversity management, which promotes the integrated management of land, water and natural capital to affect the conservation and sustainable use of biodiversity, especially the need to safeguard and maintain critical biodiversity areas.

2. Offsets - the last resort in the Mitigation Sequence

Biodiversity offsets should only be considered as a mitigation option once all feasible actions and alternatives, first to avoid or prevent impacts on important biodiversity, then to minimize impacts, and then to repair or restore areas harmed by impacts to the condition before impact or better, have been considered.

3. Limits to what can or should be offset

Biodiversity offsets are to be used in cases where the EIA process identifies negative residual impacts of '**medium**' or '**high**' significance on biodiversity. Activities resulting in impacts of 'low' significance may not require an offset.

Impacts on biodiversity of 'very high' significance may not be able to be fully offset because of the conservation status, irreplaceability, or level of threat to affected biodiversity, or the risk of preventing scientific targets for conserving that biodiversity from being met. In these cases, given that the proposed activity would lead to irreversible impacts and irreplaceable loss of biodiversity, alternatives to the proposal should be sought; i.e. the proposed activity should not be authorized in its current form.

4. Ecosystem protection

Biodiversity offsets should ensure the long-term protection of priority ecosystem on the ground and improve their condition and function, thereby resulting in measurable positive outcomes for biodiversity conservation 'on the ground'. These outcomes could contribute to improved ecosystem integrity and increased use and/ or cultural value of offset areas and the ecosystems of which they are part.

5. No Net Loss up to specified limits of acceptable change

Offsets should not be used to 'soften' a development proposal that would result in unacceptable loss of biodiversity. Biodiversity offsets should be designed in such a way that scientific targets for conserving ecosystems and other biodiversity features in the long term are attainable and not undermined as a consequence of the proposed activity. No biodiversity feature (species or ecosystem) should be at risk of being pushed beyond an Endangered threat status by a development.

6. Locating biodiversity offsets in the landscape

Biodiversity offsets should be located in the landscape in such a way that they help to secure priority areas for conservation, improve connectivity between these priority areas, and/ or consolidate or expand existing protected areas. Where priority ecosystem services are residually affected, biodiversity offsets should preferably be located in the landscape in such a way that they deliver equivalent services to affected parties; that failing, additional compensation measures would be needed for these parties.

7. Equivalence – 'like for like'

Biodiversity offsets should comprise - or benefit - the same biodiversity components as those components that would be negatively affected by development. *In exceptional cases* only, and only with support from the provincial conservation agency, could consideration be given to the biodiversity offset targeting a relatively more threatened ecosystem or habitat.

8. Additionality – new action required

Biodiversity offsets must result in conservation gains above and beyond measures that are already required by law or would have occurred had the offset not taken place.

9. Timing and duration of biodiversity offsets

The design of the biodiversity offset and plans for its implementation should be approved by the provincial biodiversity conservation agency and the CEA before the proposed listed activity starts. Implementation of the biodiversity offset should preferably take place before the impacts of the activity occur, or as soon thereafter as reasonable and feasible.

The biodiversity offset site(s) should endure at least for the duration of the residual impact on biodiversity, but preferably in perpetuity, in order to make a long-term contribution to biodiversity conservation. It should be monitored and managed adaptively to sustain biodiversity outcomes.

10. Defensibility

The measure of residual negative impacts on biodiversity caused by a proposed development, as well as the design and implementation of biodiversity offsets, should be based on the best available biodiversity

information and sound science, and should incorporate local traditional or conventional knowledge as appropriate.

Offsets must consider all significant residual impacts on biodiversity: direct, indirect and/ or cumulative impacts. The scope of assessment must include due consideration of impacts on recognized priority areas for biodiversity conservation; impacts on biodiversity pattern (conservation status of ecosystem and species, importance to migratory species) and ecological and evolutionary processes (must look across scales and take into account connectivity, gradients and corridors); and impacts on ecosystems or species on which there is high dependence for health, livelihoods, and/ or wellbeing.

11. Precaution

The biodiversity offset must be designed in a risk-averse and cautious way to take into account uncertainties about the measure of residual negative impacts (including uncertainties about the effectiveness of planned measures to avoid/ prevent, minimize and rehabilitate impacts), and the successful outcome and/ or timing of the biodiversity offset.

12. Fairness and equity

The determination of residual negative impacts, and the design and implementation of biodiversity offsets, should be undertaken in an open and transparent manner, providing for stakeholder engagement, respecting recognised rights, and seeking positive outcomes for affected parties.

Biodiversity offsets should not displace negative impacts on biodiversity to other areas, and/ or cause significant negative effects that in turn would need to be remedied.

13. Non substitutable

A biodiversity offset cannot be exchanged for, or traded off against, compensation for social, cultural heritage or other residual impacts unrelated to biodiversity. Moreover, offsets for residual impacts on use or cultural values of biodiversity cannot be exchanged or substituted for offsets on intrinsic values of biodiversity.

14. Enforceable and auditable

Offsets must be able to be monitored and audited in relation to clear management and performance targets. In addition, they must be able to be enforced through explicitly worded, legally binding conditions, and/or common law contracts.

The desired outcome of biodiversity offsets is to ensure that the cumulative impact of development authorization and land use change does not:

- result in the loss of CBA's or jeopardize the ability to meet South Africa's targets for biodiversity conservation;
- lead to ecosystems becoming more threatened than 'Endangered'; and/or
- cause a decline in the conservation status of species and the presence of 'special habitats

1.4. THE NATURE OF COMPENSATION AND OFFSETS

1.4.1. THE FORM AND NATURE OF ACCEPTABLE BIODIVERSITY OFFSETS

It is useful to clarify the important conceptual differences between **trade-offs, compensation** and **offsets.** These mean different things and have rather different outcomes.

A measure must satisfy the principles above to call itself an 'offset'. In particular, an offset would not undermine conservation targets or lead to irreplaceable loss of biodiversity and would be commensurate with the residual impacts of the proposed activity.[1]

If a measure does not satisfy these principles, and instead offers some form of remedy that is not commensurate with, equivalent in type, or is insufficient to qualify as an offset (although it could contribute to meeting the target of the affected component biodiversity), then it would be termed 'compensation'.

A 'trade-off' is typically made between, rather than within, different categories or 'pillars' of capital (e.g. between socioeconomic benefits and biodiversity loss). A trade-off is not to be confused with 'trading-up' which can be accommodated in the offsets framework and allows impacts on one biodiversity feature to be offset by safeguarding another biodiversity feature of greater value and/or under greater threat.

Ultimately, even if an offset is deemed unacceptable due to, for example, the irreplaceability of the impacted biodiversity, ecological process or the ecosystem service being lost, this would not impede a regulator's ability to require compensation, or even to make a trade-off, provided that such compensation or trade-off is made within our legal framework and is defensible.

Biodiversity offsets can be achieved by:

- Increasing a target site's security against land use change, in the long term
- Restoring or repairing degraded areas
- Improved management, and/ or
- Preventing likely transformation or degradation of areas through formal/ legal protection. For protection and restoration to be effective in the offset context, they should endure in perpetuity, and be accompanied by significant land use and allied protection mechanisms to safeguard the biodiversity features for which they initially set aside. While it may be possible to achieve net gain in some critical habitat through successful restoration (of structure, function or condition), it is almost always preferable, in the South African context, to conserve a more pristine expression of the type, habitat of feature first.

1.4.2 OFFSET QUANTUM AND DESIGN

The quantum of biodiversity offsets in South Africa uses a basic ratio derived from a target which is in turn linked to the status[2] of residually affected ecosystems. Multipliers are often applied to this basic ratio where:

[1] In the international context of the IFC PS6 and the BBOP Standard (BBOP 2012b), an offset must achieve NNL or net gain; any measure that does not achieve that outcome would be termed 'compensation'

[2] The NEM: Biodiversity Act (Act 10 of 2004) provides for gazetting the threat status of different ecosystems. Notation used is the same as for Threatened species. Endangered = EN, Least Threatened = LT etc. The most recent list was published in 2013 (GN 3637516 APRIL 2013) amended 3 June 2020 GN 43386)

- the area comprises a component of a wider landscape recognized as having high conservation importance;
- the area supports several threatened species or species of special conservation significance;
- the area plays an important role at a landscape level with regard to ecological and/or evolutionary processes that, amongst others, help adapt to climate change;
- the natural systems of the affected area deliver ecosystem services on which there is a high dependency by local or downstream communities, or society as a whole;
- there is either a lack of confidence in impact predictions and/ or a risk of failure of proposed measures to avoid, minimize or rehabilitate/ restore negative impacts within stated time frames, implying that residual impacts would be greater (in extent and severity) than initially estimated; and/ or the delay between the impact and the return to pre-develpment condition is greater than 10 years, or a lifespan of a key component of the rehabilitation system, whichever is longer.

The design of the final offset area is dependent on several factors:

- The location and proximity of existing protected areas which may be expanded or consolidated
- The distribution of those biodiversity features and components of the offset across properties in the region
- The availability of specific properties on the market and/or the willingness of the owners to sell them or have them encumbered with offset restrictions
- Consideration of the objectives of the offset area, and its specific management requirements or efficiencies (e.g. having a sensible boundary to secure and avoiding disjointed management units that cross communication and transport lines)
- Capitalising on existing or proposed land use developments that could augment the offset and increase establishment success, and avoidance of current and future land use conflicts.

2. THE AFFECTED AREA

2.1. SIGNIFICANCE OF THE BIODIVERSITY IN THE AREA

The study area falls within the Bushmanland Bioregion of the Nama-Karoo Biome and on the edge of the Kalahari Duneveld Bioregion of the Savanna Biome (Mucina & Rutherford 2006). According to the vegetation classification of Mucina & Rutherford (2006, BGIS vegetation map updated 2018), there are two vegetation types present within the development footprint –Kalahari Karroid Shrubland and Gordonia Duneveld. The pipeline and water abstraction for Bokpoort I point runs through Bushmanland Arid Grassland and the Lower Gariep Alluvial vegetation types.

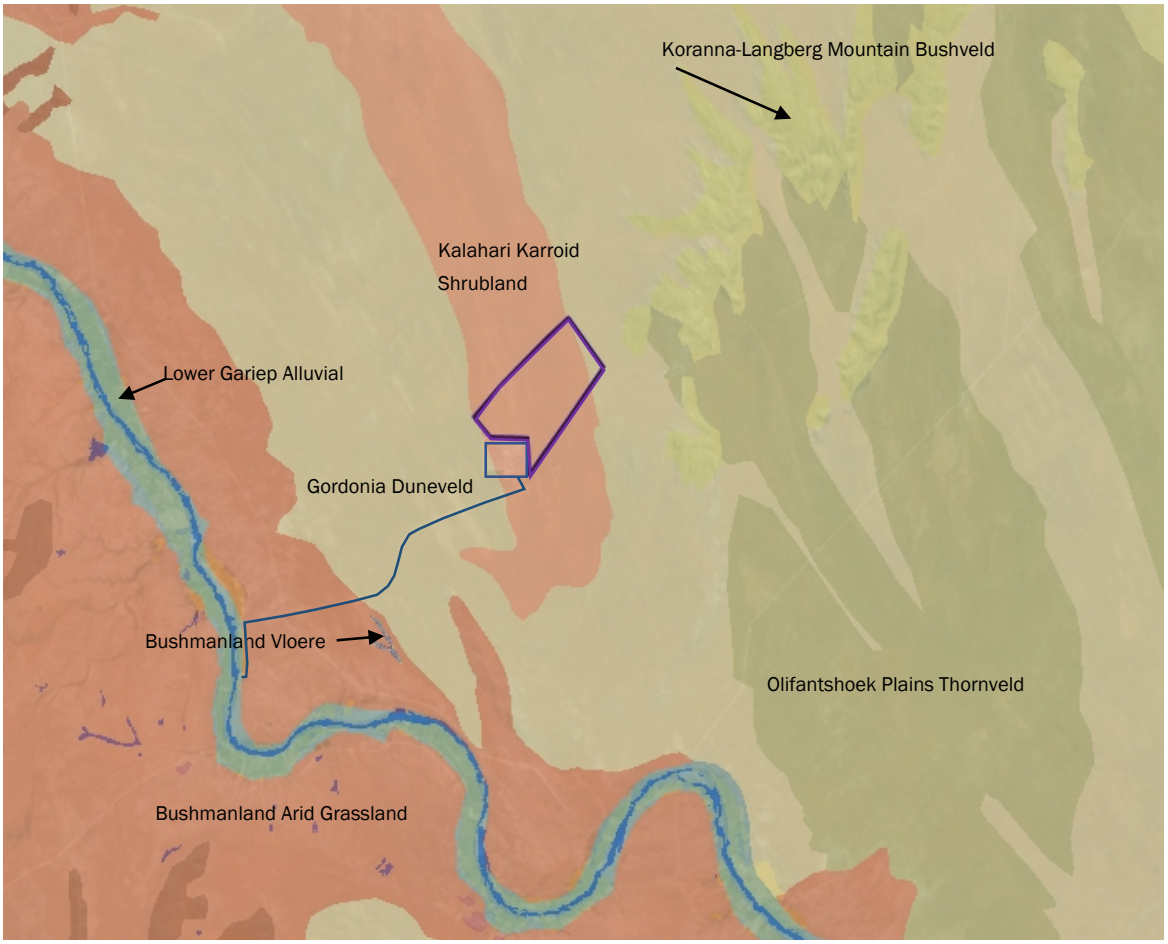

Figure 1 Vegetation distribution map of the area showing the proposed Bokpoort II development (Purple polygon) and the Bokpoort I development (blue polygon)

The botanical specialist survey and subsequent walk through surveys identified 8 floral species of conservation concern that occur on site. Most of these species are classified as LEAST CONCERNED, two are classified as DATA DEFICIENT. Three of the species are trees which are listed as protected under the National Forestry Act.

Species	Status	Permit applicable Legislation
Boscia albitrunca	LC Protected	National Forests Act 1998 NCNCA schedule 2
Vachellia erioloba	LC Protected	National Forests Act 1998
Vachellia haematoxylon	LC Protected	National Forests Act 1998
Aloe claviflora	LC Protected	NCNCA schedule 2
Acanthopsis hoffmannseggiana	DDT	NA
Euphorbia Davyi	LC Protected	NCNCA schedule 2
Hoodia gordonii	DDT Protected	NCNCA schedule 1 TOPS Protected schedule B1
Ruschia divaricata	LC Protected	NCNCA schedule 2

Table 1. Summary of the floral species of conservation concern (SCC) that occur on site

A number of specialist faunal studies have been conducted across the site, these have revealed a number of protected species confirmed on site, which are listed in the table below

Species	Common Name	Status	Permit applicable Legislation
Reptiles			
Pedioplanis lineoocellata	Spotted Sand Lizard	LC Protected	NCNCA Schedule 2
Psammobates oculifer	Serrated tent Tortoise	LC Protected	NCNCA Schedule 2
Pedioplanis inornata	Plain sand lizard	LC Protected	NCNCA Schedule 2
Varanus albigularis albigularis	Rock Monitor	LC Protected	NCNCA Schedule 2
Mammals			
Raphicerus campestris	Steenbok	LC Protected	NCNCA Schedule 2
Otocyon megalotis	Bat-eared Fox	LC Protected	NCNCA Schedule 1
Atilax paludinosus	Water Mongoose	LC Protected	NCNCA Schedule 2
Cynictis penicillata	Yellow Mongoose	LC Protected	NCNCA Schedule 2
Galerella sanguinea	Slender Mongoose	LC Protected	NCNCA Schedule 2
Hystrix africaeaustralis	Porcupine	LC Protected	NCNCA Schedule 2
Lepus capensis	Cape Hare	LC Protected	NCNCA Schedule 2
Lepus saxatilis	Scub Hare	LC Protected	NCNCA Schedule 2
Ictonyx striatus	Striped Polecat	LC Protected	NCNCA Schedule 1
Mellivora capensis	Honey Badger	LC Protected	NCNCA Schedule 1
Orycteropus afer	Aardvark	LC Protected	NCNCA Schedule 1
Aonyx capensis	Cape Clawless otter	Near threatened Protected	NCNCA Schedule 2

Table 2. Summary of the faunal species of conservation concern identified on site

No invertebrate SCC were recorded on site during these surveys, although two species *Alfredectes browni* (Browns Shieldback) and *Lepidochrysops penningtoni* (Pennington's Blue) are noted as possibly occurring in the area. Both these species are listed as Data Deficient. No Amphibian SCC were noted to occur in the study area. The *Agama atra* (Southern Rock Agama) was noted during the faunal surveys, this species is classified as Near endemic, although it is not listed as protected. The only avifaunal SCC recorded near the site was Verreaux's Eagle (*Aquila verreauxii*) which is listed as regionally Vulnerable. This species was recorded in the mountainous areas to the north of the site.

2.2. CONSERVATION VALUE OF AREA TO BE DISTURBED

In terms of the definition for critical habitats as described by IFC's Performance Standard 6 (PS6) on Biodiversity Conservation and Sustainable Management of Living Natural Resources. The Guidance Note 6, describes the criteria for critical habitat as follows;

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. Key Evolutionary Processes

In terms of the site the following synthesis of site characteristics and the critical habitat criteria is provided below.

(i) Habitat of significant importance to Critically Endangered and/or Endangered species;

There are no Critically Endangered or Endangered, floral or faunal species located on or in the immediate vicinity of the site. Consequently, this criterion is not triggered for the site.

(ii) Habitat of significant importance to endemic and/or restricted-range species;

The study area falls within the Griqualand West Centre of Endemism (described in van Wyk & Smith 2001). Centres of endemism are extremely vulnerable; relatively small disturbances in a centre of endemism may easily pose a serious threat to its many range-restricted species (Van Wyk & Smith 2001). The Griqualand West Centre (GWC) is one of the 84 African centres of endemism and one of 14 centres in southern Africa, and these centres are of global conservation significance. The GWC is considered a priority area for conservation in the Northern Cape, as the number of threats to the area is increasing rapidly and it has been little researched and is poorly understood. Furthermore, this centre of endemism is extremely poorly conserved, and is a national conservation priority.

Although the site occur in a center of endemism, none of the SCC plant species that occur within the study site are endemic to South Africa, and only one of the plants, *Vachellia haematxylon* occurs only in the Northern Cape, the other species all occur in at least one other province. There are however two plant species that are categorized as data deficient which means there is insufficient information on the species at present to estimate population status but they are both considered to be widespread. No SCC reptiles or mammals that occur on site are endemic to South Africa, although the scrub hare is endemic to Southern Africa

As the *Vachellia haematoxylon* is mostly restricted to the dune veld and only a small area of dune veld will be impacted by the development, this criterion is not triggered for the site.

(iii) Habitat supporting globally significant concentrations of migratory species and/or congregatory species;

There are no migratory or congregatory species which are known to gather at the site. As such, the site is not considered important for any such species and this criterion is not triggered.

(iv) Highly threatened and/or unique ecosystems;

The National Biodiversity Assessment (NBA) is released every seven years and provides an assessment of South Africa's biodiversity and ecosystems. The current National Biodiversity Assessment (NBA) is the 2018 assessment. The NBA, includes headline indicators and national maps for the terrestrial, freshwater, estuarine and marine environments. The two headline indicators assessed in the NBA are ecosystem threat status and ecosystem protection level. Ecosystem threat status tells us about the degree to which ecosystems are still intact or alternatively losing vital aspects of their structure, function and composition, on which their ability to provide ecosystem services ultimately depends. Ecosystem types are categorised as critically endangered (CR), endangered (EN), vulnerable (VU) or least concerned (LC), based on the proportion of each ecosystem type that remains in good ecological condition relative to a series of thresholds. Ecosystem protection level tells us whether ecosystems are adequately protected or under-protected. Ecosystem types are categorised as not protected, poorly protected, moderately protected or well protected, based on the proportion of each ecosystem type that occurs within a protected area recognised in the Protected Areas Act.

Ecosystem status is based on the percentage of original area remaining untransformed (by croplands, mining, urban development & roads) in relation to the biodiversity target and a threshold for ecosystem functioning. Biodiversity target refers to the percentage of the original areas required to capture 75% of the species occurring in each vegetation type. The targets are aimed only at species conservation, and ecological processes are not considered. No significant disruption of ecosystem functioning is assumed in *least concerned* vegetation units, which still have more than 80% of their original extent untransformed.

The Kalahari Karroid Shrubland is listed as Least Concerned (NBA 2018). It is not well conserved, with only a small amount (0.1%) formally conserved within the Augrabies National Park. The total extent of this vegetation type is 8582,553 Sq Km, with 8291.594 Sq Km occurring within the ZF Mgcawu District Municipality of which 8,267.590 sq Km is considered to be in good condition (99% within the district). It is listed as a high conservation priority within the District Municipalities Environmental Management Framework (EMF), and its target is set at 21%.

The Gordonia duneveld is listed as Least Concerned (NBA 2018). It is considered to be moderately protected with 14.8% formally conserved, in the Kgalagadi Transfrontier Park. The total extent of this vegetation type is 37035,7065 Sq Km and 99.8% is considered to be in good condition, the target is set at 16%.

The Bushmanland Arid Grassland is listed as Least Concerned (NBA 2018) it is not well protected with 0.5% formally conserved within the Augrabies National Park. It is listed as a medium conservation priority within the District Municipalities Environmental Management Framework (EMF), and its target is set at 21%.

The Lower Gariep Alluvial is listed as Least Concerned (NBA 2018), however this vegetation type was listed as Endangered in the 2011 biodiversity assessment. There are ecosystem types which, based on the new land cover data, are in a lower threat category than the 2011 NEMBA assessment. In some cases this represents an improved understanding of the extent of natural habitat remaining, and in others it may be that the new land cover data is over estimating the extent of natural habitat, therefore it is recommended that these ecosystems are investigated further and supplementary assessments should be undertaken to substantiate the change in threat category. As an endangered ecosystem this vegetation unit qualifies as critical habitat under Criterion 4 highly threatened ecosystems. However, the abstraction point is located in an area that is already transformed by agricultural cultivation, and an existing abstraction point, and no longer supports natural vegetation; thus the area where the abstraction pipeline was placed is classified as modified habitat, and therefore cannot trigger this criterion.

The study area does not fall within a Freshwater Ecosystem Priority Area (FEPA) but it does fall within a fish support area. The study area does not overlap with any Important Bird Areas, or protected area.

Generally, the vegetation types present at the site are listed as least threatened. In addition, the site is homogeneous and there are no unique or rare habitats or ecosystems within or in close proximity to the site., this criterion is not triggered at the site.

(v) Areas associated with key evolutionary processes.

The area around the Bokpoort site is not classified as a CBA, indicating that it has not been identified as being important for the maintenance of landscape connectivity and ecological processes. However parts of the pipeline and the abstraction point does traverse a CBA, the presence of a CBA is considered to represent Critical Habitat for key Evolutionary Processes.

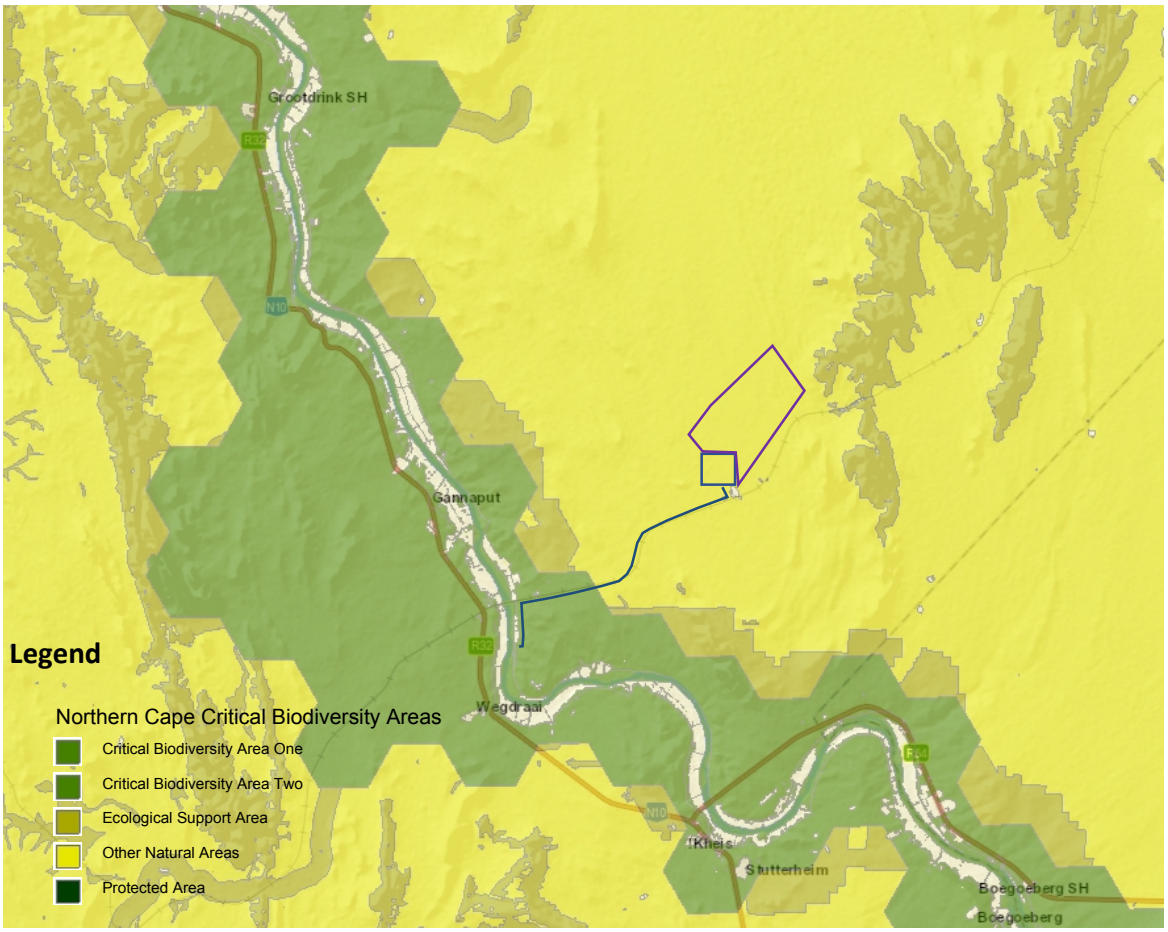

Figure 2 Critical Area Biodiversity map showing the proposed Bokpoort II development (Purple polygon) and the Bokpoort I development (blue polygon)

2.3. THREATS TO THE BIODIVERSITY ON SITE AND IN THE AREA

The Orange River provides water via an irrigation scheme that has resulted in much of the surrounding area of the river being developed and under irrigation. The greatest threat to the biodiversity in the area is the cultivation of land, which is mostly confined within the Lower Gariep Alluvial vegetation adjacent to the river. In addition to this, overgrazing, alien plant infestations, plant collecting for medicinal purposes and firewood contribute to the overall threat to biodiversity in the area.

Cultivation

Agriculture is a major economic activity along the lower reaches of the Orange River. At the moment it amounts to roughly 300 000 hectares of crops, grown west of the Vanderkloof dam. Livestock farming is generally practiced in the drier areas, with high-value crops such as grapes, pistachios, citrus, pecans and vegetables grown in a narrow riparian strip along the Orange River, supported by intensive irrigation supplied directly from the river.

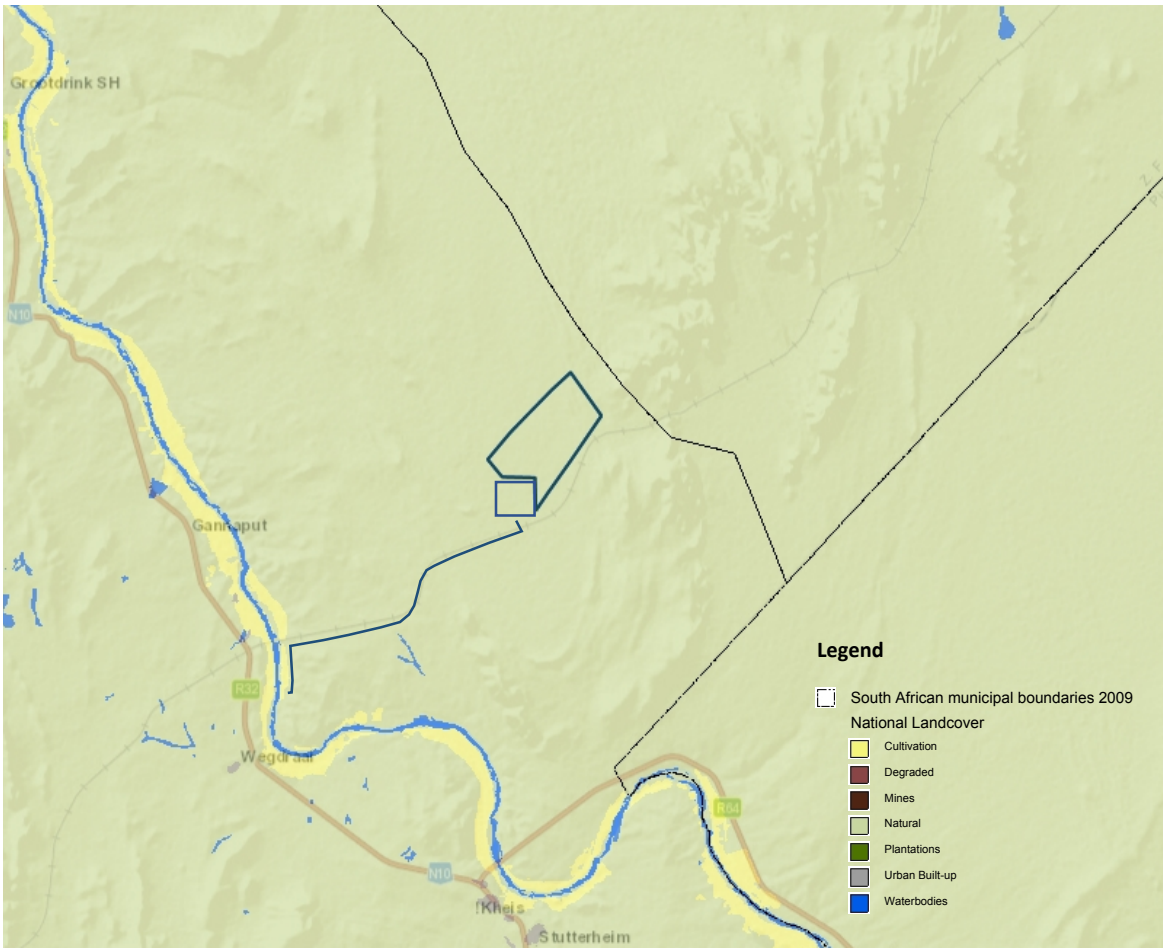

Figure 3 Landcover map of the area showing the proposed Bokpoort II development (Purple polygon) and the Bokpoort I development (blue polygon)

Overgrazing

Vegetation cover must be maintained to prevent soil and veld degradation. Carrying capacity indicates the number of hectares needed to sustain one Large Stock Unit without reducing the potential of the veld to carry livestock in future through degrading the vegetation condition. Overstocking results in vegetation species loss as well as a reduction in vegetation cover which in turn leads to soil erosion and sterilisation of soil resources.

Arid areas typically have sweet veld (veld that does not lose its palatability during the dry/winter season), sweet veld is more prone to overgrazing. The semi-arid to arid climate of the Northern Cape Province limits the vegetation cover and therefore the productivity of agriculture in the province. This lack of productivity results in farmers utilising marginal ground and stocking with higher animal numbers than what should be stocked in order to compete in the market. This pressure however has resulted in most agricultural ground in the Northern Cape being overgrazed. The degree of over utilisation does vary with plant communities and areas but it is a large threat to biodiversity. No detailed information is currently available on the extent of overgrazing and what areas are more overgrazed that others for the area surrounding the project site. However the property itself has in the past been extensively farmed, the large "monostands" of *Schmidtia*

kalahariensis across the site indicate over utilisation. The population of *Boscia albitrunca* further attest to heavy utilisation, as a large number of trees across the property show damage from over utilisation.

Alien infestations and bush encroachment

The project site and the area immediately surrounding the site do not have heavy infestations of AIS however they do occur witjin the greater area. These are at present mostly confined to areas that have been subjected to disturbance, such as mined areas and road reserves etc, but their presence is a threat to local biodiversity. Not only are alien species a threat to species diversity but the encroachment of indigenous species into an area, that causes a loss of species diversity and results in large patches of single species stands a threat to biodiversity.

Medicinal & firewood plant collections and illegal trade

Illegal harvesting of succulent plants to support the specialist horticultural trade and illegal collection of reptiles for the pet trade are taking place. However it still remains largely unknown to what extent the plants are being utilised within the area and on what scale illegal trade in faunal species is taking place although but does seem to be less than what occurs in the Namakwa District Animals such as vultures, monitor lizards, snakes and hedgehog are known to be used in traditional healing.

2.4. CURRENT & FUTURE PROTECTED AREAS

The formal protected areas include land-based and marine protected areas that are recognised in terms of the Protected Areas Act (Act 57 of 2003). In other words these formal protected areas are defined as areas of land or sea that are formally protected by law and managed mainly for biodiversity conservation.

Informal protected areas (eg conservancies) are areas of land not formally protected by law but informally protected by the current owners and users and managed at least partly for biodiversity conservation. It is important to differentiate protected areas from conservation areas, because there is no long-term security associated with conservation areas, they are not considered a strong form of protection.

Focus areas for land-based protected area expansion are large, intact and unfragmented areas of high importance for biodiversity representation and ecological persistence, suitable for the creation or expansion of large protected areas. The focus areas were identified through a systematic biodiversity planning process undertaken as part of the development of the National Protected Area Expansion Strategy 2010 (NPAES). They present the best opportunities for meeting the ecosystem-specific protected area targets set in the NPAES and were designed with strong emphasis on climate change resilience and requirements for freshwater ecosystems. The site is does not fall within a NPAES focus area and is not near any protected area.

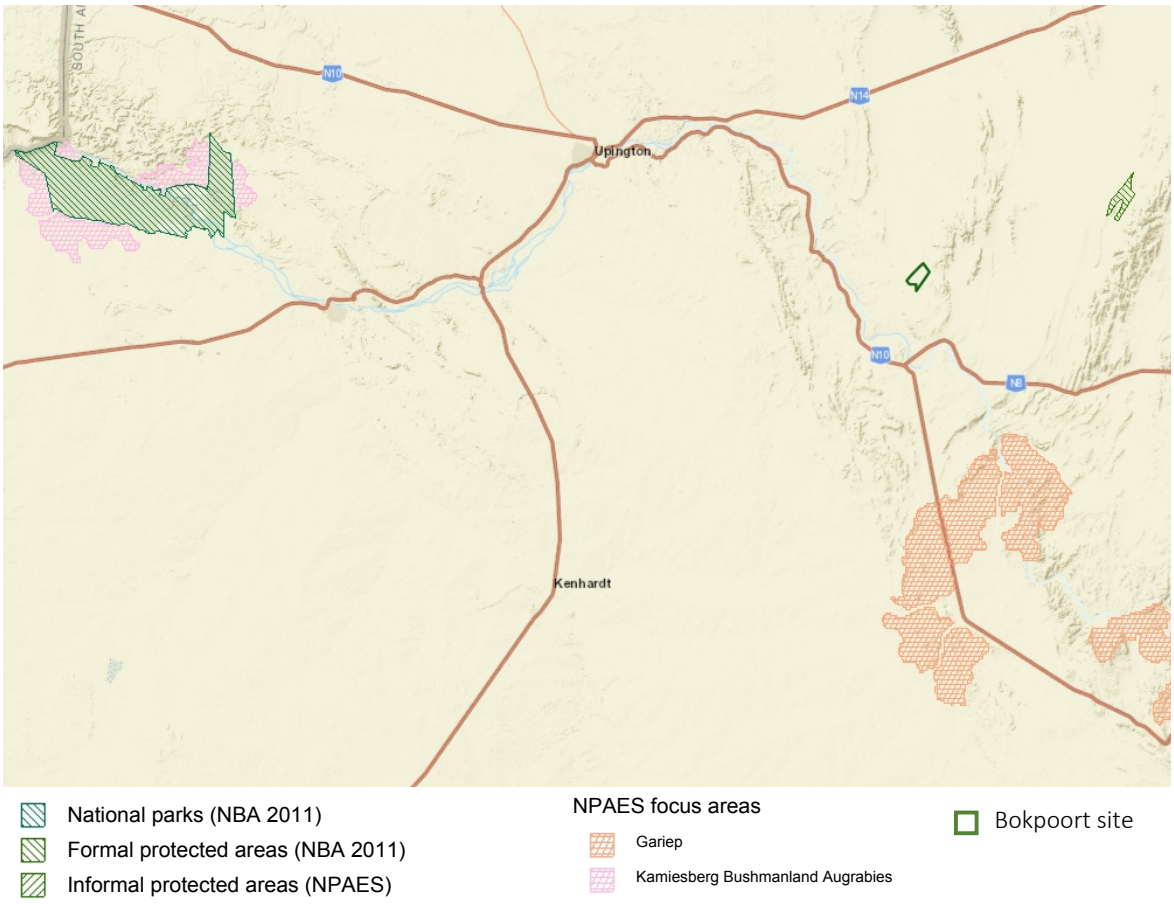

Figure 4 Protected areas and focus areas for land-based protected area expansion identified by the National Protected Area Expansion Strategy, in relation to the Bokpoort site

3. DETERMINING THE NEED FOR AN OFFSET

3.1. EVALUATE THE POTENTIAL FOR AN OFFSET.

In order to identify if there is a need for a biodiversity offset one needs to evaluate the occurrence of unavoidable and residual negative impacts of a proposed development, and whether an offset would in fact compensate for these impacts.

The actual need to offset the impacts of a development are only known once all the options and alternatives to avoid, minimize or repair/restore the impacts (the so-called 'mitigation hierarchy') have been evaluated during the EIA process. The common school of thought is that if these residual negative impacts on biodiversity have been found to be of 'medium' to 'high' significance then an offset is desirable.

The mitigation hierarchy is defined as:

1. **Avoidance**: measures taken to avoid creating impacts from the outset, such as careful spatial or temporal placement of elements of infrastructure, in order to completely avoid impacts on certain components of biodiversity.
2. **Minimisation:** measures taken to reduce the duration, intensity and / or extent of impacts (including direct, indirect and cumulative impacts, as appropriate) that cannot be completely avoided, as far as is practically feasible.
3. **Rehabilitation/restoration**: measures taken to rehabilitate degraded ecosystems or restore cleared ecosystems following exposure to impacts that cannot be completely avoided and/ or minimised.
4. **Offset:** measures taken to compensate for any residual significant, adverse impacts that cannot be avoided, minimised and / or rehabilitated or restored, in order to achieve no net loss or a net gain of biodiversity. Offsets can take the form of positive management interventions such as restoration of degraded habitat, arrested degradation or averted risk, protecting areas where there is imminent or projected loss of biodiversity.

The EIA process for this project states, that the photovoltaic plant development will potentially affect biodiversity in three main ways;

- Loss in extent of vegetation communities and loss & 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.

3.1.1. EXHAUSTING THE MITIGATION HIERARCHY

AVOIDANCE

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. It is assumed that a suite of alternative options was explored in the original EIA process. These are not commented on here as it is deemed that the most feasible option was proposed.

MANAGEMENT AND MITIGATION

The various potential impacts to the biodiversity as set out in the EIA process were provided with numerous mitigation measures, and these are summarized below;

CONSTRUCTION PHASE

Mitigation Measure 1 - An Environmental Officer (EO) should be appointed prior to construction,

Mitigation Measure 2 - The following shall be instituted at the onset of the construction phase and shall be the responsibility of the EO, or delegated to an appropriate person:

- Development and implementation of a vegetation monitoring protocol, with appropriate
- Development and implementation of a faunal monitoring protocol,
- Development and implementation of an alien and invasive plant monitoring protocol,

Mitigation Measure 3 - Develop and implement an Alien and Invasive Plant Management Programme.

Mitigation Measure 4 - The Project shall ensure that permits for the removal, destruction and/or transplant of protected and conservation important plant species from the development site is valid for the time period of construction/ impact;

Mitigation Measure 5 - Execute the relocation of the *Hoodia gordonii* individual according to the recommendations to an area that is considered suitable in terms of habitat requirements, also ensuring that future disturbances/ developments will not result in additional impacts.

Mitigation Measure 6 - Prior to site clearance, conduct targeted searches for animal species of limited mobility within the development footprint (i.e. small mammals, burrowing species, etc.) that may have dens/resting places/ roosts, burrows, etc. within the footprint to allow natural movement from disturbance factors to take place where necessary, and avoid mortalities of these species;

Mitigation Measure 7 - Develop a conservation/ rehabilitation programme

Mitigation Measure 8 - Develop an effective waste management plan

Mitigation Measure 9 - Under no circumstances must any natural area on neighboring properties (outside the approved development footprint) be impacted, degraded, cleared, or affected in any manner. Demarcate the development footprint and relevant areas by semi-permanent means at the onset of site preparation to prevent accidental, or unwanted impacts in surrounding natural habitat and to control movement of personnel, vehicles, providing boundaries for construction and operational sites.

Mitigation Measure 10 - Areas proposed for vegetation clearance should be clearly marked and no heavy vehicles should travel beyond any of the marked works zone.

Mitigation Measure 11 - 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 the construction activities (presence of people and heavy machinery, disturbance of faunal species of conservation concern), and will also contribute to the conservation of natural vegetation adjacent to the project boundary.

Mitigation Measure 12 - No painting or marking of rocks or vegetation (in remaining or adjacent natural habitat) to identify locality or other information will be allowed, as it will disfigure the natural setting. Marking should be done by steel stakes with tags, if required. All temporary markings will be removed upon completion.

Mitigation Measure 13 - Prevent contamination of surrounding, natural habitat from any source of pollution, notably from hydrocarbon spillages, runoff, end-contamination from transformed areas, erosion, etc. Ducts that facilitate water flow underneath roads must be kept clear of litter, debris and must not be used to dispose of chemicals, unwanted effluent, etc. The waste management plan should take note of the storage and protection of the environment from hydrocarbon spillages.

Mitigation Measure 14 - No spoil material may be dumped outside the defined site.

OPERATIONAL PHASE

Mitigation Measure 15 - Continue the ecological (botanical, faunal and AIP) monitoring plans, at a frequency of at least annually for the duration of the Operational Phase of the operation. These monitoring programmes are considered separate from procedural and periodic environmental audits conducted by the EO.

Mitigation Measure 16 - Continue the Alien and Invasive Management Programme of declared and invasive plant species. The Environmental Manager should compile relevant action plans to deal with the presence of alien and invasive species.

Mitigation Measure 17 - Rehabilitation should be ongoing and should target areas where activities have been completed.

Mitigation Measure 18 - Site induction for contractors and personnel should include a familiarization with all aspects relating to environmental components of the project, notably the harvesting, collecting and removal of any plant and animal species, but also with specific reference to protected and conservation important taxa.

Mitigation Measure 19 - 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 must be kept clear of litter, debris and must not be used to dispose of chemicals, unwanted effluent, etc.

Mitigation Measure 20 - Movement control of vehicles across the site should be strictly controlled. No vehicles should be allowed outside the approved footprint areas. In particular, no vehicle movements should be allowed in natural habitat.

Mitigation Measure 21- Establishment of a fire management plan

Mitigation Measure 22 - A road management plan should be compiled prior to the commencement of construction activities to avoid exacerbated impacts on vegetation and minimize the exposure of natural habitat to disruptive activities.

Mitigation Measure 23 - 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), Use light bulbs that produces long wavelengths (ambers and reds) for all lights that are not under CAA regulatory specifications

Mitigation Measure 24 - Absolutely no animals may be hunted, trapped, snared, or killed for any purpose (apart from approved biodiversity management actions). Boundary fences should be patrolled regularly to check for and remove any snares or other animal traps;

Mitigation Measure 25 - Establish operational procedures for the safe capture and release of snakes from operational/construction areas, notably by a qualified specialist;

Mitigation Measure 26 - Develop a sighting and register log for observations pertaining to the presence/ abundance and occurrence of animals on site, killings along access roads, internal roads, etc;

The significance statement for the impacts on biodiversity for this project was based on the implementation of the above management and mitigation measures.

REHABILIATION/RESTORATION

Land rehabilitation as a part of environmental remediation is the process of returning the land in each area to some degree of its former state post development.

The aim of the rehabilitation plan is to:

- Return the disturbed area to an acceptable post development state;
- Ensure that all areas are stable, and there is no risk of erosion;
- Prevent alien plant invasion on the site until the site is in a stable state; and
- Ensure that all areas are free draining and non-polluting.

A plant species rehabilitation and re-vegetation plan has been compiled as part of the EMPr to establish a rehabilitation programme and plant species plan for the purpose of rehabilitating areas of temporary habitat loss as well as to establish ecological connectivity under the solar field.

This has been drawn up to manage the areas that will have a temporary loss of habitat and those areas that require restoration to ensure ecosystem function is re-established within the area.

RESIDUAL IMPACTS

Residual impacts are impacts that remain after mitigation and management measures have been implemented.

The actual need to offset the impacts of a development are only known once all the options and alternatives to avoid, minimize or repair/restore the impacts (the mitigation hierarchy) have been evaluated during the EIA process. It is only if there is an occurrence of unavoidable and residual impacts should an offset be considered.

Four of the impacts to the biodiversity listed in the EIA are assessed to show a moderated negative significance after mitigation, ie moderate residual impacts, these are

- Loss of habitats
- Loss/disturbance of flora and fauna species of conservation concern
- Direct loss (injury/mortality) of fauna species via roadkill
- Disturbance of faunal species of conservation concern – barrier to movement

The EIA however states 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 recorded on the site 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.

The EIA does nevertheless state that the high number of protected tree species recorded on the site would requires legislative authorisation prior to removal. During this permit application process for Bokpoort I the Department of Forestry stipulated as a condition of the Protected Tree Removal License, that ACWA Power Energy Africa (Pty) Ltd implement a Biodiversity Offset. This was deemed necessary owing to the high number of protected trees , most notably the *Boscia albitrunca* that would be removed from site as a result of the project.

3.1.2. CONSIDERING OFFSETS

The need for offsets does not depend on the scale or nature of the particular development, but on the significance of residual negative impacts on biodiversity and ecosystem services predicted as a result of that development. Biodiversity offsets should be considered to remedy residual negative impacts on biodiversity of 'medium' to 'high' significance.

The need for a biodiversity offset is determined by the significance of residual impacts as follows;

- Residual impacts of **'very high' significance** are a fatal flaw for development. Impacts would in all likelihood lead to irreplaceable loss of biodiversity, and/ or irreversible deterioration in valued ecosystem services, and therefore should not be authorised;
- Residual impacts of '**medium' to 'high' significance** should trigger a requirement for a biodiversity offset; and
- Residual biodiversity impacts of **'low' significance** would usually not require offsets, provided that all factors informing the evaluation of impact significance have been considered

Accordingly, as there are residual biodiversity impacts of 'medium' significance the project should trigger a biodiversity offset.

3.1.3. ADDITIONAL INFORMATION, ASSUMPTIONS, LIMITATION & UNCERTAINIES

It can be assumed that as there was a stipulation from the Department of Forestry to implement an offset for the removal of 975 trees (as per the license) for Bokpoort I, that the removal of additional trees as part of the Bokpoort II development , a similar condition as part of the protected tree removal application would be required.

With the expansion of the solar project, in terms of the development of Bokpoort II the offset needs to now cover the requirements for both Bokpoort I and Bokpoort II with respect to the loss of protected trees.

The term 'No Net Loss' (NNL) is defined as the outcome of an offset where there would be no loss of a vegetation type, habitat or feature beyond the scientifically established conservation target for that feature. For NNL, we assume that provision is made for a budget to ensure that the biodiversity values of that species, or habitat or feature, is maintained in the long term. However, in the absence of regional fine scale mapping, the determination of No Net Loss is not possible at fine scale vegetation community level or species level. No net loss of protected trees cannot be adequately tested as the extent of the resource is not known and has not been mapped or quantified.

3.2. QUANTIFYING THE OFFSET

At present there is a draft National Biodiversity Offsets Policy Framework that has been developed by the Department of Environmental Affairs which governs the methodology for quantifying offsets in South Africa.

The quantum of biodiversity offsets in South Africa uses a basic ratio derived from a target which is in turn linked to the status of residually affected ecosystems. Multipliers are then applied to this basic ratio dependent on the onsite conditions, the affected biodiversity and the risks associated with the project.

This is calculated using the criteria described in the table below (Table 3). Ecosystems or habitats are categorised according to their conservation status, which is in turn, assessed according to the degree of the transformation relative to the expected extent of each ecosystem or habitat. The status of a habitat or ecosystem is based on how much of its original area still remains intact relative to various thresholds.

Feature	Basic offset ratio[3]	Adjustments to size and/or number of offsets
Critically Endangered ecosystems, protected areas, Critical Biodiversity 1 (CBA1) areas identified in plans	30:1 ratio.	Negative impacts should be avoided as a priority and would be unacceptable unless exceptional circumstances can be

[3] **Note**: The above ratios do not apply to wetland offsets, where restoration of ecological function and services, as well as biodiversity, is the principal offset activity. For guidance on wetland offsets, reference must be made to wetland offset guidelines.

published or adopted by the relevant authorities.		demonstrated. Reference must be made to provincial guidance.
Endangered ecosystems, Critical Biodiversity 2 (CBA2) areas identified in plans published or adopted by the relevant authorities.	Minimum 5:1, up to 20:1.	Offset would need to be determined based on exact level of threat and taking into account levels of protection, ecological condition, presence of threatened species**, contribution to important ecological processes and ecosystem services. The minimum size of a viable offset should be determined by provincial guidance.
Vulnerable ecosystems, areas earmarked for Protected Area expansion, Ecological Support Areas (ESAs) identified in plans published or adopted by the relevant authorities.	Minimum 2:1, up to 5:1.	Offset would need to be determined based on exact level of threat and taking into account levels of protection, ecological condition, presence of threatened species**[4], contribution to important ecological processes and ecosystem services. The minimum size of a viable offset should be determined by provincial guidance.
Least threatened, Other Natural Areas (ONAs) identified in plans published or adopted by the relevant authorities.	Generally, no offset required.	Offset may be necessary to cater for residual negative impacts on rare habitats, threatened species**[2], on important ecological processes and ecosystem services. The appropriate size of a viable offset should be determined by provincial guidance.

Table 3. Criteria used to determine basic offset ratio based on ecosystem status.

In terms of the criteria in Table 3, the Bokpoort CSP field and PV project area does not contain any Critically Endangered, Endangered or Vulnerable Ecosystems. All habitat types within this area are listed as Least Threatened. For Least threatened ecosystem offsets are not generally required. The abstraction point and some of the pipeline area however traverses an area classified as a CBA, the presence of a Critical Biodiversity Areas does trigger a requirement for an offset. The basic offset ratio for a CBA 1 is set at a ratio of 30:1 and up to 20:1 for a CBA 2. Only 434m of the pipeline and abstraction point occurs within the CBA 1 and 5.49km traverses a CBA 2, and of this a very small amount of area will be disturbed and cleared. Owing to its proximity to agricultural development, a road and railway line very little primary vegetation will be lost in the CBA.

The walk-through survey and the permit applications confirmed the following protected species would be lost

Species	Bokpoort I		Bokpoort II	Total for permit applications
	Permit application	Removal register	Walk through survey	
Boscia albitrunca	975	478	4350	5325

4 **Note:** biodiversity offsets to accommodate threatened species or local endemic species with restricted distributions are not determined using offset ratios. Specialist advice on the particular affected species must be obtained, to inform an appropriate size and type of offset.

Vachelliai haematoxylon	135	107	653	788
Vachellia erioloba	45	31	394	439
Aloe claviflora	2290	183*	552	2842
Euphorbia sp	125	31*	5	130
Acanthopsis hoffmannseggiana	-	-	2607	-
Hoodia gordonii	-	-	4	4
Ruschia divaricata	-	-	252	252

*Plants were relocated not destroyed

Table 4. Protected plant species affected by the development.

Of particular concern is the substantial amount of *Boscia albitrunca* that will be lost as a result of this development. Offsets related to threatened species are usually not determined using an offset ratio but is guided by specific information on the species to inform an appropriate size and type of offset. However, very little research has been done on *Boscia albitrunca*, and thus questions remain on species occurrence (historical and current range), what its conservation status is and its population dynamics. Setting targets for species to determine an appropriate offset is not a simple task as it depends on many factors including the type of distribution data available as well as the taxa under consideration. Ideally species targets should be population level targets. In the absence of this information to set conservation targets for species, one can revert to the ecosystem data to facilitate setting these offset ratios. One would then need to consider the ecosystem targets for the Kalahari Karroid shrubland and the Gordonia Duneveld in which this species occurs in the study area to determine offset ratios.

The required percentage of remaining habitat needed to meet the target is set at 21% for the Kalahari Karroid Shrubland and 16% for Gordonia Duneveld. A revised conservation target for this exercise could include the initial national target plus a buffer to ensure that no species within the habitat becomes endangered. A Basic Offset Ratio can then be assigned by reading it off against its corresponding target on the "No-Net- Loss up to a Target" graph. For example an adjusted target set at 50% for the Kalahari Karroid Shrubland would result in basic offset ratio of 1:1.

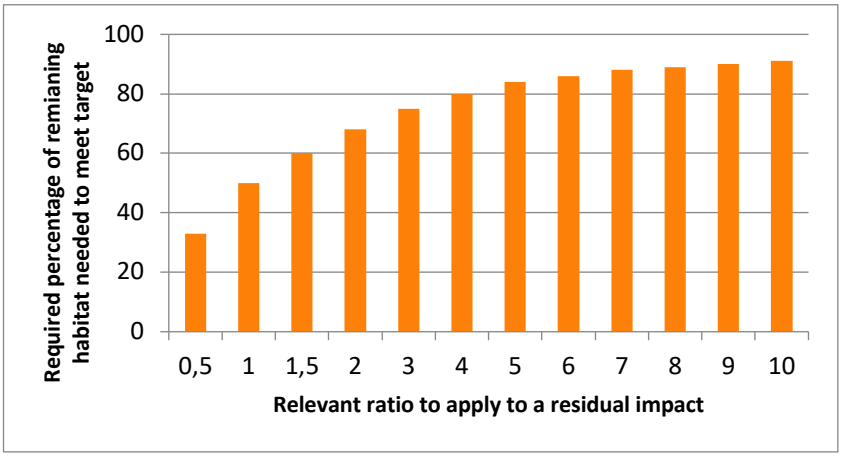

Figure 5 No Net Loss up to a Target graph for determining Basic Offset Ratio

Offset ratios are subject to other influences which act as additional multipliers to the basic offset ratio. These multiplier factors include;

Risks and uncertainties – the basic offset ratio can be multiplied to accommodate uncertainty regarding impacts, the multiplier is determined by the amount of risk or uncertainty of an impact occurring. For instance, in habitats where a complete loss of relevant species due to vegetation clearing (such as under the PV plants) will occur uncertainty is not relevant in these cases and an additional multiplier will not be required.

Condition of habitat – this multiplier caters for differences in condition of the habitat impacted. If the habitat within a development area is significantly better than in the surrounding area then an additional multiplier would be applicable. For this project the condition of the habitat within the development area is not better than the surrounding areas. The area surrounding the abstraction point and the pipeline has been disturbed and most of the natural vegetation has been removed. The abstraction point is within an existing agricultural development, the pipeline for the most part runs along a railway line and gravel road, thus is considered to be more disturbed than the surrounding area. The property where the CSP plant and PV plants will be located is comparable in condition to the surrounding area. There are signs of over utilization on the property but it is not significantly different to the habitat in the immediate surrounds, thus an additional multiplier for habitat condition is not applicable, for any of the ecosystem units affected by the development.

Biodiversity priority – This multiplier recognizes biodiversity priority. It may also be necessary to cater for special habitats, or areas that contain a large number of protected species. In areas where a significant amount of threatened and/or protected species occur and will be lost an additional multiplier is required to account for this loss. This multiplier is relevant within the project development area where large numbers of SCC, most notably *Boscia albitrunca* will be lost from the site

The multipliers can then be applied to the basic offset ratio to obtain a final offset ratio, which is then multiplied by the area of disturbance within each ecosystem, to give the required offset area for the project.

	Vegetation type	Conservation status	Conservation target NBA 2018	Critical Biodiversity Area	Residual loss (Ha)	Final Ratio	Offset required (Ha)
Bokpoort I	Kalahari Karroid Shrubland	Least Concerned	21%	NA	179,19803	2	358,39606
	Gordonia duneveld	Least Concerned	16%	NA	79,44154	1,5	119,16231
	Bushmanland arid grassland	Least Concerned	21%	CBA2	5,49305	20	109,861
	Lower Gariep Alluvial	LC/ Endangered	31%	CBA1	0,43401	30	13,0203
Bokpoort II	Kalahari Karroid Shrubland	Least Concerned	24%	NA	1243,12	2	2486,24
	Gordonia duneveld	Least Concerned	16%	NA	256,88	1,5	385,32
					1764,56663		**3471,99967**

Table 5. Offset summary table.

3.3. DESIGNING AN OFFSET

Offsets should be located in the landscape to :

- Be in the same bioregion, vegetation or ecosystem type and, preferably, the same quinary catchment as the impact site;

- Consolidate or buffer existing protected or priority conservation areas and/or minimize fragmentation of habitat;
- Make a maximum contribution to securing, protecting and/or linking biodiversity priority areas, and consolidating ecological corridors in the landscape identified in the provincial biodiversity plan, bioregional or other provincial or municipal biodiversity plans, SDF, EMF, fine scale plans, (etc.);
- Provide habitat for threatened species that would be adversely impacted; and
- Provide comparable ecosystem services specifically to those parties adversely affected by impacts on 'their' ecosystem services;

Internationally biodiversity offsets are currently used in reference to both like-for-like exchange for land, trading up to a higher conservation value habitat, and activities such as funding of biodiversity research, provision of financing for protected areas or support for capacity building in government agencies. In South Africa generally only land-based offsets are considered.

In order to establish what type of offset would be appropriate, a clear and valid purpose for the offset in broader conservation planning terms needs to be investigated. The offset must slot into existing provincial spatial conservation plans, and it needs to be established how the offset will contribute to this. Thus any proposed offset must align with existing development and conservation plans for the region in order for it to be successful.

3.3.1 REGIONAL INTEGRATED ENVIRONMENTAL MANAGEMENT PLANNING

The Management Framework for the District Municipality (EMF, EnviroNomics 2008) identifies Bushmanland Arid Grassland as being a medium conservation priority in the region, and Lower Gariep Alluvial Vegetation as being of high conservation priority. Conservation strategies for this region focused on the Lower Gariep Alluvial Vegetation of the Orange River (EnviroNomics 2008). No conservation areas for this vegetation type were proposed anywhere near Groblershoop. However the EMF also identifies environmental control zones, near the development site that includes

- Zone 2 – Potential wind erosion areas,
- Zone 3 – Potential high to very high vegetation conservation areas,
- Zone 6 Potential wind erosion areas in combination with potential high to very high vegetation conservation areas and
- Zone 7 Low control zone.

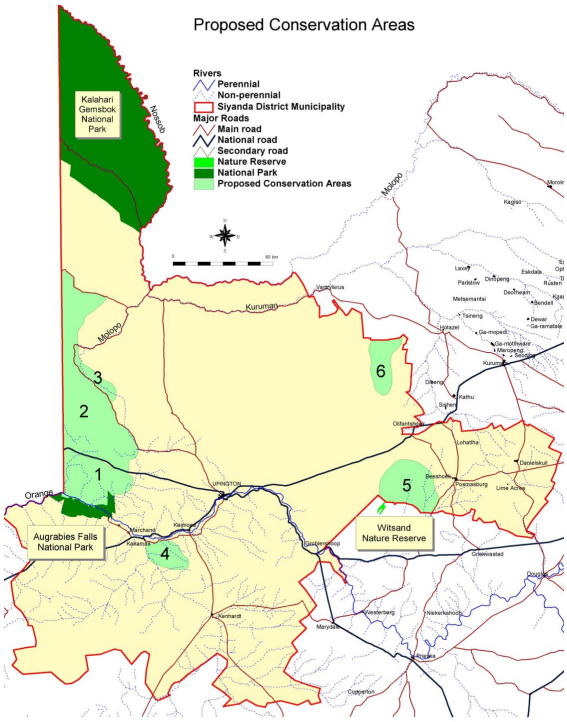

Figure 6 Proposed conservation areas identified in the EMF for the District Municipality in which the powerline falls.

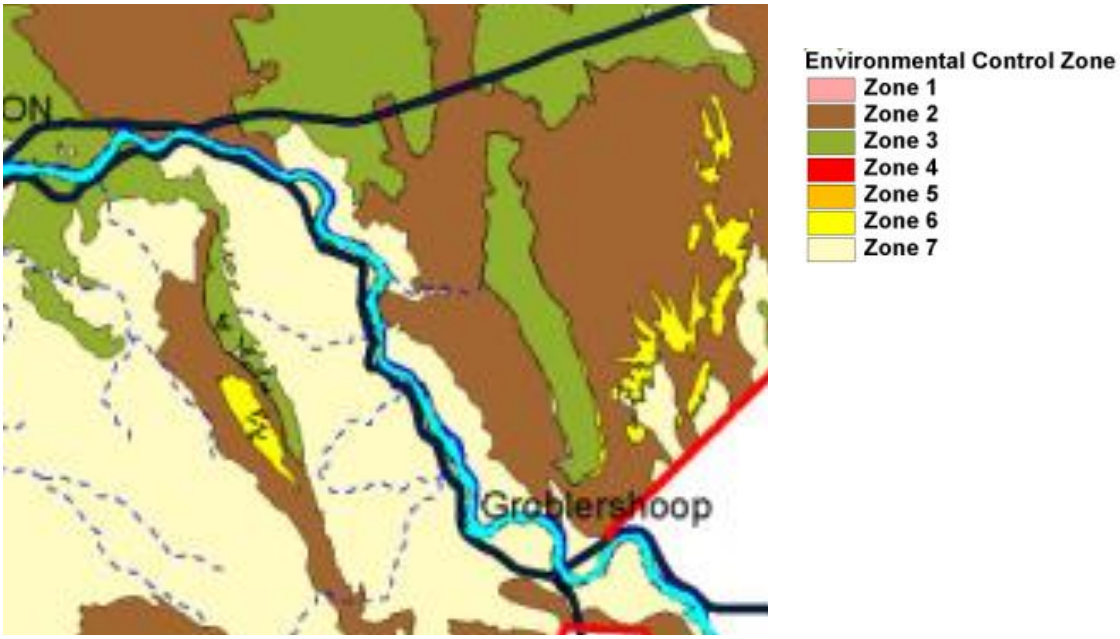

Figure 7 Environmental Control Zones identified in the EMF for the District Municipality

The Formal Protected areas that occur within the District Municipality include the Kgalagadi Transfrontier Park and Augrabies National Park. The NPAES have identified a focus area for protected area expansion within the region (see Figure 4).

3.3.2 OFFSET OPTIONS

LIKE FOR LIKE OFFSET

Biodiversity offset policies around the world are often based on the principle of 'LIKE-FOR-LIKE or better'. The outcome is to offset the biodiversity components to be impacted by targeting the same biodiversity components elsewhere (an 'in-kind' offset).

It is assumed that the area adjacent to the solar development contains that same local scale plant communities and habitat that will lost through the process of clearing of vegetation. Thus conserving an area around the development will ensure that the specific loss to biodiversity through vegetation clearing will be offset, as the exact same communities and habitats will be conserved rather than conserving areas removed from the impact site that may be slightly different.

A total offset area of 3471 Ha is not significantly large for this area, however this size offset area given the average density of trees for the area would secure approximately 10 000 trees provided the vegetation communities were comparable to the development area.

There are no existing formal conservation areas in the immediate vicinity into which the biodiversity offset could feed. The EMF has however identified a zone 3 Area (Potential high to very high vegetation conservation areas) indicating there may be some potential to develop a conservation zone in this area. There are also private reserve areas within the vicinity, such as Kalahari oryx, Glen Lyon and Thuru Lodge that may provide options into which the offset could feed.

An additional option would be the procurement of land within the focus area for the land-based protected area expansion. A focus area has been identified in the region. This area has already been ear-marked as an area in which to expand the protected areas network for the region, however as it is removed from the development site it may not include all the plant communities and/or species of special concern. The presence of all required vegetation units such as the Kalahari Karroid Shrubland wold have to be investigated. This option would require assistance and guidance from the DENC to ensure it will form part of a greater conservation initiative, as small isolated pockets of conserved land have little holistic conservation value and are not sustainable in perpetuity.

TRADING UP –OFF SITE OFFSET

This would entail conserving land considered to have a higher conservation value than the vegetation within the proposed development area, i.e. conserving the vegetation in another area that has been less disturbed and degraded. Trading up by conserving vegetation in better condition elsewhere, if possible, would compensate for biodiversity loss. It is also best if the offset is a part of an existing conservation area or earmarked for declaration as a protected area.

Existing conservation areas include the Augrabies National Park, the Kgalagadi Transfrontier Park and Witsand Nature Reserve . Options for these areas would include buying land to expand their conservation

areas, if required. However the exact plant communities that will be affected by this development may not be offset by this option as these areas are somewhat removed from the project site. There is some uncertainty in the literature whether protecting land that is similar to the land being developed is as ecologically meaningful as creating offsets on the actual site being developed. However if it can be established that a significant amount of protected trees would be conserved by this option it would provide a sufficient argument to pursue this option.

4. CONCLUSION & WAYFORWARD

The scope of this report is not to present a suitable offset but to investigate the need for an offset and conceptualize that offset requirement.

The investigation has established that there is a need for an offset given the scope of residual impacts, particularly with respect to the impacts on the *Boscia albitrunca* trees. According to the SCC plant removal register 478 *Boscia albitrunca* have already been removed for the Bokpoort I development and it is possible that an additional 4350 *Boscia albitrunca* will be lost during the construction of Bopoort II, thus almost 5000 trees could be impacted by the development

Offsets related to a particular species are generally not determined using an offset ratio. Information on the affected species is used, to inform an appropriate size and type of offset. However, in the absence of available data on conservation targets for the species the ecosystem data can be used to determine offset ratios. Using this approach an offset area of 3471Ha (600Ha for Bokpoort I and 2871 for Bokpoort II) was calculated for this development.

All offset options must include both Bokpoort I and Bokpoort II, in terms of offset obligations. Once consensus has been reached by the various stakeholders in terms of determining offset size and appropriated offset (ie Like-for-like offset), the next step in the offset process will be the identification of a suitable offset site. Once this has been achieved a management and implementation plan can be produced for the offset.

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Recommendations from the Northern Cape Department Agriculture, Environmental Affairs, Rural Development & Land Reform (DAERL)

forestry, fisheries & the environment
Department:
Forestry, Fisheries and the Environment
REPUBLIC OF SOUTH AFRICA

agriculture, environmental affairs, rural development and land reform
Department:
agriculture, environmental affairs,
rural development and land reform .
NORTHERN CAPE PROVINCE
REPUBLIC OF SOUTH AFRICA

Directorate: Forestry Management (Other Regions)	**Directorate: Research and Technology Development & Environmental Policy, Planning and Coordination**
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Enquiries: J. Mans **E-mail:** JMans@environment.gov.za **DFFE (Forestry) Ref:** **40.8.14.2/NC/194**	**Enquiries:** E. Swart **E-mail:** Elsabe.dtec@gmail.com **DENC Ref:** **Bokpoort I & II Biodiversity Offset**

Ref: (Draft) Bokpoort Feasibility Investigation for the ACWA Power Bokpoort Solar Project near Groblershoop **Date: 07 June 2021**

ACWA Power Energy Africa (Pty) Ltd
P.O. Box 650200
Benmore
2010
Tel: +27 11 722 4100

Attention: Mr. Prabashen Govender (Email: pgovender@acwapower.com)
cc Ms Natalie Birch (Email: birch@hinet.co.za)

RE: (DRAFT) BOKPOORT FEASIBILITY INVESTIGATION FOR THE ACWA POWER BOKPOORT SOLAR PROJECT NEAR GROBLERSHOOP

The Forestry Branch in the Department of Forestry, Fisheries and the Environment (DFFE) and the provincial Department Agriculture, Environmental Affairs, Rural Development & Land Reform (DAERL) studied the above-mentioned report, dated May 2021. This letter is in response to the said report and virtual meeting held on the 18th of May 2021 regarding the established Bokpoort I and proposed Bokpoort II developments and their impacts on protected plant species and the environment.

A. COMMENTS ON THE REPORT:

1. *Boscia albitrunca* is dually protected under the Northern Cape Nature Conservation Act (No. 9 of 2009) and the National Forest Act (No. 84 of 1998). This should be corrected on page 3 and throughout the document.
2. The Department of Environment and Nature Conservation has since merged with the Department of Agriculture and is now known as the Department of Agriculture, Environmental Affairs, Rural Development and Land Reform. Please correct this and use the following acronym for the department throughout the document: DAERL.
3. It has been found that the main host plant source for the Pioneer Caper White/ Brown-veined White butterfly's caterpillar (*Belenois aurota*) is the indigenous shepherd's tree (*Boscia albitrunca*), i.e. the species of conservation concern that the Bokpoort I & II developments will be impacting on (i.e. >5000 trees destroyed as a result). Removal of this keystone species will have cascading effects on other biodiversity components such as the Brown-veined White butterfly. Please take note and add this information on page 24 and elsewhere in the document where it is relevant.
4. Please refer to the DFFE's protected areas register at https://egis.environment.gov.za/ and update the protected areas accordingly (Figure 4, page 31). Glen Lyon and Rockwood Nature Reserves have not been included in the map. Please note that, although these are private protected areas, they are indeed formally protected under the National Environmental Management: Protected Areas Act (No. 57 of 2003).
5. Please also update the information on the Northern Cape's Protected Areas Expansion Strategy Focus Areas (Figure 4, page 31) to include the latest data. The data can be obtained from Mr. Enrico Oosthuysen at enricooosthuysen@gmail.com.

B. RECOMMENDATIONS ON THE WAY FORWARD:

(ref. Draft Biodiversity Offset Feasibility Investigation for the ACWA Power Bokpoort Solar Project near Groblershoop, Northern Cape. By N Birch, dated May 2021)

1. The suggested (combined) offset area of ~3472ha (600ha for Bokpoort l and 2871 ha for Bokpoort ll) as a result of the combined impact of Bokpoort I & II is supported.

2. The following should be taken into consideration with regard to the potential offset site going forward:
    i. **A few offsets receiving site options must be proposed in the final biodiversity offset report** to allow for flexibility when negotiating with land-owners**.**
    ii. The purpose of the Biodiversity Offset site is to conserve a viable population of *Boscia albitrunca* within a sufficiently large supporting ecosystem to support its ecology, while also catering for adaptability and resilience under climate change.
    iii. **The biodiversity offset site should cater for the species of concern that's being impacted on** by the Bokpoort I & II developments **i.e. *Boscia albitrunca***.
        a) Relevant literature should be sourced to obtain the species' distribution ranges and investigation for a potential site should be done accordingly.
        b) The Boscia's population health (demography & live:dead ratios) of the offset site must be in a healthier state than that being destroyed, and the associated habitat (ecosystem) must be in a good ecological state (not degraded and / or heavily overgrazed).
        c) Suitable habitat availability analysis under climate change conditions is highly recommended to ensure the long-term persistence of the species, that would prevent the obtainment of an offset site that will become unsuitable for the species within the next 50 – 100 years.
        d) A close-nit relationship exists between *Boscia albitrunca* and the Brown-veined White butterfly (*Belenois aurota*). It is advised that the migratory path of the latter species be taken into account when sourcing a potential offset site. Please contact Renier Terblanche (specialist on the species; reinierf.terblanche@gmail.com) for further discussion.

    iv. The affected vegetation types are Kalahari Karroid Shrubland, Gordonia Duneveld, Bushmanland Arid Grassland. These vegetation units' conservation statuses are Least threatened with ± ~99% remaining as per Mucina & Rutherford (2006). Major changes have however occurred since as these vegetation units are under severe pressure due to agricultural activities and recent renewable energy developments. This is of particular concern for the Kalahari Karroid Shrubland as the latter is a considerately small vegetation type for the arid region (828 389.89 ha) with only 0.1% under formal protection in the

Augrabies Falls NR (note that, as per Table 1 below, the Bokpoort developments will destroy about ~0.17% of the conservation target, this is approximately what is currently under formal protection). Even though it has a conservation target of 21%, no conservation land has been added to this vegetation unit since 2006. The concern is that increased impacts on this vegetation unit can result in fragmented islands which can ultimately result in the hindering of ecosystem functions and processes.

v. **The biodiversity offset site should thus, preferably, cater for the Kalahari Karroid Shrubland vegetation type.**

vi. **The offset site should cater for the mosaic of vegetation units and diverse set of ecosystems being impacted on.**

vii. **The biodiversity offset site should thus provide an effective substitute corridor/ link.**

viii. **A Biodiversity Offset Implementation Agreement must be in place within one year of the permit date issued.** Parties to this agreement will depend on where the offset will be located (e.g. SANParks, DAERL, or privately owned protected area).

ix. **All costs pertaining to the establishment of the offset and the 20 year management costs thereof will be for the developer.**

x. **Monitoring and research must form part of the management plan** of which the population dynamics and population health, with associated veld condition and habitat, of *Boscia albitrunca* must be attended to. The purpose of it would be to ensure that the population is conserved and that if its health deteriorates, that the causes can be identified. It is further to improve our knowledge of the species to better understand its population dynamics and its recruitment & habitat requirements. The goal would be to enable population viability analysis that can allow for minimum population size, quantification of conservation targets and the identification of priority conservation areas that would include this species.

Table 1. The vegetation units associated with the Bokpoort I & II developments.

Vegetation type & Feature[1]	*Gordonia Duneveld*	*Kalahari Karroid Shrubland*	*Bushmanland Arid Grassland*
Protected	*14.2%*	*0.1%*	*0.04%*
Conservation target	*16% / 588 347.38 ha*	*21% / 169220 ha*	*21% / 954470 ha*
Remaining	*99.8%*	*99.2%*	*99%*
Vegetation type size (ha)	*~3 677 171*	*~828 390*	*~4 545 070*
Size of vegetation type that will be impacted by Bokpoort I & II (ha)	*336.322*	*1 422.318*	*5.493*
Vegetation type lost %	*0.009%*	*0.172%*	*0.001%*

The proponent is thus encouraged to investigate potential intact units that can be linked into corridors and conservation areas and identify suitable offset-receiving areas and migration corridors to safeguard long-term functionality of the ecosystem(s) that support the keystone species, *Boscia albitrunca*.

Kind Regards,

.....	pp ..... 11 June 2021
Jacoline Mans	Elsabé Swart
Chief Forester: Regulations	Scientific Manager Gr A: Environmental Research & Development
DATE: 10 June 2021	**DATE: 07 June 2021**

[1] All values except are in accordance with the 2006 vegetation map (Mucina & Rutherford, 2006).

Appendix C2:
Avifauna

Lusani Jacqueeline Madali
ACWA Power Energy Africa (Pty) Ltd
7th Floor 90 Grayston Drive
Sandton
2196
South Africa

28 June 2021

Dear Lusani,

RE: Avifaunal Specialist Letter of Potential Impacts of a Proposed Overhead Power Line Grid Connection, Substation Expansion and Associated Infrastructure for the Project DAO Solar Facilities, Northern Cape Province

ACWA Power Energy Africa (Pty) Ltd ('ACWA Power') obtained three Environmental Authorisations in 2016 for 2 x 75 MW photovoltaic (PV) facilities (PV 1 and PV 2) as well as a 150 MW concentrated solar power (CSP) tower facility near Groblershoop, Northern Cape Province.

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 original Environmental Authorisations, which included pre-construction avifaunal monitoring, the results of which advised the initial impact assessment. ACWA Power initiated a Part II Amendment process to update the project description to remove the CPS component and add additional PV facilities within the authorised project footprint. As part of this process Arcus revisited the project site and assessed the potential impacts associated with the changes detailed in the amendment application. Environmental Authorisation has been approved for a total ten Solar PV facilities and ten 132 kV overhead power lines associated with the development. ACWA Power have been awarded preferred bidder status for 'Project DAO' (comprising seven Solar PV facilities, previously called 'Bokpoort II') in December 2020.

ACWA Power were subsequently informed by Eskom that a 400 kV line is required to connect Project DAO to the Garona substation and the national grid, therefore ACWA Power is applying for environmental authorisation for the required grid connection infrastructure.

To facilitate the grid connection, ACWA Power is considering two options: Option 1 includes upgrades to the Garona Substation required to facilitate a loop-in-loop-out ('LILO') connection that includes a loop into the existing Ferrum – Garona 400 kV overhead power line and loop out from the existing Garona – Niewehoop 400 kV overhead power line (approx. 2 x 5 km in length) into the Garona Substation; Option 2 includes the construction of a substation within the project boundary (previously assessed, Arcus 2020) with a 400 kV LILO connection to the adjacent existing overhead power line, with no pylons to be constructed in any unauthorised areas previously identified.

The grid connection proposal includes the requisite expansion of the existing Garona substation comprising the establishment of a 400 kV busbar, two 400 kV feeder bays, the extension of the 132 kV busbar to accommodate one initial 400/132 kV transformer and one future 400/132 kV transformer, the installation of a 500 MVA 400/132 kV transformer and the equipping and commissioning of a single 132 kV feeder bay.

Grid Connection Capacity

The grid connection and substation associated with the proposed 400 kV grid connection was previously assessed for a 132 kV overhead power line through the Environmental Impact

Assessment ('EIA') processes for the Solar PV facilities that have already received approval (Arcus, 2020).

This letter offers an avifaunal specialist opinion on the potential impacts associated with an increased capacity of the grid connection from 132 kV to 400 kV, noting that ACWA Power envisage only one of the original ten 132 kV overhead power lines previously assessed and authorised will be required.

Any habitat loss associated with an increase in servitude width would be negligible as the available habitats in surrounding landscape are largely contiguous and intact. Electrocution risk to birds from power lines is generally low for infrastructure with a capacity of 132 kV or more due to the larger sizes of the clearances between energised components when compared to smaller capacity power lines.

Collision risk with power lines remains the most important potential impact to consider regarding avifauna. However, many of the individual contributions of power line specific features (e.g. capacity, configuration, conductor cable diameter and height) to collision risk remain relatively poorly understood. In most cases individual contributions of each feature such as wire height cannot be dissociated from other features associated with voltage such as number and spacing of wires levels, span length, and cable diameter of conductors (etc.). Therefore studies assessing the impacts of power lines on various bird species most often consider both 132 kV and 400 kV power lines to be in the same 'high voltage transmission line' category[1,2] and assume that both pose similar risks to avifauna.

As bustards and cranes, particularly Ludwig's Bustard (relevant to this project) and Blue Crane (not relevant to this project) appear to dominate the tally of collision victims in South Africa[3] the results of Anderson (2002)[4] may be relevant. These results indicate that the increased capacity of the grid connection from 132 kV to 400 kV may impose a lower risk to bustards, as the study reported an average of 1.6 bustard fatalities per kilometre per year on a 132 kV line and 0.91 bustards per kilometre per year on a 400 kV line during 1997-1999 in the eastern karoo.

As the proposed servitude route for the 400 kV grid connection has already been assessed for avifaunal impacts by Arcus (albeit for a 132 kV overhead power line, Arcus 2020) and a recent site visit was conducted by the Arcus avifaunal specialist (December 2019), we are confident in our opinion that the proposed increase in the capacity of the grid connection from 132 kV to 400 kV will **not result in a material increase in the significance of impacts** to avifauna beyond those already assessed for the existing and approved environmental authorisation. **The impacts of a grid connection along the proposed route are considered to be of low significance for avifauna.**

When considering the potential impacts of the proposed increase in capacity of the grid connection it is important to not only consider the physical attributes of the grid connection infrastructure but also the position of the route in the context of the landscape, in this case particularly in relation to the existing and authorised infrastructure in the immediate surroundings.

The proposed power line route is relatively short and runs in close proximity to existing and authorised infrastructure. In the immediate vicinity, the proposed power line route runs near or adjacent to the operational Bokpoort CSP Solar facility, the existing Ferrum - Nieuwehoop 400 kV line, the existing Sishen-Saldanha railway, an existing road and the authorised and approved

[1] Jenkins, A., Shaw, J., Smallie, J., Gibbons, B., Visage, R., & Ryan, P. G. 2011. Estimating the impacts of power line collisions on Ludwig's Bustards Neotis ludwigii. Bird Conservation International, 21(3), 303-310. doi:10.1017/S0959270911000128

[2] Shaw, J. M., Reid, T. A., Schutgens, M., Jenkins, A. R., & Ryan, P. G. 2017. High power line collision mortality of threatened bustards at a regional scale in the Karoo, South Africa. Ibis, 160(2), 431–446. doi:10.1111/ibi.12553

[3] Shaw, J.M., T.A Reid, B.K Gibbons, M Pretorius, A.R Jenkins, R Visagie, M.D Michael, P.G Ryan. 2021. A large-scale experiment demonstrates that line marking reduces power line collision mortality for large terrestrial birds, but not bustards, in the Karoo, South Africa, Ornithological Applications, Volume 123, Issue 1.

[4] Anderson, M. D. 2002. The effectiveness of two different marking devices to reduce large terrestrial bird collisions with overhead electricity cables in the eastern Karoo, South Africa. Report 1. Karoo Large Terrestrial Bird Power line Project, Eskom, Johannesburg, South Africa.

Project DAO Solar PV Facilities (Figure 1). It is therefore likely that birds such as bustards will avoid the immediate area due to ongoing disturbance and be at a reduce risk of collision when approaching from multiple directions when compared to power lines traversing areas of open habitat. **The likelihood that a power line of any capacity along the proposed route would result in a significant negative impact on the avifauna in the area is therefore considered to be low.**

Both self-support towers and guyed or cross-rope towers have their pros and cons with respect to impacts on avifauna and either configuration is acceptable from an avifaunal perspective. Self-support towers are likely to attract nesting birds such as sociable weavers and other disturbance tolerant species that may find the structures suitable for the construction of their nests. Guyed and cross-rope do not provide as much structural support for nests as self-support towers, however they rely on additional support and guy wires which may increase the potential for collisions.

Expansion of the existing Garona Substation

The area immediately surrounding the existing Garona substation that would be the focus of the proposed expansion (i.e. directly north of the existing infrastructure, Figure 1) already experiences high levels of existing disturbance. Therefore any direct habitat loss associated with expansion of the substation would not have a significant negative impact on avifauna in the area, particularly regarding priority species as they have likely already been displaced from the area. Priority species are similarly unlikely to enter the substation yard and therefore impacts associated with collisions or electrocutions caused by electrical infrastructure are unlikely to be significant. The proposal for the expansion of the existing Garona substation to facilitate the grid connection can therefore be approved from an avifaunal perspective.

No additional avifaunal mitigation measures beyond those specified in the original avifaunal impact assessment (Arcus, 2020) are required for the scope of works required for the expansion of the Garona substation.

Loop-in-loop-out Route

The position of the proposed LILO overhead power line infrastructure to loop in to the existing Ferrum – Garona 400 kV overhead power line and loop out from the existing Garona – Niewehoop 400 kV overhead power line (Figure 1) is between a road, railway line and the operational Bokpoort solar facility and runs in close proximity to- or adjacent to existing overhead power line infrastructure. This position combined with the high levels of existing disturbance on the site make it unlikely that the proposed LILO grid connection route will significantly contribute to an increased cumulative negative impact on local avifauna, particularly with regards to priority species as they are unlikely to be present. Additional overhead power lines and towers have the potential to reduce the existing risks to avifauna (such as power line collisions) by increasing the visibility of the lines to avifauna if suitable line-marking devices (such as bird flight diverters) are used and if new pylons can be positioned in a staggered manner relative to the existing pylons.

The proposed LILO grid connection route is therefore acceptable from an avifaunal perspective following the implementation of the mitigation measures outlined in the original avifaunal impact assessment (Arcus, 2020) as well as those specified below.

Additional Mitigation Measures Required

The preferred pylon option from an avifaunal perspective would be whichever design achieves the lowest maximum height.

Should guyed pylons be constructed the supporting guy wires must be marked with suitable marking devices such as flappers or appropriate bird flight diverters.

All new spans of overhead power lines are to be fitted with appropriate bird flight diverters (i.e. on the earth wires) to reduce the risk of collisions should birds be attracted towards the solar facilities and associated infrastructure such as evaporation ponds.

Where the grid connection power line runs adjacent to an existing line, new pylon positions should be staggered between existing pylons (where practically possible given the limitations of the design and engineering requirements) to increase the visibility of both lines to birds and further reduce the risk of collisions.

Conclusions

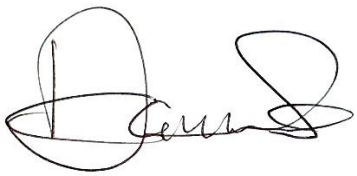
From an avifaunal perspective, the increase of the grid connection capacity from the previously assessed and authorised capacity of 132 kV to the proposed 400 kV overhead power line and associated substation requirements **will result in a low overall impact significance**. **The proposed grid connection power lines and substation expansion are therefore supported** provided that the mitigation measures originally specified in the Avifaunal Specialist Amendment Report (Arcus, 2020) and those detailed above are implemented accordingly and where applicable and practically possible.

Either Option 1 or Option 2 are equally acceptable from an avifaunal perspective as the proposed changes are unlikely to increase the significance of impacts to birds beyond those previously identified and authorised. Option 1 is nevertheless the preferred option as much of the existing disturbance associated with operational activities of the facilities present are concentrated in the area of the proposed Option 1 development.

In addition, the fact that ACWA Power currently envisions only one out of the ten currently authorised 132 kV overhead power lines will be required for the project would translate into an additional **reduction** in the risks imposed on birds from power lines previously assessed and authorised (if realised).

We trust this letter will provide the competent authority with sufficient information required to make an informed decision on the amendment application.

Yours Sincerely,



Dr Owen Rhys Davies *Pr. Sci. Nat.*
Avifaunal Specialist

ARCUS

- Existing Eskom Overhead Power Line
- Proposed Ferrum - Garona Loop In
- Proposed Garona - Niewehoop Loop Out
- Garona Substation Infrastructure
- Garona Substation (Current Extent)
- Garona Substation (Proposed Extension)

1:7 000 Scale @ A3

0 125 250 Meters

NORTH

Produced By: OD	Ref: 3570-LET-0003
Checked By: AB	Date: 2021/06/28

Proposed Grid Connection and Substation Expansion
Figure 1

Project DAO
Avifaunal Specialist Letter

S:\GIS\Projects\Older Projects\3570 Bokpoort Solar Amendment\3570-Bokpoort-Solar-Amendment.aprx\3570_Project_DAO_Lilo_Fig1.1

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

PROJECT DAO

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

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:	OWEN RHYS DAVIES			
Specialist Qualifications:	PHD ZOOLOGY (ORNITHOLOGY)			
Professional affiliation/registration:	SACNASP REG NO, 117555			
Physical address:	OFFICE 607 CUBE WORKSPACE ICON BUILDING CNR HANS STRIJDOIV AVE CPT			
Postal address:	AS ABOVE			
Postal code:	8001	Cell:	+27725580080	
Telephone:	+27214121529	Fax:	N/A	
E-mail:	OWEND@ARCUSCONSULTING.CO.ZA			

1. 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:

2021-06-25

Date

2. 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

2021-06-25
Date

7171859-1
at Simoni
Signature of the Commissioner of Oaths

2021-06-25
Date

SUID-AFRIKAANSE POLISIEDIENS
DIST. 3
STASIEVELVOERDER
25 JUN 2021
STATION COMMANDER
DIEPRIVIER, K.P./C.P.
SOUTH AFRICAN POLICE SERVICE

CURRICULUM VITAE

Dr Owen Davies Pr. Sci. Nat. (Ecology)

Senior 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 Beaufort West, Western Cape Province (Avifaunal monitoring, data analysis and reporting)
- Confidential WEF near Lutzville, Western Cape Province (Ecological assessment and reporting)
- Umsinde Emoyeni WEF (Avifaunal assessment, data analysis and reporting)
- Confidential WEF near Molteno, Northern Cape Province (Avifaunal monitoring data analysis and reporting)
- Confidential Battery Energy Storage System (BESS) near De Aar, Northern Cape Province (Avifaunal assessment, Ecological Assessment, site-walkthrough 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)
- Confidential WEF near Kuruman, Northern Cape Province (Ecological Assessment and reporting)
- Confidential WEF near Pofadder, Northern Cape Province (Avifaunal assessment and reporting)
- Confidential WEF near Nelspoort, Western Cape Province (Avifaunal assessment 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)
- 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 (Avifaunal assessment, bird observations, data analysis and reporting)

Publications

FJELDSÅ, J., DINESEN, L., DAVIES, O.R., IRESTEDT, M., KRABBE, N.K., HANSEN, L.A. AND BOWIE, R.C. 2021, Description of two new Cisticola species endemic to the marshes of the Kilombero floodplain of southwestern Tanzania. Ibis. Accepted Author Manuscript. https://doi.org/10.1111/ibi.12971

JUNKER, K., SPICKETT, A., DAVIES, O.R., JANSEN, R., KRASNOV, B. R. In Press. The effect of host sex and age on gastrointestinal nematodes in two galliform avian hosts from South Africa. Parasitology Research.

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.

CURRICULUM VITAE

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.

AVIFAUNAL SPECIALIST AMENDMENT REPORT FOR THE PROPOSED BOKPOORT II SOLAR FACILITY

On behalf of

Royal HaskoningDHV (Pty) Ltd

November 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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Regulation GNR 326 of 4 December 2014, as amended 7 April 2017, Appendix 6	**Section of Report**
(a) details of the specialist who prepared the report; and the expertise of that specialist to compile a specialist report including a *curriculum vitae*;	*Attached*
(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	*Attached*
(c) an indication of the scope of, and the purpose for which, the report was prepared;	*1*
(cA) an indication of the quality and age of base data used for the specialist report;	*2.2.1*
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	*2.3, 6*
(d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	*2.2*
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	*2*
(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;	*6*
(g) an identification of any areas to be avoided, including buffers;	*5, 6, Figure 3*
(h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	*Figure 3*
(i) a description of any assumptions made and any uncertainties or gaps in knowledge;	*1.2*
(j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment, or activities;	*4, 5, 6, 7*
(k) any mitigation measures for inclusion in the EMPr;	*6*
(l) any conditions for inclusion in the environmental authorisation;	*6*
(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	*6*
(n) a reasoned opinion— i. as to whether the proposed activity, activities or portions thereof should be authorised; iA. Regarding the acceptability of the proposed activity or activities; and 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 or Environmental Authorization, and where applicable, the closure plan;	*7*
(o) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	*N/A*
(p) any other information requested by the competent authority	*N/A*
Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	

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 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 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) 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, 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, the proposed amendment imposes a greater risk to birds as new substations 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 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 improvement of the habitat for certain important bird species such as coursers, francolins

[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.

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			

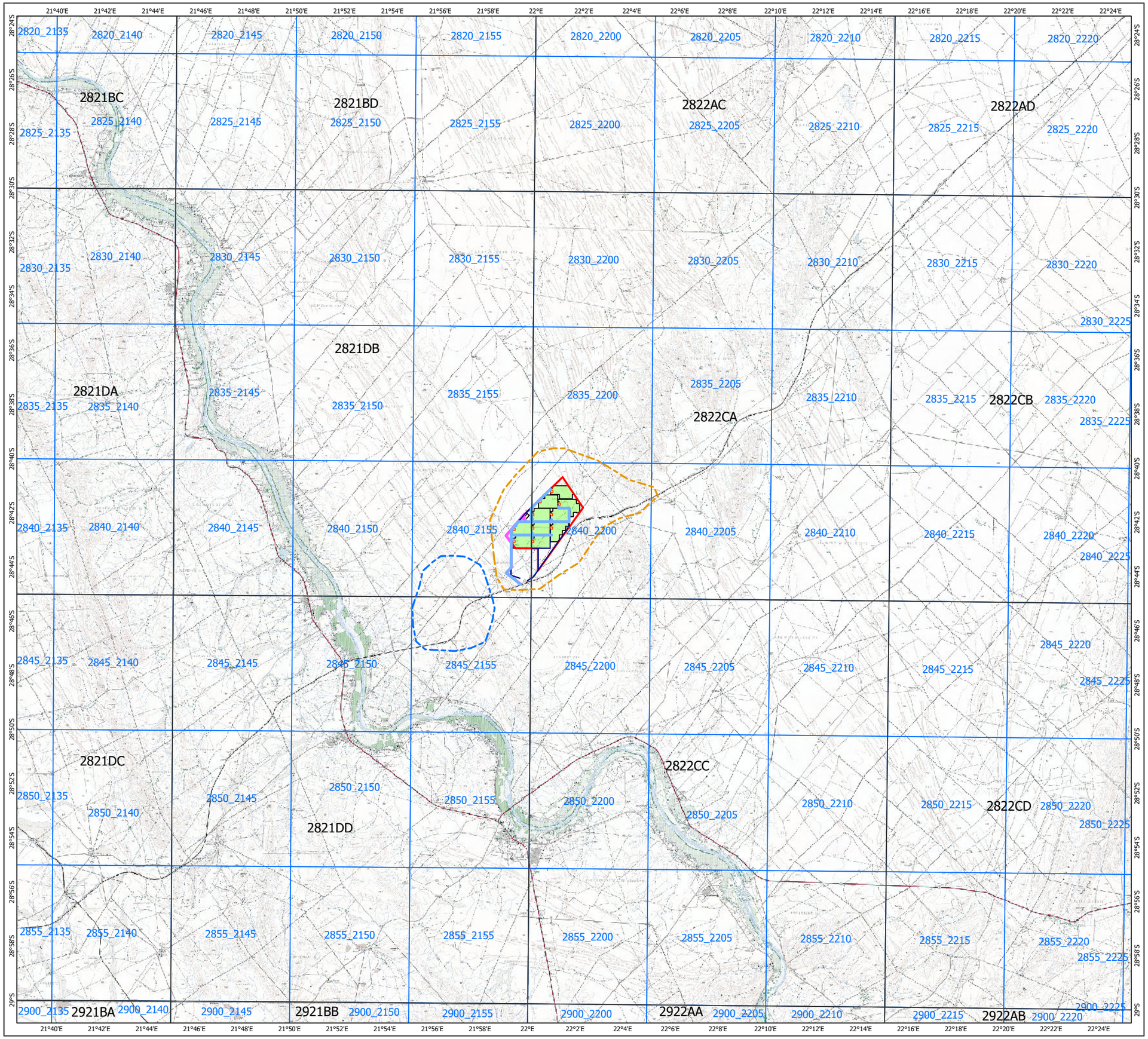
Alphabetical Name	Red Data	Ende-mism*	Arcus 2016	Jeal 2017	SABAP2 Reporting Rate %**										
					2845_2205	2845_2200	2845_2155	2845_2150	2840_2205	2840_2200	2840_2155	2840_2150	2835_2205	2835_2200	2835_2155
Swift, Bradfield's			X					14.3	33.3						
Swift, Common					28.6	25			33.3			20			
Swift, 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).



ARCUS

- Control Site
- Broader Project Area
- Quarter Degree Squares
- Pentads

1:250 000 Scale @ A3

0 5 10 km NORTH

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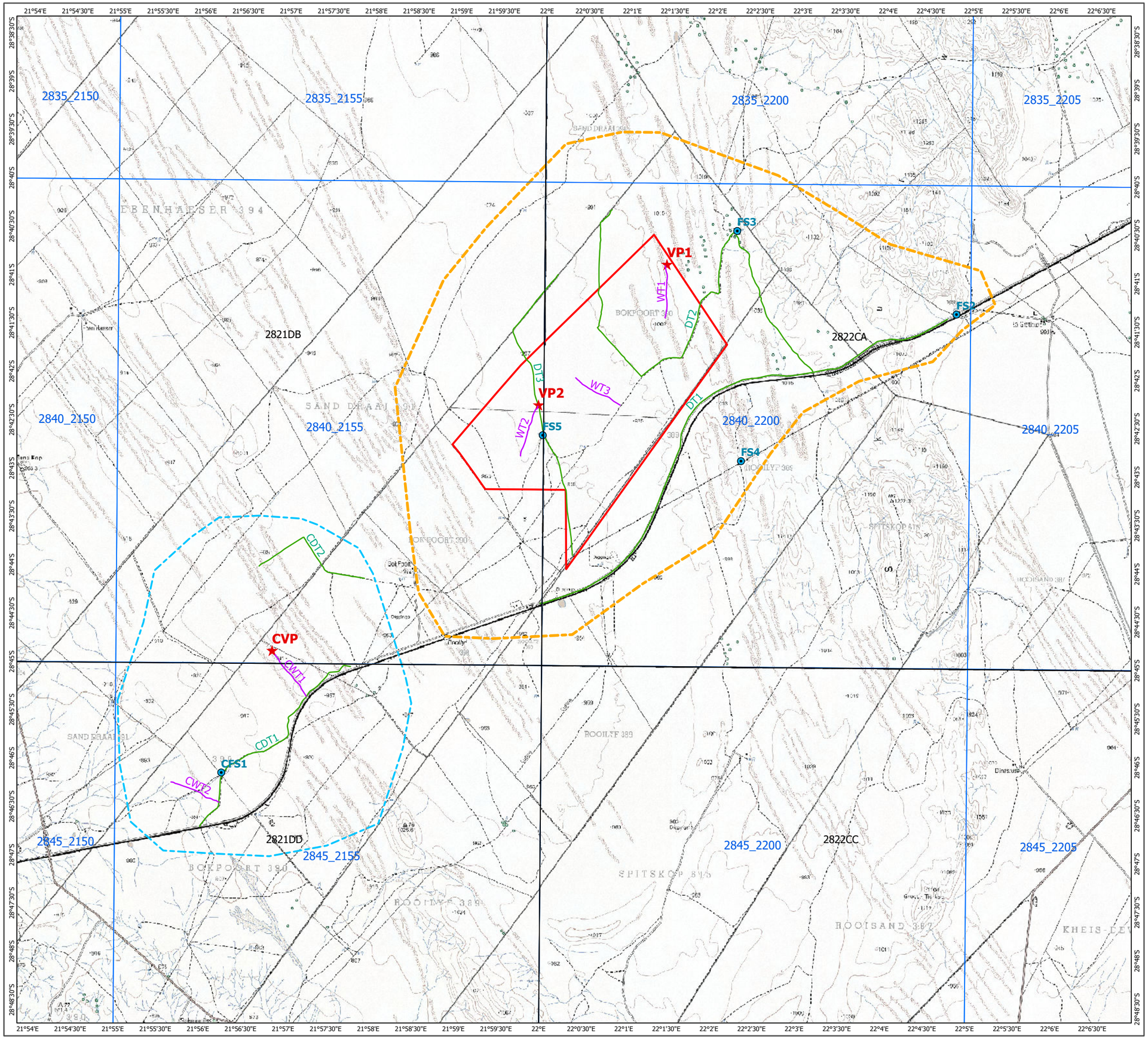
Project Site and Control Site Locations
Figure 1

BOKPOORT II SOLAR FARM AVIFAUNAL SPECIALIST AMENDMENT REPORT

C:\Users\Andrew\Documents\Owen Davies\3570 Bokpoort\3570-Bokpoort-Solar-Amendment\3570-Bokpoort-Solar-Amendment.aprx\3570_Bokpoort_Fig_1_Pentads



ARCUS

- Project Site
- Drive Transects
- Focal Sites
- Vantage Points
- Walk Transects
- Broader Project Area
- Control Site
- Pentads
- Quarter Degree Squares

1:70 000 Scale @ A3

0 1 2 km

NORTH

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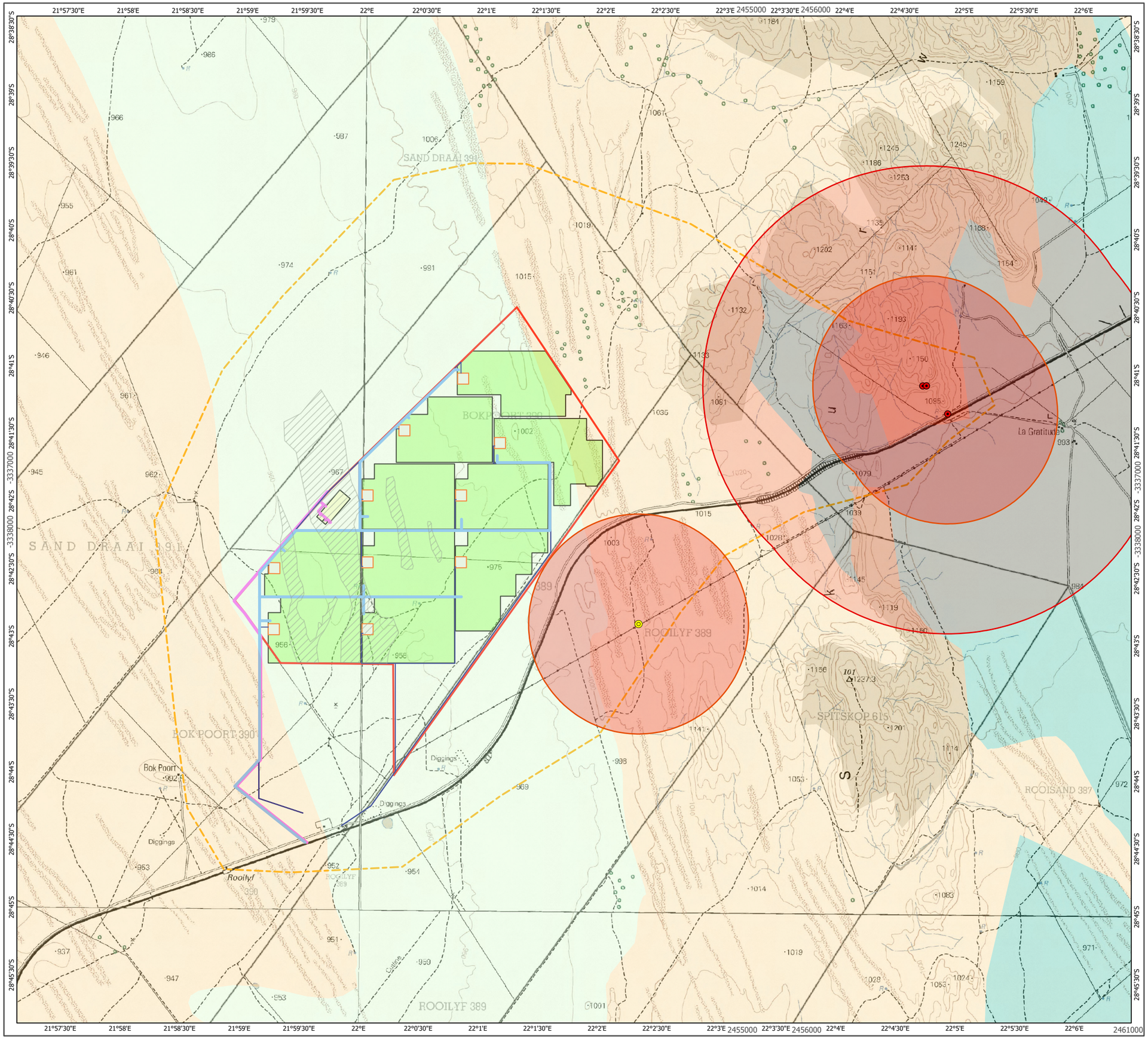
Pentads, QDS, and Monitoring Locations
Figure 2

BOKPOORT II SOLAR FARM AVIFAUNAL SPECIALIST AMENDMENT REPORT

C:\Users\Andrew\Documents\Owen Davies\3570 Bokpoort\3570-Bokpoort-Solar-Amendment\3570-Bokpoort-Solar-Amendment.aprx\3570_Bokpoort_Fig_2_Locations



ARCUS

- Verreaux's Eagle Nests
- Martial Eagle Nest (Old)
- 1.5 km Nest Buffer (Very High Sensitivity)
- 3 km Nest Buffer (High Sensitivity)
- Gravel Patches
- Gordonia Duneveld
- Kalahari Karroid Shrubland
- Koranna-Langeberg Mountain Bushveld
- Olifantshoek Plains Thornveld
- Broader Project Area
- Roads
- Overhead Powerlines
- Water Pipeline
- PV Plants
- Project Boundary
- Proposed Substations
- Temporary Contractors Facility

1:50 000 Scale @ A3

0 1 2 km

NORTH

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Checked By: AB	Date: 2020/11/23

Proposed Layout, Vegetation Types and Avifaunal Sensitivity Map
Figure 3

BOKPOORT II SOLAR FARM AVIFAUNAL SPECIALIST AMENDMENT REPORT

S:\GIS\Projects\Older Projects\3570 Bokpoort Solar Amendment\3570-Bokpoort-Solar-Amendment.aprx\3570_Bokpoort_Fig_3_Sensitivity

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

- Umsinde Emoyeni WEF (Avifaunal assessment, data analysis and reporting)
- 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)
- 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 (Avifaunal assessment, bird observations, data analysis and reporting)

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 C3:
Heritage