Appendix B5: Ecology

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

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

Kindly note the following:

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
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Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
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SOUTH AFRICAN POLICE SERVICE
COMMUNITY SERVICE CENTRE
2020 -02- 19
WIERDABRUG SAPS

1. SPECIALIST INFORMATION

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

2. DECLARATION BY THE SPECIALIST

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

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

Signature of the Specialist

Bathusi Environmental Consulting cc

Name of Company:

2020 / 02 / 18

Date

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

3. UNDERTAKING UNDER OATH/ AFFIRMATION

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

Signature of the Specialist

Bathusi Environmental Consulting cc

Name of Company

2020 / 02 / 18

Date

0232 7722
C 81
NO CHAUHCACA

Signature of the Commissioner of Oaths

2020-02-19

Date

SOUTH AFRICAN POLICE SERVICE
COMMUNITY SERVICE CENTRE
2020 -02- 19
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Reference:	RHD - BPT – 2020/02
Version:	2020.02.08.05
Date:	8th February 2020

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

THAT WILL BE SITUATED ON:

THE REMAINING EXTENT OF FARM BOKPOORT 390,

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

OF THE NORTHERN CAPE PROVINCE

{excluding avifauna and bats}

drafted by

BEC
Bathusi
Environmental
Consulting

this report was this report was prepared for:

Royal HaskoningDHV
Enhancing Society Together

DOCUMENT NAVIGATION

LIST OF TABLES

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1 PROJECT DETAILS

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

2 REPORT REFERENCE & CITATION

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

3 SPECIALIST INVESTIGATOR[1]

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

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

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

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

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

4 PROJECT SYNOPSIS AND BACKGROUND INFORMATION

4.1 BACKGROUND

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

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

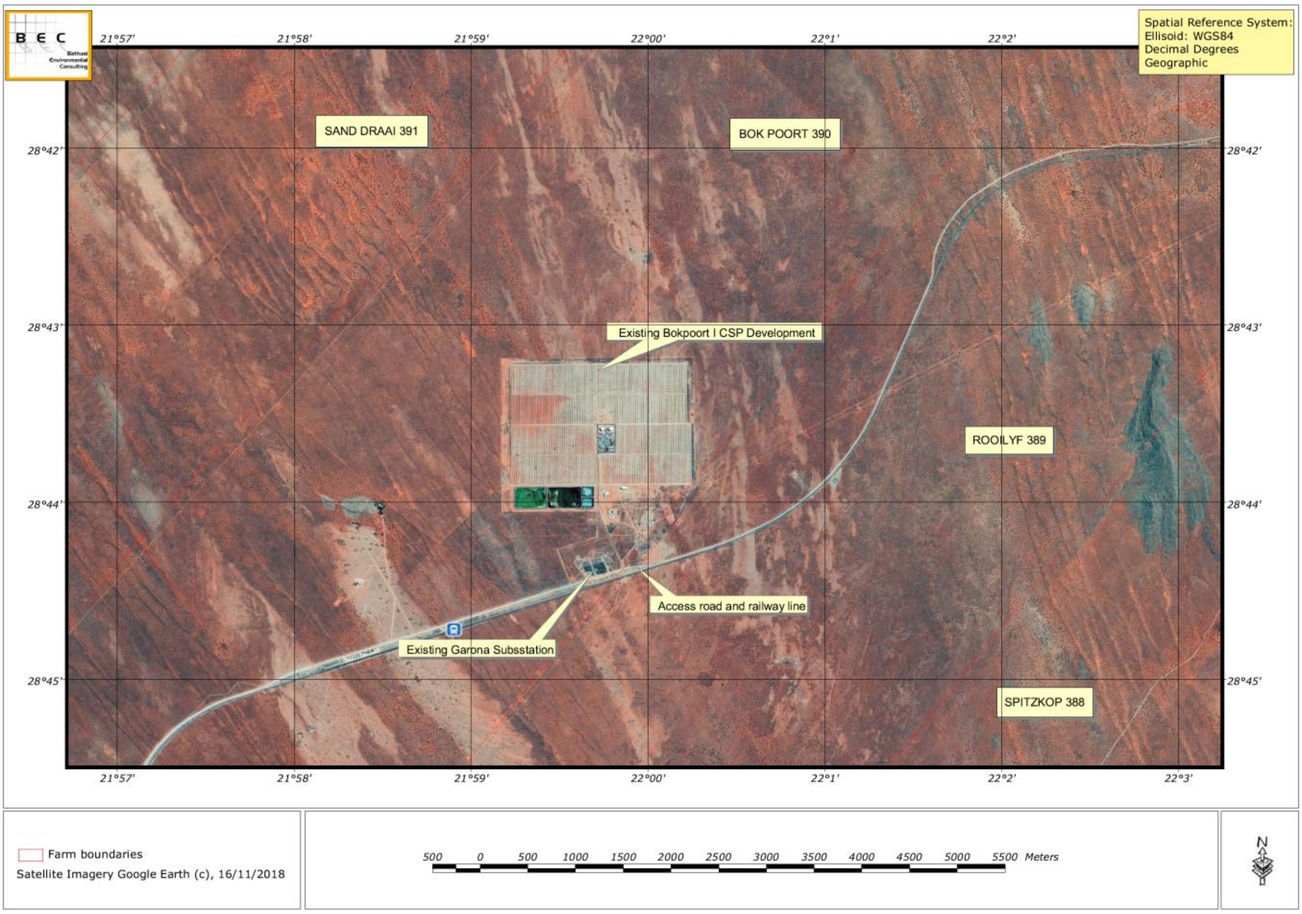


Figure 1: Satellite imagery that reflects the existing status of the site and immediate surrounds, indicating the operational Bokpoort I CSP Development

4.2 AMENDMENTS TO THE DEVELOPMENT

The proposed Bokpoort II development would originally have comprised a combination of Photovoltaic and Concentrated Solar Power Tower technology, including the respective phases Bokpoort II PV1, Bokpoort II PV2 and Bokpoort CSP (refer **Figure 2**). However, to allow for technical advancements and considerations, ACWA Power is now proposing an amendment to the project that will entail the construction of 8 PV plants within the CSP footprint with an output of 200 MW each, instead of the CSP tower. It should be noted that two of the proposed PV Plants (i.e. Ndebele and Xhosa, refer **Figure 3**) have already been authorised; however the authorisation for these two sites did not include the battery energy storage systems for either of the sites as well as the capacity increase from 75 to 200 MW and will be undergoing a separate BA study (refer **Figure 3**). The total area that will be required for the development will be 1,500 ha.

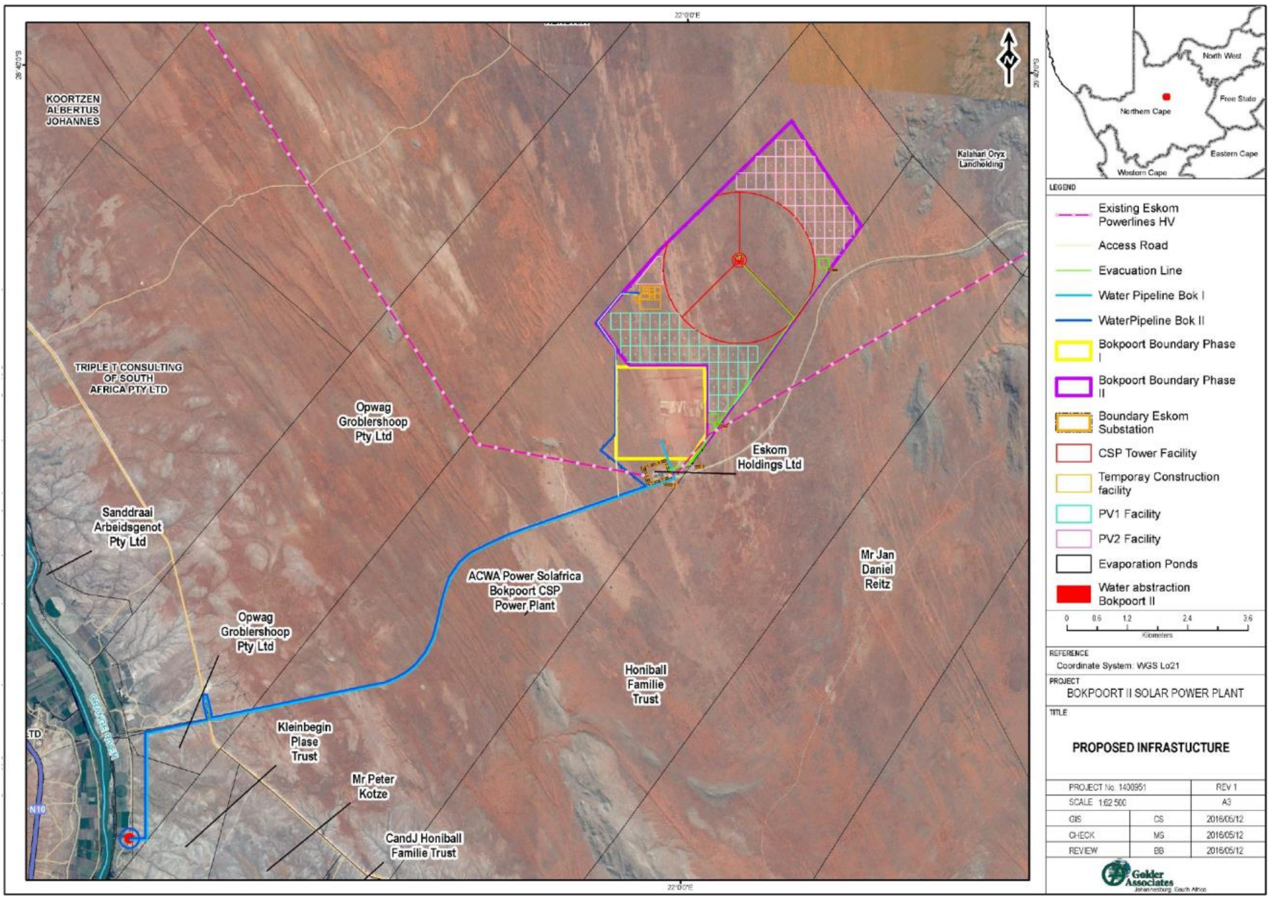


Figure 2: Initial layout of the Bokpoort II PV1, PV2 and CSP development footprint prior to amendment of the application
Image courtesy of Golder Associates

4.3 THE 200 MW PV SOLAR POWER PLANT DESIGN SPECIFICATIONS

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

⇒ Solar PV modules that will comprise of monocrystalline PV modules that will be able to deliver up to 200 MW to the Eskom National Grid;
⇒ Inverters that convert direct current (DC) generated by the PV modules into alternating current (AC) to be exported to the electrical grid;
⇒ A transformer that raises the system AC low voltage (LV) to medium voltage (MV). The transformer converts the voltage of the electricity generated by the PV panels to the correct voltage for delivery to Eskom;
⇒ Transformer substation;
⇒ Inclusion of a Battery Energy Storage System (BESS) on all 10 PV sites, with an anticipated storage capacity of 150 MW and a footprint of 16 ha on each of the 10 sites; and
⇒ Instrumentation and control consisting of hardware and software for remote plant monitoring and operation of the facility.

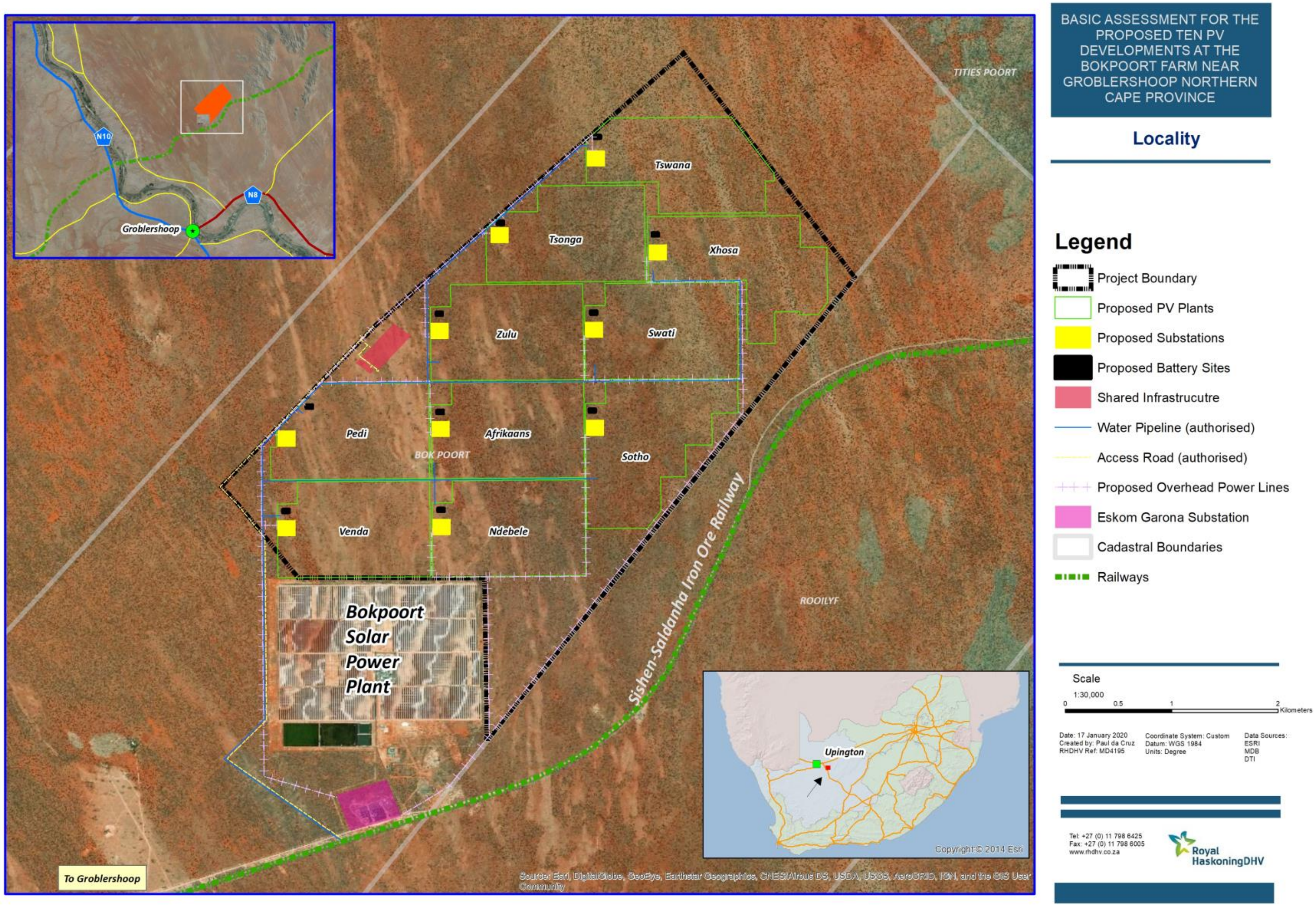


Figure 3: Proposed layout of the 200 MW PV Power Development, indicating the 10 PV footprints and appurtenant infrastructure

Appurtenant infrastructure:

⇒ Mounting structures for the solar panels;

⇒ Cabling between the structures, to be lain underground where practical;

⇒ A new 132 kV overhead power line which will connect the facility to the national grid via Eskom's existing Garona Substation;

⇒ The powerline will be approximately 5 km in length and will be located within a servitude spanning 15.5 meters on both sides. The powerline towers will be 35 meters high; and

⇒ Internal access roads (4 – 6 m wide) will be constructed where necessary, but existing roads will be used as far as possible, with appropriate fencing (approximately 3 m in height).

⇒ Shared infrastructure consisting of buildings, including a workshop area for maintenance, storage (i.e. fuel tanks, etc.), laydown area, parking, warehouse, and offices (previously approved).

Some physical dimensions:

⇒ The proposed total photovoltaic development will cover 1,500 ha in totality (development footprint);

⇒ The proposed solar facility will have the following infrastructure that are important in terms of height:
   - The PV panels disposition over support structures will be maximum 4.5 meters high; and
   - The substation will be 10 meters high;

⇒ The construction laydown area will be 5 ha; and

⇒ The proposed individual solar facility will generate 200 MW.

Battery Energy Storage System:

⇒ Battery power at the point of connection is 150 MW;

⇒ Footprint of each BESS site will be approximately 16 ha, i.e. 400 m x 400 m

⇒ The BESS will store approximately 4,500 m³ of hazardous substance; and

⇒ Water volumes during construction and operational phase will be approximately 22,000 m³.

4.4 THIS ASSESSMENT

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

1 present an overview of the ecological receiving environment that will be affected by the proposed PV development, also with reference to recent changes in available information sources; and

2 establish the impact on the biodiversity and ecological receiving environment that are relevant to the amended project.

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

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

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

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

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

5 EXECUTIVE SUMMARY

5.1 Biophysical Environment

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

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

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

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

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

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

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

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

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

5.2 Key Results of the Ecological Assessment

The following key results were obtained from the ecological assessments:

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

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

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

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

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

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

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

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

⇒ No amphibian species have been recorded within the study area. Taking cognisance of the absence of surface water within the proposed development footprint, it is regarded unlikely that any amphibian species will occur on site.
⇒ Eight reptile species were observed during the previous baseline studies (BEC, 2010).
⇒ A total of fifty-one (51) mammal species are considered potentially occupants of the study area. Fourteen (14) of these have been confirmed during field studies (RHV, 2014; BEC, 2010).

A review of the local and regional context of the Biodiversity Value that the site exhibit, indicated the following:
⇒ 3 plant species of conservation consideration (protected trees) have been recorded within the site; these trees occur at moderate densities and their removal is subject to permit authorisation (DEFF).
⇒ Several other plant taxa of local importance is known to occur in the site, their removal is subject to a detailed assessment and permit authorisation (NCDENC).
⇒ Several fauna species (excluding birds and bats) are regarded likely to persist within the site, or are known from surrounding localities. Anticipated impacts on these animals have been demonstrated as moderate and the mitigation approach should be dedicated to avoiding direct impacts on these animals.
⇒ Ecosystems of priority conservation concern that are relevant to this study, include the following:
  - The rocky outcrop to the north of the study area associated with the Koranna-Langeberg Mountain Bushveld Vegetation type. Apart from exhibiting intact ecological integrity in terms of vegetation community composition, it is an important area in terms of its support of roosting bat species, and is classified as Natural Habitat by IFC; and
  - The riparian habitat associated with the Orange River – this area supports the endangered vegetation type Lower Gariep Alluvial Vegetation, and has importance as an ecological corridor through the landscape. In addition, it is an important support area for foraging faunal species, including bats.
⇒ A review of the IFC criteria for natural and modified habitat indicated that only the Rocky outcrops and foothills of the Koranna Mountains to the north of the proposed site is categorised as natural habitat. As a result of persistent and intensive grazing and deterioration, the actual footprint of the development comprises largely modified habitat.
⇒ A review of IFC criteria for Critical Habitat indicated that only the Lower Gariep Alluvial Vegetation unit qualifies as Critical Habitat within the study area, under Criterion 4, and although it is not likely to be directly affected by this project, it is being considered in terms of Cumulative Impacts from the remainder of the project. No area within the development footprint is regarded Critical Habitat.

5.3 IMPACT ASSESSMENT AND SIGNIFICANCE

The proposed project is likely to result in significant, albeit localised impacts on the ecological receiving environment. Specific project impacts that could occur include:
⇒ Reduction in extent of habitats within the Project footprint;
⇒ Introduction and exacerbation of declared and invasive plant species;
⇒ Loss/disturbance of flora and fauna species of conservation concern;
⇒ Loss/disturbance of other fauna species;
⇒ Reduction in extent of Natural Habitat; and
⇒ Reduction in extent of Critical Habitat; and
⇒ Soil erosion and sediment loading of surface water runoff.

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

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

5.4 CONCLUDING REMARKS

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

This concluding statement is based on the following key considerations:

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

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

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

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

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

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

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

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

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

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

6 TERMS OF REFERENCE FOR THIS STUDY

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

⇒ Collate and appraise all relevant reports, studies, applications and EMPr documents pertaining to the project;

⇒ Provide a brief overview of the (regional and local scale) biophysical characteristics of the receiving environment;

⇒ Review the regional and local botanical and faunal diversity by means of a desk-top assessment of available historic reports;

⇒ Reflect on the potential presence of conservation important plant and animal species (excluding bats and birds) on the site (DAFF, IUCN, SANBI);

⇒ Establish sensitive biodiversity/ ecological receptors on the site that might be adversely affected by the proposed development;

⇒ Verify/ amend the Impact Statement presented as part of the principal ecological reports that is relevant to the project development footprint and the nature of the proposed development activity;

⇒ Provide a comprehensive mitigation approach and EMPr contributions that will ameliorate anticipated impacts on the ecological environment;

⇒ Provide monitoring recommendations that should be executed as part of the proposed project as part of the construction and operational phases;

⇒ Compile suitable maps, illustrating pertinent aspects; and

⇒ Present all results in a suitable report.

7 APPROACH AND METHODS STATEMENT

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

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

7.1 STUDY AREA

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

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

7.2 DESKTOP REVIEW AND GAP ANALYSIS

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

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

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

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

7.3 BASELINE DATA GATHERING

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

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

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

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

7.4 ASSESSMENT OF BIODIVERSITY VALUE

7.4.1 ECOSYSTEMS OF CONSERVATION CONCERN

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

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

7.4.2 *Species of Conservation Concern*

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

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

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

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

7.4.3 *Natural, Modified and Critical Habitat*

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

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

7.5 Impact Assessment

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

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

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

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

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

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

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

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

8 LIMITATIONS AND ASSUMPTIONS

It is assumed that:

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

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

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

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

9 SITE LOCATION

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

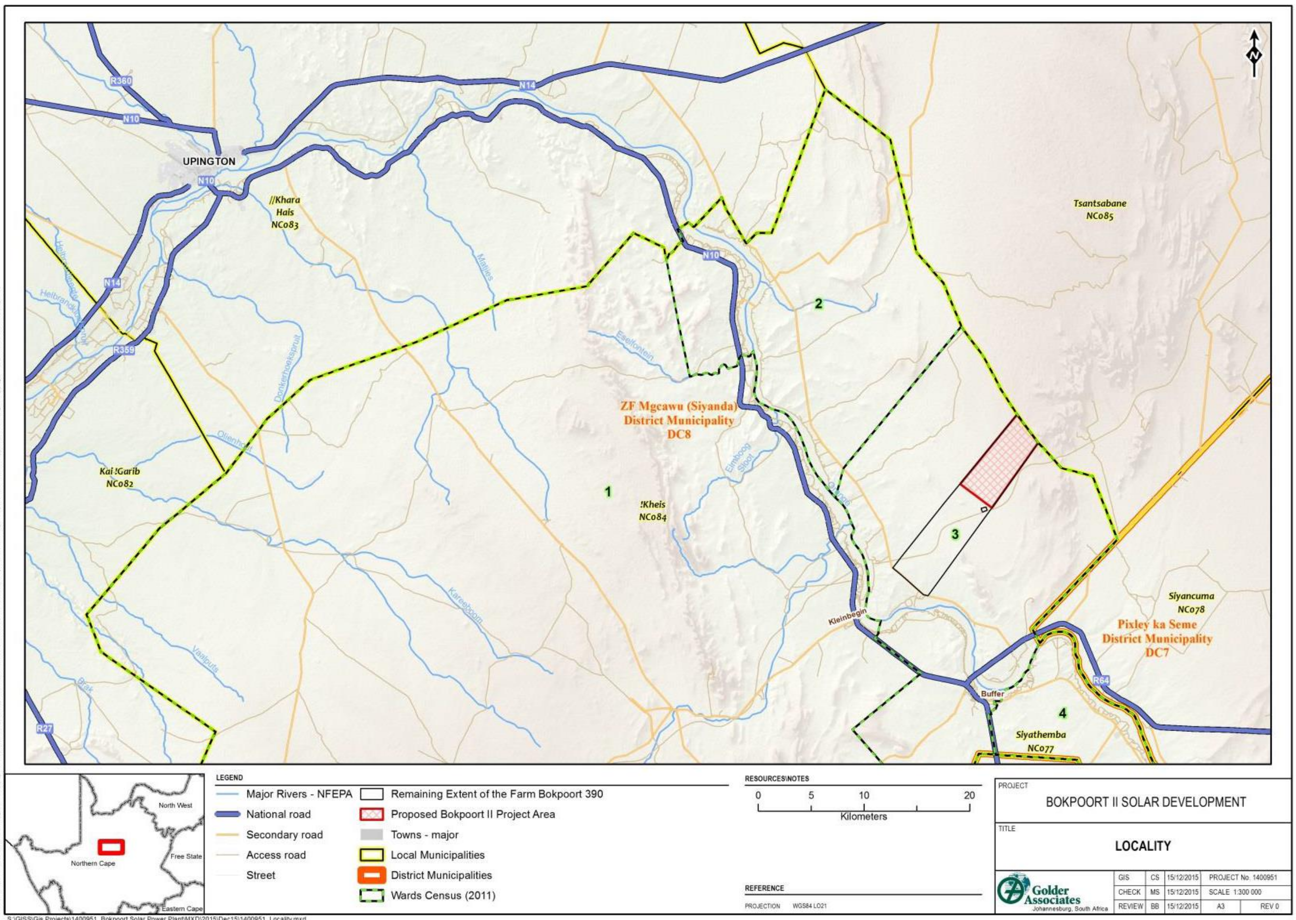


Figure 4: Geographic location of the proposed Bokpoort II: 200 MW PV Power Development

10 LAND COVER & LAND USE OF THE REGION

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

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

11 SOILS & GEOLOGY

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

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

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

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

12 CLIMATE

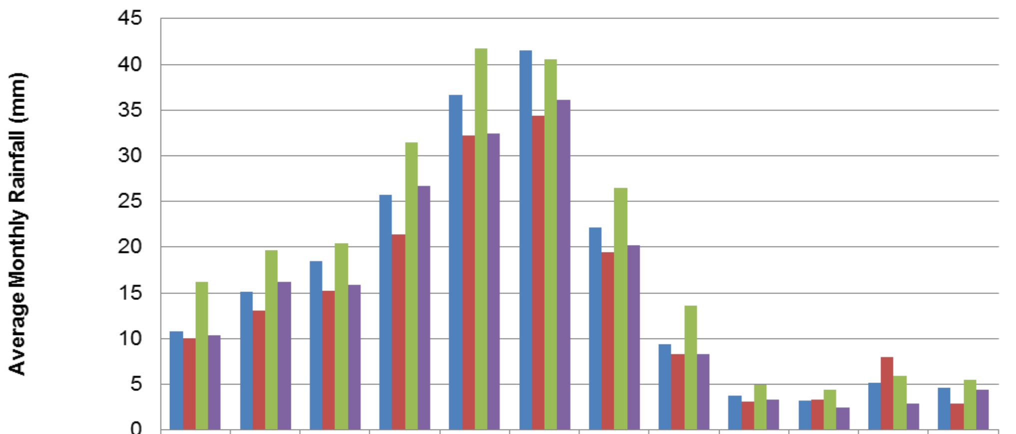
Climate data in the area around the project site was sourced from the Daily Rainfall Extraction Utility (Kunz, 2004) and the Department of Water and Sanitation's website (Department of Water Affairs, 2008).

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

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

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

[2] Graphs and figures courtesy of Golder Associates



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

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

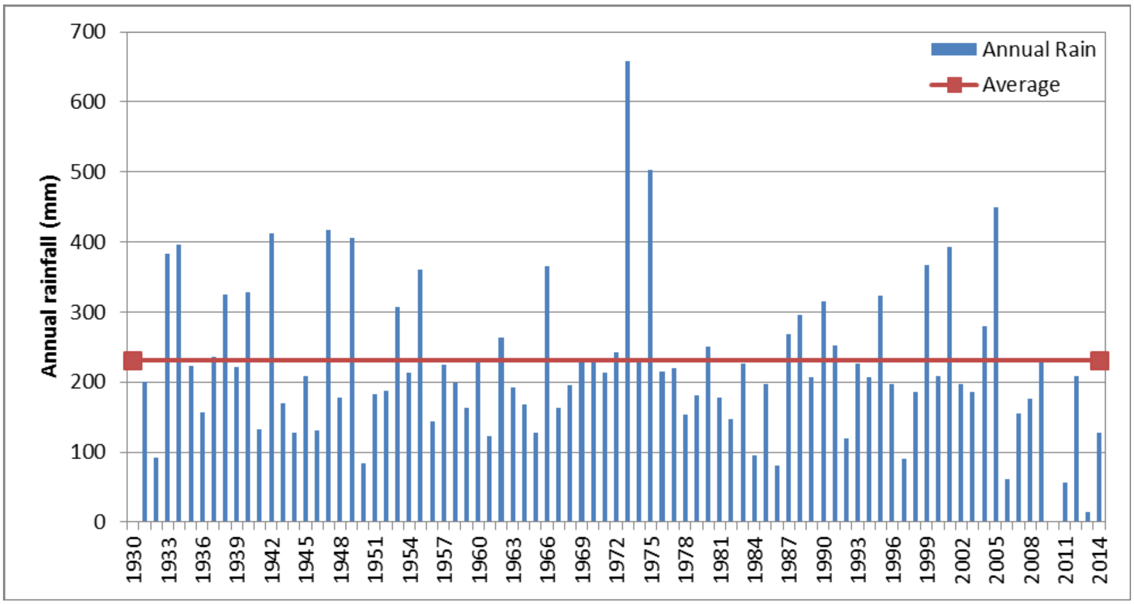


Figure 6: Annual rainfall recorded at the D7E001 (Boegoeberg Dam) station

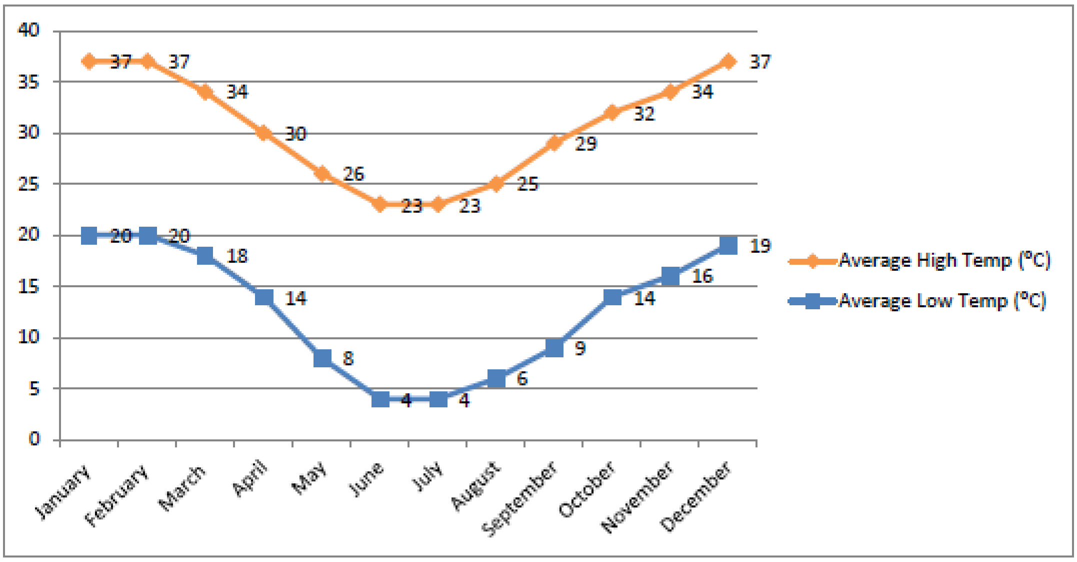


Figure 7: Average temperature (°C) graph for Groblershoop

13 TOPOGRAPHY, RELIEF AND SLOPES

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

14 PROTECTED AREAS & THREATENED ECOSYSTEMS

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

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

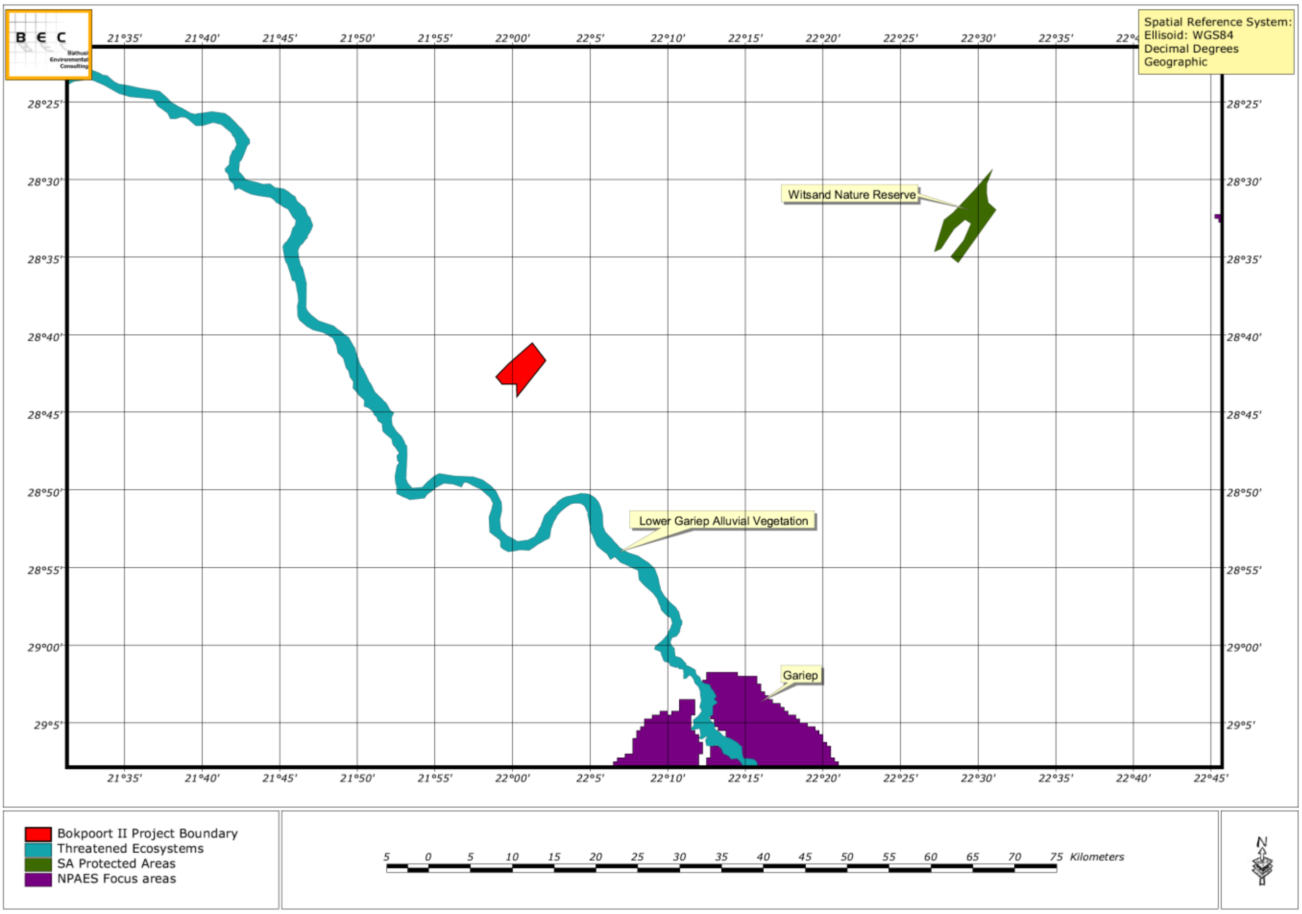


Figure 8: Protected and conservation important areas in relation to the study area

15 BASELINE BIODIVERSITY CHARACTERISATION

15.1 REGIONAL VEGETATION TYPES

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

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

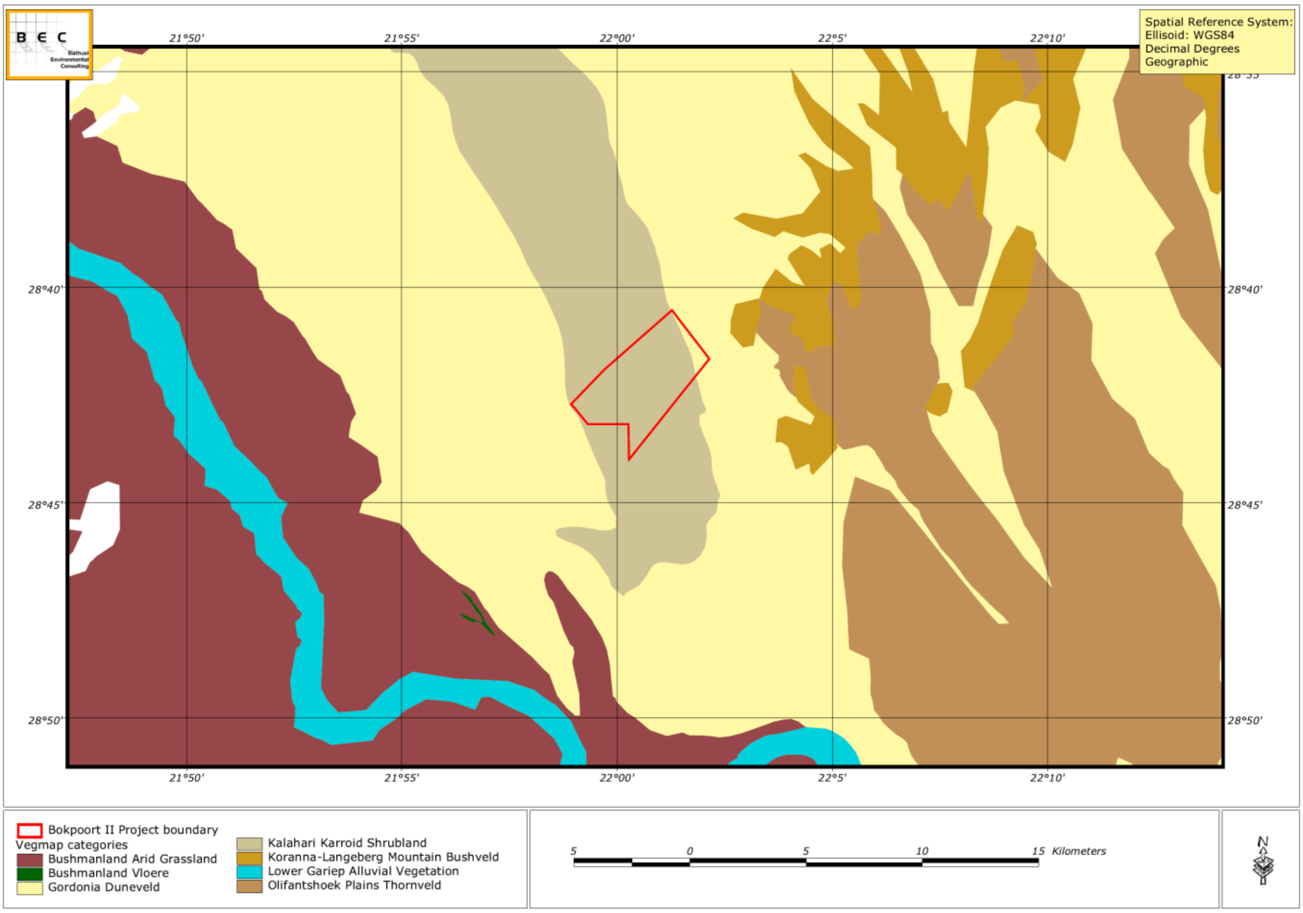


Figure 9: Regional ecological types in spatial relation to the study area

15.1.2 KALAHARI KARROID SHRUBLAND (NKB5)

This vegetation type occurs in the Northern Cape Province, forming part of the Nama Karoo Biome (Bushmanland Bioregion), typically forming belts alternating with belts of Gordonia Duneveld on plains northwest of Upington through Lutzputs and Noenieput to the Rietfontein/ Mier area in the north. Other patches occur around Kakamas and north of Groblershoop. The unit is also found in the neighbouring Namibia. The vegetation and landscape features are typically low karroid shrubland on flat, gravel plains. Karoo-related elements (shrubs) meet here with northern floristic elements, indicating a transition to the Kalahari region and sandy soils. The geographically important taxon (South-western distribution limit) graminoid *Dinebra retroflexa* is present in this unit.

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

Important taxa that characterise this unit include the following:

Small Trees	*Acacia*[3] *mellifera* subsp. *detinens, Parkinsonia africana* and *Boscia foetida* subsp. *foetida.*
Tall shrub	*Rhigozum trichotomum*
Epiphytic Semiparasitic shrub -	*Tapinanthus oleifolius*
Low Shrubs	*Hermannia spinosa, Limeum aethiopicum, Phaeoptilum spinosum, Aizoon schellenbergii, Aptosimum albomarginatum, A. lineare, A. marlothii, A. spinescens, Barleria rigida, Hermannia modesta, Indigofera heterotricha, Leucosphaera bainesii, Monechma genistifolium* subsp. *genistifolium, Phyllanthus maderaspatensis, Polygala seminuda, Ptycholobium biflorum* subsp. *biflorum, Sericocoma avolans, Solanum capense* and *Tephrosia dregeana.*
Herbs	*Dicoma capensis, Chamaesyce inaequilatera, Amaranthus praetermissus, Barleria lichtensteiniana, Chamaesyce glanduligera, Chascanum garipense, Cleome angustifolia* subsp. *diandra, Cucumis africanus, Geigeria ornativa, Hermannia abrotanoides, Indigastrum argyraeum, Indigofera alternans, I. auricoma, Kohautia cynanchica, Limeum argutecarinatum, Mollugo cerviana, Monsonia umbellata, Sesamum capense, Tribulus cristatus, T. pterophorus* and *T. terrestris.*
Succulent Herbs	*Gisekia africana, G. pharnacioides* and *Trianthema parvifolia.*
Graminoids	*Aristida adscensionis, Enneapogon desvauxii, E. scaber, Stipagrostis obtusa, Aristida congesta, Enneapogon cenchroides, Eragrostis annulata, E. homomalla, E. porosa, Schmidtia kalahariensis, Stipagrostis anomala, S. ciliata, S. hochstetteriana, S. uniplumis, Tragus berteronianus* and *T. racemosus.*

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

15.1.3 GORDONIA DUNEVELD N(SVKD1)

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

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

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

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

Important taxa include the following:

Small Tree	*Acacia mellifera* subsp. *detinens*
Tall Shrubs	*Grewia flava* and *Rhigozum trichotomum.*
Low Shrubs	*Aptosimum albomarginatum, Monechma incanum* and *Requienia sphaerosperma.*
Succulent Shrubs	*Lycium bosciifolium, L. pumilum* and *Talinum caffrum.*
Graminoids	*Schmidtia kalahariensis, Brachiaria glomerata, Bulbostylis hispidula, Centropodia glauca, Eragrostis lehmanniana, Stipagrostis ciliata, S. obtusa* and *S. uniplumis.*
Herbs	*Hermbstaedtia fleckii, Acanthosicyos naudinianus, Hermannia tomentosa, Limeum arenicolum, L. argute-carinatum, Oxygonum dregeanum* subsp. *canescens* var. *canescens, Sericorema remotiflora, Sesamum triphyllum* and *Tribulus zeyheri.*

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

15.2 REGIONAL FLORISTIC DIVERSITY (SANBI, 2010)

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

Table 3: Extent of biomes within the Northern Cape Province

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

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

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

The SANBI database indicates the known presence of approximately 5,315 plant species within Northern Cape Province, with only 91 species within the ¼ degree grids in which the study site is located (2821DB, DD, 2822CA). This low diversity reflects a paucity of floristic knowledge of the region. The species diversity of the immediate region comprises a diversity of growth forms, and is typically dominated by herbs, dwarf shrubs and grasses. Trees and tall shrubs comprise a relative low part of the total, reflecting on the open savanna/ shrubland physiognomy of the region.

15.3 VEGETATION OF THE STUDY AREA

15.3.1 ALPHA DIVERSITY OF THE STUDY AREA

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

Table 4: Growth forms for the study area

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

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

15.3.2 DECLARED INVASIVE SPECIES AND COMMON WEEDS

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

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

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

15.3.3 PLANTS WITH TRADITIONAL MEDICINAL USES

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

Table 6: List of traditional and medicinal uses within the study area		
Species Name	*Status/ Uses*	*Common Name*
Acacia erioloba	Declining Status, Protected Tree (National Forest Act, 1998), edible parts, medicinal uses, firewood	Camel Thorn (e), Kameeldoring (a)
Acacia mellifera	Declared indicator of encroachment, medicinal uses, poison source	Black Thorn (e), Swarthaak (a)
Adenium oleifolium	Poisonous parts	Sand Quick (e)
Aptosimum procumbens	Medicinal uses (sheep)	
Boscia albitrunca (Burch.) Gilg & Gilg-Ben.	Protected Tree (National Forest Act, 1998), important fodder, traditional uses, traditional medicinal uses	Sheperd's Tree (e), Witgat (a), Matoppie (a), Mohlopi (ns)
Cadaba aphylla (Thunb.) Wild	Medicinal properties, potentially poisonous	Desert Spray (e), Bobbejaanarm (a)
Ceratotheca triloba (Bernh.) Hook.f.	Medicinal properties	Wild Foxglove (e), Vingerhoedblom (a)
Croton gratissimus	Medicinal uses, larval food for *Charaxes candiope candiope*	Lavender fever-berry (e), Laventelkoorsbessie (a)
Dicoma capensis	Medicinal uses	Koorsbossie (a)
Gomphocarpus fruticosus (L.) Aiton f.	Medicinal uses, common weed	Milkweed (e), Melkbos (a)
Grewia flava DC.	Edible parts, weaving, traditional uses, declared indicator of encroachment	Velvet Raisin (e), Fluweelrosyntjiebos (a)
Kleinia longiflora DC.	Traditional uses	Sjambokbos (a)
Momordica balsamina L.	Edible parts, medicinal uses	Balsam Pear (e), Laloentjie (a), Balsam Peer (a)
Monechma genistifolium subsp. *australe*	Medicinal uses	Medicinal uses, traditional uses
Pergularia daemia	Medicinal uses	Bobbejaankambro (a), Kgaba
Plinthus sericeus	None	--
Senna italica	Medicinal uses	Wild senna (e), Elandsertjie (a)
Solanum supinum Dunal	Medicinal uses	
Tribulus terrestris L.	Medicinal uses	Common Dubbeltjie (e), Gewone Dubbeltjie (a)
Tribulus zeyheri	Medicinal uses, grazed but potentially poisonous	Devil-thorn Weed (e), Dubbeltjiedoring (a)
Ziziphus mucronata Willd. subsp. *mucronata*	Edible parts, traditional medicinal uses, traditional uses	Buffalo-thorn (e), Blinkblaar-wag-'n-bietjie (a)

15.4 BROAD-SCALE HABITAT TYPES

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

⇒ Calcareous Low Shrub Plains;

⇒ Open Shrub Duneveld;

⇒ Open Shrub Plains;

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

Table 7: Extent of habitat types within the study area		
Habitat Type	*Extent (ha)*	*Percentage*
Calcareous Low Shrub Plains	494.8 ha	34.2 %
Open Shrub Duneveld	288.0 ha	19.9 %
Open Shrub Plains	664.6 ha	45.9 %

15.4.1 CALCAREOUS LOW SHRUB PLAINS

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

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

Table 8: Plant taxa recorded within the Calcareous Low Shrub Plains unit		
Species Name	*Growth Form*	*Family*
Acacia erioloba	Tree	Fabaceae
Acacia haematoxylon	Tree	Fabaceae
Acacia mellifera	Shrub	Fabaceae
Anthephora pubescens	Grass	Poaceae
Aptosimum procumbens	Forb	Scrophulariaceae
Aristida congesta subsp. *congesta*	Grass	Poaceae
Aristida stipitata	Grass	Poaceae
Asparagus laricinus	Shrub	Liliaceae
Asparagus species	Shrub	Liliaceae
Acacia mellifera	Shrub	Fabaceae
Adenium oleifolium	Succulent	Apocynaceae
Aristida congesta subsp. *congesta*	Grass	Poaceae
Barleria species	Forb	Acanthaceae
Boscia albitrunca	Tree	Capparaceae
Cenchrus ciliaris	Grass	Poaceae
Chrysocoma obtusata	Forb	Asteraceae
Enneapogon desvauxii	Grass	Poaceae
Eragrostis obtusa	Grass	Poaceae
Eragrostis truncata	Grass	Poaceae
Eriocephalus spinescens	Forb	Asteraceae
Fingerhuthia africana	Grass	Poaceae
Geigeria species	Forb	Asteraceae
Lycium bosciifolium	Shrub	Solanaceae
Lycium horridum	Shrub	Solanaceae
Monechma genistifolium subsp. *australe*	Forb	Acanthaceae
Nerine laticoma	Geophyte	Amaryllidaceae
Pentzia calcarea	Forb	Asteraceae
Rhigozum trichotomum	Shrub	Bignoniaceae

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

15.4.2 Open Shrub Duneveld

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

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

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

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

Table 9: Plant taxa recorded in the Open Shrub Duneveld unit

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

15.4.3 *Open Shrub Plains*

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

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

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

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

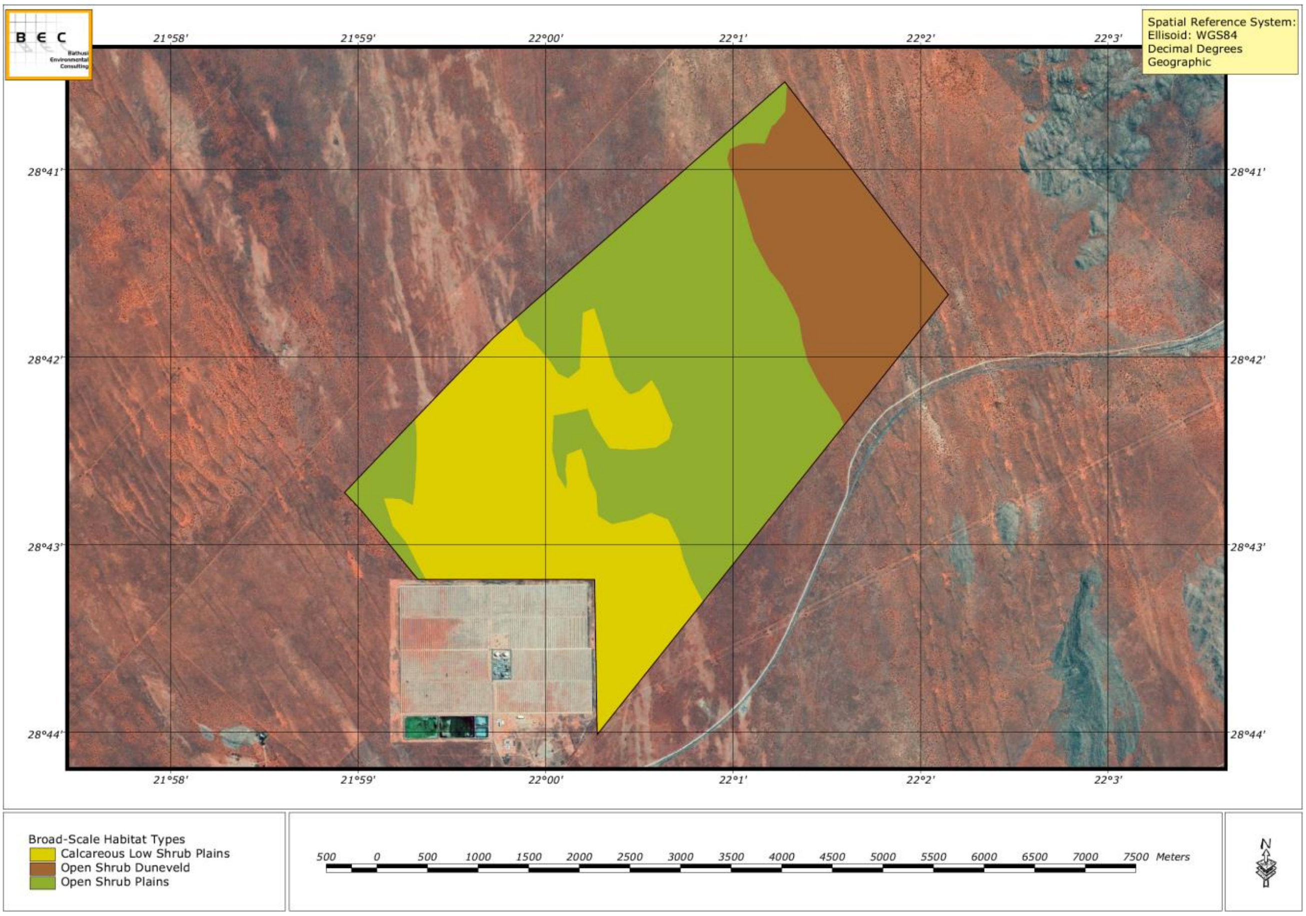


Figure 10: Broad-scale habitat types of the study area

Example of Open shrub duneveld habitat

Example of Open shrub duneveld habitat

Example of Opens shrub plains habitat

Example of Calcareous low shrub plains

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

Opens shrub plains habitat

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

16 FAUNAL ATTRIBUTES OT HE STUDY AREA

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

16.1 INVERTEBRATES

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

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

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

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

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

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

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

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

16.2 HERPETOFAUNA – AMPHIBIANS AND REPTILES

16.2.1 AMPHIBIANS

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

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

16.2.2 REPTILES

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

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

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

16.2.3 *MAMMALS (EXCLUDING BIRDS AND BATS)*

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

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

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

Table 15: Mammal taxa of the region, with Probability of Occurrence					
		Conservation Status			
Scientific Name	*Common Name*	IUCN - Regional status	NEMBA TOPS List	Northern Cape NCA	*Probability of Occurrence*
Felis nigripes	Black-footed Cat		Protected	Specially Protected	Possible – it is a specialist of open, short grass areas with an abundance of small rodents and ground-roosting birds. It inhabits dry, open savanna, grasslands and Karoo semi-desert with sparse shrub and tree cover (Sliwa, 2008), which are a feature of the Study Area
Felis sylvestris	African wild cat			Specially Protected	Possible – wide habitat tolerance (Stuart & Stuart, 2007)
Atilax paludinosus	**Water Mongoose**			**Protected**	**Confirmed (DHV, 2014)**
Cynictis penicillata	**Yellow Mongoose**			**Protected**	**Confirmed (BEC, 2010)**
Galerella sanguinea	**Slender Mongoose**			**Protected**	**Confirmed (BEC, 2010)**
Galerella pulverulenta	Small Grey Mongoose			Protected	Probable – very wide habitat tolerance includes open scrub (Stuart & Stuart, 2007)
Suricata suricatta	Suricate			Protected	Probable – its preferred habitat is arid, open country, characterised by short grasses and sparse woody growth, which characterises the Study Area
Parahyaena brunnea	Brown Hyena	Near Threatened	Protected	Specially Protected	Probable – inhabits dry areas, generally with annual rainfall less than 100 mm, particularly along the coast, in semidesert, open scrub and open woodland savanna
Hystrix africaeaustralis	**Porcupine**				**Confirmed (BEC, 2010)**
Lepus capensis	**Cape Hare**			**Protected**	**Confirmed (DHV, 2014)**
Lepus saxatilis	**Scrub Hare**			**Protected**	**Confirmed (BEC, 2010)**
Macroscelides proboscideus	Karoo Round-eared Sengi			Protected	Probable – a habitat specialist, which occupies gravel plains (Rathbun & Smit-Robinson, 2015a) such as those present within the Study Area associated with the Kalahari Karroid Shrubland vegetation type
Elephantulus rupestris	Western Rock Sengi			Protected	Possible – occupies arid habitats including dry savanna and shrubland, and is typically associated with rocky ridges, outcrops or koppies (Rathbun & Smit- Robinson, 2015b)
Elephantulus intufi	Bushveld Sengi	Data Deficient		Protected	Unlikely – prefers very arid terrain and semi-desert (Rathbun, 2015)
Manis temminckii	Ground Pangolin	Vulnerable	Vulnerable	Specially Protected	Unlikely - inhabits mainly savanna woodland in lowlying regions with moderate to dense scrub, and is not present in arid areas or deserts (Pietersen et al., 2014)
Aethomys chrysophilus	Red Rock Rat			Protected	Unlikely – typically a savanna species (Agwanda et al., 2008)
Desmodillus auricularis	Cape Shorttailed Gerbil			Protected	Probable - inhabits arid gravel plains and areas of hardened sand (Coetzee, 2008)

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

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

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

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

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

c

Slender mongoose

Rock monitor

Cape fox

Agama species

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

17 ASSESSMENT OF BIODIVERSITY VALUE

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

17.1 SPECIES OF CONSERVATION CONSIDERATION

17.1.1 FLORA

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

Table 16: Conservation important flora species for the region

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

17.1.2 FAUNA

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

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

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

17.2 Ecosystems of Conservation Value

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

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

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

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

17.3 NATURAL AND MODIFIED HABITATS

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

Table 18: Natural and modified habitat types (IFC Criteria)		
Broad-scale habitat type	*IFC Natural/ Modified*	*Comment*
Calcareous low shrub plains	Modified	Considered relatively degraded due to livestock grazing pressure.
Open shrub plains	Modified	Considered relatively degraded due to livestock grazing pressure.
Open shrub duneveld	Modified	Although previously found to be representative of the Gordonia Duneveld type (BEC, 2010), this unit was found to be degraded due to persistent livestock grazing since then
Rocky outcrop/foothills	Natural	Assessed as being in pristine condition.
Transformed areas	Modified	Areas already transformed through vegetation clearance and construction activity are considered modified.

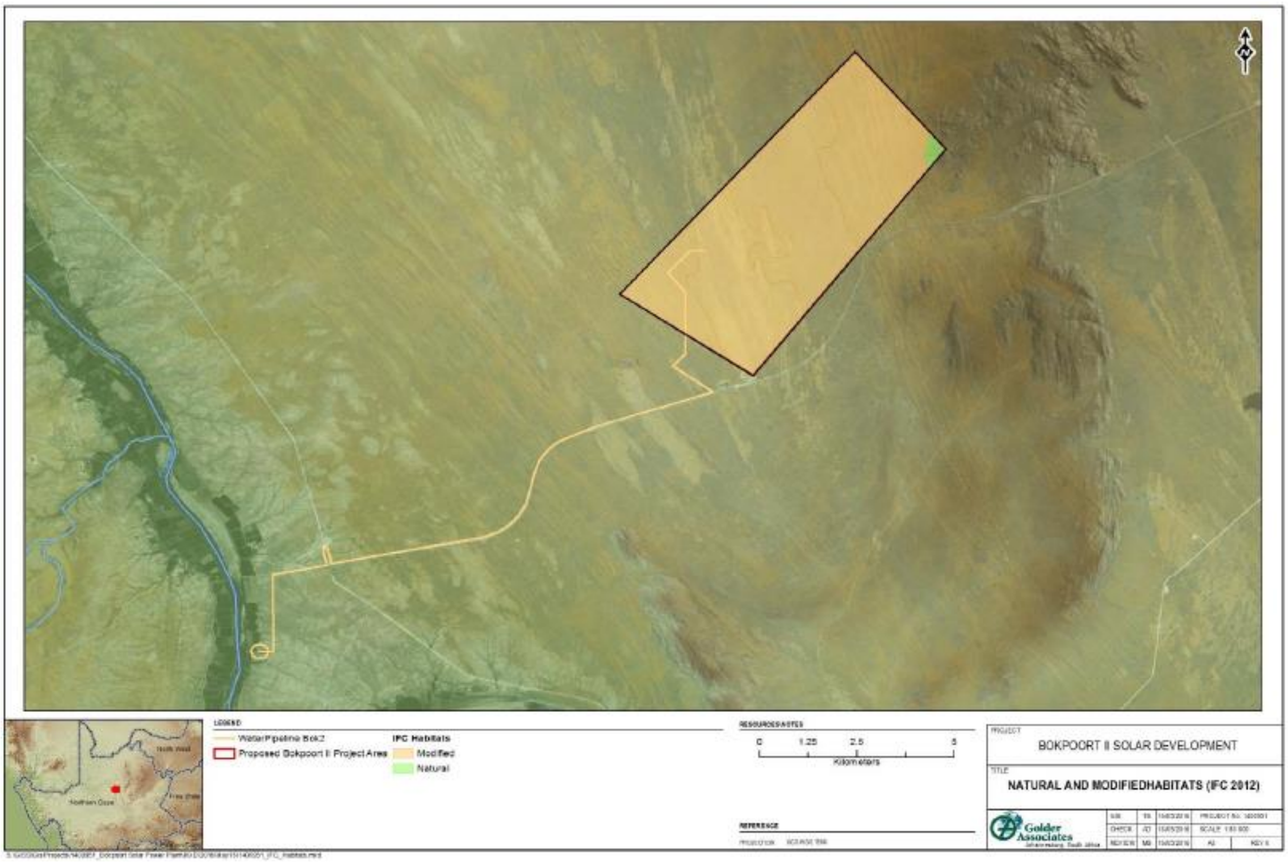


Figure 13: Illustration of modified vs remaining natural habitat according to IFC Criteria

17.4 CRITICAL HABITAT

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

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

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

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

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

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

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

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

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

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

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

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

18 BIODIVERSITY IMPACT ASSESSMENT

18.1 PREDICTED IMPACTS

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

18.1.1 *IDENTIFIED IMPACTS FOR THE CONSTRUCTION PHASE*

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

⇒ Reduction in extent of habitats within the Project footprint;

⇒ Introduction and exacerbation of declared and invasive plant species;

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

⇒ Loss/disturbance of other fauna species;

⇒ Reduction in extent of Natural Habitat; and

⇒ Reduction in extent of Critical Habitat; and

⇒ Soil erosion and sediment loading of surface water runoff.

18.1.2 *IDENTIFIED IMPACTS FOR THE OPERATIONAL PHASE*

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

⇒ Spread of invasive species; and

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

18.1.3 *IDENTIFIED IMPACTS FOR THE DECOMMISSIONING/CLOSURE PHASE*

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

⇒ Spread of invasive species;

⇒ Soil erosion and loss/disturbance of ecosystems of conservation concern.

18.2 IMPACT ASSESSMENT FOR PROJECT PHASES

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

18.2.1 *CONSTRUCTION PHASE IMPACTS*

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

Loss of extent of modified habitats within the Project footprint

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

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

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

Introduction/spread of exotic invasive species

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

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

Loss/disturbance of flora and fauna species of conservation concern

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

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

Loss/disturbance of other fauna species

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

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

Reduction in extent of natural habitats

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

Soil erosion and sediment loading of surface water runoff

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

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

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

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

18.2.2 OPERATION PHASE IMPACTS

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

Spread of invasive plant species

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

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

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

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

Disturbance of faunal species of conservation concern – site lighting

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

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

Disturbance of faunal species of conservation concern – barrier to movement

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

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

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

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

18.2.3 CLOSURE/DECOMMISSIONING PHASE

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

Spread of invasive plant species

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

Soil erosion and sediment loading of surface water runoff

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

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

Nature	Spread of invasive plant species	
	Before Mitigation	*After Mitigation*
Probability	5 (Definite)	3 (Medium probability)
Duration	4 (Long-term)	2 (Short-term)
Scale	3 (Regional)	1 (Site only)
Magnitude	6 (Moderate)	4 (Low)
Significance	65 (Moderate)	21 (Low)
Nature	Soil erosion and sediment loading of surface water runoff	
	Before Mitigation	*After Mitigation*
Probability	3 (Medium probability)	1 (Improbable)
Duration	5 (Permanent)	5 (Permanent)
Scale	2 (Local)	3 (Regional)
Magnitude	6 (Moderate)	6 (Moderate)
Significance	39 (Moderate)	14 (Low)

18.3 CUMULATIVE IMPACTS

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

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

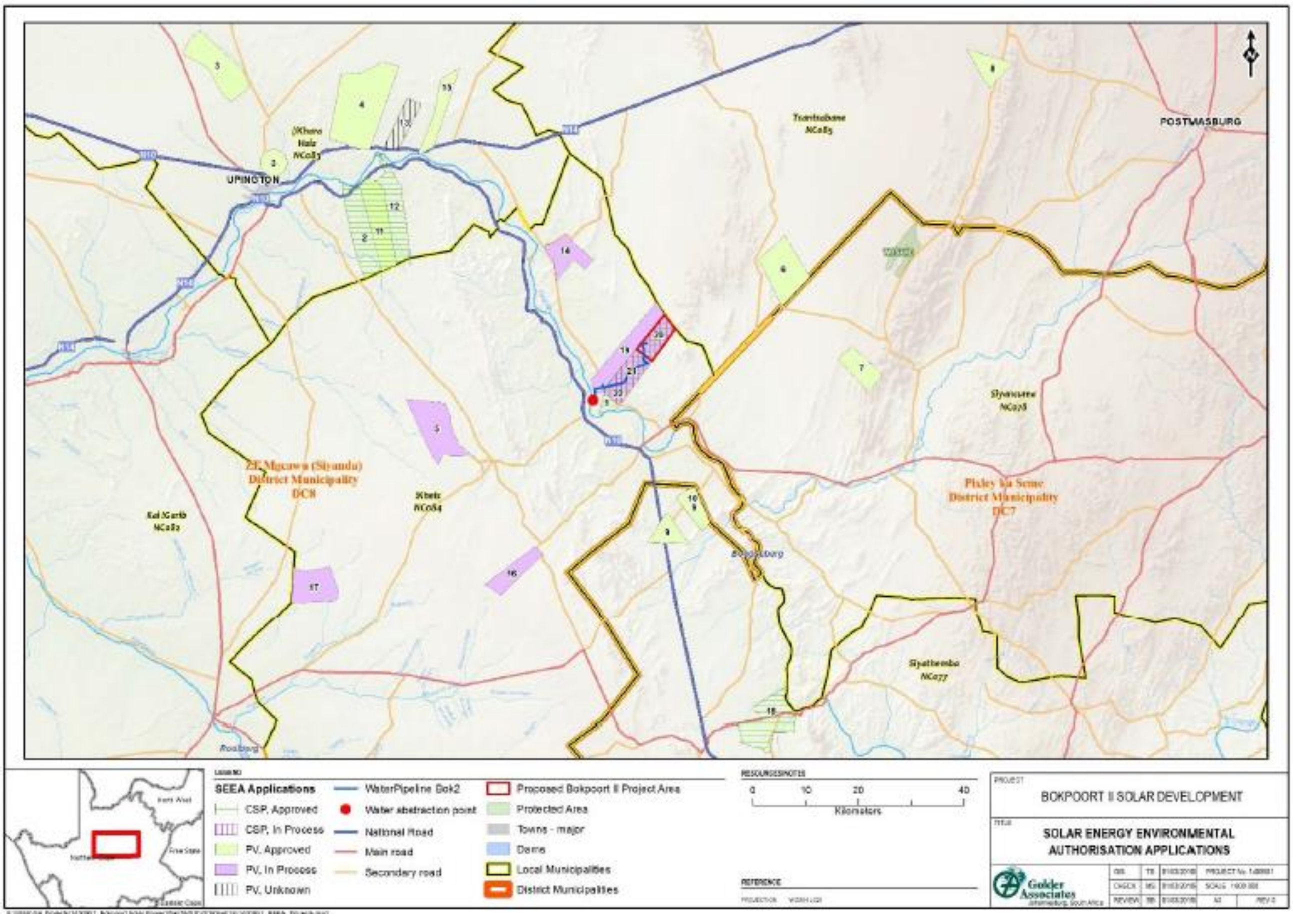


Figure 14: Proposed and authorised solar developments that may contribute to cumulative impacts

18.4 IMPACT SUMMARY (DEVELOPMENT FOOTPRINT)

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

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

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

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

19 RECOMMENDED MITIGATION APPROACH

19.1 MITIGATION HIERARCHY BACKGROUND

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

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

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

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

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

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

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

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

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

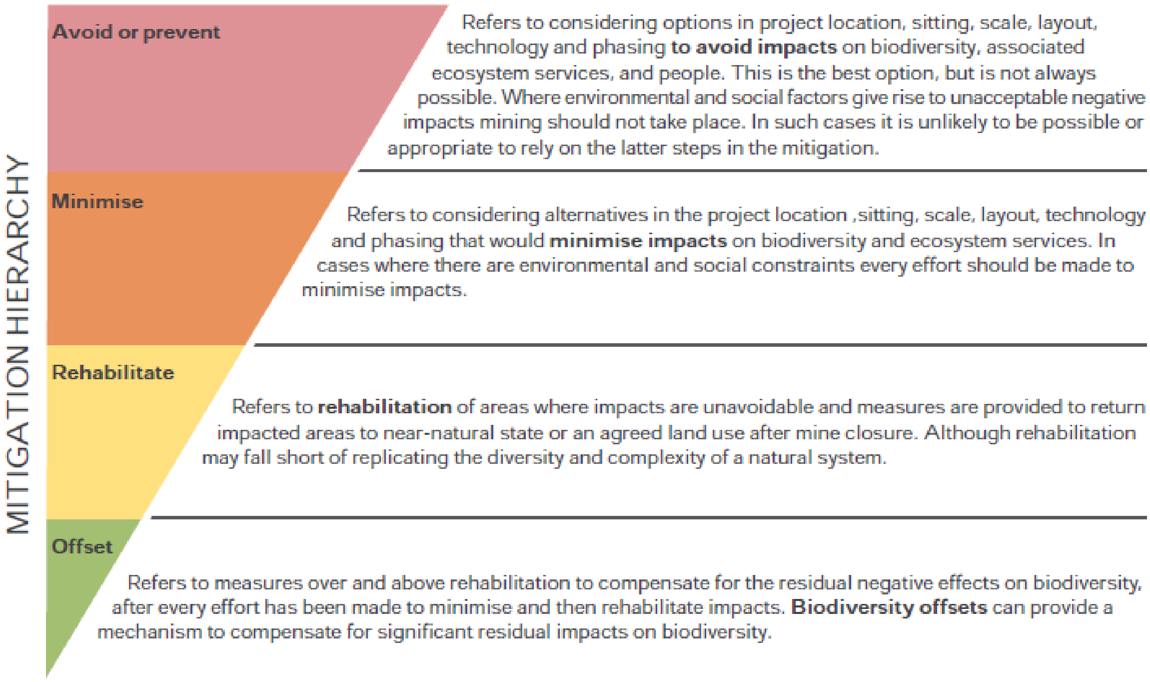


Figure 15: Mitigation hierarchy for dealing with negative impacts on biodiversity

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

19.2 THE "NO-GO' OPTION

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

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

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

19.3 Supplementing Mitigation Measures

19.3.1 Construction and Site-Clearance Phase

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Mitigation Measure 19 - Prevent all open fires on site.

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

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

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

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

Mitigation Measure 24 - Prevent contamination of surrounding, natural habitat from any source of pollution, notably from hydrocarbon spillages, runoff end contamination from transformed areas. Ducts that facilitate water flow underneath roads shall be kept clear of litter, debris and shall not be used to dispose of chemicals, unwanted effluent, etc.;

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

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

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

19.3.2 Operational Phase

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

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

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

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

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

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

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

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

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

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

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

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

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

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

19.3.3 DECOMMISSIONING AND REHABILITATION PHASE

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

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

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

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

19.3.4 SUGGESTED BIODIVERSITY MONITORING PROTOCOL

Constant and periodic monitoring of the following aspects are recommended:

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

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

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

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

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

20 CONCLUDING STATEMENT AND PROFESSIONAL OPINION

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

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

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

The Concluding Statement is based on the following key considerations:

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

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

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

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

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

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

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

- ⇒ The loss of this portion of natural habitat is also not anticipated to cause severe or unacceptable changes to or disruptions of ecological processes or animal migratory patterns on a local or regional scale;
- ⇒ No impact was identified that would result in significant or unacceptable impacts on the ecological receiving environment;
- ⇒ The application of the recommended mitigation approach is expected to ameliorate anticipated impacts to an acceptable low level.

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

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

** denotes declared AIP species

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

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

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

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

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

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

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

21 LEGISLATIVE AND POLICY CONTEXT

21.1 APPLICABLE SOUTH AFRICAN LEGISLATION AND POLICY

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

21.1.1 NATIONAL ENVIRONMENTAL MANAGEMENT ACT: BIODIVERSITY ACT (2004)

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

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

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

Project Relevance

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

21.1.2 SOUTH AFRICA'S NATIONAL BIODIVERSITY FRAMEWORK (2008)

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

Project Relevance

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

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

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

⇒ SO1: An enabling policy and legislative framework integrates biodiversity management objectives into the economy;
⇒ SO3: Integrated terrestrial and aquatic management across the country minimises the impacts of threatening processes on biodiversity, enhances ecosystem services and improves social and economic security; and
⇒ SO5: A network of conservation areas conserves a representative sample of biodiversity and maintains key ecological process across the landscape.

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

Project Relevance

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

21.1.4 *National Spatial Biodiversity Assessment (2004)*

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

Project Relevance

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

21.1.5 *Northern Cape Nature Conservation Act (2009)*

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

21.1.6 *NATIONAL FOREST ACT (ACT NO 84 OF 1998)*

According the Act (National Forests Act (Act no 84 of 1998)), the Minister may declare a tree, group of trees, woodland or a species of trees as protected. The prohibitions that 'no person may cut, damage, disturb, destroy or remove any protected tree, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a license granted by the Minister.

The National Forest Act:

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

Project Relevance

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

21.2 CONVENTIONS AND INTERNATIONAL AGREEMENTS

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

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

Project Relevance

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

21.3 IFC PERFORMANCE STANDARDS 2012

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

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

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

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

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

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

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

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

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

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

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

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

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

Project Relevance

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

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23 DECLARATION OF INDEPENDENCE

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

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

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

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

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25 INDEMNITY & LIMITATIONS OF THIS PROJECT AND REPORT

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

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

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

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

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

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

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

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

Education

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

Affiliations

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

Key Attributes

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

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

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

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

Relevant Computer Skills

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

Employment Record

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

Experience & Project Contributions

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

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

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

Languages

English: RWS - Excellent
Afrikaans: RWS – Excellent

Selected Reports and Projects

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

⇒ Biodiversity Impact Assessments (EIAs):

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

⇒ Biodiversity Scoping Assessments:

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

⇒ Biodiversity Screening Assessments:

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

⇒ Environmental Management Programme Reports (EMPR's):

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

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

⇒ Biological/ Biodiversity Monitoring Reports:

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

⇒ Biodiversity Basic Assessment Reports:

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

⇒ Species at Risk Assessments and Studies:

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

⇒ Alien and Invasive Species Management Programmes:

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

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

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

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

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

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

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

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

Selected Reference Contact List

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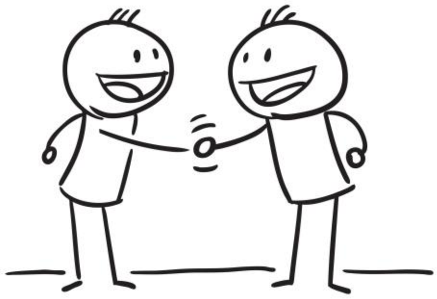
TerraManzi	Kelly Armstrong	021 701 5228	kelly@terramanzi.co.za
Ulwando	Charles Verster	082 653 6081	charles@ulwando.co.za
WSP Group/ Lidwala Consulting	Ashlea Strong	011 361 1300	Ashlea.Strong@WSPGroup.co.za

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

Certification

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

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



Contact us, let us help you!

082 3765 933

riaan@bathusi.org

012 658 5579

Appendix B6: Avifauna

ARCUS

AVIFAUNAL SPECIALIST AMENDMENT REPORT FOR THE PROPOSED BOKPOORT II SOLAR FACILITY

On behalf of

Royal HaskoningDHV (Pty) Ltd

December 2019

Prepared By:

Arcus Consultancy Services South Africa (Pty) Limited

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1 INTRODUCTION

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

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

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

1.1 Terms of Reference

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

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

1.2 Assumptions and Limitations

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

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

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

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

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

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

2 METHODOLOGY

2.1 Literature Review

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

2.2 Defining the Baseline

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

2.2.1 Sources of information

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

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

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

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

2.3 Identification and Rating of Potential Impacts

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

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

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

3 LITERATURE REVIEW

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

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

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

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

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

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

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

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

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

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

4 BASELINE ENVIRONMENT

4.1 Vegetation, Land Use and Bird Micro-habitats

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

4.2 Avifaunal Community

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

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

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

5 AVIFAUNAL SENSITIVITY ZONES

5.1 High Sensitivity Zones

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

5.2 Medium Sensitivity Zones

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

5.3 Undetermined Sensitivity Zones

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

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

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

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

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

6 AVIFAUNAL IMPACT ASSESSMENT

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

6.1 Identification and rating of Potential Impacts

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

6.1.1 Construction Phase

6.1.1.1 Habitat Destruction

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

<table>
<tr><td colspan="8">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.</td></tr>
<tr><td colspan="8">Proposed Amendment</td></tr>
<tr><td></td><td>Magnitude</td><td>Duration</td><td>Scale</td><td>Probability</td><td>Significance</td><td>Status</td><td>Confidence</td></tr>
<tr><td>Without Mitigation</td><td>8</td><td>4</td><td>2</td><td>5</td><td>70 (Moderate)</td><td>Negative</td><td>Medium</td></tr>
<tr><td>With Mitigation</td><td>8</td><td>3</td><td>1</td><td>5</td><td>60 (Moderate)</td><td>Negative</td><td>Medium</td></tr>
<tr><td colspan="3">Can the impact be reversed?</td><td colspan="5">Partially (If suitably re-habilitated after construction).</td></tr>
<tr><td colspan="3">Will impact cause irreplaceable loss or resources?</td><td colspan="5">Possibly.</td></tr>
<tr><td colspan="3">Can impact be avoided, managed or mitigated?</td><td colspan="5">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.</td></tr>
</table>

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

6.1.1.2 Disturbance and Displacement

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

Potential Impact: Birds are disturbed and displaced from the project site and surrounding areas due to construction activities and associated noise etc. Particularly at risk are sensitive species breeding on and around the site or regularly utilizing the project site for foraging/hunting e.g. eagles, korhaans, coursers and bustards.							
Proposed Amendment							
	Magnitude	**Duration**	**Scale**	**Probability**	**Significance**	**Status**	**Confidence**
Without Mitigation	8	2	2	4	48 (Moderate)	Negative	Medium
With Mitigation	6	2	2	3	30 (Moderate)	Negative	Medium
Can the impact be reversed?			Yes.				
Will impact cause irreplaceable loss or resources?			No.				
Can impact be avoided, managed or mitigated?			Partially. The mitigation measures below may help to keep the impact to a practical minimum.				
Required mitigation measures to reduce residual risk or enhance opportunities: • A site specific EMPr must be implemented, which gives appropriate and detailed description of how construction activities must be conducted; • All contractors are to adhere to the EMPr and should apply good environmental practice during construction; • ECO to oversee activities and ensure that the site specific EMPr is implemented and enforced; • The appointed ECO must be trained by an avifaunal specialist to identify the potential Red Data species as well as the signs that indicate possible breeding by these species; • The ECO must then, during audits/site visits, make a concerted effort to look out for such breeding activities of Red Data species, and such efforts may include the training of construction staff (e.g. in Toolbox talks) to identify Red Data species, followed by regular questioning of staff as to the regular whereabouts on site of these species; • If any of the Red Data species are confirmed to be breeding (e.g. if a nest site is found), construction activities within 500 m of the breeding site must cease, and an avifaunal specialist is							

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

6.1.2 Operational Phase

6.1.2.1 Disturbance and Displacement

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

Potential Impact: Birds are disturbed and displaced from the project site and surrounding areas, or from the grid connection servitude and surrounding areas, due ongoing operational and maintenance activities. Particularly at risk are sensitive species breeding or foraging/hunting in close proximity to the activities, for example raptors that may nest on the new powerline tower being disturbed by power line and servitude maintenance.							
Proposed Amendment							
	Magnitude	**Duration**	**Scale**	**Probability**	**Significance**	**Status**	**Confidence**
Without Mitigation	8	4	2	4	56 (Moderate)	Negative	Medium
With Mitigation	6	4	2	2	24 (Low)	Negative	Medium
Can the impact be reversed?			Yes.				
Will impact cause irreplaceable loss or resources?			No.				
Can impact be avoided, managed or mitigated?			Partially. The mitigation measures below may help to keep the impact to a practical minimum.				
Required mitigation measures to reduce residual risk or enhance opportunities: • A site specific operational EMPr must be implemented, which gives appropriate and detailed description of how operational and maintenance activities must be conducted to reduce unnecessary disturbance. • All contractors are to adhere to the environmental management programme and should apply good environmental practice during all operations. • The on-site operational facilities manager (or a suitably appointed Environmental Manager) must be trained by an avifaunal specialist to identify the potential Red Data species as well as the signs that indicate possibly breeding by these species. • If a priority species or Red Data species is found to be breeding (e.g. a nest site is located) on or within 2 km of the operational facility (or the grid connection servitude), the nest/breeding site must not be disturbed and the avifaunal specialist must be contacted for further instruction. • The on-site operational facilities manager (or a suitably appointed Environmental Manager) must conduct inspections every two months of the grid connection line, and all existing transmission line pylons within 2 km of the project site boundary to locate possible nesting raptors. • Any such nests must not be disturbed and should be reported to the avifaunal specialist for further instruction. • Operational phase bird monitoring, in line with the solar guidelines, must be implemented. • No operational activities or staff are permitted within 1.5 km of the identified Martial Eagle nest.							

6.1.2.2 Burning

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

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

6.1.2.3 Collision with Infrastructure (Excluding Power Lines)

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

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

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

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

Required mitigation measures to reduce residual risk or enhance opportunities:

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

6.1.2.4 Collision with Power Lines

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

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

[12]van Rooyen, C.S. 2004. The Management of Wildlife Interactions with over-headlines. In The fundamentals and practice of Over-head Line Maintenance (132kV and above), pp217-245. Eskom Technology, Services International, Johannesburg.

[13]Shaw, J.M, Jenkins, A.R., Smallie, J.J & Ryan, P.G. 2010. Modelling power-line collision risk for the Blue Crane *Anthropoids paradiseus* in South Africa. Ibis 152: 590-599

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

Potential Impact: Birds collide with the overhead power lines.							
Proposed Amendment							
	Magnitude	**Duration**	**Scale**	**Probability**	**Significance**	**Status**	**Confidence**
Without Mitigation	10	4	4	5	90 (High)	Negative	Medium
With Mitigation	6	4	2	2	24 (Low)	Negative	Medium
Can the impact be reversed?			No.				
Will impact cause irreplaceable loss or resources?			Yes.				
Can impact be avoided, managed or mitigated?			Yes. The mitigation measures below may help to keep the impact to a practical minimum.				
Required mitigation measures to reduce residual risk or enhance opportunities: • Where possible, power lines/cables on the project site should be underground. • Where possible, the routing of power line infrastructure should avoid Medium or High Sensitivity zones. • Where possible, grid connection infrastructure should follow existing servitudes such as existing power lines, roads and fences. • An avifaunal specialist must conduct a site walk through of the final Grid Connection route and pylon positions prior to construction to determine if, and where, bird flight diverters (BFDs) are required. • Install bird flight diverters as per the instructions of the specialist following the site walkthrough, which may include the need for modified BFDs fitted with solar powered LED lights on certain spans. • The operational monitoring programme for the associated CSP site must be in line with applicable monitoring guidelines and must include regular (at least monthly) monitoring of the grid connection power line for collision (and electrocution) mortalities. • Any mortalities should be reported to the Endangered Wildlife Trust (EWT). • Investigate the applicability of pole-mounted near-ultraviolet light (UV-A; 380–395 nm) Avian Collision Avoidance System (ACAS) on overhead power-lines in addition to bird flight diverters to increase visibility of power lines to birds in low light or poor visibility conditions.							

6.1.2.5 Electrocution

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

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

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

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

6.1.2.6 Water Pollution and Wastewater

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

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

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

6.1.2.7 Excessive use of Water

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

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

6.1.2.8 Disruption of Bird Movement Patterns

Utility scale solar energy facilities may form a physical barrier to movement of birds across the landscape, and this may alter migration routes and increase distances travelled and energy expenditure or block movement to important areas such as hunting and foraging areas. This potential impact is not yet well understood, is likely to be more significant as a cumulative impact with surrounding developments, is difficult to measure and assess, and therefore mitigation measures are difficult to identify. The 'lake effect' could potentially increase with the proposed amendment, evidence supporting this impact is not strong, however. The proposed amendment may reduce the risk of habitat fragmentation and permeability of the site to some species compared to the original authorisation if habitat rehabilitation and the regrowth of natural vegetation is promoted under the solar panels. This will reduce the open space and area of unsuitable habitat that would have been a barrier to movement across the site at a CSP facility with more intensive vegetation management. Perimeter fencing must be adequately designed to prevent entrapment of large bodied species attempting to move across the site. The significance rating of this impact before mitigation was 39 (Moderate) and was reduced to 36 (Moderate) after mitigation in the original authorisation. The significance ratings of this impact were 39 (Moderate) before mitigation and 20 (Low) after mitigation for the proposed amendment.

Potential Impact: The development forms a physical barrier to movement of birds across the landscape, alters migration routes and increases distances travelled and energy expenditure for hunting or foraging.							
Proposed Amendment							
	Magnitude	**Duration**	**Scale**	**Probability**	**Significance**	**Status**	**Confidence**
Without Mitigation	6	4	3	3	39 (Moderate)	Negative	Low
With Mitigation	4	4	2	2	20 (Low)	Negative	Medium
Can the impact be reversed?			Unlikely.				
Will impact cause irreplaceable loss or resources?			No				
Can impact be avoided, managed or mitigated?			Partially. The mitigation measures below may help reduce the disruption of bird movement patterns.				
Required mitigation measures to reduce residual risk or enhance opportunities: • Where not prescribed by technical or local and international requirements, external lighting to be of an intermittent and coloured nature rather than constant white light to reduce the potential impact on the movement patterns of nocturnal species. Habitat rehabilitation and promoting the regrowth of natural vegetation below the solar panels would reduce the barrier effect to some bird species reluctant to cross unsuitable habitat or cleared vegetation, such as francolins. • Perimeter fencing must be designed to prevent entrapment of large bodied species such as korhaans between fence rows, giving them sufficient space for take-off, i.e. if a double-layer of parallel fencing is used, the gap between the fences should be large enough to allow for large birds to take-off and leave the area. Where this would result in unacceptable compromises to the security of the site, large-bodied birds should be prevented from entering the gaps between parallel fence rows. Perimeter fence design to be done in consultation with an avifaunal specialist. • Markers or panel gaps on solar panels to break-up reflections and reduce the 'lake effect'.							

6.2 Cumulative Impacts

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

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

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

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

7 CONCLUSION

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

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

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

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

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

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

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

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

APPENDIX I: IMPACT ASSESMENT METHODOLOGY

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

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

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

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

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

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

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

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

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

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

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

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

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

Alphabetical Name	Red Data	Ende-mism*	Arcus 2016	Jeal 2017	SABAP2 Reporting Rate %**										
					2845_2205	2845_2200	2845_2155	2845_2150	2840_2205	2840_2200	2840_2155	2840_2150	2835_2205	2835_2200	2835_2155
Canary, Black-throated			X	X				42.9	16.7			20		33.3	
Canary, White-throated			X		28.6			42.9	33.3	50				33.3	
Canary, Yellow			X	X	42.9	75		100	50	50	100	100	100	66.7	100
Chat, Ant-eating			X	X	57.1	25		42.9	50	50	100	20	100	100	100
Chat, Familiar			X	X			66.7	57.1	50			40			
Chat, Sickle-winged		x	X												
Cisticola, Desert				X			33.3			50				66.7	
Cisticola, Grey-backed			X		57.1	50		14.3	100	50		20		100	
Cisticola, Levaillant's			X					71.4				60			
Cisticola, Zitting								42.9				40			
Coot, Red-knobbed				X											
Cormorant, Reed			X				33.3	42.9				60			
Cormorant, White-breasted			X	X				28.6				40			
Coucal, Burchell's			X					14.3				40			
Courser, Burchell's	VU		X												
Courser, Double-banded	NT		X								100				100
Crombec, Long-billed			X	X	71.4	75	33.3	85.7	100	100	100	20	100	66.7	
Crow, Pied			X	X	71.4	50	33.3	57.1	50		100		100	66.7	100
Cuckoo, Diederik					14.3	25	33.3	42.9	33.3			20			
Cuckoo, Jacobin			X		14.3	25		42.9	33.3						
Darter, African			X				0.0000	57.1				40			
Dove, Cape Turtle			X	X	100	75	100	100	66.7	100	100	40	100	100	100
Dove, Laughing			X	X	42.9	50	100	100	83.3	100	100	100	100	66.7	100
Dove, Namaqua			X	X	71.4	50	33.3	100	83.3	100	100	60		100	

Alphabetical Name	Red Data	Ende-mism*	Arcus 2016	Jeal 2017	SABAP2 Reporting Rate %**										
					2845_2205	2845_2200	2845_2155	2845_2150	2840_2205	2840_2200	2840_2155	2840_2150	2835_2205	2835_2200	2835_2155
Dove, Red-eyed							33.3	71.4				80			
Dove, Rock			X												
Drongo, Fork-tailed					14.3										
Duck, African Black			X									20			
Duck, Yellow-billed								14.3				20			
Eagle, African Fish			X	X			66.7	57.1				40			
Eagle, Black-chested Snake			X												
Eagle, Booted			X												
Eagle, Martial	EN		X												
Eagle, Verreauxs'	VU		X		42.9	25		14.3	16.7	50	100				
Egret, Little			X					28.6							
Egret, Western Cattle			X			25	66.7	57.1	16.7			80			
Eremomela, Yellow-bellied			X	X	28.6	75	66.7	71.4	50	100	100	40		100	100
Falcon, Lanner	VU		X						33.3						
Falcon, Pygmy			X	X	71.4	50		28.6	66.7	50		20		33.3	
Finch, Red-headed			X	X	28.6				83.3	50				66.7	
Finch, Scaly-feathered			X	X	71.4	25			66.7	100	100	20	100	66.7	100
Fiscal, Common			X	X	71.4	50	100	71.4	83.3	100	100	100	100	100	
Flycatcher, Chat				X	57.1	25	66.7	57.1	33.3		100	20		66.7	100
Flycatcher, Fiscal		x	X		14.3		100	100				20			
Goose, Egyptian			X	X	42.9		33.3	57.1	16.7			60			
Goose, Spur-winged			X		14.3			28.6				40			
Goshawk, Pale Chanting			X	X	85.7	25	66.7	28.6	66.7			20		66.7	
Grebe, Little			X	X											

Alphabetical Name	Red Data	Ende-mism*	Arcus 2016	Jeal 2017	SABAP2 Reporting Rate %**										
					2845_2205	2845_2200	2845_2155	2845_2150	2840_2205	2840_2200	2840_2155	2840_2150	2835_2205	2835_2200	2835_2155
Greenshank, Common				X											
Guineafowl, Helmeted			X		14.3		33.3	57.1	16.7			80			
Hamerkop								28.6				20			
Heron, Black-headed			X	X			33.3	28.6				40			
Heron, Goliath			X				33.3	42.9				20			
Heron, Grey			X					42.9				20			
Honeyguide, Lesser					14.3			57.1				20			
Hoopoe, African			X				33.3	42.9	16.7	50		60			
Hornbill, African Grey			X												
Hornbill, Southern Yellow-billed			X												
Ibis, African Sacred			X					28.6				60			
Ibis, Glossy								14.3							
Ibis, Hadeda			X	X	28.6	50	100	71.4				100			
Kestrel, Greater				X	14.3										
Kestrel, Rock			X		14.3	25	33.3		66.7	50				33.3	
Kingfisher, Brown-hooded								42.9							
Kingfisher, Giant			X					42.9							
Kingfisher, Malachite			X	X											
Kingfisher, Pied								42.9							
Kite, Black-shouldered			X									20			
Kite, Yellow-billed			X												
Korhaan, Karoo	NT		X				33.3	85.7				60			
Korhaan, Northern Black			X	X	28.6	25	33.3	85.7	16.7	50	100	20	100	66.7	100

Alphabetical Name	Red Data	Ende-mism*	Arcus 2016	Jeal 2017	SABAP2 Reporting Rate %**										
					2845_ 2205	2845_ 2200	2845_ 2155	2845_ 2150	2840_ 2205	2840_ 2200	2840_ 2155	2840_ 2150	2835_ 2205	2835_ 2200	2835_ 2155
Korhaan, Red-crested			X	X	57.1	50			50	50	100			100	100
Lapwing, Blacksmith			X	X				71.4	16.7			40			
Lapwing, Crowned			X				33.3	14.3	66.7		100	40		33.3	100
Lark, Black-eared Sparrow-		x	X												
Lark, Eastern Clapper			X	X	28.6	50		14.3	50	50	100	20		100	100
Lark, Fawn-coloured			X	X	100	100	66.7	57.1	100	100	100	40	100	100	100
Lark, Grey-backed Sparrow			X		14.3			57.1		50		20		33.3	
Lark, Karoo Long-billed							66.7	85.7	16.7	50	100	40			
Lark, Red-capped								14.3							
Lark, Sabota			X	X	28.6		100	85.7		100	100	60		33.3	
Lark, Spike-heeled			X	X	14.3	50	100	42.9	66.7	100	100	60		100	100
Lark, Stark's			X												
Martin, Brown-throated				X		25	66.7	57.1				40			
Martin, Common House								14.3							
Martin, Rock			X	X	71.4	75	66.7	28.6	100	50	100			100	
Mousebird, Red-faced			X		14.3	50	33.3	57.1	33.3	100	100	40	100	33.3	100
Mousebird, White-backed			X	X	42.9	50	66.7	57.1	33.3	100	100	60	100	33.3	100
Myna, Common						25									
Neddicky					14.3	25									
Nightjar, Fiery-necked					14.3				16.7						
Nightjar, Rufous-cheeked					42.9			14.3	16.7			20			

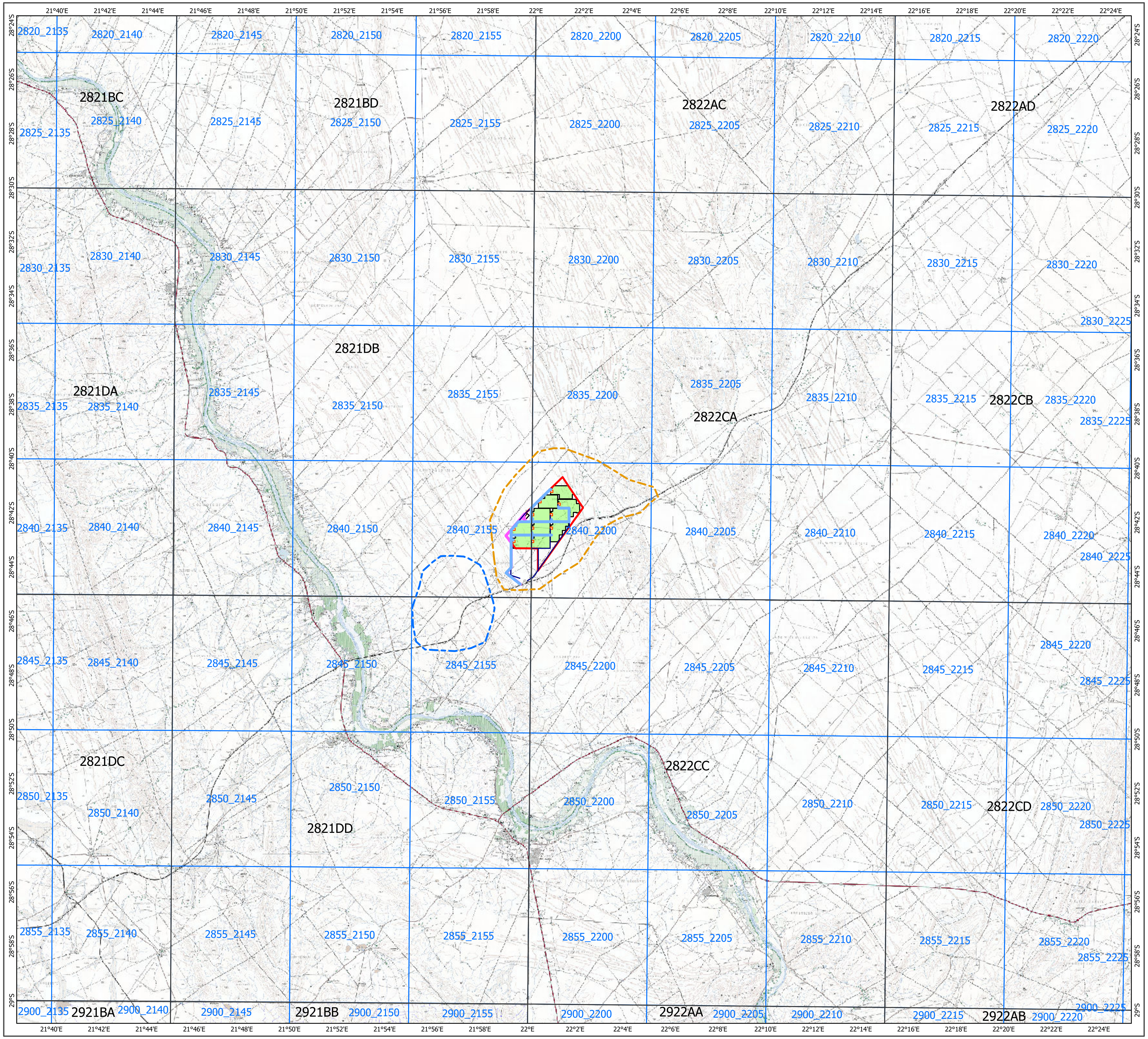
Alphabetical Name	Red Data	Ende-mism*	Arcus 2016	Jeal 2017	SABAP2 Reporting Rate %**										
					2845_2205	2845_2200	2845_2155	2845_2150	2840_2205	2840_2200	2840_2155	2840_2150	2835_2205	2835_2200	2835_2155
Ostrich, Common								42.9						100	
Owl, Cape Eagle-			X												
Owl, Spotted Eagle-					28.6	25			16.7						
Owl, Western Barn				X						50		20			
Owlet, Pearl-spotted			X					14.3							
Penduline-tit, Cape			X		57.1	25			16.7						
Pigeon, Speckled			X	X			33.3	28.6	66.7	50	100	40			
Pipit, African			X				33.3	71.4	16.7			80		33.3	
Pipit, African Rock	NT	x			57.1	25			100	50				66.7	
Pipit, Long-billed					14.3				16.7						
Plover, Grey				X											
Plover, Kittlitz's				X											
Plover, Three-banded			X	X				42.9							
Prinia, Black-chested			X	X	100	75	66.7	100	83.3	100	100	80	100	100	100
Quail, Common					14.3					50		20		33.3	
Quelea, Red-billed			X	X	14.3		33.3	57.1	16.7		100	80		66.7	
Robin, Kalahari Scrub			X	X	100	75		42.9	100	100	100	40	100	100	100
Robin, Karoo Scrub			X	X	28.6	25	33.3	85.7	16.7			80		66.7	
Robin-chat, Cape			X				66.7	57.1				80			
Ruff				X											
Sanderling				X											
Sandgrouse, Burchell's														33.3	
Sandgrouse, Namaqua			X	X	85.7	50	66.7	100	50	100	100	60	100	66.7	100
Sandpiper, Curlew				X											

Alphabetical Name	Red Data	Ende-mism*	Arcus 2016	Jeal 2017	SABAP2 Reporting Rate %**										
					2845_2205	2845_2200	2845_2155	2845_2150	2840_2205	2840_2200	2840_2155	2840_2150	2835_2205	2835_2200	2835_2155
Scimitarbill, Common			X	X	57.1	25			66.7	50	100	40	100	33.3	
Shelduck, South African			X	X				14.3							
Shoveler, Cape				X											
Shrike, Crimson-breasted			X		28.6	25			16.7				100	33.3	
Shrike, Lesser Grey					28.6	25									
Shrike, Red-backed					14.3	25		14.3	33.3						
Sparrow, Cape			X	X	28.6	25	66.7	71.4	66.7	50	100	80		66.7	100
Sparrow, Great			X												
Sparrow, House			X	X	14.3		33.3	57.1	50		100	20			
Sparrow, Southern Grey-headed								57.1	16.7			40			
Sparrow-weaver, White-browed			X	X	57.1	25	100	71.4	100	100	100	80		100	
Starling, Cape Glossy			X		14.3		100	85.7	16.7			40			
Starling, Pale-winged			X		57.1	50			83.3	100				33.3	
Starling, Wattled					14.3		33.3	28.6				20			
Stilt, Black-winged				X				14.3							
Stint, Little				X											
Sunbird, Dusky			X	X	85.7	100	66.7	100	83.3	100	100	40	100	100	100
Swallow, Barn			X		71.4	50	33.3	57.1	83.3			40			
Swallow, Greater Striped							33.3	71.4	66.7			40			
Swallow, South African Cliff		x										20			
Swallow, White-throated			X	X				57.1				80			
Swift, African Palm								14.3				20			

Alphabetical Name	Red Data	Ende-mism*	Arcus 2016	Jeal 2017	SABAP2 Reporting Rate %**										
					2845_2205	2845_2200	2845_2155	2845_2150	2840_2205	2840_2200	2840_2155	2840_2150	2835_2205	2835_2200	2835_2155
Swift, Bradfield's			X					14.3	33.3						
Swift, Common					28.6	25			33.3			20			
Swift, Little			X	X	14.3		66.7	100	33.3	50		40	100		
Swift, White-rumped					57.1	25		42.9	50			20			
Tchagra, Brown-crowned			X	X	57.1	75	33.3	42.9	66.7			20		66.7	
Teal, Cape				X											
Teal, Red-billed				X				28.6							
Tern, Whiskered				X											
Thick-knee, Spotted					28.6				16.7			20			
Thrush, Karoo		x	X				33.3	57.1				60			
Thrush, Short-toed Rock			X	X	14.3				33.3	50					
Tit, Ashy			X		42.9	25	33.3	57.1	100	100	100		100	66.7	
Tit-Babbler, Chestnut-vented			X	X	85.7	75	66.7	85.7	83.3	100	100	20	100	100	100
Tit-Babbler, Layard's		x			28.6	50			100	50					
Turnstone, Ruddy				X											
Vulture, Lappet-faced	EN		X												
Vulture, White-backed	EN												100		
Wagtail, African Pied			X				33.3	42.9							
Wagtail, Cape			X	X			33.3	71.4				80			
Warbler, African Reed								57.1				40			
Warbler, Lesser Swamp								42.9				40			
Warbler, Namaqua		x	X					57.1				60			

Alphabetical Name	Red Data	Ende-mism*	Arcus 2016	Jeal 2017	SABAP2 Reporting Rate %**										
					2845_2205	2845_2200	2845_2155	2845_2150	2840_2205	2840_2200	2840_2155	2840_2150	2835_2205	2835_2200	2835_2155
Warbler, Rufous-eared			X	X	71.4	25	66.7	85.7	33.3	50	100	60		66.7	100
Warbler, Willow								14.3							
Waxbill, Black-faced					28.6		33.3		X					33.3	
Waxbill, Common			X			25	33.3	42.9							
Waxbill, Violet-eared			X	X	14.3									33.3	
Weaver, Sociable			X	X	100	50	100	85.7	100	50	100	60	100	100	100
Weaver, Southern Masked			X	X	14.3	50	100	100	33.3	50	100	80	100	100	
Wheatear, Capped			X		57.1		33.3	14.3	33.3			40			
Wheatear, Mountain			X	X	57.1	50		14.3	100	50				100	
White-eye, Orange River			X			25	100	71.4				80			
Whydah, Pin-tailed							33.3	14.3							
Woodpecker, Cardinal			X					28.6							

SABAP2 data as accessed on 28 November 2019. VU = Vulnerable; NT = Near-threatened. Endemic or near endemic (i.e. ~70% or more of population in RSA) to South Africa (not southern Africa as in field guides) or endemic to South Africa, Lesotho and Swaziland. Taken from BirdLife South Africa Checklist of Birds in South Africa, 2014 **Reporting rates are essentially percentages of the number of times a species was recorded in the pentad, divided by the number of times that pentad was counted. It is important to note that these species were recorded in the entire pentad in each case and may not actually have been recorded on the proposed project area.*



ARCUS

Control Site
Broader Project Area
Quarter Degree Squares
Pentads

1:250 000 Scale @ A3

0 5 10 km

NORTH

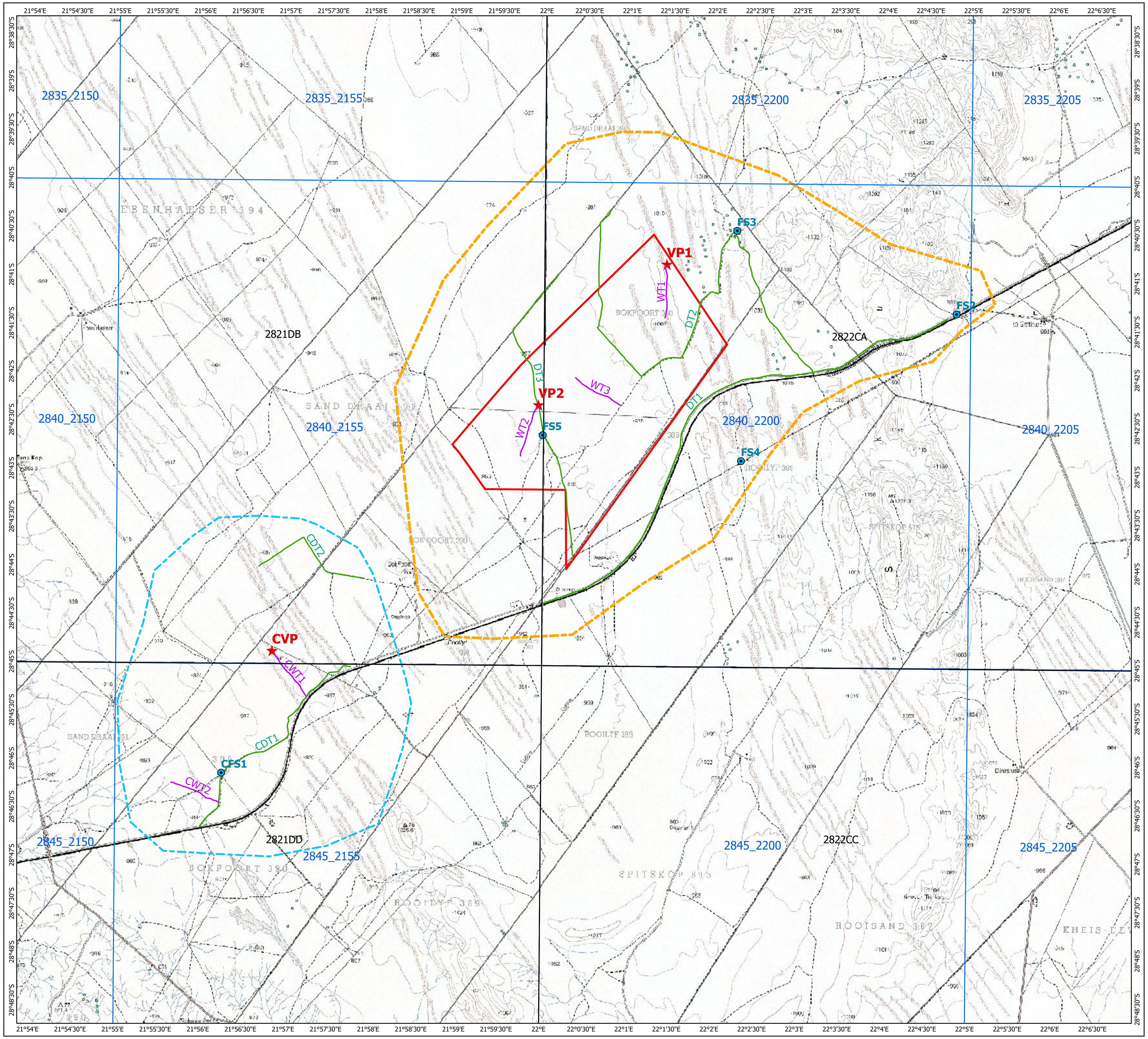
Produced By: OD	Ref: 3570-REP-0001
Checked By: AB	Date: 2019/12/11

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

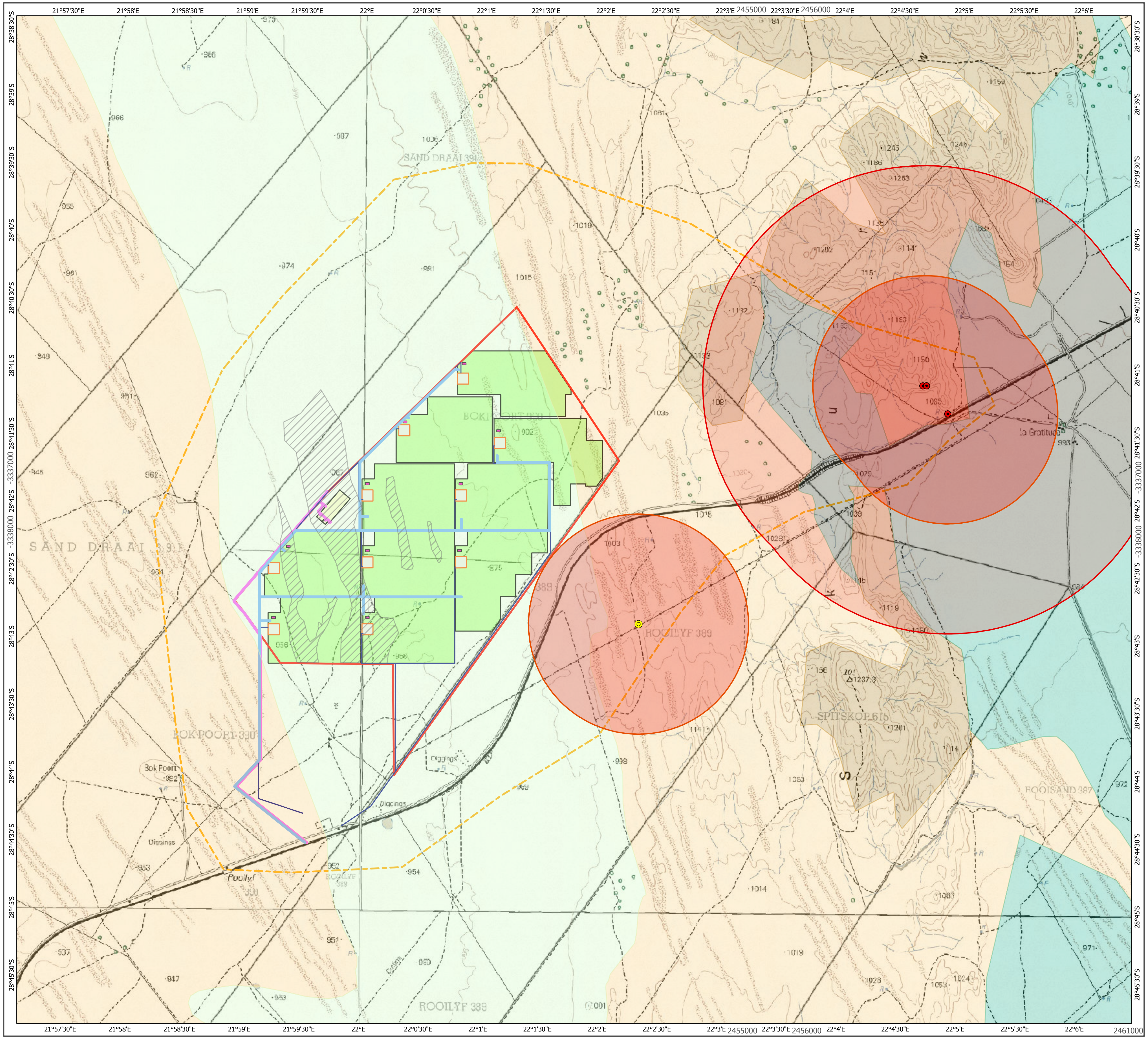
NORTH

Produced By: OD	Ref: 3570.-REP-0002
Checked By: AB	Date: 2019/12/17

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
- Battery Storage
- Project Boundary
- Proposed Substations
- Temporary Contractors Facility

1:50 000 Scale @ A3

0 1 2 km

NORTH

Produced By: OD	Ref: 3570-REP-0003
Checked By: AB	Date: 2019/12/11

Proposed Layout, Vegetation Types and Avifaunal Sensitivity Map

Figure 3

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_3_Sensitivity

Appendix B7: Bats

ARCUS

BAT SPECIALIST AMENDMENT REPORT FOR THE PROPOSED BOKPOORT SOLAR FACILITY, NORTHERN CAPE PROVINCE

On behalf of

Royal HaskoningDHV (Pty) Ltd

December 2019

Prepared By:

Arcus Consultancy Services South Africa (Pty) Limited

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1 INTRODUCTION

ACWA Power Energy Africa (Pty) Ltd obtained environmental authorisation for two 75 MW photovoltaic (PV) solar power developments, PV1 and PV2, on Farm Bokpoort (DEA reference numbers 14/12/16/3/3/2/881 and 14/12/16/3/3/2/880, respectively). Environmental authorisation was also acquired for a 150 MW concentrated solar power (CSP) tower development on Farm Bokpoort 390 (DEA reference number 14/12/16/3/3/2/879). The site is located approximately 20 km northwest of Groblershoop within the !Kheis Local Municipality of the Northern Cape Province. ACWA Power are applying to replace the CSP facility with construction of eight photovoltaic plants, on the same site as was previously assessed and authorized for the CSP facility. Previously, approval for 2 PV facilities was obtained, PV 1 (Ndebele) and PV 2 (Xhosa), however the proposal for these two sites did not include the battery energy storage system for either of the sites or the capacity increase from 75 to 200MW.

The amendment application involves the following changes to the development:

- Eight PV facilities, in place of the CSP facility, within the same footprint;
- PV facility associated infrastructure:
  - Battery storage site occupying area of 400 m by 400 m
  - Access routes between PV panels
  - Access road for maintenance of power line
  - Substation
  - Water pipeline connection to main water pipeline
  - 132 kV overhead line and 31 m servitude
  - Shared infrastructure consisting of buildings, including a workshop area for maintenance, storage (i.e. fuel tanks, etc.), laydown area, parking, warehouse, and offices (previously approved).

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

1.1 Terms of Reference

This report has been compiled under the following terms of reference and provides:

- An assessment of the advantages and disadvantages of constructing ten PV facilities instead of a CSP facility, as they relate to bats;
- An assessment of the impacts of the proposed ten PV plants and associated infrastructure;
- Measures to manage/mitigate impacts of the proposed amendment.

2 METHODOLOGY

A literature review of the impacts of CSP and PV developments on bats was conducted to assess the advantages and disadvantages of the proposed amendment. The bat impact assessment reports of the initial EIA of the CSP and two PV facilities (presented by Golder Associates, report numbers 1400951-302665-23 and 24, dated April and May 2016) were reviewed. Satellite imagery of the development area was inspected for changes in land use and changes to features that were identified as sensitive in the bat impact assessment reports of the EIA. Impacts of the proposed amendment were assessed and relevant mitigation measures outlined.

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

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

To assess each of these factors for each impact, the following four ranking scales 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	0 - None
Scale	**Magnitude**
5 - International	10 - Very high/don't know
4 - National	8 - High
3 - Regional	6 - Moderate
2 - Local	4 - Low
1 - Site only	2 - Minor
0 - None	0 - None

Once these factors have been ranked for each impact, the significance of the two aspects, occurrence and severity, must be assessed using the following formula:

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

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

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

3 RESULTS

3.1 Review of Impacts of CSP and PV Facilities on Bats

To date, there is little empirical data and very few peer reviewed experimental studies that have investigated the impacts of solar facilities on bats. Studies concerning landscape-scale impacts are also not available. Information is particularly lacking in a South African setting. The impacts of the two types of solar facilities on bats are compared below, with the caveat that a comparative study is not yet available.

Under laboratory conditions, bats demonstrated drinking behaviour over smooth artificial plates as they confused these surfaces with water sources (Greif and Siemers, 2010). This raised the concern of a risk of bats colliding with smooth PV panels as they may confuse it with water, possibly causing injuries and/or fatalities. Greif et al. (2017) investigated how bats interact with smooth vertical and horizontal surfaces. They confirmed the drinking behaviour over smooth horizontal surfaces and found bats mistake smooth vertical surfaces for open flight paths resulting in collision. The risk of injury or fatality by collision was thus with vertical surfaces rather than horizontal. Collision of bats with solar panels has not been investigated and is not confirmed. Given that PV arrays are typically tilted and not oriented vertically, risk of collision with PV panels cannot be inferred from these studies and is typically assumed to be low (Taylor et al. 2019). Additionally, a field experiment recorded bats leaving an area with artificial surfaces when they learnt after a few attempts that drinking from the surfaces was not possible (Russo et al. 2012). If there in fact is a risk of collision, over time bats should learn that PV panels are not water sources and search elsewhere for water. With enough time, collision risk should then be reduced to zero.

PV panels reflect horizontally polarized light and attract polarotactic insects (insects attracted to polarized light) as they perceive the panels to be water sources used for breeding purposes (Horvath et al. 2010). It may be assumed that the attraction of insects to PV panels would in turn attract insectivorous bats to forage around the panels (Harrison et al. 2017). However, there is no evidence to confirm the attraction of bats to the panels or collision by bats while foraging in the area of a PV facility such that this impact is assumed to be negligible.

Negative environmental impacts of CSP developments include avifaunal deaths from collisions with reflective heliostats and singeing of feathers from flight through concentrated solar flux (Ho 2016). Walston et al. (2016) reported an avian mortality rate of 7 to 21 times greater (relative to power generating capacity) at CSP facilities than PV facilities in South West California. CSP heliostats are highly reflective and concentrate light towards a central receiver, while PV panels are more absorptive than reflective of sunlight. Therefore, there is a risk of heat related injuries or fatalities associated with CSP technology that is less applicable to PV panels (Pimentel et al. 1994). There should be a lower risk of heat related injuries and fatalities for bats than birds as heat is lost through the night, but bats may be attracted to the central CSP receiver for territorial or roosting purposes. The South African Bat Assessment Association (SABAA) website notes that bat fatalities have occurred at CSP facilities in South Africa (no further information of cause or location is provided), and mentions there to be no evidence that PV farms constructed on the ground in fields pose a direct fatality risk to bats.

Drewitt and Langston (2006) identified habitat loss/fragmentation, disturbance, displacement and barrier effect as negative impacts of both CSP and PV developments on avifauna. These impacts are also applicable to bats. The development footprint of the proposed amendment remains the same as was previously approved. Thus, the impact of habitat loss, disturbance, displacement and barrier effect remain the same, irrespective of the technology, as when the development was granted authorization. Although no study has explicitly compared the impacts, the lack of evidence of collision of bats with PV panels, the higher avian mortality rate at CSP facilities and the record of bat deaths at CSP facilities in South Africa by SABAA may infer the risk of fatality to be higher for CSP than PV developments.

3.2 Review of EIA Bat Impact Assessment Reports and Satellite Imagery

The African straw-coloured fruit bat (*Eidolon helvum*) was not included in the table of bat species potentially occurring within the study area of the EIA report. It has been recorded within the central plateaus of South Africa and the site is located within this species modelled distribution range as per Monadjem et al. (2010). This omission does not influence the impact assessment of the amendment.

The construction and decommission phase impacts of the two PV developments identified in the bat impact assessment reports were the same as those identified for the CSP facility. The operational phase impacts differed in that the CSP facility had a high pre-mitigation impact significance for injury and mortality due to CSP tower and concentrated heat, while the PV facility had a low pre-mitigation impact significance for injury and mortality of bats due to collision with panels.

Review of the latest publicly available satellite imagery indicates there has been no change in agricultural land use since the environmental authorisation was granted. There is no addition of natural vegetation or natural features that bats would utilize for foraging, roosting or commuting. There has been subsequent development of buildings and a water treatment facility which may have attracted bats to the area as several species utilize buildings for roosting; and the water treatment facility may attract bats for drinking and foraging on insects attracted to the water. The development of PV plants may negatively impact the roosting or foraging activities in the area due to lighting of the facility at night and noise disturbance during construction.

4 BAT IMPACT ASSESSMENT

Potential impacts of construction, operation and decommission of ten PV plants are described and assessed below.

4.1 Construction phase

Negative impacts during the construction phase pertain to the clearance of indigenous vegetation from the development area. The vegetation clearing will cause habitat loss and fragmentation, reducing the foraging habitat available to bats in this area. The natural functioning of the ecosystem of the development footprint will be permanently altered. This impact has a pre-mitigation **moderate** significance rating that is reduced to **low** significance with mitigation measures (Table 1).

Construction activities and lighting of the site may cause disturbance and displacement whereby bats will no longer utilize the area and the bat community in the greater area may be altered. If bats have taken to roosting within the more recently built houses/buildings on site, traffic and construction noise may be a disturbance to them. This impact has a pre-mitigation **moderate** significance rating that is reduced to **low** significance with mitigation measures (Table 1).

Table 1: Construction phase impact rating

Impact	Pre-mitigation	Post-mitigation

	Magnitude	Duration	Scale	Probability	Rating	Significance	Magnitude	Duration	Scale	Probability	Rating	Significance
Reduction in foraging habitat due to vegetation clearance	6	4	1	5	55	Moderate	2	4	1	4	28	Low
Disturbance and displacement due to construction noise and lighting	6	2	1	4	36	Moderate	4	1	1	4	24	Low

4.2 Operation phase

Operation of ten PV plants will impact the foraging and commuting of bats within and around the development area as the plants have a barrier effect to their normal behaviour and use of the area. Security lighting of the plants at night will alter the natural bat community in the area as some species actively forage on insects attracted to light, while other species are deterred from the area by the light. These above-mentioned impacts have a pre-mitigation **moderate** significance rating that is reduced to **low** significance with application of mitigation measures (Table 2).

Collision of bats with PV panels has been assessed as having a **low** pre-mitigation significance rating as bats are not likely to mistake panels as water sources and will typically utilize their established drinking sources. Additionally, bats should quickly learn that the panels are not water sources and leave the area to search for water elsewhere.

Table 2: Operation phase impact rating

Impact	Pre-mitigation						Post-mitigation					
	Magnitude	Duration	Scale	Probability	Rating	Significance	Magnitude	Duration	Scale	Probability	Rating	Significance
Barrier effect of PV plants to normal foraging and commuting behaviours	8	4	1	4	52	Moderate	4	4	1	3	27	Low

Change of bat community utilizing development area due to security lighting	6	4	1	4	44	Moderate	2	4	1	4	28	Low
Collision of bats with PV panels	4	1	1	2	12	Low	4	1	1	1	6	Low

4.3 Decommission phase

The negative impact of disturbance and displacement may result from decommissioning activities due to noise, vehicles moving through the site and additional lighting of the area. This impact has a pre-mitigation **moderate** significance rating that is reduced to **low** significance with mitigation measures (Table 3).

Table 3: Decommission phase impact rating

Impact	Pre-mitigation						Post-mitigation					
	Magnitude	**Duration**	**Scale**	**Probability**	**Rating**	**Significance**	**Magnitude**	**Duration**	**Scale**	**Probability**	**Rating**	**Significance**
Disturbance and displacement due to decommission noise and lighting	6	2	1	4	36	Moderate	4	1	1	4	24	Low

5 MITIGATION MEASURES

Mitigation measures to reduce the negative effects of the proposed development on bats, and to restore the affected areas are outlined below.

5.1 Construction phase

- Vegetation clearance and disturbance of topsoil should be limited to developable areas and minimized as much as possible. Areas to be cleared should be clearly delineated and movement of vehicles should be limited to these areas;
- Upon completion of construction, vegetation rehabilitation should be carried out in areas that were disturbed during construction if the ground surface is no longer in use for the operation of the plants;
- Construction activities should be reduced as much as possible during the night to limit noise and light disturbance to bats;
- If nocturnal lighting is required during construction, it should be directed and limited to work areas to prevent light spillage; and

- If feasible, warm LED bulbs should be used for site lighting to limit the attraction of insects to the light and in turn prevent a shift in the bat community present in the area.

5.2 Operation phase

- Lighting of the site during operation should also be directional and limited to only the necessary areas to prevent light spillage, and warm LED bulbs should be used;
- Searches for bat carcasses on the ground around and beneath the PV panels should be conducted in tandem with searches for bird carcasses. The Environmental Control Officer must freeze bat carcasses and keep a record of the location, date and time of when it was found.

In addition to the above, the current EMPr requires acoustic monitoring for bats. However, this requirement should be removed from the EMPr due to the low impact to bats.

5.3 Decommission phase

- Decommission activities should be reduced as much as possible during the night to limit noise and light disturbance to bats;
- If nocturnal lighting is required during decommission, it should be directed and limited to work areas to prevent light spillage and warm LED bulbs should be used;
- Upon completion of decommission, vegetation rehabilitation should be carried out over the site to re-establish the natural ecosystem functioning of the development footprint and restore the use of the area by bats.

6 CUMULATIVE IMPACT ASSESSMENT

The renewable energy EIA application database map for the second quarter of 2019 (distributed by Department of Environmental Affairs) was used to identify all renewable energy developments within a 50 km radius of the proposed site. The applications listed as 'approved' or 'in process' are:

- Inyanga solar energy project (75 MW) on Farm O'poort 384
- Three 75 MW Arriesfontein photovoltaic solar power plants on the farm Arriesfontein
- Hydropower station at Boegoeberg dam on the Orange River
- Prieska solar power plant within the Siyathemba Municipality (19 MW)
- Marang solar project on the Blauwbospan No. 113
- PV solar energy facility on the farm Kleinbegin (50 MW)
- 150 MW Ilanga CSP facility
- Karoshoek CSP facility in the Khara Hais municipality (100 MW)
- Kheis solar park 1 and 2 PV project on a site south east of Upington
- Tew Isitha solar 1 and solar 2 facilities (75 MW) in the David Kruiper local municipality
- 86 MW PV solar facility on the farm Rooilyf No. 389
- The operational Bokpoort I PV solar plant

The proposed Bokpoort solar facility amendment and above-mentioned developments will primarily negatively impact bats by reducing foraging areas and roosting resources within the greater area. However, the Orange River and its riparian vegetation is a more important source of drinking water and prime foraging grounds for bats than the surrounding areas that the Bokpoort development is located within. It is essential for each facility to apply site specific mitigation measures recommended by relevant specialists to mitigate the cumulative impacts of renewable energy developments in the region. Thus, the proposed Bokpoort solar facility must adhere to the outlined mitigation measures listed in Section 5 of this report to reduce cumulative impacts of development in the greater area. Therefore no impact assessment table is required for cumulative assessment.

7 CONCLUSION

The literature review of the impacts of PV and CSP technologies indicates the proposed Bokpoort amendment of PV plants, instead of a CSP facility, is favourable for bats. The PV plants should have fewer negative impacts on bats. The impact assessment ratings of ten PV plants for the development are all reduced to a low significance impact rating after application of mitigation measures listed in Section 5 of this report. The mitigation measures listed in this report pose changes to the EMPr, specifically the removal for the requirement for acoustic monitoring.

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Appendix B8: Air Quality

ROYAK HASKONINGDHV

AIR QUALITY IMPACT ASSESSMENT FOR PROPOSED BOKPOORT 10 X PV SOLAR POWER FACILITIES

FARM BOKPOORT, NEAR GROBLERSHOOP, NORTHERN CAPE PROVINCE

18 FEBRUARY 2020

AIR QUALITY IMPACT ASSESSMENT FOR PROPOSED BOKPOORT 10 X PV SOLAR POWER FACILITIES

FARM BOKPOORT, NEAR GROBLERSHOOP, NORTHERN CAPE PROVINCE

ROYAK HASKONINGDHV

PROJECT NO.: 41102263
DATE: FEBRUARY 2020

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EXECUTIVE SUMMARY

WSP Environmental has been appointed by Royal HaskoningDHV to conduct an Air Quality Impact Assessment (AQIA) for the proposed Bokpoort photovoltaic (PV) solar power facilities in the Northern Cape. The site is within one of South Africa's eight renewable energy development zones, identified as most suitable for renewable energy developments in terms of environmental impact and economic and infrastructural factors.

An AQIA of the site was conducted by SSI Environmental in November 2010 for a then proposed concentrating solar plant (CSP) on the site. In 2016, Environmental Authorisations were received for two 75 MW PV plants and a 150 MW CSP plant on the site. ACWA Power Energy Africa now proposes 10 x 200 MW PV plants on the same footprint of the site. Each of the ten sites will comprise PV panels, a battery energy storage system (BESS), a substation, access routes and shared infrastructure consisting of buildings, including a workshop area for maintenance, storage, laydown area, parking, warehouse, and offices. A Basic Assessment is currently underway for the eight additional PV plants. The two already authorised for the site are being assessed for additional capacity and the inclusion of the BESS.

A regulatory assessment indicated that the PV facility does not trigger any of the regulated Listed Activities. As such, the facility does not require an Atmospheric Emission License (AEL). The closest sensitive receptor identified is a farmhouse, approximately 2 km south-west of the proposed site. Surrounding towns are at least 17 km from the site. Local existing air pollution sources include agricultural activities, domestic fuel burning and veld fires. The key pollutant from the proposed site during the construction and decommission phases would be particulate matter (PM). Various PM control measures for the construction phase are presented, the key being wet suppression. During the operational phase, there should be very limited air quality impacts, if any, beyond exhaust emissions and wheel entrainment of dust by traffic to and from the site. Strict BESS management and maintenance procedures will ensure containment and prevent any significant air quality impacts. On decommissioning, the BESS should be promptly removed offsite in line with manufacturer guidance and taken to the nearest appropriate recycling facility. While there are recycling options for lead-acid batteries in South Africa, opportunities for the recycling of lithium ion batteries needs further investigation.

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1 INTRODUCTION

1.1 BACKGROUND

WSP Environmental (WSP) has been appointed by Royal HaskoningDHV to update an existing air quality impact assessment (AQIA) for the proposed Bokpoort photovoltaic (PV) solar power facilities in the Northern Cape. The site is within one of South Africa's eight renewable energy development zones, identified as most suitable for renewable energy developments in terms of environmental impact and economic and infrastructural factors.

An AQIA of the site was conducted by SSI Environmental in November 2010[1] for a then proposed concentrating solar plant (CSP) on the site. In 2016, Environmental Authorisations were received for two 75 MW PV plants and a 150 MW CSP plant on the site. ACWA Power Energy Africa (ACWA Power) now proposes 10 x 200 MW PV plants on the same footprint of the site (**Figure 1)**. Each of the ten sites will comprise PV panels, a battery energy storage system (BESS), a substation, access routes and shared infrastructure consisting of buildings, including a workshop area for maintenance, storage, laydown area, parking, warehouse, and offices. A Basic Assessment is currently underway for the eight additional PV plants. The two already authorised for the site are being assessed for additional capacity and the inclusion of the BESS. Terms of Reference

The Terms of Reference for the AQIA can be summarised as follows:

— A regulatory assessment;
— An overview of the dispersion potential of the region;
— Identification of sensitive receptors, such as local communities, in the vicinity of the proposed site;
— Identification of existing sources of emissions in the area;
— Identification of sources of emissions on the proposed site; and
— Recommendations for appropriate mitigation measures.

1.2 REGULATORY FRAMEWORK

Until 2004, South Africa's approach to air pollution control fell under the Atmospheric Pollution Prevention Act 45 of 1965 (APPA), which was repealed with the promulgation of the National Environmental Management: Air Quality Act 39 of 2004 (NEM:AQA)[2]. NEM:AQA represented a shift in South Africa's approach to air quality management, from source-based control to a more integrated approach that includes ambient standards.

The objectives of NEM:AQA are to:

— Protect the environment by providing reasonable measures for:
  - The protection and enhancement of air quality;
  - The prevention of air pollution and ecological degradation; and
  - Securing ecologically sustainable development while promoting justifiable economic and social development.
— Give effect to the Constitutional right to an environment that is not harmful to their health and well-being[3]

Significant functions detailed in NEM:AQA include:

— The National Framework for Air Quality Management;
— Institutional planning matters, including:
  - The establishment of a National Air Quality Advisory Committee;

[1] SSI (2010). Air Quality Impact Assessment for a Proposed Concentration Solar Plant in the Norther Cape. Project Number: EO2.JNB.000674, 33 pp.
[2] National Environmental Management: Air Quality Act, Act 39 of 2004, Government Gazette 27318, 24 February 2005.
[3] Constitution of the Republic of South Africa *(No. 108 of 1996).*

- The appointment of Air Quality Officers (AQOs) at each level of government;
- The development, implementation and reporting of Air Quality Management Plans at national, provincial and municipal levels;

— Air quality management measures including:
  - The declaration of Priority Areas where ambient air quality standards are being, or may be, exceeded;
  - The listing of activities that result in atmospheric emissions and which have the potential to impact negatively on the environment and the licensing thereof through an Atmospheric Emissions License (AEL);
  - The declaration of Controlled Emitters;
  - The declaration of Controlled Fuels;
  - Procedures to enforce Pollution Prevention Plans or Atmospheric Impact Reporting for the control and inventory of atmospheric pollutants of concern; and
  - Requirements for addressing dust and offensive odours.

Ambient air quality standards are defined as those "*targets for air quality management which establish the permissible concentration of a particular substance in, or property of, discharges to air, based on what a particular receiving environment can tolerate without significant deterioration*"[4]. South Africa's National Ambient Air Quality Standards (NAAQS) are based primarily on guidance offered by two standards set by the South African National Standards (SANS), namely:

— SANS 69:2004 Framework for implementing National ambient air quality standards; and
— SANS 1929:2005 Ambient air quality – Limits for common pollutants.

SANS 69:2004 makes provision for the establishment of air quality objectives for the protection of human health and the environment as a whole. Such air quality objectives include limit values, alert thresholds and target values.

SANS1929:2005 uses the provisions in SANS 69:2004 to establish air quality objectives for the protection of human health and the environment, and stipulates that limit values are initially set to protect human health. The setting of such limit values represents the first step in a process to manage air quality and initiate a process to ultimately achieve acceptable air quality nationally.

The NAAQS presented in **Table 1** became applicable for air quality management from their promulgation in 2009[5] and 2012[6]. The NAAQS have specific averaging periods, compliance timeframes, permissible frequencies of exceedance and reference methods.

Listed Activities and associated Minimum Emission Standards (MES) were published in Government Notice 248, Government Gazette 33064 (31 March 2010) in line with Section 21 of NEM:AQA. An amended list of activities was published in Government Notice 893, Government Gazette 37054 (22 November 2013)[7], with further amendments in June 2015 (Government Notice 551 of 2015) and 2018 (Government Notice 1207 of 2018). The proposed activities of the Bokpoort site do not trigger any of the Listed Activities. As such, the facility does not require an AEL.

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[4] Department of Environmental Affairs (2000): Integrated Pollution and Waste Management Policy for South Africa. Government Gazette (No. R 227 of 2000), 17 March 2000 (No. 20978)

[5] Department of Environmental Affairs (2009): National Ambient Air Quality Standards. Government Gazette (No. R 1210 of 2009), 24 December 2009 (No. 32816)

[6] Department of Environmental Affairs (2012): National Ambient Air Quality Standard for Particulate Matter with Aerodynamic Diameter less than 2.5 Micro Metres ($PM_{2.5}$). Government Gazette (No. R 486 of 2012), 29 June 2012 (No. 35463)

[7] Department of Environmental Affairs (2013): List of Activities Which Result in Atmospheric Emissions Which Have or May Have A Significant Detrimental Effect on the Environment, Including Health, Social Conditions, Economic Conditions, Ecological Conditions Or Cultural Heritage. Government Gazette (No. 893 of 2013), 22 November 2013 (No. 37054)

Table 1: National ambient air quality standards

POLLUTANT	AVERAGING PERIOD	CONCENTRATION ($\mu g/m^3$)	PERMISSIBLE FREQUENCY OF EXCEEDANCE
Particulate Matter (PM_{10})	24 hours	75	4
	1 year	40	0
Particulate Matter ($PM_{2.5}$)	24 hour	40	4
		25[a]	4
	1 year	20	0
		15[a]	0
Benzene (C_6H_6)	1 year	5	0
Sulphur Dioxide (SO_2)	10 minutes	500	526
	1 hour	350	88
	24 hours	125	4
	1 year	50	0
Nitrogen Dioxide (NO_2)	1 hour	200	88
	1 year	40	0
Carbon Monoxide (CO)	1 hour	30000	88
	8 hour	10000	11
Ozone (O_3)	8 hour	120	11
Lead (Pb)	1 year	0.5	0

a: Effective date is 01 January 2030

1.3 STUDY SITE

The proposed site is on Farm Bokpoort 390, located approximately 80 km to the south-south-east of Upington (**Figure 1**). The region is semi-desert with cultivated crops along the floodplain of the Orange River. The chief activity on the site prior to development was sheep and cattle farming. A number of game farms are located to the north of the proposed site.

1.3.1 SENSITIVE RECEPTORS

A sensitive receptor is a person or place where involuntary exposure to pollutants released by the proposed project could take place (e.g. residences, schools, medical facilities, etc.). Receptors surrounding the proposed site were identified by SSI (2010)[8] from satellite images of the area. The closest sensitive receptor is a neighbouring farmhouse, approximately 2 km south-west of the proposed site. Residential areas identified include:

- Wegdraai (17 km south-west of the site);
- Groblershoop (18 km south of the site);
- Sutterheim (19 km south of the site);
- Brandboom (24 km south-south-east of the site);
- Boegoberg (34 km south-south-east of the site); and
- Upington (80 km west-north-west of the site).

[8] SSI (2010). Air Quality Impact Assessment for a Proposed Concentration Solar Plant in the Norther Cape. Project Number: EO2.JNB.000674, 33 pp.

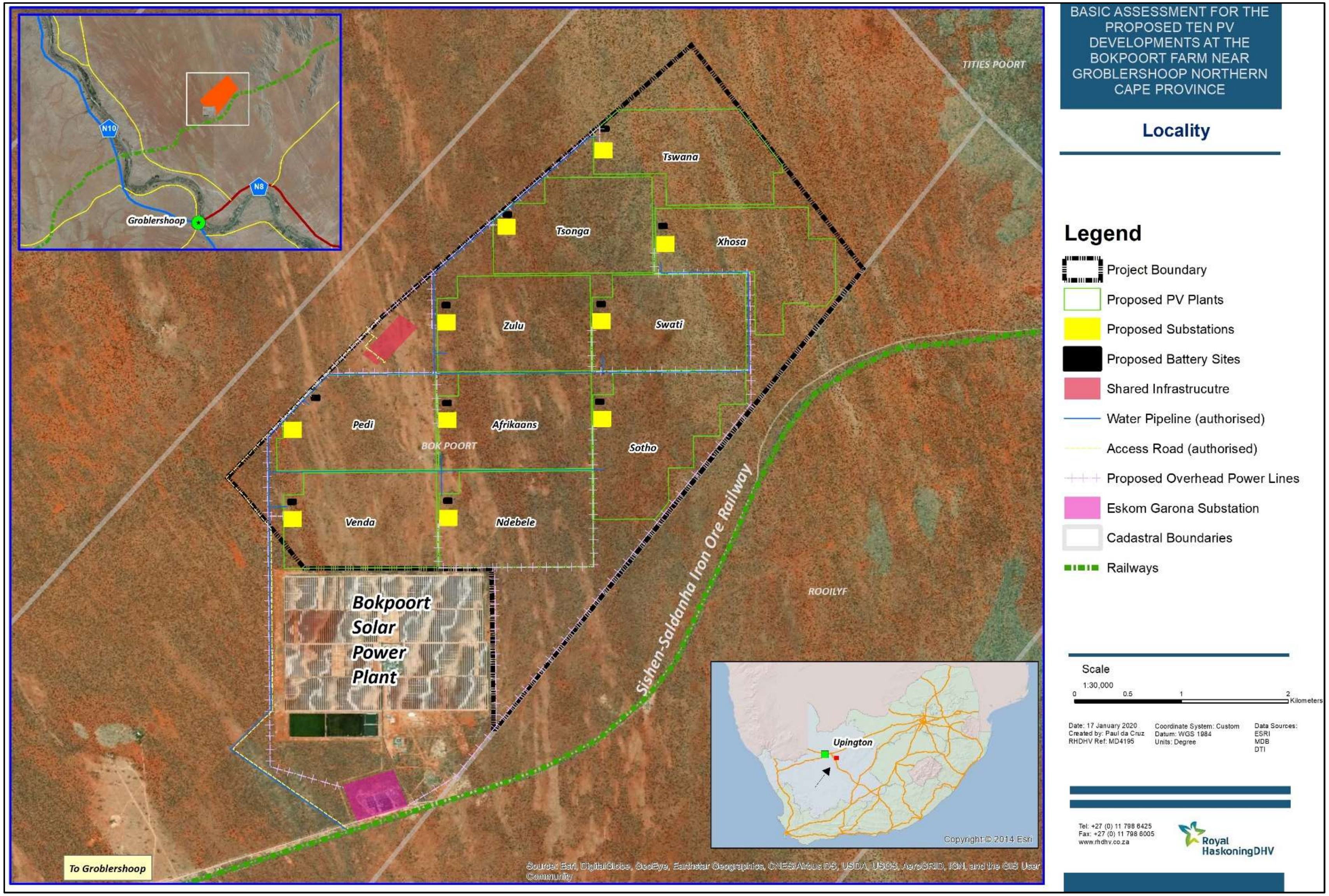

Figure 1: Site locality map

1.3.2 EXISTING SOURCES OF AIR POLLUTION

SSI (2010)[9] used satellite imagery to identify the following sources of air pollution in the area:

- Agriculture;
- Domestic fuel burning; and
- Veld fires.

The following sections, providing a qualitative description of the identified sources, were extracted from the SSI (2010)[10] AQIA report:

AGRICULTURE

Land-use along the Orange River is predominantly agricultural with crops such as grapes grown on the flood plains. The activities responsible for the release of particulate matter (PM) and gases to atmosphere include:

- Particulate emissions generated due to wind erosion from exposed areas;
- Particulate emissions generated due to the mechanical action of equipment used for tilling and harvesting operations
  - Tilling, harvesting and other activities associated with field preparation are seasonally based;
- Vehicle entrained dust on paved and unpaved road surfaces;
- Gaseous and particulate emissions due to fertilizer treatment; and
- Gaseous emissions due to the application of herbicides and pesticides.

DOMESTIC FUEL BURNING

It is anticipated that low income households in the area are likely to use coal and wood for space heating and cooking purpose. Biomass and coal smoke contain a large number of pollutants, including PM, carbon monoxide (CO), nitrogen oxides (NO_x), sulphur oxides (SO_3), formaldehyde, and polycyclic organic matter, including carcinogens such as benzo[a]pyrene[11].

Exposure to indoor air pollution (IAP) from the combustion of solid fuels has implications for acute respiratory infections (ARI) and otitis media (middle ear infection), chronic obstructive pulmonary disease (COPD), lung cancer (from coal smoke), asthma, cancer of the nasopharynx and larynx, tuberculosis, perinatal conditions and low birth weight, and diseases of the eye such as cataract and blindness[12].

Monitoring of pollution and personal exposures in biomass-burning households has shown concentrations are many times higher than those in industrialized countries. A typical 24-hr average concentration of PM_{10} in homes using biofuels may range from 200 to 5 000 µg/m^3, depending on the type of fuel, stove, and housing. Significant temporal and spatial variations may occur within a house. Field measurements, for example, recorded peak concentrations of > 50 000 µg/m^3 in the immediate vicinity of the fire, with concentrations falling significantly with increasing distance from the fire. Overall, it has been estimated that approximately 80% of total global exposure to airborne particulate matter occurs indoors in developing nations. Levels of CO and other pollutants also often exceed international guidelines[13].

[9] *Ibid.*
[10] *Ibid.*
[11] Ezzati, M. and D.M. Kammen, 2002. Environmental Health Perspective. The health impacts of exposure to indoor air pollution from solid fuels in developing countries: Knowledge, Gaps and data needs. Risk Resource and Environmental Management Divisions, Resources for the future, Washington DC, USA, Energy and Resources Group and Goldman School of Public Policy, University of California, Berkley California, USA.
[12] *Ibid.*
[13] *Ibid.*

VELD FIRES

A veld fire is a large-scale natural combustion process. The size and intensity of a veld fire depends variables such as meteorological conditions, vegetation variables, particularly moisture content, and the density of consumable fuel per hectare (available fuel loading).

The major pollutants from veld burning are PM, CO and volatile organics. NO_x is emitted at rates of from 1 to 4 g/kg burned, depending on combustion temperatures. Emissions of SO_x are negligible[14].

1.3.3 METEOROLOGY

The meteorological description below is extracted from the SSI (2010)[15] AQIA report:

MESO-SCALE METEOROLOGY

Local meteorology determines what happens to pollution when it is released into the atmosphere[16]. Pollution levels fluctuate daily and hourly, in response to changes in atmospheric stability and variations in mixing depth. Similarly, atmospheric circulation patterns will have an effect on the rate of transport and dispersion of pollution.

The release of atmospheric pollutants into a large volume of air results in the dilution of those pollutants. This is most effectively achieved during conditions of free convection and when the mixing layer is deep (unstable atmospheric conditions). These conditions occur most frequently in summer during the daytime. This dilution effect can however be inhibited under stable atmospheric conditions in the boundary layer (shallow mixing layer), particularly if pollution is trapped within a surface inversion. Surface inversions develop under conditions of clear, calm and dry conditions and often occur at night and during winter. Radiative loss during the night results in the development of a cold layer of air close to the earth's surface. These surface inversions dissipate once the sun rises and warms the earth's surface.

With the absence of surface inversions, the pollutants are able to diffuse freely upward; this upward motion may however be prevented by the presence of an elevated inversion. Elevated inversions occur commonly in high pressure areas. Sinking air warms adiabatically to temperatures in excess of those in the mixed boundary layer. The interface between the upper, gently subsiding air is marked by an absolutely stable layer or an elevated subsidence inversion. This type of elevated inversions is common over the interior Southern Africa. The continental high pressure present over the region in the winter months results in fine conditions with little rainfall and light winds with a northerly flow[17].

Seasonal variations in the positions of the high pressure cells have an effect on atmospheric conditions over the region. For most of the year the tropical easterlies cause an air flow with a north-easterly to north-westerly component. In the winter months the high pressure cells move northward, displacing the tropical easterlies northward resulting in disruptions to the westerly circulation. The disruptions result in a succession of cold fronts over the area in winter with pronounced variations in wind direction, wind speeds, temperature, humidity, and surface pressure. Airflow ahead of a cold front passing over the area has a strong north-north-westerly to north-easterly component, with stable and generally cloud-free conditions. Once the front has passed, the airflow is has a dominant southerly component[18].

Easterly and westerly wave disturbances cause a southerly wind flow and tend to hinder the persistence of inversions, either temporarily removing them or increasing their altitude, thereby facilitating the dilution and dispersion of pollutants. Pre-frontal conditions tend to reduce the mixing depth. The potential for the accumulation of pollutants during pre-frontal conditions is therefore enhanced over the plateau[19].

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[14] U.S Environmental Protection Agency, (1996). Compilation of Air Pollution Emission Factors (AP-42), 6th Edition, Volume 1, Available at URL: http://www.epa.gov/ttn/chief/ap42/
[15] SSI (2010). Air Quality Impact Assessment for a Proposed Concentration Solar Plant in the Norther Cape. Project Number: EO2.JNB.000674, 33 pp.
[16] Tyson, P.D. and R.A. Preston-Whyte, 2000. The Weather and Climate of Southern Africa. Oxford University Press, Cape Town.
[17] *Ibid.*
[18] *Ibid.*
[19] *Ibid.*

SITE-SPECIFIC DISPERSION POTENTIAL

Given the remote location of the proposed site, local meteorological measurements were not available. SSI (2010)[20] made use of site-specific modelled MM5 meteorological data for the period January 2005 – December 2009 from Lakes Environmental.

Wind roses comprise of 16 spokes that represent the directions from which winds blew during the reference period. The colours reflect the different categories of wind speeds. The dotted circles provide information regarding the frequency of occurrence of wind speed and direction categories.

Based on an evaluation of the meteorological data provided, winds originated predominantly from the north-north-east (10.5% of the time) and north (9% of the time) (**Figure 1**). Gentle to moderate breezes prevailed over the monitoring period. Calm wind speeds, which are designated as wind speeds less than 0.5 m/s, occur infrequently (<4 % of the time).

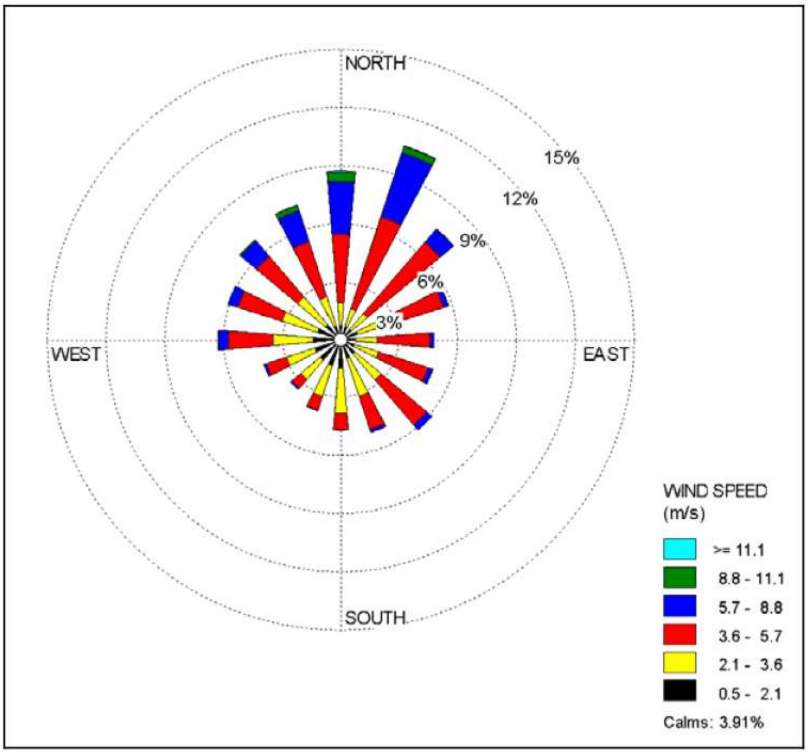

Figure 2: Period wind rose for study site, 2005 – 2009 MM5

A diurnal trend in the wind field is recorded at the proposed site (**Figure 3**). During the morning (06:00 – 12:00), moderate to fresh breezes prevail from the north-northeast to the north-north-west. During the afternoon (12:00 – 18:00), on average gentler breezes blow from the north-westerly sector. The evening (18:00 -00:00) shows a more varied wind rose, but with gentle westerlies prevailing. During the night-time (00:00 – 06:00), average wind speeds increase, with winds prevailing form the north-north-east to east-north-east.

The seasonal variability in the wind field at the proposed site is shown in **Figure 4**. During the summer months (Dec, Jan and Feb), winds originate predominantly from the west. During autumn (Mar, Apr and May), a shift is observed with winds originating predominantly from the north-north-east and north-east. A similar pattern to the autumn months is observed during the winter months (Jun, Jul and Aug) but with a northerly shift and higher average wind speeds. During spring (Sep, Oct and Nov), winds originate from all sectors, with the highest frequency recorded from the westerly sector. Lowest average wind speeds occur during spring.

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[20] SSI (2010). Air Quality Impact Assessment for a Proposed Concentration Solar Plant in the Norther Cape. Project Number: EO2.JNB.000674, 33 pp.

Based on the prevailing meteorological conditions for the area, emissions released from the proposed site will be transported predominantly in a south-south-westerly and southerly direction from the proposed site.

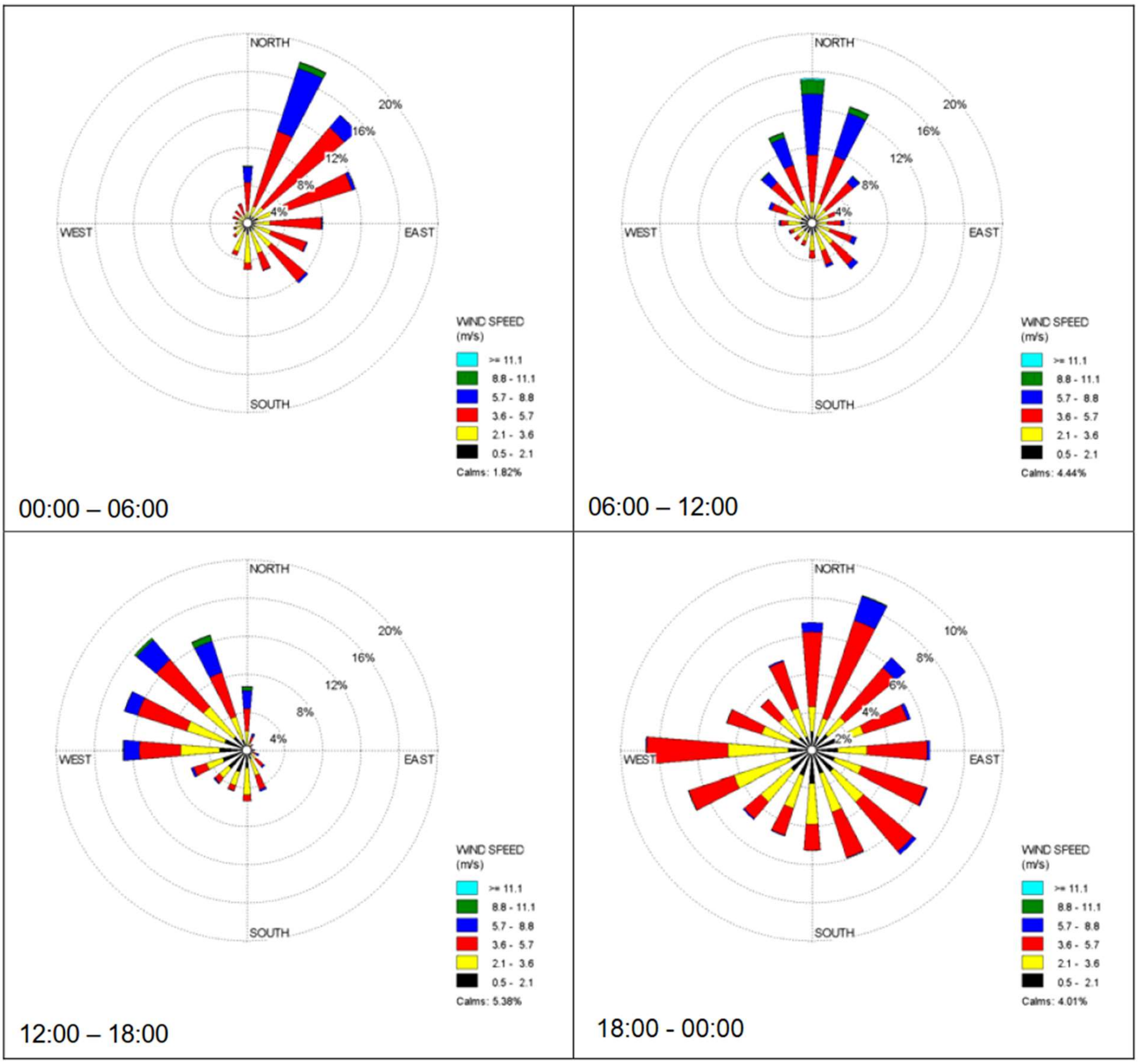

Figure 3: Diurnal wind rose for the study site, 2005 - 2009 MM5

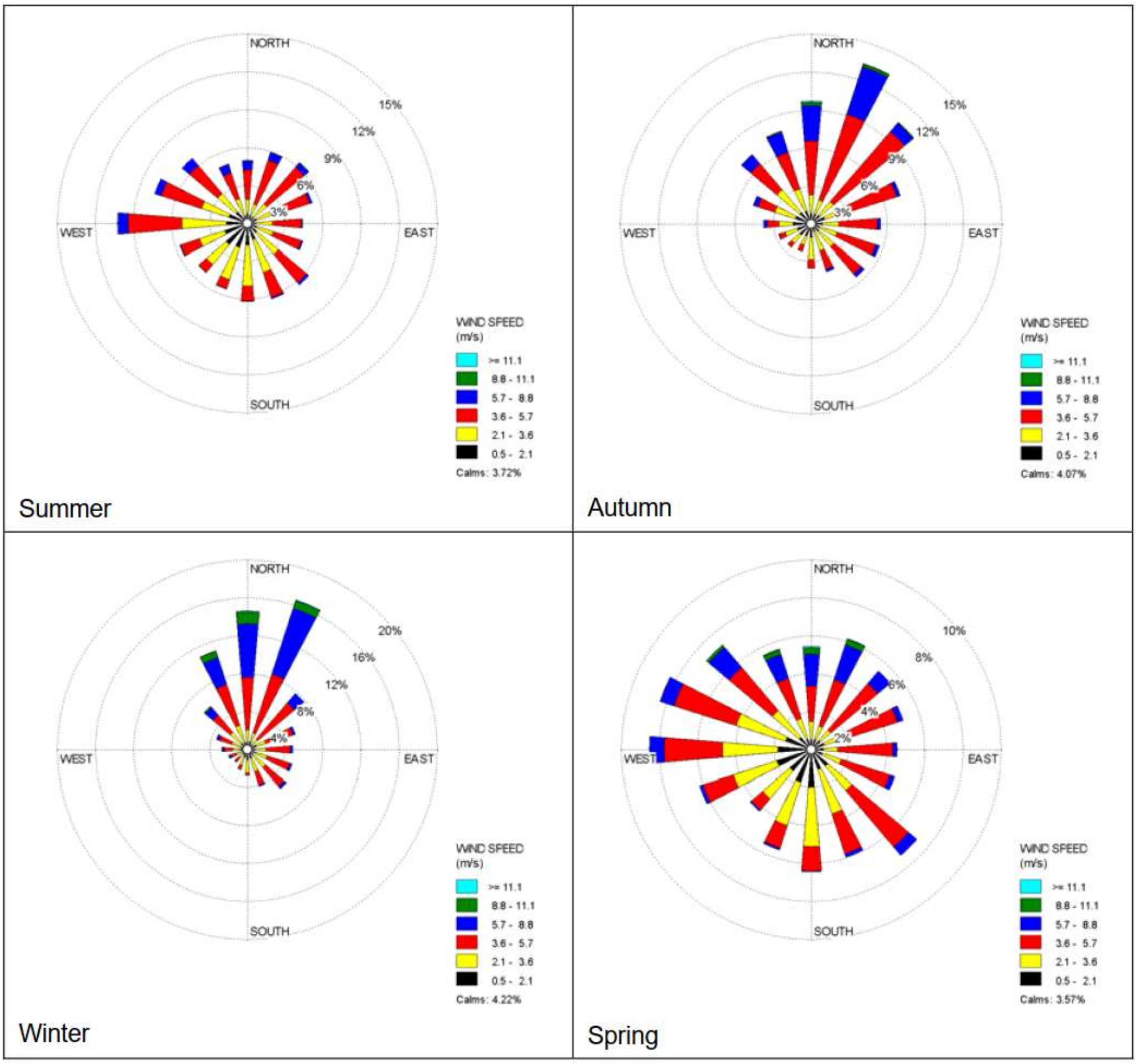

Figure 4: Seasonal wind rose, 2005 - 2009 MM5

ATMOSPHERIC STABILITY

Atmospheric stability is categorised into six classes (**Table 2**). The atmospheric boundary layer is generally most unstable during the day due to turbulence caused by the sun's heating effect on the earth's surface. The depth of this mixing layer depends mainly on the amount of solar radiation, increasing in size gradually from sunrise to reach a maximum at about 5 - 6 hours after sunrise, dependent on cloud cover. The degree of thermal turbulence is increased on clear warm days with light winds. During the night-time a stable layer, with limited vertical mixing, exists. During windy and cloudy conditions, the atmosphere is normally neutral.

Table 2: Atmospheric stability classes

A	Very unstable	calm wind, clear skies, hot daytime conditions
B	Moderately unstable	clear skies, daytime conditions
C	Unstable	moderate wind, slightly overcast daytime conditions
D	Neutral	high winds or cloudy days and nights
E	Stable	moderate wind, slightly overcast night-time conditions
F	Very stable	low winds, clear skies, cold night-time conditions

In general, the proposed site experiences neutral (Class D) to stable (Class E) atmospheric conditions (**Figure 5**). This is expected given the predominance of a high-pressure anticyclone over the interior of South Africa, which produces stable, clear conditions.

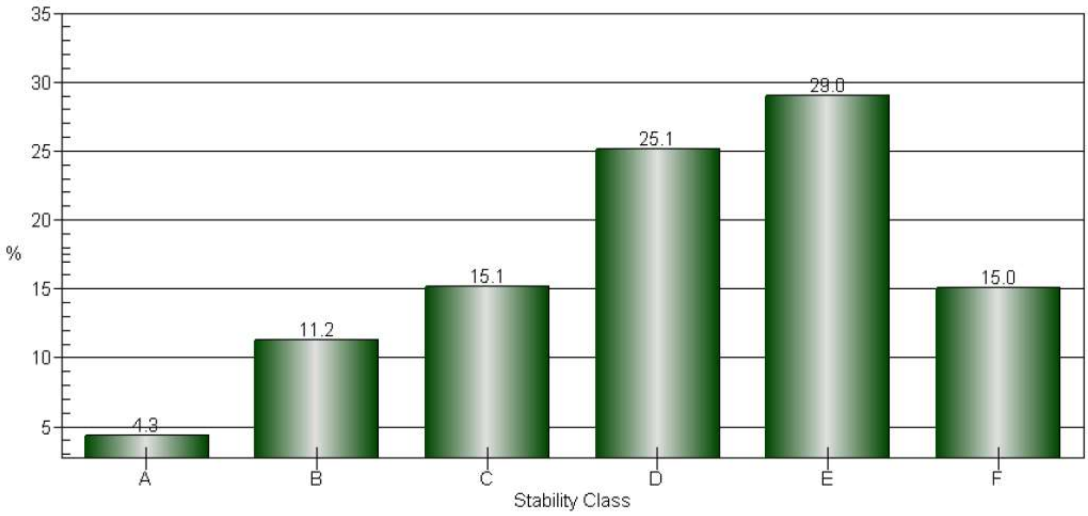

Figure 5: Stability class frequency distribution, 2005 – 2009 MM5

TEMPERATURE AND HUMIDITY

Temperature affects the formation, action, and interactions of pollutants in various ways. Chemical reaction rates tend to increase with temperature. Evaporation rates increase with temperature. When relative humidity exceeds 70%, light scattering by suspended particles can result in decreased visibility due to the resultant haze. Temperature also provides an indication of the rate of development and dissipation of the mixing layer[21].

Average monthly temperature and humidity at the proposed site for the period 2005 – 2009 is presented in **Figure 6**. Daily average summer temperatures range between ~24 °C and ~26 °C while winter temperatures range between ~11 °C and ~13 °C. Relative humidity peaks during the winter months.

[21] CEPA/FPAC Working Group, 1999. National Ambient Air Quality Objectives For Particulate Matter. Part 1: Science Assessment Document. Minister, Public Works and Government Services, Ontario. Available at URL: http://www.hc-sc.gc.ca/bch.

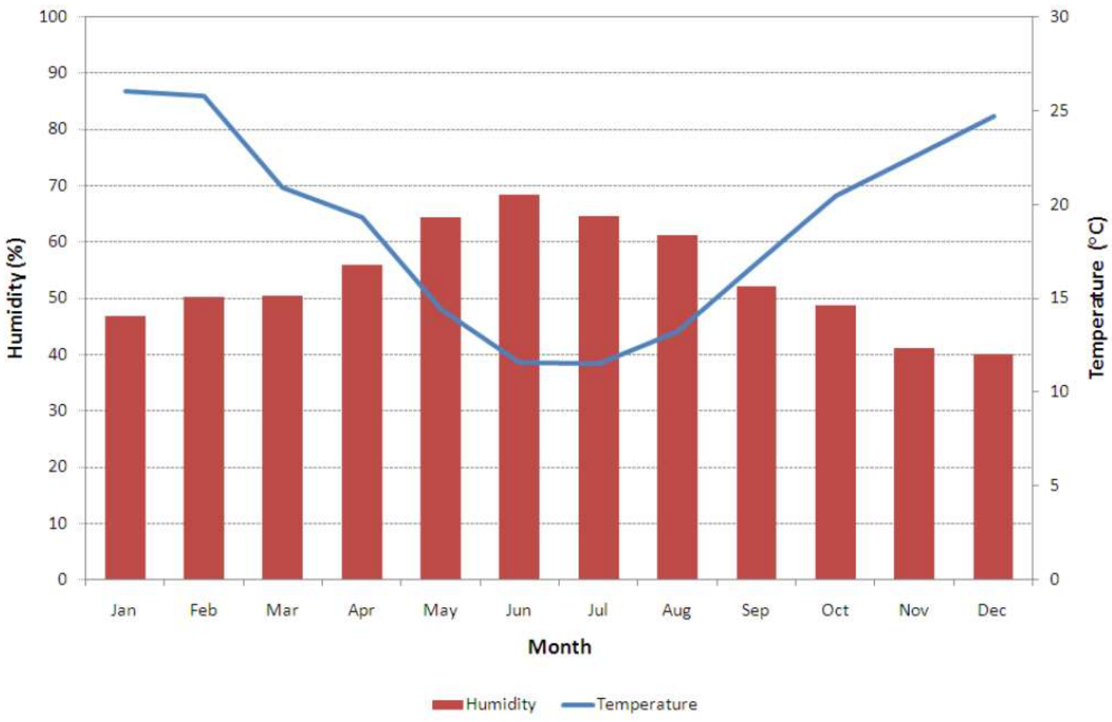

Figure 6: Monthly average temperature and relative humidity at the study site, 2005 - 2009 MM5

1.4 PROPOSED INFRASTRUCTURE

1.4.1 PHOTOVOLTAIC INFRASTRUCTURE

The solar PV development of up to 200 Megawatt (MW) that will consist of the following infrastructure:

- Solar PV modules that will be able to deliver up to 200 MW per PV plant 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 alternating current (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;
- A BESS at each of the ten plants:
  - Battery power at point of connection: 150 MW
  - The BESS will store approximately 4500 m^3 of hazardous substance.
- Instrumentation and Control - hardware and software for remote plant monitoring and operation.

1.4.2 ENERGY STORAGE OPTIONS

ACWA Power favour a lithium ion BESS on each of the ten sites. Parsons (2017)[22] outline various advanced battery systems, including lead and advanced lead-acid batteries, ultracapacitators, lithium ion batteries, vanadium flow batteries, zinc bromine flow batteries, ion-chromium flow batteries, and sodium sulphur batteries. Ultracapacitators and lithium ion batteries generally are limited by high production costs, while vanadium flow batteries, zinc bromine flow batteries, and ion-chromium flow batteries remain developing technologies. Sodium sulphur batteries require high operating temperatures (250-300ºC).

Should ACWA Power not select the lithium ion option, we assume a lead-acid battery option will be selected. This is a mature battery technology with lower initial costs, albeit higher maintenance requirements than some of the alternatives. Our impact assessment thus consider both the lithium ion and lead-acid options.

1.4.3 ASSOCIATED INFRASTRUCTURE

Associated infrastructure includes:

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

1.4.4 POLLUTANTS ASSOCIATED WITH THE PROPOSED FACILITY

PARTICULATE MATTER (PM)

Particulate matter (PM) is the key pollutant of concern during the construction phase of the project. PM refers to solid or liquid particles suspended in the air, varying in size from particles that are only visible under an electron microscope to soot or smoke particles that are visible to the human eye. PM contributes greatly to deteriorations in visibility, as well as posing major health risks, as small particles (PM_{10}) can penetrate deep into lungs (inhalable fraction), while even smaller particle sizes ($PM_{2.5}$) can enter the bloodstream via capillaries in the lungs (respirable fraction), with the potential to be laid down as plaques in the cardiovascular system or brain. Health effects include: respiratory disease, lung tissue damage, cardiovascular disease, cancer and premature death. Acidic particles may damage buildings, vegetation and acidify water sources.

Total suspended particulates (TSP) includes particles of aerodynamic diameter of 30 microns or less and is generally a nuisance as dust fallout. Dust fallout comprises of particulate matter with varying aerodynamic diameters and mass characteristics. Visible dust fallout typically has a high particle size and mass characteristic, and thus a localized impact due to the rapid gravity settling of the larger particles. Nuisance effects can be caused by particles of any size, though are generally associated with particles greater than 20 microns. Large dust particles fall out of the air relatively close to the source and form dust layers on furniture, motor vehicles, etc.

[22] Parsons (2017). South Africa Energy Storage Technology and Market Assessment, Job Number 640368, USTDA Activity Number 2015-11032A, Objective 4: Environmental Impact Assessment.

GASEOUS EMISSIONS FROM BATTERY ENERGY STORAGE SYSTEMS

BESS loss of containment due to corrosion or fires, or during maintenance procedures poses risks to ambient air quality.

In the case of lithium ion batteries, the following emissions are of concern[23]:

- When exposed to water (including humidity), lithium emits flammable gases;
- Most lithium-ion batteries contain organic electrolytes (e.g. lithium perchlorate, acetonitrile), that are combustible, with associated emissions; and
- Additional heavy metals (such a cobalt and manganese) within the battery can be emitted to atmosphere under upset conditions (a containment breach or thermal runaway fire conditions).

In the case of lead-acid batteries, the following emissions are of concern[24]:

- Overcharging of lead-acid batteries can result in the emissions of hydrogen (H_2) and hydrogen sulphide (H_2S). H_2 does not have health implications, but has explosion risks. H_2S has a rotten egg smell. Concentrations of H_2S high enough to cause health impacts are not expected in the offsite ambient environment.
- Containment loss is the greatest concern in relation to the storage of hazardous chemicals onsite, and is a particular concern with the lead-acid BESS since sulphuric acid is highly corrosive:
  - Acute exposure to sulphuric acid fumes can cause irritation to eyes and the mucus membranes of the respiratory system;
  - Toxic fumes of molten lead:
    - Ambient lead is regulated under the NAAQS (**Table 1**) due to well established health implications of chronic exposure;
  - Fugitive emissions of other gases (e.g. H_2S and SO_x) pose further risks; and
  - Depending on the metal alloy composition in lead-acid batteries, arsine (arsenic hydride, AsH_3) and stibine (antimony hydride, SbH_3) can also be emitted.

[23] *Ibid.*
[24] *Ibid.*

2 IMPACT ASSESSMENT

2.1 CONSTRUCTION PHASE

The PM emissions associated with the construction will be of a temporary nature. Emission will vary from day to day depending on the phase of construction, the level of activity, and the prevailing meteorological conditions (USEPA, 1996).

The following possible sources of PM emissions have been identified for the construction phase:

— Vehicle activities associated with the transport of equipment to the site;
— Preparation of the surface area prior to development; and
— The removal of construction equipment from site after the set-up of new infrastructure.

Vehicles travelling to and from the site will emit PM and gases, such as NO_x. Expected vehicle volumes, however, will not result in any significant impact on local air quality beyond the direct vicinity of key transport routes.

2.2 OPERATIONAL PHASE

If areas exposed during the construction phases are promptly revegetated, emissions during the operational phase of the facility are expected to be insignificant. Two sources of potential emissions are presented below:

2.2.1 EXPOSED AREAS

Areas left exposed after construction can results in emissions of PM particularly during periods of high wind speeds, or due to wheel entrainment of PM if vehicles travel over these areas.

2.2.2 VEHICULAR TRAFFIC

Vehicles travelling to and from the site will emit PM and gases. Expected vehicle volumes, however, will not result in any significant impact on local air quality beyond the direct vicinity of the main access road and access gate.

2.2.3 BATTERY ENERGY STORAGE SYSTEMS

Loss of containment due to corrosion or fires, or during maintenance procedures poses risks to ambient air quality.

In the case of lithium ion batteries, the following emissions are of concern[25]:

— When exposed to water (including humidity) due to a containment breach, lithium emits flammable gases;
— Most lithium-ion batteries contain organic electrolytes (e.g. lithium perchlorate, acetonitrile), that are combustible, with associated emissions;
— Additional heavy metals (such a cobalt and manganese) within the battery can be emitted to atmosphere under upset conditions (e.g. thermal runaway fire conditions)

In the case of lead-iron batteries, the following considerations are relevant[26]:

— When overcharged the battery can produce H_2, which poses an explosion risk, and H_2S, which has an odour nuisance (rather than health risk) at expected ambient concentrations;

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[25] *Ibid.*
[26] *Ibid.*

- Containment loss is the greatest concern in relation to the storage of hazardous chemicals onsite, and is a particular concern with the lead-acid BESS since sulphuric acid is highly corrosive:
  - Acute exposure to sulphuric acid fumes (an occupational rather than ambient air quality risk) can cause irritation to eyes and the mucus membranes of the respiratory system;
  - Toxic fumes of molten lead:
    - Ambient lead is regulated under the NAAQS (**Table 1**) due to well established health implications of chronic exposure;
  - Fugitive emissions of other gases (e.g. H_2S and SO_x) pose further risks; and
  - Depending on the metal alloy composition in lead-acid batteries, AsH_3 and SbH_3 can also be emitted.

2.3 DECOMMISSIONING PHASE

The following activities are associated with the decommissioning phase:

- Existing structures demolished, rubble removed and the area levelled;
- Remaining exposed excavated areas filled and levelled;
- Topsoil replaced; and
- Land and permanent waste piles prepared for revegetation.

Possible sources of particulate emissions during the closure and post-closure phase include:

- Smoothing of areas by bulldozer;
- Grading of sites;
- Transport and dumping of material for void filling;
- Infrastructure demolition;
- Infrastructure rubble piles;
- Transport and dumping of building rubble;
- Transport and dumping of topsoil; and
- Preparation of soil for revegetation – ploughing and addition of fertiliser, compost etc.

Decommissioning of BESS can also result in emissions to atmosphere due to containment issues (refer to *2.2. Operational Phase).* As such, the decommissioned components should be removed from site as soon as possible and transferred to an appropriate recycling facility. While there are recycling options for lead-acid batteries in South Africa, opportunities for the recycling of lithium ion batteries needs further investigation.

3 MITIGATION MEASURES

We highlight that the nearest identified receptor (a farmhouse) is 2 km away from the site. Identified towns are at least 17 km from the site. As such, it is not expected that there will be a significant number of complaints regarding activities on site. However, in line with good environmental practice, various air pollution mitigation measures are presented below. It is also recommended that a complaint receipt, recording and response procedure is developed. A record of complaints and the response thereto should be stored in hard and digital copy onsite.

3.1 CONSTRUCTION PHASE

Control techniques for fugitive PM sources during the construction phase include watering, chemical stabilisation or reduction of surface wind speed with windbreaks or source enclosures. Watering is the most common and least expensive method, although it only provides temporary dust control. Wet suppression of unpaved areas can achieve dust emission reductions of approximately 70% or more, which can be increased by up to 95% through the use of chemical stabilisation. The use of chemicals provides for longer dust suppression but is more costly and may have adverse environmental effects. It is unlikely that such methods will be required at the proposed site. Windbreaks and source enclosures are often impractical because of the size of the construction area, but key areas of current activity can be closed off to limit impacts. A summary of control measures for the proposed plant is provided in **Table 3**. Wet suppression is the recommended method for the proposed plant to control PM emissions during the construction phase[27].

Table 3: Potential sources of particulate matter during the construction phase and suggested control measures[28]

Source	Suggested Control Method
Debris handling	Wind speed reduction (e.g wind-breaks)
	Wet suppression
Truck transport	Wet suppression
	Paving of roads
Bulldozers	Wet suppression
Pan scrapers	Wet suppression
Cut/fill materials handling	Wind speed reduction
	Wet suppression
Cut/fill haulage	Wet suppression
	Paving of roads
General construction	Wind speed reduction
	Wet suppression
	Early paving of haul/access road

[27] SSI (2010). Air Quality Impact Assessment for a Proposed Concentration Solar Plant in the Norther Cape. Project Number: EO2.JNB.000674, 33 pp.
[28] *Ibid.*

3.2 OPERATIONAL PHASE

3.2.1 EXPOSED AREAS

Revegetation of areas exposed for long-term dust and water erosion control is the most cost effective option. Plant roots bind the soil, and vegetation cover breaks the impact of falling raindrops, thus preventing wind and water erosion. Plants used for revegetation should be indigenous to the area, hardy, fast-growing, nitrogen-fixing, provide high plant cover, be adapted to growing on exposed and disturbed soil (pioneer plants) and should easily be propagated by seed or cuttings[29].

3.2.2 VEHICULAR TRAFFIC

While motor vehicles emit gaseous pollutants such as NO_x, the expected traffic levels to and from the site indicate that there will not be significant ambient air quality impacts beyond the access routes. Wheel entrained dust can supplement the PM load. Various measures are available to limit emissions by vehicles accessing and travelling onsite:

- Clear, signposted roads with no offroad driving permitted;
- Limit unnecessary travel onsite:
  - Planned, efficient check and maintenance routines;
  - Controlled access; and
  - Clear signage.
- Signposted speed limits onsite and the use of speed humps if necessary to enforce onsite speed limit; and
- Prevent idling of vehicles at the access gate.

3.2.3 BATTERY ENERGY STORAGE SYSTEMS

The following are recommended to limit air quality impacts by the BESS:

- Strict BESS management and monitoring systems:
  - Temperature monitoring to ensure the system does not overheat;
  - Prevent overcharging as this poses an explosion risk[30]; and
  - Checks and maintenance in line with manufacturer specifications to prevent containment breaches; and
- Secondary containment areas to prevent ambient air quality impacts in the case of a breach[31].

3.3 DECOMMISSIONING PHASE

Windbreaks and source enclosures can be used during demolition, rubble removal, infilling, levelling and topsoil covering. Rubble piles can be covered and transported away from the site in covered trucks. It is key that all exposed areas are vegetated as soon as possible during the decommissioning process. Plants used for revegetation should be indigenous to the area, hardy, fast-growing, nitrogen-fixing, provide high plant cover, be adapted to growing on exposed and disturbed soil (pioneer plants) and should easily be propagated by seed or cuttings[32].

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[29] *Ibid.*
[30] Parsons (2017). South Africa Energy Storage Technology and Market Assessment, Job Number 640368, USTDA Activity Number 2015-11032A, Objective 4: Environmental Impact Assessment.
[31] *Ibid.*
[32] SSI (2010). Air Quality Impact Assessment for a Proposed Concentration Solar Plant in the Norther Cape. Project Number: EO2.JNB.000674, 33 pp.

BESS must be decommissioned by trained personnel in line with manufacturer specifications. Decommissioned BESS must be removed offsite promptly and taken to the nearest appropriate recycling facility. While there are recycling options for lead-acid batteries in South Africa, opportunities for the recycling of lithium ion batteries needs further investigation.

4 IMPACT RATING

The air quality impact ratings for the construction, operational and decommissioning phases are presented in **Tables 4** to **6** respectively.

Table 4: Impact rating for construction phase

IMPACT	Occurrence		Severity		Significance	
	Probability (P)	**Duration (D)**	**Scale/Extent (S)**	**Magnitude (M)**	**(M+D+S) x P**	**Rating**
Fugitive PM	5	2	2	2	30	Moderate

Table 5: Impact rating for operational phase

IMPACT	Occurrence		Severity		Significance	
	Probability (P)	**Duration (D)**	**Scale/Extent (S)**	**Magnitude (M)**	**(M+D+S) x P**	**Rating**
Fugitive PM	2	4	2	2	16	Low
Wheel entrained PM	5	4	2	2	40	Moderate
Vehicular Emissions	5	4	2	2	40	Moderate
BESS: Lead-iron overcharging	2	4	2	2	16	Low
BESS: Containment loss	1	4	3	10	17	Low

Table 6: Impact rating for decommissioning phase

IMPACT	Occurrence		Severity		Significance	
	Probability (P)	**Duration (D)**	**Scale/Extent (S)**	**Magnitude (M)**	**(M+D+S) x P**	**Rating**
Fugitive PM	5	2	2	2	30	Moderate
BESS: Containment loss	1	4	3	10	17	Low

5 CONCLUSION

This report provides an AQIA for the proposed Bokpoort 10 x PV solar power plant, each with an onsite BESS. A regulatory assessment indicated no triggers of the Listed Activities. As such, the facility does not require an AEL. The closest sensitive receptor identified is a farmhouse, approximately 2 km south-west of the proposed site. Surrounding towns are at least 17 km away from the site. Local existing air pollution sources include agricultural activities, domestic fuel burning and veld fires. The key pollutant from the proposed site during the construction and decommissions phases would be PM. Various PM control measures for the construction phase are presented, the key being wet suppression. During the operational phase, there should be very limited air quality impacts, if any, beyond exhaust emissions and wheel entrainment of dust by traffic to and from the site. Strict BESS management and maintenance procedures will ensure containment and prevent any significant air quality impacts. On decommissioning, the BESS should be promptly removed offsite in line with manufacturer guidance and taken to the nearest appropriate recycling facility. While there are recycling options for lead-acid batteries in South Africa, opportunities for the recycling of lithium ion batteries needs further investigation.

Appendix B9: Heritage

Phase 1 Cultural Heritage Impact Assessment:

THE PROPOSED BOKPOORT II PV SOLAR POWER FACILITIES ON THE FARM BOKPOORT 390 NEAR GROBLERSHOOP, !KHEIS LOCAL MUNICIPALITY, NORTHERN CAPE PROVINCE

Prepared for:

Royal HaskoningDHV: Mr M Roods

- Address: P O Box 867, Gallo Manor, 2052, Gauteng, Tel: 087 352 1528; E-mail: Malcolm.Roods@rhdhv.com

Prepared by:

J A van Schalkwyk (D Litt et Phil),

- Heritage Consultant: ASAPA Registration No.: 164 - Principal Investigator: Iron Age, Colonial Period, Industrial Heritage.
- Postal Address: 62 Coetzer Avenue, Monument Park, 0181; Tel: 076 790 6777; E-mail: jvschalkwyk@mweb.co.za

Report No: 2020/JvS/001

- Status: Final
- Date: January 2020
- Revision No: -
- Date: -

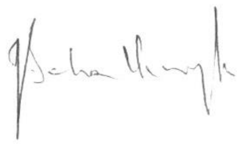






Specialist competency:

Johan A van Schalkwyk, D Litt et Phil, heritage consultant, has been working in the field of heritage management for more than 40 years. Originally based at the National Museum of Cultural History, Pretoria, he has actively done research in the fields of anthropology, archaeology, museology, tourism and impact assessment. This work was done in Limpopo Province, Gauteng, Mpumalanga, North West Province, Eastern Cape Province, Northern Cape Province, Botswana, Zimbabwe, Malawi, Lesotho and Swaziland. Based on this work, he has curated various exhibitions at different museums and has published more than 70 papers, most in scientifically accredited journals. During this period, he has done more than 2000 impact assessments (archaeological, anthropological, historical and social) for various government departments and developers. Projects include environmental management frameworks, roads, pipeline-, and power line developments, dams, mining, water purification works, historical landscapes, refuse dumps and urban developments.



J A van Schalkwyk
Heritage Consultant
January 2020

SPECIALIST DECLARATION

I, J A van Schalkwyk, as the appointed independent specialist, in terms of the 2014 EIA Regulations (as amended), hereby declare that I:

- I act as the independent specialist in this application;
- I 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;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 (as amended) and any specific environmental management Act;
- 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 have no vested interest in the proposed activity proceeding;
- 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;
- I have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study 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

J A van Schalkwyk
January 2020

EXECUTIVE SUMMARY

Phase 1 Cultural Heritage Impact Assessment: **THE PROPOSED BOKPOORT II PV SOLAR POWER FACILITIES ON THE FARM BOKPOORT 390 NEAR GROBLERSHOOP, !KHEIS LOCAL MUNICIPALITY, NORTHERN CAPE PROVINCE**

ACWA Power obtained 3 Environmental Authorisations in 2016 for 2 x 75MW PV facilities as well as a 150MW CSP facility. An EIA study was undertaken for the 75MW CSP plant in Bokpoort, Northern Cape and approved by Department of Environmental Affairs (DEA). In accordance with Section 38 of the National Heritage Resources Act, No. 25 of 1999, a heritage study (Dreyer 2015) was completed and submitted to SAHRA and was subsequently accepted by that authority.

However, ACWA Power Energy Africa (Pty) Ltd (formerly known as ACWA Power Africa Holdings) now proposes to, instead of the 150MW CSP facility, construct 8 x 200 MW PV plants in its place on the same footprint, which was assessed in 2016. Two PV Plants (Xhosa and Ndebele) have already been authorised but are undergoing another Basic Assessment (BA) study for the battery storage energy system (BESS) as well as the capacity increase from 75 to 200MW.

Royal HaskoningDHV (Pty) Ltd was contracted as independent environmental consultant to undertake the EIA process for the proposed construction of the 8 x 200 MW PV plants and the increased capacity and inclusion of BESS in the already authorised 2 PV projects.

In accordance with Section 38 of the NHRA, an independent heritage consultant was appointed by *Royal HaskoningDHV (Pty) Ltd* to conduct a cultural heritage assessment to determine if the construction of the PV plants and associated infrastructure would have an impact on any sites, features or objects of cultural heritage significance.

- As the total area was previously surveyed by Dreyer (2015), the purpose of the current survey was purely to verify his findings, as well as to assess the possible cumulative impact of the development as this was not done previously.

This report describes the methodology used, the limitations encountered, the heritage features that were identified and the recommendations and mitigation measures proposed relevant to this. It should be noted that the implementation of the mitigation measures is subject to SAHRA/PHRA's approval.

The cultural landscape qualities of the region are made up of a pre-colonial element consisting of Stone Age and a much later colonial (farmer) component, which eventually gave rise to an urban component which manifest in a number of small towns and an intensive farming industry.

<u>Identified sites</u>

Stone Age lithics dating to the MSA are found only as low-density surface scatters, which is confirmed by similar findings in the larger region by other researchers (Dreyer 2014, 2015; Morris 2014, 2018; van der Walt 2015; van Schalkwyk 2019). The density of artefacts is less than 1/50m^2.

- The low density of the lithic scatters is, on archaeological grounds, viewed to be of low significance and require no further action.

<u>Impact assessment and proposed mitigation measures</u>

Impact analysis of cultural heritage resources under threat of the proposed development, is based on the present understanding of the development:

- As no sites, features or objects of cultural significance are known to exist in the development area, there would be no impact as a result of the proposed development.

Heritage sites	Significance of impact	Mitigation measures
Bokpoort II Solar Power Plant: Construction Phase		
Without mitigation	n/a	n/a
With mitigation	n/a	n/a
Bokpoort II Solar Power Plant: Operation Phase		
Without mitigation	n/a	n/a
With mitigation	n/a	n/a

Cumulative impact assessment

The cultural heritage profile of the larger region is very limited and consists of isolated findspots of Stone Age (MSA) tools, farmsteads and burial sites. Consequently, the cumulative impact of the proposed development is viewed to be **low**

Site type	**NHRA category**	**Field rating**	**Impact rating: Before/After mitigation**
Archaeological sites/material	Section 35	Generally protected: Low significance – Grade IV-C	Low (16)
			Low (16)
Burial sites and graves	Section 36	Generally protected: Low significance – Grade IV-A	Low (16)
			Low (16)

Legal requirements

The legal requirements related to heritage specifically are specified in Section 3 of this report. For this proposed project, the assessment has determined that no sites, features or objects of heritage significance occur in the study area. If heritage features are identified during construction, as stated in the management recommendation, these finds would have to be assessed by a specialist, after which a decision will be made regarding the application for relevant permits.

Reasoned opinion as to whether the proposed activity should be authorised:

- From a heritage point of view, it is recommended that the proposed development be allowed to continue on acceptance of the proposed mitigation measures and the conditions proposed below.

Conditions for inclusion in the environmental authorisation:

- The Palaeontological Sensitivity Map (SAHRIS) indicate that the study area has a moderate sensitivity of fossil remains to be found and therefore a desktop palaeontological required.
- Should archaeological sites or graves be exposed in other areas during construction work, it must immediately be reported to a heritage practitioner so that an investigation and evaluation of the finds can be made.

J A van Schalkwyk
Heritage Consultant
January 2020

TECHNICAL SUMMARY

Project description	
Description	Development of 10 X 200MW Solar PV facilities
Project name	Bokpoort II Solar Power Plant (each individually identified as Afrikaans; Ndebele; Pedi; Sotho; Swati; Tsonga; Tswana; Venda; Xhosa; Zulu)

Applicant
ACWA Power Green Energy Africa (Pty) Ltd

Environmental assessors
Mr M Roods
Royal HaskoningDHV (Pty) Ltd

Property details						
Province	Northern Cape					
Magisterial district	Gordonia					
Local municipality	!Kheis					
Topo-cadastral map	2821DB, 2822CA					
Farm name	Bokpoort					
Closest town	Groblershoop					
Coordinates	Corner points (approximate)					
	No	Latitude	Longitude	No	Latitude	Longitude
	1	-28.73309	22.00469	2	-28.71962	22.00451
	3	-28.71952	21.98857	4	-28.71189	21.98206
	5	-28.67546	22.02122	6	-28.69420	22.03567

Development criteria in terms of Section 38(1) of the NHR Act	Yes/No
Construction of road, wall, power line, pipeline, canal or other linear form of development or barrier exceeding 300m in length	Yes
Construction of bridge or similar structure exceeding 50m in length	No
Development exceeding 5000 sq m	Yes
Development involving three or more existing erven or subdivisions	No
Development involving three or more erven or divisions that have been consolidated within past five years	No
Rezoning of site exceeding 10 000 sq m	No
Any other development category, public open space, squares, parks, recreation grounds	No

Land use	
Previous land use	Farming
Current land use	Farming

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GLOSSARY OF TERMS AND ABBREVIATIONS

TERMS

Bioturbation: The burrowing by small mammals, insects and termites that disturb archaeological deposits.

Cumulative impacts: "Cumulative Impact", in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to existing and reasonably foreseeable impacts eventuating from similar or diverse activities.

Debitage: Stone chips discarded during the manufacture of stone tools.

Factory site: A specialised archaeological site where a specific set of technological activities has taken place – usually used to describe a place where stone tools were made.

Historic Period: Since the arrival of the white settlers - c. AD 1830 - in this part of the country.

Holocene: The most recent time period, which commenced c. 10 000 years ago.

Iron Age (also referred to as **Early Farming Communities**)**:** Period covering the last 1800 years, when new people brought a new way of life to southern Africa. They established settled villages, cultivated domestic crops such as sorghum, millet and beans, and they herded cattle as well as sheep and goats. As they produced their own iron tools, archaeologists call this the Iron Age.

Early Iron Age	AD 200 - AD 900
Middle Iron Age	AD 900 - AD 1300
Later Iron Age	AD 1300 - AD 1830

Midden: The accumulated debris resulting from human occupation of a site.

Mitigation, means to anticipate and prevent negative impacts and risks, then to minimise them, rehabilitate or repair impacts to the extent feasible.

National Estate: The collective heritage assets of the Nation.

Pleistocene: Geological time period of 3 000 000 to 20 000 years ago.

Stone Age: The first and longest part of human history is the Stone Age, which began with the appearance of early humans between 3-2 million years ago. Stone Age people were hunters, gatherers and scavengers who did not live in permanently settled communities. Their stone tools preserve well and are found in most places in South Africa and elsewhere.

Early Stone Age	2 500 000 - 250 000 Before Present
Middle Stone Age	250 000 - 40-25 000 BP
Later Stone Age	40-25 000 - until c. AD 200

Tradition: As used in archaeology, it is a seriated sequence of artefact assemblages, particularly ceramics.

ACRONYMS and ABBREVIATIONS

AD	Anno Domini (the year 0)
ASAPA	Association of Southern African Professional Archaeologists
BC	Before the Birth of Christ (the year 0)
BCE	Before the Common Era (the year 0)
BP	Before Present (calculated from 1950 when radio-carbon dating was established)
CE	Common Era (the year 0)
CRM	Cultural Resources Management
EAP	Environmental Assessment Practitioner
EIA	Early Iron Age
ESA	Early Stone Age
HIA	Heritage Impact Assessment
I & AP's	Interested and Affected Parties
ICOMOS	International Council on Monuments and Sites
LIA	Late Iron Age
LSA	Later Stone Age
MIA	Middle Iron Age
MSA	Middle Stone Age
NASA	National Archives of South Africa
NHRA	National Heritage Resources Act
PHRA	Provincial Heritage Resources Agency
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System

COMPLIANCE WITH APPENDIX 6 OF THE 2014 EIA REGULATIONS (AS AMENDED)

Requirements of Appendix 6 – GN R982	**Addressed in the Specialist Report**
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	 Front page Page i Addendum Section 6
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Page ii
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1
(cA) an indication of the quality and age of base data used for the specialist report;	Section 4
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 7.3
d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 4.2.2
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 4
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;	Addendum Section 5; Figure 13
g) an identification of any areas to be avoided, including buffers;	Section 8
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 13 Addendum Section 5
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 2
j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Section 7
k) any mitigation measures for inclusion in the EMPr;	Section 9 & 10
l) any conditions for inclusion in the environmental authorisation;	Section 10
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 9
n) a reasoned opinion- i. 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, and where applicable, the closure plan;	 Section 10 Section 8, 9, 10
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Formed part of the original assessment
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Formed part of the original assessment
q) any other information requested by the competent authority.	Formed part of the original assessment
(2) Where a government notice 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.	-

Phase 1 Cultural Heritage Impact Assessment:
THE PROPOSED BOKPOORT II PV SOLAR POWER FACILITIES ON THE FARM BOKPOORT 390 NEAR GROBLERSHOOP, !KHEIS LOCAL MUNICIPALITY, NORTHERN CAPE PROVINCE

1. INTRODUCTION

1.1 Background

ACWA Power obtained 3 Environmental Authorisations in 2016 for 2 x 75MW PV facilities as well as a 150MW CSP facility. An EIA study was undertaken for the 75MW CSP plant in Bokpoort, Northern Cape and approved by Department of Environmental Affairs (DEA). In accordance with Section 38 of the National Heritage Resources Act, No. 25 of 1999, a heritage study (Dreyer 2015) was completed and submitted to SAHRA and was subsequently accepted by that authority.

However, ACWA Power Energy Africa (Pty) Ltd (formerly ACWA Power Africa Holdings) now proposes to, instead of the 150MW CSP facility, construct 8 x 200 MW PV plants in its place on the same footprint, which was assessed in 2016. Two PV Plants (Xhosa and Ndebele) have already been authorised but are undergoing another Basic Assessment (BA) study for the battery storage energy system (BESS) as well as the capacity increase from 75 to 200MW.

Royal HaskoningDHV (Pty) Ltd was contracted as independent environmental consultant to undertake the EIA process for the proposed construction of the 8 x 200 MW PV plants, and the increased capacity and inclusion of BESS in the already authorised 2 PV projects.

South Africa's heritage resources, also described as the 'national estate', comprise a wide range of sites, features, objects and beliefs. However, according to Section 27(18) of the National Heritage Resources Act (NHRA), No. 25 of 1999, no person may destroy, damage, deface, excavate, alter, remove from its original position, subdivide or change the planning status of any heritage site without a permit issued by the heritage resources authority responsible for the protection of such site.

In accordance with Section 38 of the NHRA, an independent heritage consultant was appointed by *Royal HaskoningDHV (Pty) Ltd* to conduct a cultural heritage assessment to determine if the construction of the 10, 200 MW PV plants and associated infrastructure would have an impact on any sites, features or objects of cultural heritage significance.

- As the total area was previously surveyed by Dreyer (2015), the purpose of the current survey was purely to verify his findings, as well as to assess the possible cumulative impact of the development as this was not done previously.

This report forms part of the Environmental Impact Assessment (EIA) as required by the EIA Regulations in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) as amended and is intended for submission to the South African Heritage Resources Agency (SAHRA).

1.2 Terms and references

The aim of a full HIA investigation is to provide an informed heritage-related opinion about the proposed development by an appropriate heritage specialist. The objectives are to identify heritage resources (involving site inspections, existing heritage data and additional heritage specialists if necessary); assess their significances; assess alternatives in order to promote heritage conservation issues; and to assess the acceptability of the proposed development from a heritage perspective.

The result of this investigation is a heritage impact assessment report indicating the presence/ absence of heritage resources and how to manage them in the context of the proposed development.

Depending on SAHRA's acceptance of this report, the developer will receive permission to proceed with the proposed development, on condition of successful implementation of proposed mitigation measures.

1.2.1 *Scope of work*

The aim of this study is to determine if any sites, features or objects of cultural heritage significance occur within the boundaries of the area where the 8 x 200 MW PV plants and the increased capacity and inclusion of BESS in the already authorised 2 PV projects is to take place. This included:

- Conducting a desk-top investigation of the area;
- A visit to the proposed development site.

The objectives were to:

- Identify possible archaeological, cultural and historic sites within the proposed development areas;
- Identify any potential 'fatal flaws' related to the proposed development;
- Evaluate the potential impacts of construction, operation and maintenance of the proposed development on archaeological, cultural and historical resources;
- Recommend mitigation measures to ameliorate any negative impacts on areas of archaeological, cultural or historical importance;
- Provide guideline measures to manage any impacts that might occur during the construction phase as well as the implementation phase.

1.2.2 *Assumptions and Limitations*

The investigation has been influenced by the following factors:

- It is assumed that the description of the proposed project, provided by the client, is accurate.
- The unpredictability of buried archaeological remains.
- No subsurface investigation (i.e. excavations or sampling) were undertaken, since a permit from SAHRA is required for such activities.
- It is assumed that the public consultation process undertaken as part of the Environmental Impact Assessment (EIA) is sufficient and that it does not have to be repeated as part of the heritage impact assessment.

2. LEGISLATIVE FRAMEWORK

2.1 Background

Heritage Impact Assessments are governed by national legislation and standards and International Best Practise. These include:

- South African Legislation
    - National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA);
    - Mineral and Petroleum Resources Development Act, 2002 (Act No. 22 of 2002) (MPRDA);
    - National Environmental Management Act 1998 (Act No. 107 of 1998) (NEMA); and
    - National Water Act, 1998 (Act No. 36 of 1998) (NWA).
- Standards and Regulations
    - South African Heritage Resources Agency (SAHRA) Minimum Standards;
    - Association of Southern African Professional Archaeologists (ASAPA) Constitution and Code of Ethics;
    - Anthropological Association of Southern Africa Constitution and Code of Ethics.
- International Best Practise and Guidelines
    - ICOMOS Standards (Guidance on Heritage Impact Assessments for Cultural World Heritage Properties); and
    - The UNESCO Convention concerning the Protection of the World Cultural and Natural Heritage (1972).

2.2 Heritage Impact Assessment Studies

South Africa's unique and non-renewable archaeological and palaeontological heritage sites are 'generally' protected in terms of the National Heritage Resources Act (Act No 25 of 1999, Section 35) and may not be disturbed at all without a permit from the relevant heritage resources authority.

The National Heritage Resources Act (Act No. 25 of 1999, Section 38) provides guidelines for Cultural Resources Management and prospective developments:

"38 (1) Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorised as:

> *(a) the construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;*
> *(b) the construction of a bridge or similar structure exceeding 50m in length;*
> *(c) any development or other activity which will change the character of a site:*
> *(i) exceeding 5 000 m2 in extent; or*
> *(ii) involving three or more existing erven or subdivisions thereof; or*
> *(iii) involving three or more erven or divisions thereof which have been consolidated within the past five years; or*
> *(iv) the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;*
> *(d) the re-zoning of a site exceeding 10 000 m^2 in extent; or*
> *(e) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority, must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development."*

And:

"38 (3) The responsible heritage resources authority must specify the information to be provided in a report required in terms of subsection (2)(a): Provided that the following must be included:

> *(a) The identification and mapping of all heritage resources in the area affected;*
> *(b) an assessment of the significance of such resources in terms of the heritage assessment criteria set out in section 6(2) or prescribed under section 7;*
> *(c) an assessment of the impact of the development on such heritage resources;*
> *(d) an evaluation of the impact of the development on heritage resources relative to the sustainable social and economic benefits to be derived from the development;*
> *(e) the results of consultation with communities affected by the proposed development and other interested parties regarding the impact of the development on heritage resources;*
> *(f) if heritage resources will be adversely affected by the proposed development, the consideration of alternatives; and*
> *(g) plans for mitigation of any adverse effects during and after the completion of the proposed development."*

3. HERITAGE RESOURCES

3.1 The National Estate

The National Heritage Resources Act (No. 25 of 1999) defines the heritage resources of South Africa which are of cultural significance or other special value for the present community and for future generations that must be considered part of the national estate to include:

- places, buildings, structures and equipment of cultural significance;
- places to which oral traditions are attached or which are associated with living heritage;
- historical settlements and townscapes;

- landscapes and natural features of cultural significance;
- geological sites of scientific or cultural importance;
- archaeological and palaeontological sites;
- graves and burial grounds, including-
    - ancestral graves;
    - royal graves and graves of traditional leaders;
    - graves of victims of conflict;
    - graves of individuals designated by the Minister by notice in the Gazette;
    - historical graves and cemeteries; and
    - other human remains which are not covered in terms of the Human Tissue Act, 1983 (Act No. 65 of 1983);
- sites of significance relating to the history of slavery in South Africa;
- movable objects, including-
    - objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens;
    - objects to which oral traditions are attached or which are associated with living heritage;
    - ethnographic art and objects;
    - military objects;
    - objects of decorative or fine art;
    - objects of scientific or technological interest; and
    - books, records, documents, photographic positives and negatives, graphic, film or video material or sound recordings, excluding those that are public records as defined in section 1(xiv) of the National Archives of South Africa Act, 1996 (Act No. 43 of 1996).

3.2 Cultural significance

In the NHRA, Section 2 (vi), it is stated that ‘‘cultural significance’’ means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance. This is determined in relation to a site or feature’s uniqueness, condition of preservation and research potential.

According to Section 3(3) of the NHRA, a place or object is to be considered part of the national estate if it has cultural significance or other special value because of

- its importance in the community, or pattern of South Africa's history;
- its possession of uncommon, rare or endangered aspects of South Africa's natural or cultural heritage;
- its potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage;
- its importance in demonstrating the principal characteristics of a particular class of South Africa's natural or cultural places or objects;
- its importance in exhibiting particular aesthetic characteristics valued by a community or cultural group;
- its importance in demonstrating a high degree of creative or technical achievement at a particular period;
- its strong or special association with a particular community or cultural group for social, cultural or spiritual reasons;
- its strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa; and
- sites of significance relating to the history of slavery in South Africa.

A matrix (see Section 2 of Addendum) was developed whereby the above criteria were applied for the determination of the significance of each identified site. This allowed some form of control over the application of similar values for similar identified sites.

4. PROJECT DESCRIPTION

4.1 Site location

The proposed development is located on the north-eastern portion of the Remaining Extent of the Farm Bokpoort 390, which is 20 km north-north-west of the town of Groblershoop within the !Kheis Local municipality in the ZF Mgcawu District Municipality, Northern Cape Province (Fig. 1). For more information, see the Technical Summary on p. V above.

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.

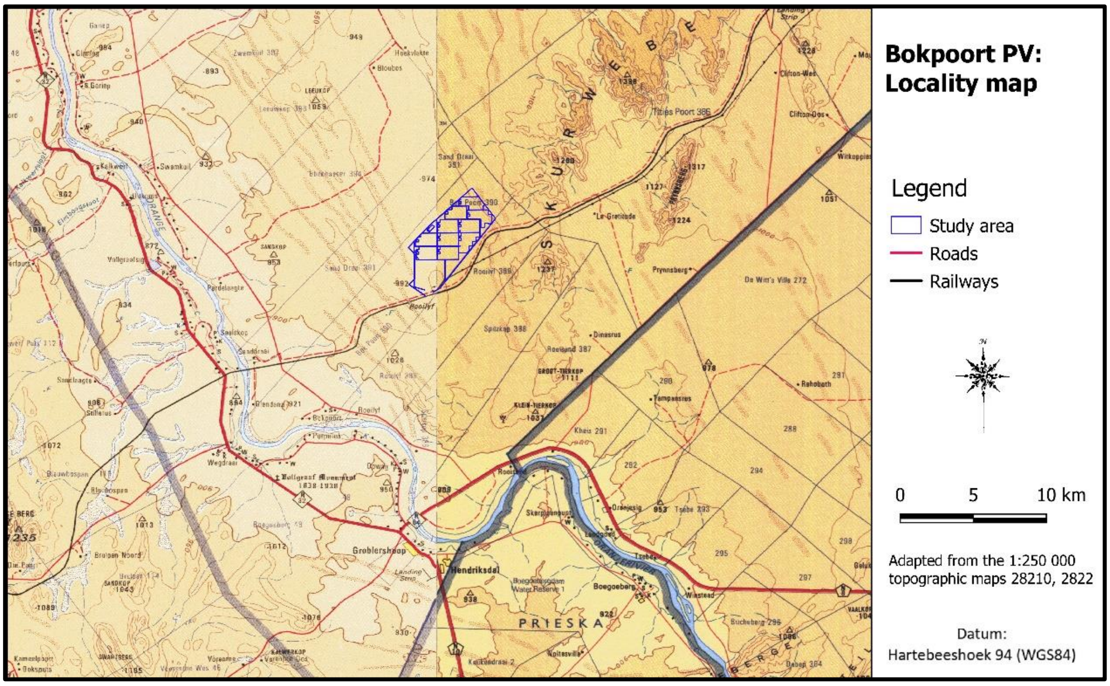


Figure 1. Location of the study area in regional context

4.2 Development proposal

The proposed development is 8 Photovoltaic (PV) Solar Developments of up to 200 Megawatt (MW) each, that will consist of the following infrastructure (Fig. 2):

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

Associated infrastructure includes:

- Mounting structures for the solar panels;
- Cabling between the structures, to be lain underground where practical;
- A new 132 kV overhead power line which will connect the facility to the national grid via Eskom's existing Garona Substation;
- The powerline will be approximately 5 km in length and will be located within a servitude spanning 15.5m on both sides. The powerline towers will be 35 m high;
- Internal access roads (4 - 6 m wide roads will be constructed but existing roads will be used as far as possible) and fencing.
- 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).

Battery energy storage system (applicable to the two authorised PV plants as well):

- Battery Power at Point of Connection: 150MW;
- Area Required: 16ha;
- The BESS will store approximately 4500m^3 of hazardous substance.

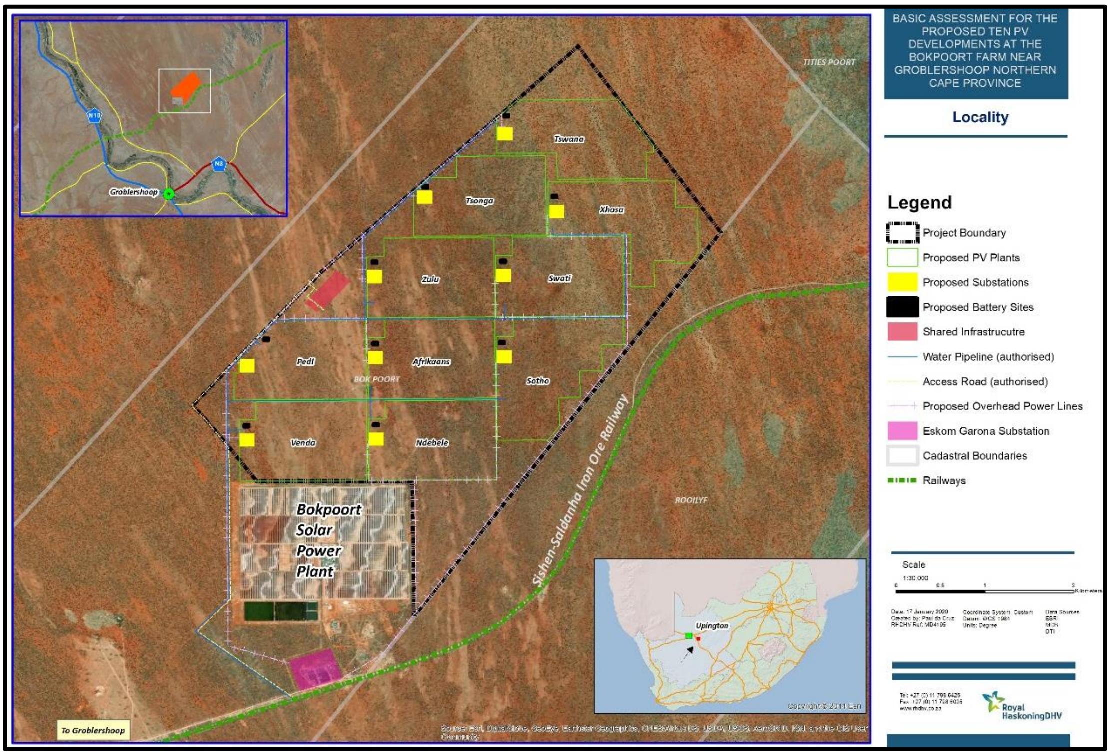


Figure 2. Layout of the project

5. STUDY APPROACH AND METHODOLOGY

5.1 Extent of the Study

This survey and impact assessment cover all facets of cultural heritage located in the study area as presented in Section 4 above and illustrated in Figure 2.

5.2 Methodology

5.2.1 *Pre-feasibility assessment*

5.2.1.1 Survey of the literature
A survey of the relevant literature was conducted with the aim of reviewing the previous research done and determining the potential of the area. In this regard, various anthropological, archaeological and historical sources were consulted – see list of references in Section 11.

- Information on events, sites and features in the larger region were obtained from these sources.

5.2.1.2 Survey of heritage impact assessments (HIAs)
A survey of HIAs done for projects in the region by various heritage consultants was conducted with the aim of determining the heritage potential of the area – see list of references in Section 11.

- Information on sites and features in the larger region were obtained from these sources.

5.2.1.3 Data bases
The *Heritage Atlas Database,* various SAHRA databases, the *Environmental Potential Atlas*, the *Chief Surveyor General* and the *National Archives of South Africa* were consulted.

- Database surveys produced a number of sites located in the larger region of the proposed development.

5.2.1.4 Other sources
Aerial photographs and topocadastral and other maps were also studied - see the list of references below.

- Information of a very general nature were obtained from these sources

The results of the above investigation are presented in Figure 3 below – see list of references in Section 11 – and can be summarised as follows:

- Stone tools, mostly dating to the Middle Stone Age (MSA), occur sporadically across the larger region and is mostly located on hills, outcrops and along drainage channels;
- Historic structures, inclusive of buildings and bridges, occur in a sporadic manner across the larger landscape as well as in urban centres;
- Formal and informal burial sites occur in a number of places in towns and across the countryside.

Based on the above assessment, the probability of cultural heritage sites, features and objects occurring in the study area is deemed to be **very low**.

Table 1: Pre-Feasibility Assessment

Category	Period	Probability	Reference
Natural			
Landscapes		None	
Early hominin	Pliocene – Lower Pleistocene		
	Early hominin	None	
Stone Age	Lower Pleistocene – Holocene		
	Early Stone Age	None	
	Middle Stone Age	Low	Dreyer (2014, 2015); Morris (2012, 2014); van der Walt (2015a, 2015b); van Ryneveld (2007); van Schalkwyk (2011, 2019)
	Later Stone Age	Low	

	Rock Art	None	
Iron age	Holocene		
	Early Iron Age	None	
	Middle Iron Age	None	
	Late Iron Age	None	
Colonial period	Holocene		
	Contact period/Early historic	Possible	Dreyer (2014)
	Recent history	Possible	Van der Walt (2015a); van Schalkwyk (2019)
	Industrial heritage	None	

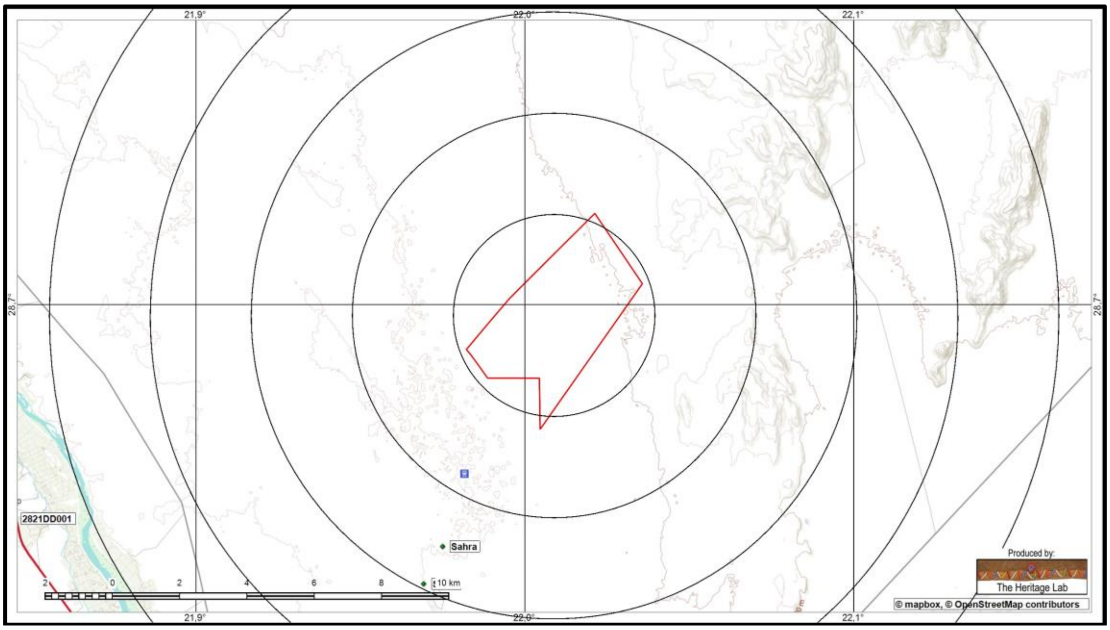


Figure 3. Location of known heritage sites and features in relation to the study area
(Circles spaced at a distance of 2km: heritage sites = coded green dots)

5.2.2 *Field survey*

The field survey was done according to generally accepted archaeological practices, and was aimed at locating all possible sites, objects and structures. The area that had to be investigated was identified by the *Royal HaskoningDHV (Pty) Ltd* by means of maps and .k*ml* files indicating the development area. This was loaded onto an ASUS digital device and used in Google Earth during the field survey to access the areas.

The site was visited on 4 December 2019 and was investigated by using internal tracks to access the sites and then walking a number of transects across it – see Fig. 4 below. During the site visit, archaeological visibility was good due to the prolonged period of drought in the region which prevented the vegetation cover from re-growing (see Fig. 5 below).

- As the total area was previously surveyed by Dreyer (2015), the purpose of this survey was just to confirm his findings. Therefore, only a cursory survey was done, stopping at places that seemed promising, especially to confirm the presence of stone tools.

5.2.3 *Documentation*

All sites, objects and structures that are identified are documented according to the general minimum standards accepted by the archaeological profession. Coordinates of individual localities are determined by means of the *Global Positioning System* (GPS) and plotted on a map. This information is added to the description in order to facilitate the identification of each locality. Map datum used: Hartebeeshoek 94 (WGS84).

The track log and identified sites were recorded by means of a Garmin Oregon 550 handheld GPS device. Photographic recording was done by means of a Canon EOS 550D digital camera.

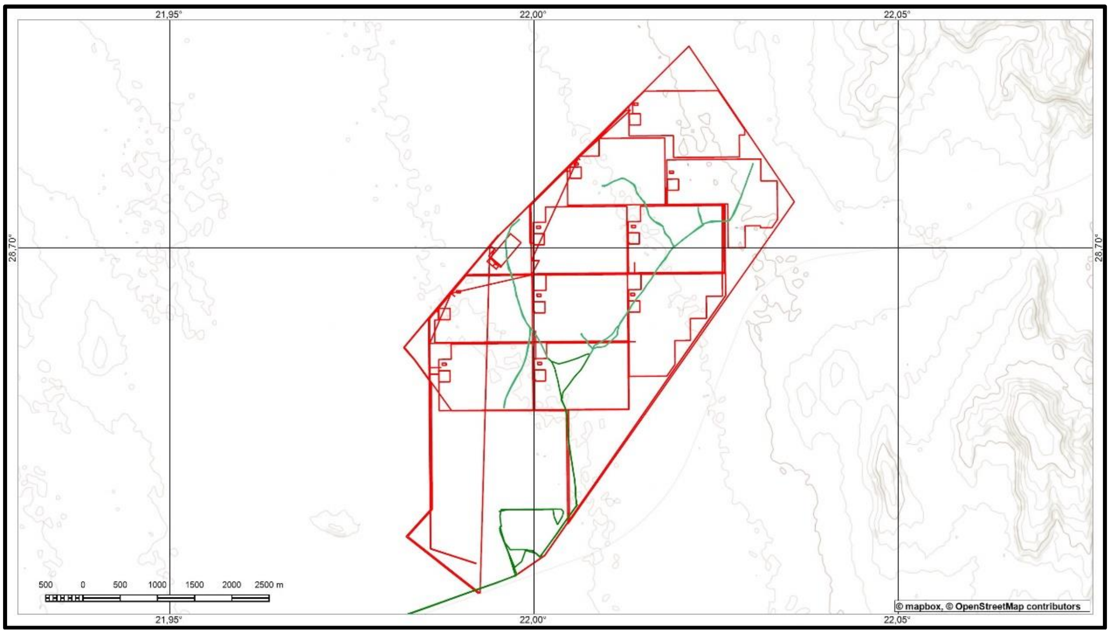


Figure 4. Map indicating the track log of the field survey.

6. DESCRIPTION OF THE AFFECTED ENVIRONMENT

6.1 Natural Environment

The geology of the study area is made up of superficial deposits comprising gravels, clays, sandstone, silcrete, calcrete and aeolian sand. The topography is described as plains and no rivers, outcrops or hills occur in the study area or its immediate vicinity (Fig. 5).

The original vegetation in the study area is classified as Kalahari Karroid Shrubland, part of the Nama-Karoo Biome, which is part of the Bushmanland Bioregion (Muncina & Rutherford 2006) (Fig. 6).

According to Dreyer (2015) the site is characterised by a repeated pattern of alternating red sand dunes, calcrete scatters and quartzite outcrops. The nature of the site varied from Aeolian (Kalahari) dune veld, visible spreads of calcrete and scatters of quartzite sills.

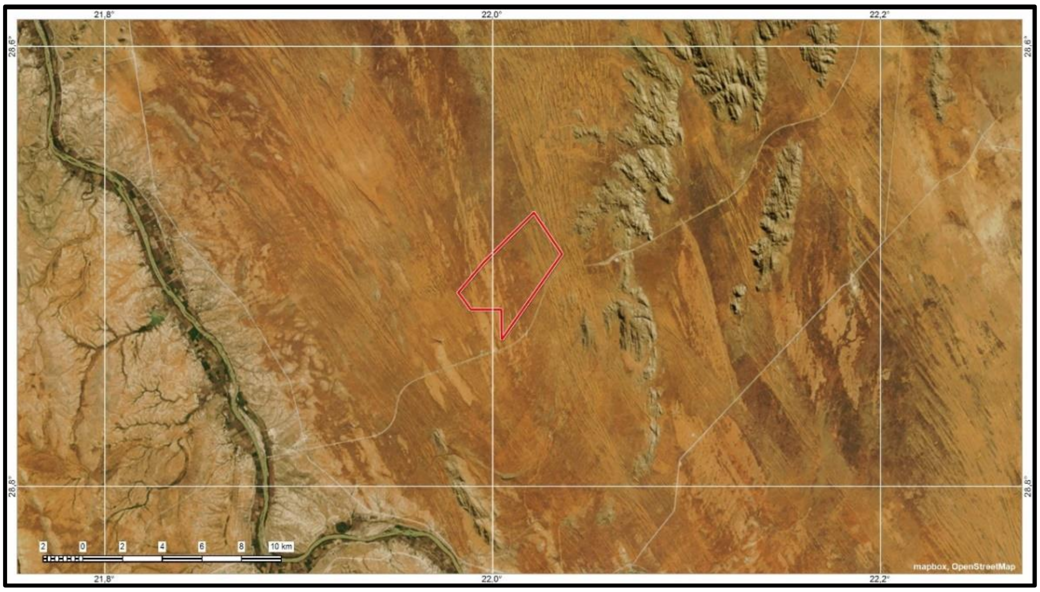
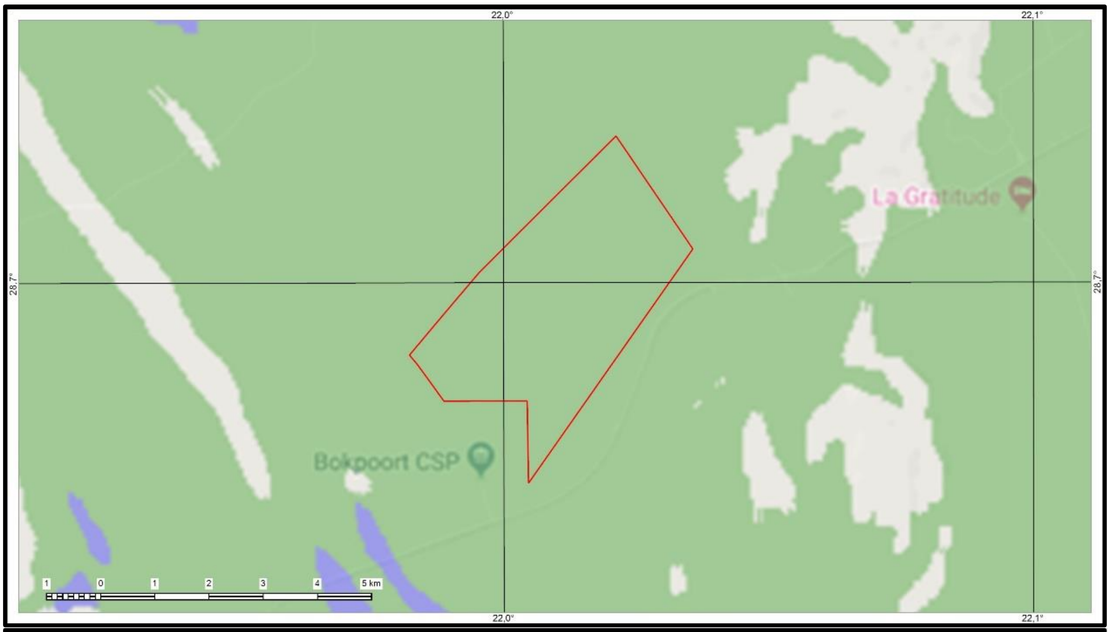


Figure 5. The topography of the larger region

 Bushman grass	 Scrub veldt
 Calcrete scatters	 Ruins of old dam

Figure 6. Views over the study area

The Palaeontological Sensitivity Map (SAHRIS) indicate that the study area (Fig. 7) has a moderate sensitivity of fossil remains to be found and therefore a desktop palaeontological study is required.



Colour	Sensitivity	Required Action
RED	VERY HIGH	field assessment and protocol for finds is required
ORANGE/YELLOW	HIGH	desktop study is required and based on the outcome of the desktop study, a field assessment is likely
GREEN	MODERATE	desktop study is required
BLUE	LOW	no palaeontological studies are required however a protocol for finds is required
GREY	INSIGNIFICANT/ZERO	no palaeontological studies are required
WHITE/CLEAR	UNKNOWN	these areas will require a minimum of a desktop study. As more information comes to light, SAHRA will continue to populate the map.

Figure 7. The Palaeontological sensitivity of the study areas

6.2 Cultural Landscape

The aim of this section is to present an overview of the history of the larger region in order to eventually determine the significance of heritage sites identified in the study area, within the context of their historic, aesthetic, scientific and social value, rarity and representativity.

The cultural landscape qualities of the region are made up of a pre-colonial element consisting of Stone Age and a much later colonial (farmer) component, which eventually gave rise to an urban component which manifest in a number of small towns and an intensive farming industry.

6.2.1 *Stone Age*

Surveys in the area has revealed that the archaeological record in the larger region is temporarily confined to the Early and Middle Stone Age, with a smaller occurrence dating to the Later Stone Age. It is spatially concentrated around the rims of pans, the banks of stream and rivers (Morris 2005), but also in the vicinity of raw material resources.

Recently Parsons (2007, 2008) demonstrated that the so-called Swartkop and Doornfontein industries possibly relate to different socio-economies – those of hunter-gatherers and stock keepers. Based on an analysis of material recovered from five sites in the Northern Cape Province, all dating to the last two millennia, she compares variability between assemblages attributed to the Swartkop and Doornfontein industries and identify areas of overlap and difference.

6.2.2 *Iron Age*

Early Iron Age occupation did not take place in the region and seems as if the earliest Bantu-language speakers to have settled in the larger region were those of Tswana-speaking origin (Tlhaping and Tlharo) that settled mostly to the north and a bit to the west of Kuruman. However, they continued spreading westward and by the late 18th century some groups occupied the Langeberg region. With the annexation of the Tswana areas by the British in 1885, the area became known as British Betchuana Land. A number of reserves were set up for these people to stay in. In 1895 the Tswana-speakers rose up in resistance to the British authority as represented by the government of the Cape Colony. They were quickly subjected, and their land was taken away, divided up into farms and given out to white farmers to settle on (Snyman 1986).

In his study on the spread of the Iron Age into the Northern Cape, Humphreys (1976) used not only archaeological evidence, literary sources and eyewitness accounts, but also environmental factors such as rainfall data and vegetation cover. From this he concluded that it was not an environment conducive for keeping large herds of cattle, which was the mainstay of Iron Age communities' economy. He even indicates that the occupation of these people contracted from 1700 south of Postmasburg to just south of Kuruman by 1800, indicating a huge change in environmental factors.

Although some researchers would want to identify isolated, undecorated pieces of pottery found in the vicinity of Douglas as of Late Iron Age origin, this is doubtful as they also do not consider the possibility of it being of Khoi origin. Or, alternatively, of very recent origin, i.e. brought into the region by people working as labourers on the various diamond diggings in the larger region.

6.2.3 *Historic period*

It was only during the last part of the 19th century, early part of the 20th century when population numbers in the region increased. This was the result of intensive irrigation farming that developed along the Orange River.

The town of Upington, originally known as Olijvenhoutsdrift, was founded in 1871 as part of a mission station by the German missionary Rev Schröder. The town was renamed in 1884 after Sir Thomas Upington, who was the Prime Minister of the Cape Colony and who visited the town in 1884.

An irrigation canal was started by Rev Schröder in 1883. It was completed in 1885. By 1884 there were already 77 irrigation farms. Nowadays, it is disputed that Schröder was the original builder of the canal, and it is claimed that he only carried on with an idea that was started by a local inhabitant by the name of Abraham September.

Groblershoop developed as a result of development of the Boegoeberg Dam and water channels in 1929, which gave rise to grapes and wine production. During the Rebellion of 1914, a number of skirmishes were fought in the region.

6.3 Site specific review

Although landscapes with cultural significance are not explicitly described in the NHRA, they are protected under the broad definition of the National Estate (Section 3): Section 3(2)(c) and (d) list "historical settlements and townscapes" and "landscapes and natural features of cultural significance" as part of the National Estate.

The examination of historical maps and aerial photographs help us to reconstruct how the cultural landscape has changed over time as is show how humans have used the land.

As this used to be a very isolated region, little information exists about it. It was only recently when a number of development projects were initiated in the region, that the heritage potential of the region was investigated. Most of these studies focussed on the Stone Age presence in the region, which, by all accounts seems to be very limited (Dreyer 2014, 2015; Morris 2014, 2018; van der Walt 2015; van Schalkwyk 2019) as it presents a very low profile in the landscape.

From the Deed of Transfer no. 1294 (Fig. 8), it can be seen that the farm was first surveyed in December 1892 and then granted to F.W.C Loxton on 14 November 1894.

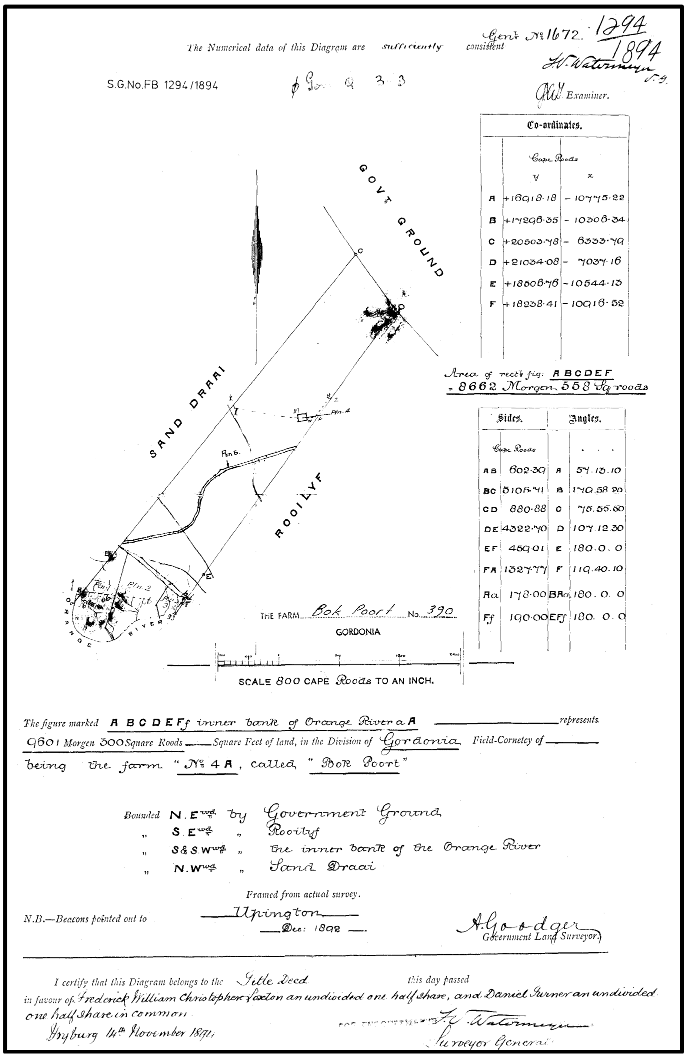


Figure 8. Copy of the original Deed of Transfer for the farm Bokpoort
(Chief Surveyor-General: 10026W01)

One of the older maps of the region (Fig. 9), dating to 1914, shows an area with little development in the interior where the isolated sheep post of vehicle tracks is indicated. Closer to the river and number of presumably farm names are indicated in the vicinity of the Orange River.

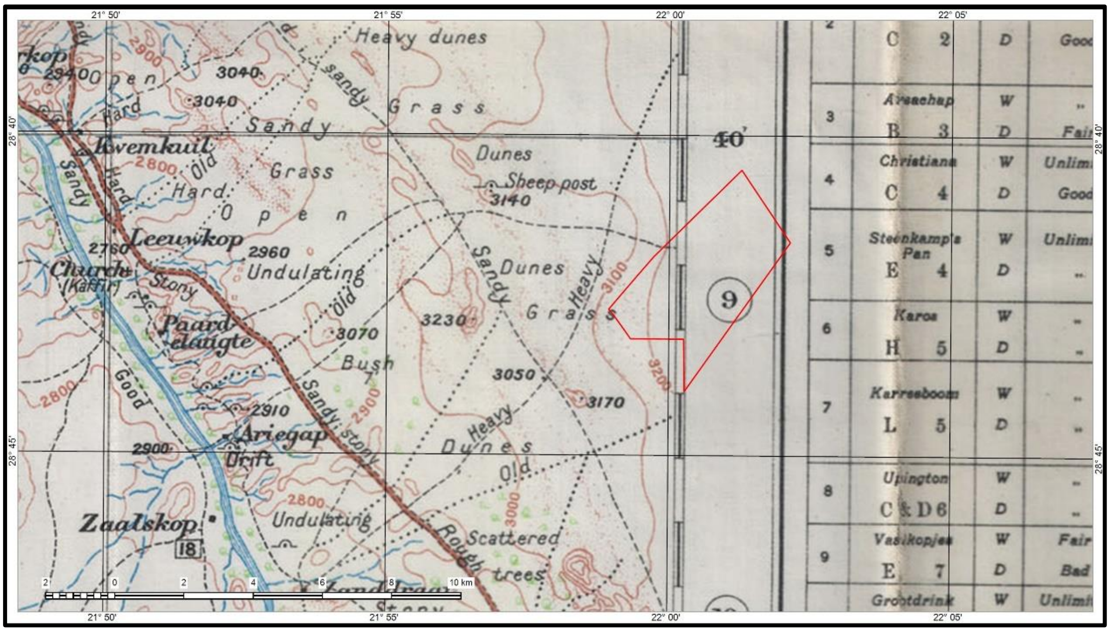


Figure 9. The study areas on the 1914 version of the 1:250 000 topographic map ‘Upington’

The official aerial photograph dating to 1964 (Fig. 10) still shows, apart from fence boundaries, a landscape empty of any development. It was only by the middle of the 1970s when the Sishen-Saldanha railway line was opened (1976) and the associated powerlines were constructed, that any development can be seen. This presented on the 1981 version of the 1:50 000 topographic map (11).

However, this lack of development, i.e. built environment, seems to continue as can be seen on the various Google Image aerial photographs (Fig. 12) and it is only with the recent development of the Bokpoort Concentrated Solar Thermal that some built features were added to the region.

Figure 10. The study area on the 1964 version of the official aerial photograph (Photograph: 524_003_00863)

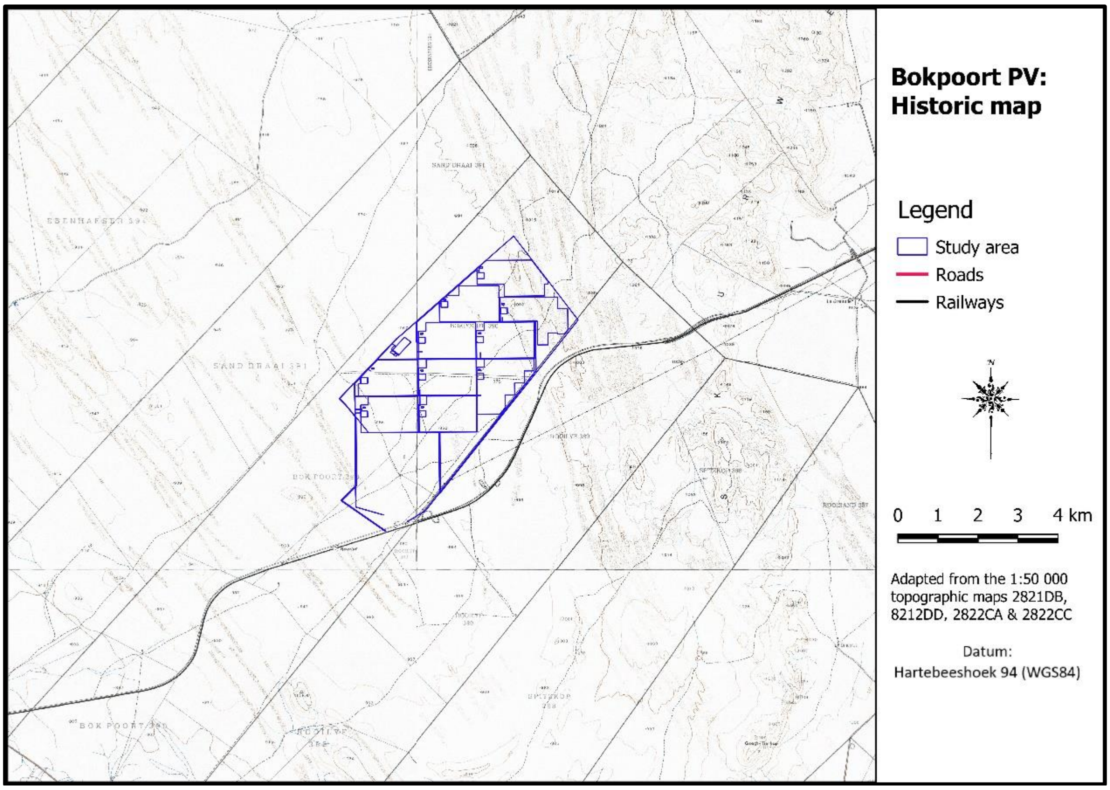


Figure 11. The study area on the 1982 version of the 1:50 000 topographic maps

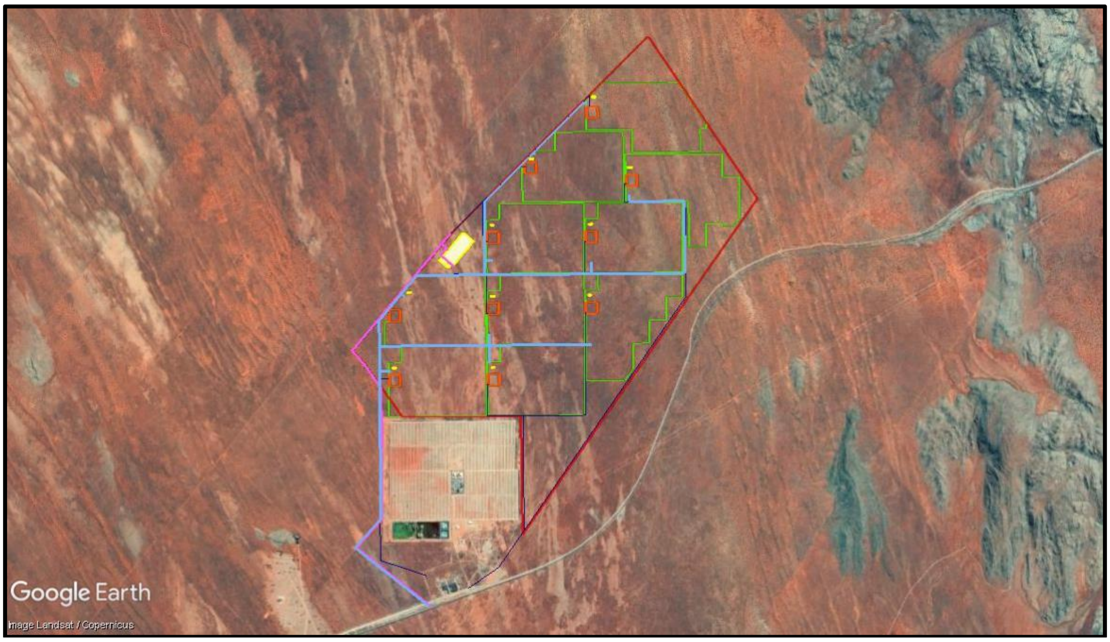


Figure 12. The study area on the 2019 aerial photograph
(Image: Google Earth)

7. SURVEY RESULTS

During the physical survey, the following sites, features and objects of cultural significance were identified in the study area (Fig. 13).

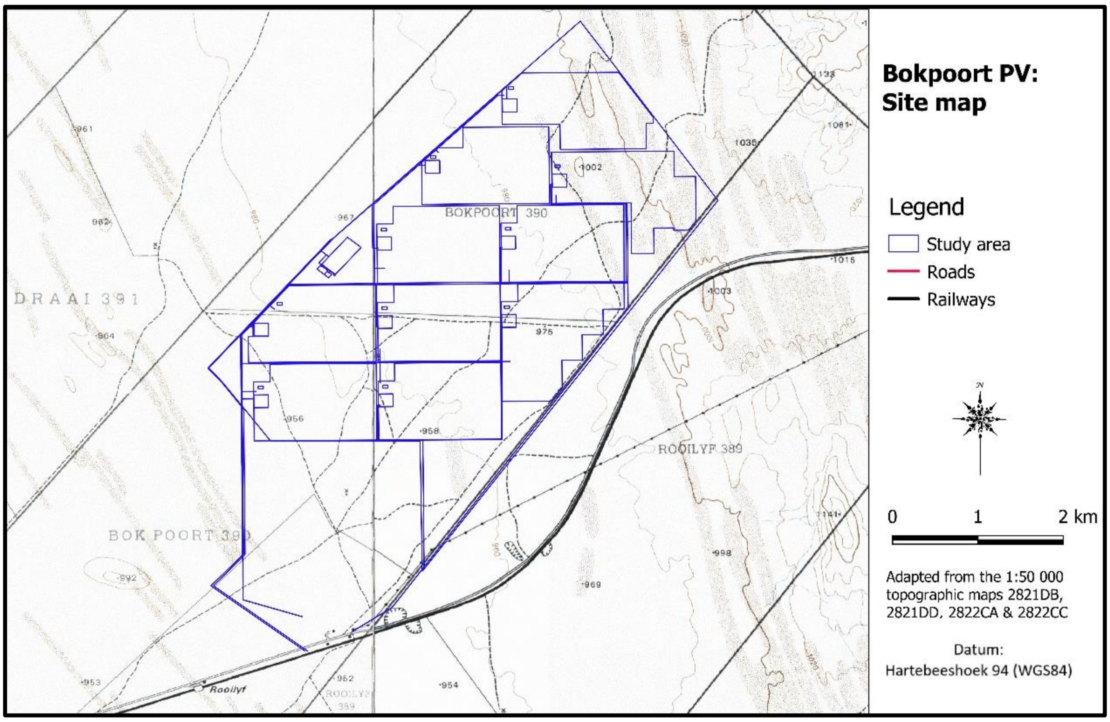


Figure 13. Location of heritage sites in the study area
(Please note that as nothing was found, nothing is indicated on the map)

7.1 Stone Age

Stone Age lithics dating to the MSA are found only as low-density surface scatters, which is confirmed by similar findings in the larger region by other researchers (Dreyer 2014, 2015; Morris 2014, 2018; van der Walt 2015; van Schalkwyk 2019). They are commonly found on the pebble plains where source material is readily available. The density of artefacts is less than 1/50m^2. The tools are mostly made from banded iron stone (jaspelite), although some quartzite and hardened shale flakes were also noted. Cores, flakes and tools are found. The tools are very rough and informal and only a few that can be described as typical, i.e. blades and scrapers, were identified.

- The low density of the lithic scatters is, on archaeological grounds, viewed to be of low significance and require no further action.

Figure 14. Some of the identified tools and flakes

7.2 Iron Age

- No sites, features or objects of cultural significance dating to the Iron Age were identified in the study area.

7.3 Historic period

- Apart from current farming related features such as water troughs, no sites, features or objects of cultural significance dating to the historic period were identified in the study area.

8. IMPACT ASSESSMENT RATINGS AND MITIGATION MEASURES

8.1 Impact assessment

Heritage impacts are categorised as:

- Direct or physical impacts, implying alteration or destruction of heritage features within the project boundaries;
- Indirect impacts, e.g. restriction of access or visual intrusion concerning the broader environment;
- Cumulative impacts that are combinations of the above.

Impact analysis of cultural heritage resources under threat of the proposed development, is based on the present understanding of the development and is summarised in Table 1 below:

Table 2: Calculation of the impact on the identified heritage features

Heritage sites	Significance of impact	Mitigation measures
Bokpoort II Solar Power Plant: Construction Phase		
Without mitigation	n/a	n/a
With mitigation	n/a	n/a
Bokpoort II Solar Power Plant: Operation Phase		
Without mitigation	n/a	n/a
With mitigation	n/a	n/a

8.2 Mitigation measures

Mitigation: means to anticipate and prevent negative impacts and risks, then to minimise them, rehabilitate or repair impacts to the extent feasible.

- For the current study, as no sites, features or objects of cultural significance were identified, no mitigation measures are proposed.

8.3 Cumulative assessment

The cumulative impact of the proposed Bokpoort project is assessed by adding impacts from this proposed development to existing and other proposed developments with similar impacts within a 60 km radius. The existing and proposed developments that were taken into consideration for cumulative impacts include a total of six other plants and are listed in Table 3. From the map 'South African Generation Projects' (Fig. 13) below, it can be seen that the Bokpoort project is located in an area where little such development has taken place, with the implication that the cumulative impact would be very low.

Table 3: Existing and planned alternative energy generation facilities in the larger region

Name	Nearest town	Technology	Capacity	Status
Bokpoort	Groblershoop	Concentrated Solar Thermal	50MW	Fully operational
Eskom	Upington	Concentrated Solar Thermal	100MW	Awaiting construction
Grootdrink	Upington	Solar PV	?	Proposed
Karoshoek	Upington	Concentrated Solar Thermal	100MW	Awaiting construction
Tewa Isitha	Upington	Solar PV	?	Proposed
Upington	Upington	Solar PV	8.9MW	Fully operational

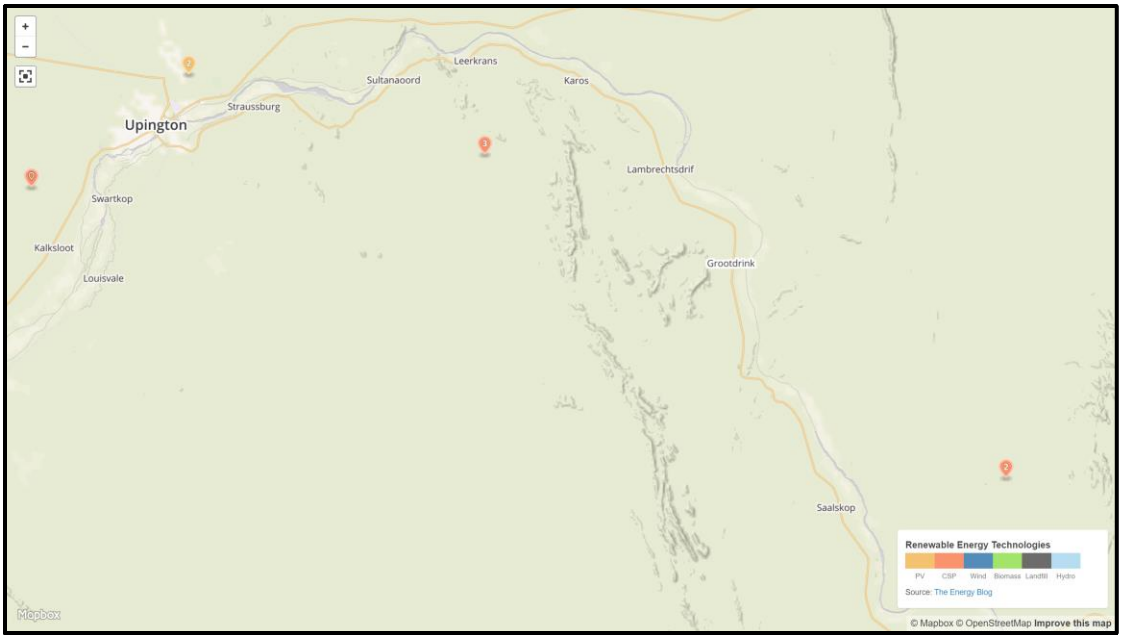


Figure 15. Map indicating the location of alternative energy generation facilities in the larger region (https://www.energy.org.za/map-south-african-generation-projects - accessed 27/01/2020)

The cultural heritage profile of the larger region is very limited. Most frequently found are stone artefacts, mostly dating to the Middle Stone Age. Sites containing such material are usually located along the margins of water features (pans, drainage lines), small hills and rocky outcrops. Such surface scatters or 'background scatter' is usually viewed to be of limited significance (Orton 2016). In addition to the Stone Age profile, there is also the colonial element. This manifests largely as individual farmsteads, in all its complexity, burial sites and infrastructure features such as roads, railways and power lines, which occurs only in limited numbers. This again has the implication that the cumulative impact would be very low.

Table 4: Cumulative impact assessment summary

Nature: Loss of or damage to sites, features or objects of cultural significance on the development site		
	Without mitigation	With mitigation
Extent	Local area (1)	Local area (1)
Duration	Permanent (5)	Permanent (5)
Intensity	Minor (2)	Minor (2)
Probability	Improbable (2)	Improbable (2)
Significance	Low (16)	Low (16)
Status (positive or negative)	Negative	Neutral
Reversibility	Non-reversible	Non-reversible
Irreplaceable loss of resources?	High	Low
Can impacts be mitigated	Yes	
Mitigation: Avoidance of site/excavation if required		
Cumulative impact: Limited loss of similar features in the larger landscape.		

Site type	**NHRA category**	**Field rating**	**Impact rating: Before/After mitigation**
Archaeological sites/material	Section 35	Generally protected: Low significance – Grade IV-C	Low (16) Low (16)
Burial sites and graves	Section 36	Generally protected: Medium significance – Grade IV-A	Low (16) Low (16)
Built environment	Section 34	Generally protected: Low significance – Grade IV-C	Low (16) Low (16)

9. MANAGEMENT MEASURES

Heritage sites are fixed features in the environment, occurring within specific spatial confines. Any impact upon them is permanent and non-reversible. Those resources that cannot be avoided and that are directly impacted by the proposed development can be excavated/recorded and a management plan can be developed for future action. Those sites that are not impacted on can be written into the management plan, whence they can be avoided or cared for in the future.

Sources of risk were considered with regards to development activities defined in Section 2(viii) of the NHRA that may be triggered and are summarised in Table 3A and 3B below. These issues formed the basis of the impact assessment described. The potential risks are discussed according to the various phases of the project below.

9.1 Objectives

- Protection of archaeological, historical and any other site or land considered being of cultural value within the project boundary against vandalism, destruction and theft.
- The preservation and appropriate management of new discoveries in accordance with the NHRA, should these be discovered during construction activities.

The following shall apply:

- Known sites should be clearly marked in order that they can be avoided during construction activities.
- The contractors and workers should be notified that archaeological sites might be exposed during the construction activities.
- Should any heritage artefacts be exposed during excavation, work on the area where the artefacts were discovered, shall cease immediately and the Environmental Control Officer shall be notified as soon as possible;
- All discoveries shall be reported immediately to a heritage practitioner so that an investigation and evaluation of the finds can be made. Acting upon advice from these specialists, the Environmental Control Officer will advise the necessary actions to be taken;

- Under no circumstances shall any artefacts be removed, destroyed or interfered with by anyone on the site; and
- Contractors and workers shall be advised of the penalties associated with the unlawful removal of cultural, historical, archaeological or palaeontological artefacts, as set out in the National Heritage Resources Act (Act No. 25 of 1999), Section 51. (1).

9.2 Control

In order to achieve this, the following should be in place:

- A person or entity, e.g. the Environmental Control Officer, should be tasked to take responsibility for the heritage sites and should be held accountable for any damage.
- Known sites should be located and isolated, e.g. by fencing them off. All construction workers should be informed that these are no-go areas, unless accompanied by the individual or persons representing the Environmental Control Officer as identified above.
- In areas where the vegetation is threatening the heritage sites, e.g. growing trees pushing walls over, it should be removed, but only after permission for the methods proposed has been granted by SAHRA. A heritage official should be part of the team executing these measures.

Table 5A: Construction Phase: Environmental Management Programme for the project

Action required	Protection of heritage sites, features and objects		
Potential Impact	The identified risk is damage or changes to resources that are generally protected in terms of Sections 27, 28, 31, 32, 34, 35, 36 and 37 of the NHRA that may occur in the proposed project area.		
Risk if impact is not mitigated	Loss or damage to sites, features or objects of cultural heritage significance		
Activity / issue	**Mitigation: Action/control**	**Responsibility**	**Timeframe**
1. Removal of Vegetation 2. Construction of required infrastructure, e.g. access roads, water pipelines	See discussion in Section 9.1 above	Environmental Control Officer	During construction only
Monitoring	See discussion in Section 9.2 above		

Table 5B: Operation Phase: Environmental Management Programme for the project

Action required	Protection of heritage sites, features and objects		
Potential Impact	It is unlikely that the negative impacts identified for pre-mitigation will occur if the recommendations are followed.		
Risk if impact is not mitigated	Loss or damage to sites, features or objects of cultural heritage significance		
Activity / issue	**Mitigation: Action/control**	**Responsibility**	**Timeframe**
1. Removal of Vegetation 2. Construction of required infrastructure, e.g. access roads, water pipelines	See discussion in Section 9.1 above	Environmental Control Officer	During construction only
Monitoring	See discussion in Section 9.2 above		

10. CONCLUSIONS AND RECOMMENDATIONS

This report describes the methodology used, the limitations encountered, the heritage features that were identified and the recommendations and mitigation measures proposed relevant to this. It should be noted that the implementation of the mitigation measures is subject to SAHRA/PHRA's comments.

The cultural landscape qualities of the region are made up of a pre-colonial element consisting of Stone Age and a much later colonial (farmer) component, which eventually gave rise to an urban component which manifest in a number of small towns and an intensive farming industry.

Identified sites

Stone Age lithics dating to the MSA are found only as low-density surface scatters, which is confirmed by similar findings in the larger region by other researchers (Dreyer 2014, 2015; Morris 2014, 2018; van der Walt 2015; van Schalkwyk 2019). The density of artefacts is less than $1/50m^2$.

- The low density of the lithic scatters is, on archaeological grounds, viewed to be of low significance and require no further action.

Impact assessment and proposed mitigation measures

Impact analysis of cultural heritage resources under threat of the proposed development, is based on the present understanding of the development:

- As no sites, features or objects of cultural significance are known to exist in the development area, there would be no impact as a result of the proposed development.

Heritage sites	Significance of impact	Mitigation measures
Bokpoort II Solar Power Plant: Construction Phase		
Without mitigation	n/a	n/a
With mitigation	n/a	n/a
Bokpoort II Solar Power Plant: Operation Phase		
Without mitigation	n/a	n/a
With mitigation	n/a	n/a

Cumulative impact assessment

The cultural heritage profile of the larger region is very limited and consists of isolated findspots of Stone Age (MSA) tools, farmsteads and burial sites. Consequently, the cumulative impact of the proposed development is viewed to be **low**

Site type	**NHRA category**	**Field rating**	**Impact rating: Before/After mitigation**
Archaeological sites/material	Section 35	Generally protected: Low significance – Grade IV-C	Low (16) Low (16)
Burial sites and graves	Section 36	Generally protected: Low significance – Grade IV-A	Low (16) Low (16)

Legal requirements

The legal requirements related to heritage specifically are specified in Section 3 of this report. For this proposed project, the assessment has determined that no sites, features or objects of heritage significance occur in the study area. If heritage features are identified during construction, as stated in the management recommendation, these finds would have to be assessed by a specialist, after which a decision will be made regarding the application for relevant permits.

Reasoned opinion as to whether the proposed activity should be authorised:

- From a heritage point of view, it is recommended that the proposed development be allowed to continue on acceptance of the proposed mitigation measures and the conditions proposed below.

Conditions for inclusion in the environmental authorisation:

- The Palaeontological Sensitivity Map (SAHRIS) indicate that the study area has a moderate sensitivity of fossil remains to be found and therefore a desktop palaeontological required.
- Should archaeological sites or graves be exposed in other areas during construction work, it must immediately be reported to a heritage practitioner so that an investigation and evaluation of the finds can be made.

11. REFERENCES

11.1 Data bases

Chief Surveyor General
Environmental Potential Atlas, Department of Environmental Affairs and Tourism.
Heritage Atlas Database, Pretoria
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SAHRA Archaeology and Palaeontology Report Mapping Project (2009)
SAHRIS Database

11.2 Literature

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11.3 Archival sources, maps and aerial photographs

1: 50 000 Topographic maps
Google Earth
Aerial Photographs: Chief Surveyor-General

12. ADDENDUM

1. Indemnity and terms of use of this report

The findings, results, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. The report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken and the author reserve the right to modify aspects of the report including the recommendations if and when new information may become available from ongoing research or further work in this field, or pertaining to this investigation.

Although all possible care is taken to identify all sites of cultural importance during the investigation of study areas, it is always possible that hidden or sub-surface sites could be overlooked during the study. The author of this report will not be held liable for such oversights or for costs incurred as a result of such oversights.

Although the author exercises due care and diligence in rendering services and preparing documents, he accepts no liability and the client, by receiving this document, indemnifies the author against all actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, directly or indirectly by the author and by the use of the information contained in this document.

This report must not be altered or added to without the prior written consent of the author. This also refers to electronic copies of this report which are supplied for the purposes of inclusion as part of other reports, including main reports. Similarly, any recommendations, statements or conclusions drawn from or based on this report must make reference to this report. If these form part of a main report relating to this investigation or report, this report must be included in its entirety as an appendix or separate section to the main report.

2. Assessing the significance of heritage resources and potential impacts

A system for site grading was established by the NHRA and further developed by the South African Heritage Resources Agency (SAHRA 2007) and has been approved by ASAPA for use in southern Africa and was utilised during this assessment.

2.1 *Significance of the identified heritage resources*

According to the NHRA, Section 2(vi) the **significance** of a heritage sites and artefacts is determined by it aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technical value in relation to the uniqueness, condition of preservation and research potential. It must be kept in mind that the various aspects are not mutually exclusive, and that the evaluation of any site is done with reference to any number of these.

Matrix used for assessing the significance of each identified site/feature

<table>
<tr><td colspan="5">1. SITE EVALUATION</td></tr>
<tr><td colspan="5">1.1 Historic value</td></tr>
<tr><td colspan="4">Is it important in the community, or pattern of history</td><td></td></tr>
<tr><td colspan="4">Does it have strong or special association with the life or work of a person, group or organisation of importance in history</td><td></td></tr>
<tr><td colspan="4">Does it have significance relating to the history of slavery</td><td></td></tr>
<tr><td colspan="4">1.2 Aesthetic value</td><td></td></tr>
<tr><td colspan="4">It is important in exhibiting particular aesthetic characteristics valued by a community or cultural group</td><td></td></tr>
<tr><td colspan="4">1.3 Scientific value</td><td></td></tr>
<tr><td colspan="4">Does it have potential to yield information that will contribute to an understanding of natural or cultural heritage</td><td></td></tr>
<tr><td colspan="4">Is it important in demonstrating a high degree of creative or technical achievement at a particular period</td><td></td></tr>
<tr><td colspan="4">1.4 Social value</td><td></td></tr>
<tr><td colspan="4">Does it have strong or special association with a particular community or cultural group for social, cultural or spiritual reasons</td><td></td></tr>
<tr><td colspan="4">1.5 Rarity</td><td></td></tr>
<tr><td colspan="4">Does it possess uncommon, rare or endangered aspects of natural or cultural heritage</td><td></td></tr>
<tr><td colspan="4">1.6 Representivity</td><td></td></tr>
<tr><td colspan="4">Is it important in demonstrating the principal characteristics of a particular class of natural or cultural places or objects</td><td></td></tr>
<tr><td colspan="4">Importance in demonstrating the principal characteristics of a range of landscapes or environments, the attributes of which identify it as being characteristic of its class</td><td></td></tr>
<tr><td colspan="4">Importance in demonstrating the principal characteristics of human activities (including way of life, philosophy, custom, process, land-use, function, design or technique) in the environment of the nation, province, region or locality.</td><td></td></tr>
<tr><td colspan="2">2. Sphere of Significance</td><td>High</td><td>Medium</td><td>Low</td></tr>
<tr><td colspan="2">International</td><td></td><td></td><td></td></tr>
<tr><td colspan="2">National</td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Provincial</td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Regional</td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Local</td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Specific community</td><td></td><td></td><td></td></tr>
<tr><td colspan="5">3. Field Register Rating</td></tr>
<tr><td>1.</td><td colspan="3">National/Grade 1: High significance - No alteration whatsoever without permit from SAHRA</td><td></td></tr>
<tr><td>2.</td><td colspan="3">Provincial/Grade 2: High significance - No alteration whatsoever without permit from provincial heritage authority.</td><td></td></tr>
<tr><td>3.</td><td colspan="3">Local/Grade 3A: High significance - Mitigation as part of development process not advised.</td><td></td></tr>
</table>

4.	Local/Grade 3B: High significance - Could be mitigated and (part) retained as heritage register site	
5.	Generally protected 4A: High/medium significance - Should be mitigated before destruction	
6.	Generally protected 4B: Medium significance - Should be recorded before destruction	
7.	Generally protected 4C: Low significance - Requires no further recording before destruction	

2.2 *Significance of the anticipated impact on heritage resources*

All impacts identified during the HIA stage of the study will be classified in terms of their significance. Issues would be assessed in terms of the following criteria:

Nature of the impact
A description of what causes the effect, what will be affected and how it will be affected.

Extent
The physical **extent**, wherein it is indicated whether:

- 1 - The impact will be limited to the site;
- 2 - The impact will be limited to the local area;
- 3 - The impact will be limited to the region;
- 4 - The impact will be national; or
- 5 - The impact will be international.

Duration
Here it should be indicated whether the lifespan of the impact will be:

- 1 - Of a very short duration (0–1 years);
- 2 - Of a short duration (2-5 years);
- 3 - Medium-term (5–15 years);
- 4 - Long term (where the impact will persist possibly beyond the operational life of the activity); or
- 5 - Permanent (where the impact will persist indefinitely).

Magnitude (Intensity)
The magnitude of impact, quantified on a scale from 0-10, where a score is assigned:

- 0 - Small and will have no effect;
- 2 - Minor and will not result in an impact;
- 4 - Low and will cause a slight impact;
- 6 - Moderate and will result in processes continuing but in a modified way;
- 8 - High, (processes are altered to the extent that they temporarily cease); or
- 10 - Very high and results in complete destruction of patterns and permanent cessation of processes.

Probability
This describes the likelihood of the impact actually occurring and is estimated on a scale where:

- 1 - Very improbable (probably will not happen);
- 2 - Improbable (some possibility, but low likelihood);
- 3 - Probable (distinct possibility);
- 4 - Highly probable (most likely); or
- 5 - Definite (impact will occur regardless of any prevention measures).

Significance
The significance is determined through a synthesis of the characteristics described above (refer to the formula below) and can be assessed as low, medium or high:

S = (E+D+M) x P; where
S = Significance weighting

E = Extent
D = Duration
M = Magnitude
P = Probability

Significance of impact		
Points	Significant Weighting	Discussion
< 30 points	Low	Where this impact would not have a direct influence on the decision to develop in the area.
31-60 points	Medium	Where the impact could influence the decision to develop in the area unless it is effectively mitigated.
> 60 points	High	Where the impact must have an influence on the decision process to develop in the area.

Confidence
This should relate to the level of confidence that the specialist has in establishing the nature and degree of impacts. It relates to the level and reliability of information, the nature and degree of consultation with I&AP's and the dynamic of the broader socio-political context.

- High, where the information is comprehensive and accurate, where there has been a high degree of consultation and the socio-political context is relatively stable.
- Medium, where the information is sufficient but is based mainly on secondary sources, where there has been a limited targeted consultation and socio-political context is fluid.
- Low, where the information is poor, a high degree of contestation is evident and there is a state of socio-political flux.

Status
- The status, which is described as either positive, negative or neutral.

Reversibility
- The degree to which the impact can be reversed.

Mitigation
- The degree to which the impact can be mitigated.

Nature:		
	Without mitigation	With mitigation
Construction Phase		
Probability		
Duration		
Extent		
Magnitude		
Significance		
Status (positive or negative)		
Operation Phase		
Probability		
Duration		
Extent		
Magnitude		
Significance		
Status (positive or negative)		
Reversibility		
Irreplaceable loss of resources?		
Can impacts be mitigated		

3. Mitigation measures

- *Mitigation: means to anticipate and prevent negative impacts and risks, then to minimise them, rehabilitate or repair impacts to the extent feasible.*

Impacts can be managed through one or a combination of the following mitigation measures:

- Avoidance
- Investigation (archaeological)
- Rehabilitation
- Interpretation
- Memorialisation
- Enhancement (positive impacts)

For the current study, the following mitigation measures are proposed, to be implemented only if any of the identified sites or features are to be impacted on by the proposed development activities:

- (1) Avoidance/Preserve: This is viewed to be the primary form of mitigation and applies where any type of development occurs within a formally protected or significant or sensitive heritage context and is likely to have a high negative impact. This measure often includes the change / alteration of development planning and therefore impact zones in order not to impact on resources. The site should be retained *in situ* and a buffer zone should be created around it, either temporary (by means of danger tape) or permanently (wire fence or built wall). Depending on the type of site, the buffer zone can vary from
    - o 10 metres for a single grave, or a built structure, to
    - o 50 metres where the boundaries are less obvious, e.g. a Late Iron Age site.

- (2) Archaeological investigation/Relocation of graves: This option can be implemented with additional design and construction inputs. This is appropriate where development occurs in a context of heritage significance and where the impact is such that it can be mitigated. Mitigation is to excavate the site by archaeological techniques, document the site (map and photograph) and analyse the recovered material to acceptable standards. This can only be done by a suitably qualified archaeologist.
    - o This option should be implemented when it is impossible to avoid impacting on an identified site or feature.
    - o This also applies for graves older than 60 years that are to be relocated. For graves younger than 60 years a permit from SAHRA is not required. However, all other legal requirements must be adhered to.
        - ▪ Impacts can be beneficial – e.g. mitigation contribute to knowledge

- (3) Rehabilitation: When features, e.g. buildings or other structures are to be re-used. Rehabilitation is considered in heritage management terms as an intervention typically involving the adding of a new heritage layer to enable a new sustainable use.
    - o The heritage resource is degraded or in the process of degradation and would benefit from rehabilitation.
    - o Where rehabilitation implies appropriate conservation interventions, i.e. adaptive reuse, repair and maintenance, consolidation and minimal loss of historical fabric.
        - ▪ Conservation measures would be to record the buildings/structures as they are (at a particular point in time). The records and recordings would then become the 'artefacts' to be preserved and managed as heritage features or (movable) objects.
        - ▪ This approach automatically also leads to the enhancement of the sites or features that are re-used.

- (4) Mitigation is also possible with additional design and construction inputs. Although linked to the previous measure (rehabilitation) a secondary though ‘indirect’ conservation measure would be to use the existing architectural ‘vocabulary' of the structure as guideline for any new designs.
  - The following principle should be considered: **heritage informs design**.
    - This approach automatically also leads to the enhancement of the sites or features that are re-used.

- (5) No further action required: This is applicable only where sites or features have been rated to be of such low significance that it does not warrant further documentation, as it is viewed to be fully documented after inclusion in this report.
  - Site monitoring during development, by an ECO or the heritage specialist are often added to this recommendation in order to ensure that no undetected heritage/remains are destroyed.

4. Curriculum vitae

<u>Johan Abraham van Schalkwyk</u>

Personal particulars

Date of birth:	14 April 1952
Identity number:	520414 5099 08 4
Marital status:	Married; one daughter
Nationality:	South African

Current address: home

62 Coetzer Ave, Monument Park, Pretoria, 0181
Mobile: 076 790 6777; E-mail: jvschalkwyk@mweb.co.za

Qualifications

1995	DLitt et Phil (Anthropology), University of South Africa
1985	MA (Anthropology), University of Pretoria
1981	BA (Hons), Anthropology, University of Pretoria
1979	Post Graduate Diploma in Museology, University of Pretoria
1978	BA (Hons), Archaeology, University of Pretoria
1976	BA, University of Pretoria

Non-academic qualifications

12th HSRC-School in Research Methodology - July 1990
Dept. of Education and Training Management Course - June 1992
Social Assessment Professional Development Course - 1994
Integrated Environmental Management Course, UCT - 1994

Professional experience

Private Practice
2017 - current: Professional Heritage Consultant

National Museum of Cultural History
1992 - 2017: Senior researcher: Head of Department of Research. Manage an average of seven researchers in this department and supervise them in their research projects. Did various projects relating to Anthropology and Archaeology in Limpopo Province, Mpumalanga, North West Province and Gauteng. Headed the Museum's Section for Heritage Impact Assessments.
1978 - 1991: Curator of the Anthropological Department of the Museum. Carried out extensive fieldwork in both anthropology and archaeology

Department of Archaeology, University of Pretoria
1976 - 1977: Assistant researcher responsible for excavations at various sites in Limpopo Province and Mpumalanga.

Awards and grants

1. Hanisch Book Prize for the best final year Archaeology student, University of Pretoria - 1976.
2. Special merit award, National Cultural History Museum - 1986.
3. Special merit award, National Cultural History Museum - 1991.
4. Grant by the Department of Arts, Culture, Science and Technology, to visit the various African countries to study museums, sites and cultural programmes - 1993.
5. Grant by the USA National Parks Service, to visit the United States of America to study museums, sites, tourism development, cultural programmes and impact assessment programmes - 1998.
6. Grant by the USA embassy, Pretoria, under the Bi-national Commission Exchange Support Fund, to visit cultural institutions in the USA and to attend a conference in Charleston - 2000.
7. Grant by the National Research Foundation to develop a model for community-based tourism - 2001.

8. Grant by the National Research Foundation to develop a model for community-based tourism - 2013. In association with RARI, Wits University.

Publications
Published more than 70 papers, mostly in scientifically accredited journals, but also as chapters in books.

Conference Contributions
Regularly presented papers at conferences, locally as well as internationally, on various research topics, ranging in scope from archaeology, anthropological, historical, cultural historical and tourism development.

Heritage Impact Assessments
Since 1992, I have done more than 2000 Phase 1 and Phase 2 impact assessments (archaeological, anthropological, historical and social) for various government departments and developers. Projects include environmental management frameworks, roads, pipeline-, and power line developments, dams, mining, water purification works, historical landscapes, refuse dumps and urban developments.

Appendix B10: Palaeontology

PALAEONTOLOGICAL IMPACT ASSESSMENT: DESKTOP STUDY

Proposed Bokpoort II Solar Power Facility on the Remaining Extent of Farm Bokpoort 390 near Groblershoop, Northern Cape Province

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February 2020

1. EXECUTIVE SUMMARY

ACWA Power Energy Africa (Pty) Ltd is proposing to develop the Bokpoort II Solar Power Facility on the Remaining Extent (RE) of the Farm Bokpoort 390 near Groblershoop, Northern Cape. An associated, authorised water pipeline to the Orange River running along an existing servitude will also traverse the adjoining Farm Sand Draai 391. The combined power generation capacity of the Bokpoort II solar development will be up to 2000 MW that will be generated by ten x 200 MW photovoltaic (PV) facilities, two of which have already been authorised but are undergoing another Basic Assessment (BA) study for the battery storage energy system as well as the capacity increase from 75 to 200MW. The total size of the Bokpoort II Solar Power Facility is approximately 1 500 ha.

The proposed alternative energy developments are underlain by highly metamorphosed Precambrian basement rocks (schists, quartzites, gneisses) of the Namaqua-Natal Province that are entirely unfossiliferous. These are largely mantled by Late Caenozoic superficial sediments including Quaternary aeolian sands of the Gordonia Formation (Kalahari Group), calcrete pedocretes (soil limestones) and alluvium of the Orange River and its tributaries. These younger superficial sediments are generally of low palaeontological sensitivity. Potentially fossiliferous older alluvial gravels are not mapped along the banks of the Orange River close to Groblershoop where these are intersected by the proposed water pipeline.

No significant fossil heritage resources have been recorded within the Bokpoort II Solar Power Facility study area. The area is inferred to be of low sensitivity in terms of palaeontological heritage and no sensitive or no-go areas have been identified within it during the present desktop assessment. The proposed solar power facility is of LOW (negative) impact significance with respect to palaeontological heritage resources. This assessment applies to all the planned infrastructure within the project area – *including* the water pipeline to the Orange River (already authorised) as well as the short 132 kV overhead line connection to the existing Eskom Garona Substation - and applies equally to all PV plants under consideration for the Bokpoort II Solar Power Facility. Cumulative impacts associated with the ten alternative energy developments are probably low and there are no fatal flaws in the development proposal as far as fossil heritage is concerned. The no-go alternative is of neutral significance for palaeontology. Providing that the recommendations outlined below for palaeontological monitoring and mitigation are fully implemented, there are no objections on palaeontological heritage grounds to authorisation of this alternative energy project. Pending the potential discovery of significant new fossil remains during development - notably fossil vertebrate bones & teeth - no further specialist palaeontological studies or mitigation are considered necessary for this project.

In the case of any significant chance fossil finds during construction (*e.g.* vertebrate teeth, bones, burrows, petrified wood, shells), these should be safeguarded - preferably *in situ* - and reported by the ECO as soon as possible to the South African Heritage Resources Agency, SAHRA (Contact

details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Phone: +27 (0)21 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za). This is so that appropriate mitigation by a professional palaeontologist can be considered. Such mitigation usually involves the judicious sampling, collection and recording of fossils as well as of relevant contextual data concerning the surrounding sedimentary matrix. The palaeontologist concerned would need to apply beforehand for a collection permit from SAHRA. A tabulated Chance Fossil Finds Procedure is appended to this report.

These recommendations should be incorporated into the Environmental Management Plan (EMP) for all the Bokpoort II alternative energy developments.

2. INTRODUCTION & BRIEF

The company ACWA Power Energy Africa (Pty) Ltd is proposing to develop a solar power facility – to be known as Bokpoort II - on the Remaining Extent (RE) of the Farm Bokpoort 390. An associated water pipeline to the Orange River running along an existing servitude will also traverse the adjoining Farm Sand Draai 391. The Bokpoort II project area is situated *c*. 20 km north of the town of Groblershoop within the !Kheis Local Municipality in the ZF Mgcawu District Municipality, Northern Cape Province (Fig. 1). In 2016 ACWA Power obtained three Environmental Authorisations (EAs) for two 75 MW PV facilities as well as a 150 MW CSP facility on the property. The water main pipeline to the Orange has also already been authorised. However, it is now being proposed that, instead of the CSP facility, eight additional PV plants are developed within the same footprint. The two authorised PV facilities are undergoing another BA study for the battery storage energy system as well as the capacity increase from 75 to 200MW. The combined power generation capacity of the entire Bokpoort II solar development will be up to 2000 MW that will be generated by ten x 200 MW photovoltaic (PV) facilities.

Each of the eight proposed additional 200 Megawatt (MW) Photovoltaic (PV) Solar Developments will cover approximately 150 hectares and will comprise the following infrastructure:

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

Associated infrastructure (Figs. 2 & 3) includes:

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

Since fossils preserved within the sedimentary rocks represented within the project area might be disturbed, damaged or destroyed during the construction phase of the proposed Bokpoort II development (*e.g.* during excavations or surface clearance) a desktop palaeontological heritage assessment was originally requested for this development by SAHRA (Case IDs 9659, 9699 and 9702; three letters of 27 June 2016). The present palaeontological heritage desktop study covering the entire Bokpoort II project area has accordingly been commissioned on the proponent's behalf by Royal HaskoningDHV (Pty) Ltd, Woodmead, Gauteng. The present palaeontological report contributes to a Basic Assessment process that covers:

- Eight additional 200 MW PV developments on the originally authorised CSP site.
- Two BESS sites to be included within the footprint of the approved PV 1 (Ndebele) and PV 2 (Xhosa) plants with a combined dangerous good storage volume of approximately 4500 m^3 for each additional BESS site as well as the capacity increase up to 200MW.

It is noted that:

(1) Two PV plants of 75 MW each (*i.e.* Ndebele and Xhosa) have already been authorised. These two PV plants will be subject to their own BA, for the proposed new BESS sites and capacity upgrade from 75 to 200MW. Basic Assessment processes for each of the proposed PV plants are being co-ordinated by Royal HaskoningDHV (Pty) Ltd. (Contact details: Ms Seshni Govender. Royal HaskoningDHV (Pty) Ltd. Address: Building No. 5 Country Club Estate, 21 Woodlands Drive, Woodmead, 2191. PO Box 867, Gallo Manor, 2052, Gauteng, South Africa. Tel: 087 352 1592. Mobile: 072 442 0086. E-mail: seshni.govender@rhdhv.com).

(2) The Bokpoort II site is within one of South Africa's eight Renewable Energy Development Zones (RED7 Upington area *cf* Heritage review by Fourie *et al.* 2014), 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.

2.1. Legislative context for palaeontological assessment studies

The present desktop palaeontological heritage report falls under Sections 35 and 38 (Heritage Resources Management) of the South African Heritage Resources Act (Act No. 25 of 1999), and it will also inform the Environmental Management Programme for this project.

The various categories of heritage resources recognised as part of the National Estate in Section 3 of the National Heritage Resources Act include, among others:

- geological sites of scientific or cultural importance;
- palaeontological sites;
- palaeontological objects and material, meteorites and rare geological specimens.

According to Section 35 of the National Heritage Resources Act, dealing with archaeology, palaeontology and meteorites:

(1) The protection of archaeological and palaeontological sites and material and meteorites is the responsibility of a provincial heritage resources Agency.

(2) All archaeological objects, palaeontological material and meteorites are the property of the State.

(3) Any person who discovers archaeological or palaeontological objects or material or a meteorite in the course of development or agricultural activity must immediately report the find to the responsible heritage resources Agency, or to the nearest local Agency offices or museum, which must immediately notify such heritage resources Agency.

(4) No person may, without a permit issued by the responsible heritage resources Agency—

(a) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;

(b) destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;

(c) trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or

(d) bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites.

(5) When the responsible heritage resources Agency has reasonable cause to believe that any activity or development which will destroy, damage or alter any archaeological or palaeontological site is under way, and where no application for a permit has been submitted and no heritage resources management procedure in terms of section 38 has been followed, it may—

(a) serve on the owner or occupier of the site or on the person undertaking such development an order for the development to cease immediately for such period as is specified in the order;

(b) carry out an investigation for the purpose of obtaining information on whether or not an archaeological or palaeontological site exists and whether mitigation is necessary;

(c) if mitigation is deemed by the heritage resources Agency to be necessary, assist the person on whom the order has been served under paragraph *(a)* to apply for a permit as required in subsection (4); and

(d) recover the costs of such investigation from the owner or occupier of the land on which it is believed an archaeological or palaeontological site is located or from the person proposing to undertake the development if no application for a permit is received within two weeks of the order being served.

Minimum standards for the palaeontological component of heritage impact assessment reports (PIAs) have been published by SAHRA (2013).

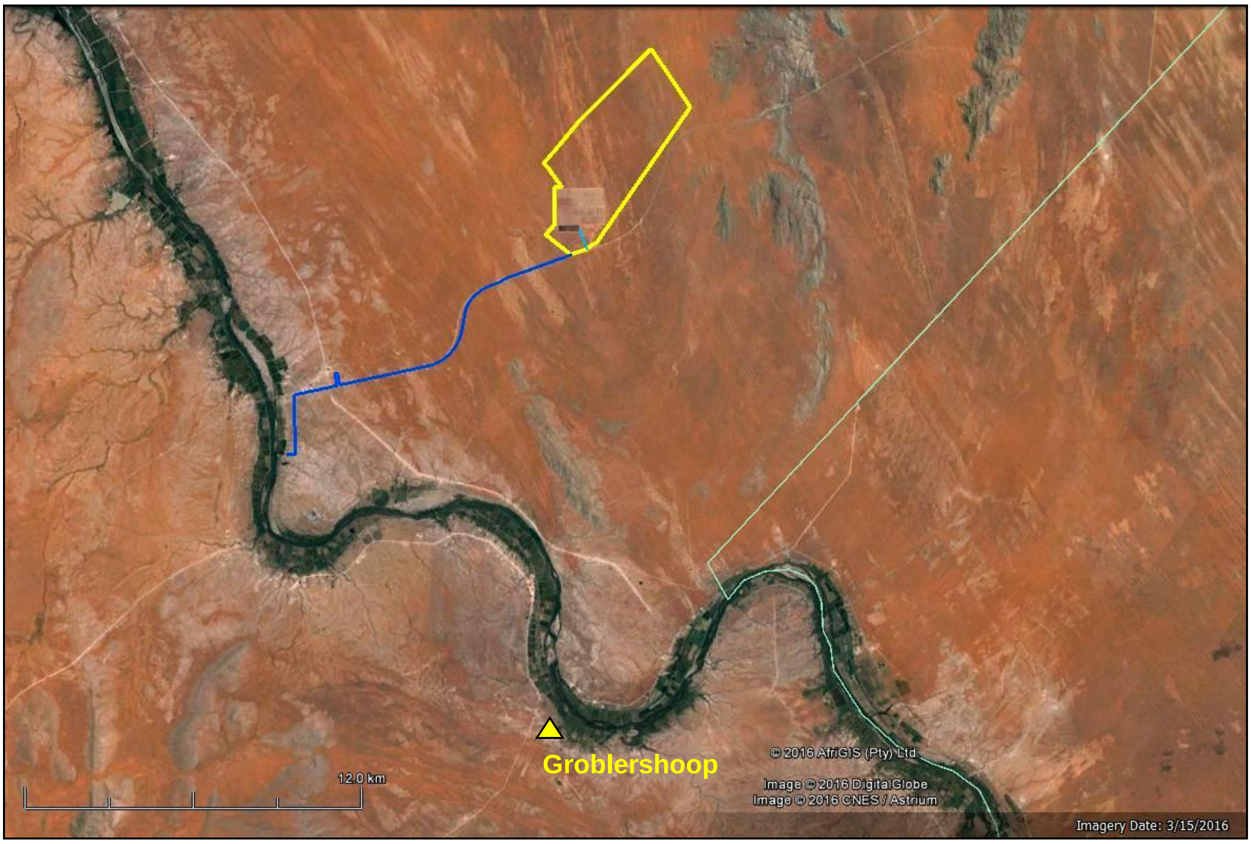

Figure 1: Google earth© satellite image showing the location of the Bokpoort II Solar Power Facility project area (yellow polygon) situated *c*. 20 km north of Groblershoop, Gordonia District, Northern Cape. The associated water pipeline to the Orange River (already authorised) is indicated by the blue line. N is towards the top of the image. Scale bar = 12 km.

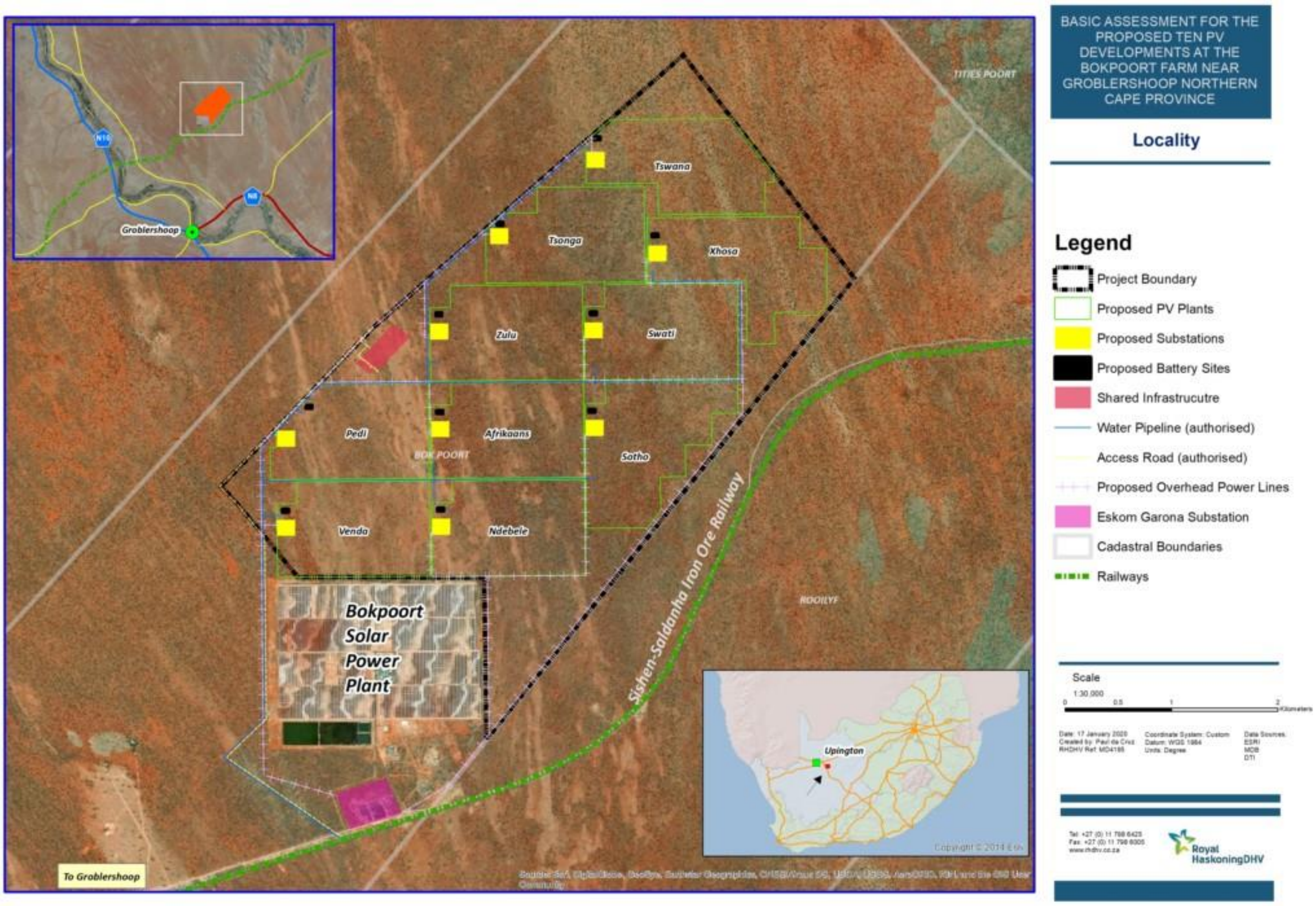

Figure 2: Google earth© satellite image of the Bokpoort II Solar Power Facility project area on the Remaining Extent (RE) of the Farm Bokpoort 390. Shown here are the project boundary (black dashed lines), 10 x PV plants (green) each with a battery site (black) and on-site substation (yellow), the existing Eskom Garona Substation (lilac), main access road (yellow) and shared infrastructure (red). The cleared area for the existing Bokpoort Solar Power Plant can be clearly seen.

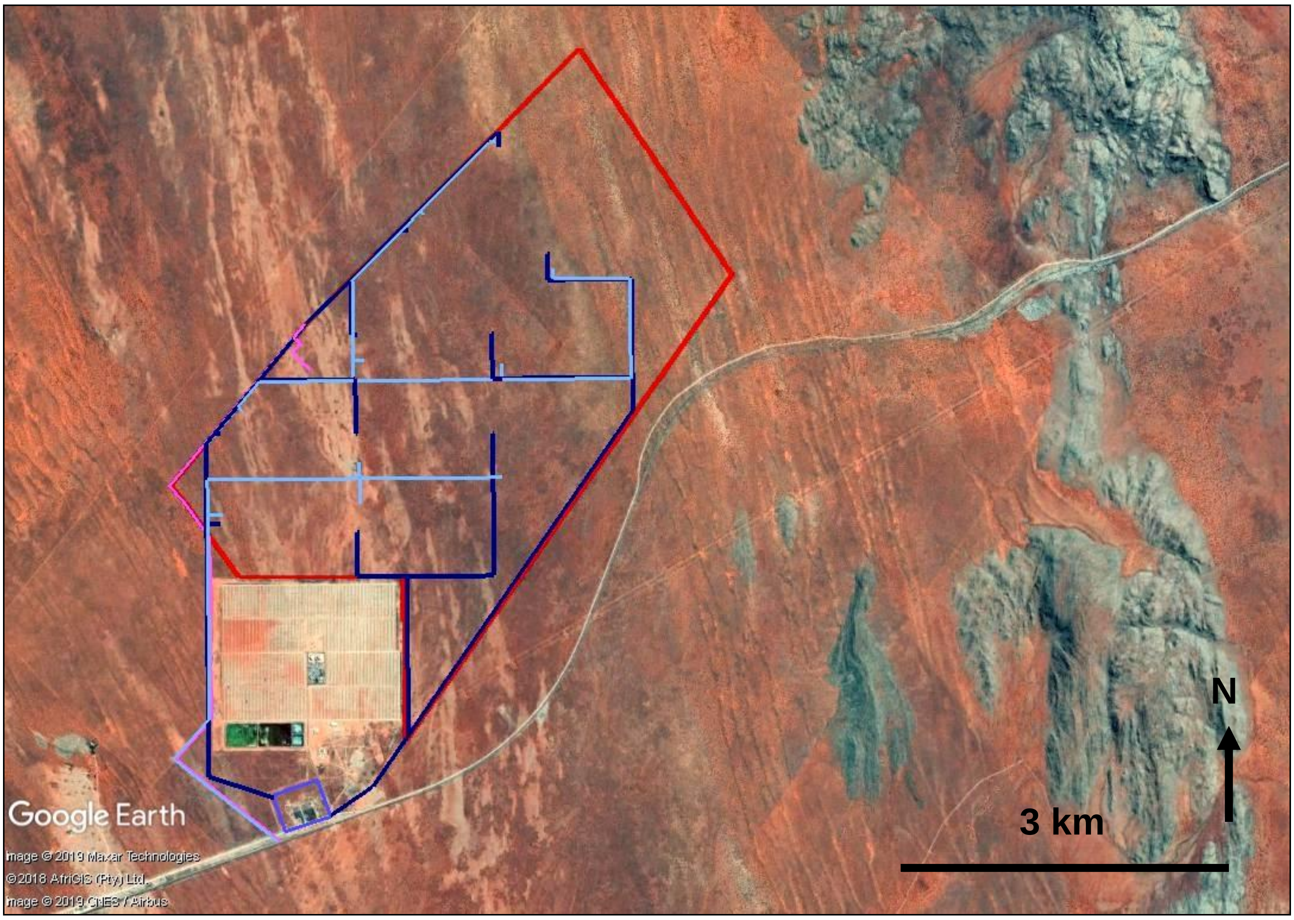

Figure 3: Google earth© satellite image of the Bokpoort II Solar Power Facility project area on the Remaining Extent (RE) of the Farm Bokpoort 390. Shown here are the project boundary (red), overhead powerlines (dark blue), water pipelines, main access road (pink) and the existing Eskom Garona Substation (lilac).

2.2. General approach used for this palaeontological impact study

This PIA report provides an assessment of the observed or inferred palaeontological heritage within the broader study area, with recommendations for specialist palaeontological mitigation where this is considered necessary. The report is based on (1) a review of the relevant scientific literature, including previous palaeontological impact assessments in the area (*e.g.* Almond 2012, 2013a, 2013b, Bamford 2016), (2) published geological maps and accompanying sheet explanations (*e.g.* Moen 2007), as well as (3) the author's extensive field experience with the formations concerned and their palaeontological heritage (*e.g.* Almond & Pether 2008).

In preparing a palaeontological desktop study the potentially fossiliferous rock units (groups, formations *etc*) represented within the study area are determined from geological maps and satellite images. The known fossil heritage within each rock unit is inventoried from the published scientific literature, previous palaeontological impact studies in the same region, and the author's field experience (Consultation with professional colleagues as well as examination of institutional fossil collections may play a role here, or later following scoping during the compilation of the final report). This data is then used to assess the palaeontological sensitivity of each rock unit to development (Provisional tabulations of palaeontological sensitivity of all formations in the Western, Eastern and Northern Cape have already been compiled by J. Almond and colleagues; *e.g.* Almond & Pether 2008). The likely impact of the proposed development on local fossil heritage is then determined on the basis of (1) the palaeontological sensitivity of the rock units concerned and (2) the nature and scale of the development itself, most notably the extent of fresh bedrock excavation envisaged. When rock units of moderate to high palaeontological sensitivity are present within the development footprint, a field assessment study by a professional palaeontologist is usually warranted.

The focus of palaeontological field assessment is *not* simply to survey the development footprint or even the development area as a whole (*e.g.* farms or other parcels of land concerned in the development). Rather, the palaeontologist seeks to assess or predict the diversity, density and distribution of fossils within and beneath the study area, as well as their heritage or scientific interest. This is primarily achieved through a careful field examination of one or more representative exposures of all the sedimentary rock units present (*N.B.* Metamorphic and igneous rocks rarely contain fossils). The best rock exposures are generally those that are easily accessible, extensive, fresh (*i.e.* unweathered) and include a large fraction of the stratigraphic unit concerned (*e.g.* formation). These exposures may be natural or artificial and include, for example, rocky outcrops in stream or river banks, cliffs, quarries, dams, dongas, open building excavations or road and railway cuttings. Uncemented superficial deposits, such as alluvium, scree or wind-blown sands, may occasionally contain fossils and should also be included in the field study where they are well-represented in the study area. It is normal practice for impact palaeontologists to collect representative, well-localized (*e.g.* GPS and stratigraphic data) samples of fossil material during field assessment studies. In order to do so, a fossil collection permit from SAHRA is required and all fossil material collected must be properly curated within an approved repository (usually a museum or university collection).

Note that while fossil localities recorded during field work within the study area itself are obviously highly relevant, most fossil heritage here is embedded within rocks beneath the land surface or obscured by surface deposits (soil, alluvium *etc*) and by vegetation cover. In many cases where levels of fresh (*i.e.* unweathered) bedrock exposure are low, the hidden fossil resources have to be *inferred* from palaeontological observations made from better exposures of the same formations elsewhere in the region but outside the immediate study area. Therefore a palaeontologist might reasonably spend far *more* time examining road cuts and borrow pits close to, but outside, the study area than within the study area itself. Field data from localities even further afield (*e.g.* an adjacent province) may also be adduced to build up a realistic picture of the likely fossil heritage within the study area.

On the basis of the desktop and field studies, the likely impact of the proposed development on local fossil heritage and any need for specialist mitigation are then determined. Adverse palaeontological impacts normally occur during the construction rather than the operational or decommissioning phase. Mitigation by a professional palaeontologist – normally involving the recording and sampling of fossil material and associated geological information (*e.g.* sedimentological and taphonomic data) – is usually most effective during the construction phase when fresh fossiliferous bedrock has been exposed by excavations. To carry out mitigation, the palaeontologist involved will need to apply for a palaeontological collection permit from the relevant heritage management Agency, *i.e.* the South African Heritage Resources Agency, SAHRA (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Phone: +27 (0)21 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za). It should be emphasized that, *providing appropriate mitigation is carried out*, the majority of developments involving bedrock excavation can make a *positive* contribution to our understanding of local palaeontological heritage.

2.3. Assumptions and limitations

The accuracy and reliability of palaeontological specialist studies as components of heritage impact assessments are generally limited by the following constraints:

1. Inadequate database for fossil heritage for much of the RSA, given the large size of the country and the small number of professional palaeontologists carrying out fieldwork here. Most development study areas have never been surveyed by a palaeontologist.

2. Variable accuracy of geological maps which underpin these desktop studies. For large areas of terrain these maps are largely based on aerial photographs alone, without ground-truthing. The maps generally depict only significant (“mappable”) bedrock units as well as major areas of superficial “drift” deposits (alluvium, colluvium) but for most regions give little or no idea of the level of bedrock outcrop, depth of superficial cover (soil *etc*), degree of bedrock weathering or levels of small-scale tectonic deformation, such as cleavage. All of these factors may have a major influence on the impact significance of a given development on fossil heritage and can only be reliably assessed in the field.

3. Inadequate sheet explanations for geological maps, with little or no attention paid to palaeontological issues in many cases, including poor locality information.

4. The extensive relevant palaeontological “grey literature” - in the form of unpublished university theses, impact studies and other reports (*e.g*. of commercial mining companies) - that is not readily available for desktop studies.

5. Absence of a comprehensive computerized database of fossil collections in major RSA institutions which can be consulted for impact studies. A Karoo fossil vertebrate database is now accessible for impact study work.

In the case of palaeontological desktop studies without supporting Phase 1 field assessments these limitations may variously lead to either:

(a) *underestimation* of the palaeontological significance of a given study area due to ignorance of significant recorded or unrecorded fossils preserved there, or

(b) *overestimation* of the palaeontological sensitivity of a study area, for example when originally rich fossil assemblages inferred from geological maps have in fact been destroyed by tectonism or weathering, or are buried beneath a thick mantle of unfossiliferous “drift” (soil, alluvium *etc*).

Since most areas of the RSA have not been studied palaeontologically, a palaeontological desktop study usually entails *inferring* the presence of buried fossil heritage within the study area from relevant fossil data collected from similar or the same rock units elsewhere, sometimes at localities far away. Where substantial exposures of bedrocks or potentially fossiliferous superficial sediments are present in the study area, the reliability of a palaeontological impact assessment may be significantly enhanced through field assessment by a professional palaeontologist.

In the case of the present study area near Groblershoop in the Northern Cape preservation of potentially fossiliferous bedrocks is favoured by the arid climate but bedrock exposure is very limited indeed due to cover by extensive superficial deposits (*e.g.* alluvium, sandy soils, surface gravels), especially in areas of low relief, as well as by Kalahari vegetation. Very few previous palaeontological heritage assessments have been carried out in the study region (*cf* SAHRIS website; Bamford 2016).

3. GEOLOGICAL CONTEXT

The Bokpoort II Solar Power Facility study area on the Remaining Extent (RE) of the Farm Bokpoort 390 comprises arid, low relief terrain in the Gordonia region on the north-eastern side of the Orange River some 20 km north of Groblershoop, Northern Cape (Fig. 1). The terrain within the solar facility study area slopes broadly southwards from *c*. 1010 m amsl in the north to c. 950 m amsl in the south. As clearly seen in satellite images (Figs. 1 to 3) bedrock exposure is good close to the river and along some sectors of the river bank, while away from the river the bedrocks are largely mantled with orange-brown Kalahari sands. NNW to SSE trending linear sand dunes here surround occasional emergent rocky Inselberge of basement rocks. Bedrock exposures in the vicinity are dissected by the dendritic drainage courses of small, intermittently-flowing streams.

The geology of the study area near Groblershoop is shown on the adjoining 1: 250 000 geological maps 2820 Upington and 2822 Postmasburg (Council for Geoscience, Pretoria; Fig. 4 herein). A comprehensive sheet explanation for the Upington map has been published by Moen (2007) while only a very brief explanation for the Postmasburg area is printed on the map itself. The entire study area is underlain at depth by ancient Precambrian igneous and metamorphic rocks that belong to the **Namaqua-Natal Province** of Mid Proterozoic (Mokolian) age (Cornell *et al.* 2006, Moen 2007). These metamorphosed basement rocks are approximately two to one billion years old and are entirely unfossiliferous (Almond & Pether 2008); they are only represented at surface by small bouldery outcrops (*cf* Dreyer 2015). They include a range of schistose and quartzitic units assigned to the **Brulpan Group** (*e.g.* **Groblershoop Formation** and **Prynnsburg Formation**), details of which are given by Moen (2007) as well as Cornell *et al.* (2006). Outside the present study area the Brulpan rocks are locally intruded by the **Kalkwerf Granite-gniess**, likewise unfossiliferous.

The Precambrian basement rocks within the study area are to a great extent mantled with a spectrum of coarse- to fine-grained **superficial deposits** such as rocky soils, downwasted surface gravels, colluvium (slope deposits), sheet wash, calcrete hardpans, aeolian sands and alluvium of intermittently-flowing streams. These younger deposits are generally young (Quaternary to Recent) and are largely unfossiliferous. Field photos of the study area (*e.g.* Dreyer 2015) show orange-brown Kalahari sands, exhumed calcrete hardpans and dispersed, surface gravels dominated by reworked or downwasted calcrete with minor basement quartzite and cherty clasts (these last probably derived from alluvial gravels of the Orange River).

Small patches of Late Tertiary to Quaternary **calcretes** or pedogenic limestones (T, darker yellow in Fig. 4) are mapped between the solar facility study area and the Orange River; some of these are traversed by the water pipeline servitude. Some of these calcretes may be correlated with the Pleistocene or Late Pliocene **Mokalanen Formation** of the **Kalahari Group**, while others may be of younger age (Partridge *et al.* 2006, Moen 2007). They include horizons of layered to structureless or nodular calcretes overlying basement rocks that are usually less than 3 m thick and often partially covered by wind-blown sands.

The great majority of the study area, including the water pipeline corridor, is covered by fine-grained aeolian (wind-blown) sands of the **Gordonia Formation** (**Qg**, pale yellow in Fig. 4), the youngest, Pleistocene to Recent, subunit of the Kalahari Group. Prominent NNW-SSE trending linear dunes of orange-hued sands are clearly visible on satellite images of the study area (Figs. 1 to 3). The geology of the Late Cretaceous to Recent Kalahari Group is reviewed by Thomas (1981), Dingle *et al.* (1983), Thomas & Shaw 1991, Haddon (2000) and Partridge *et al.* (2006). The Gordonia dune sands are considered to range in age from the Late Pliocene / Early Pleistocene to Recent, dated in part from enclosed Middle to Later Stone Age stone tools (Dingle *et al*., 1983, p. 291). Note that the recent extension of the Pliocene - Pleistocene boundary from 1.8 Ma back to 2.588 Ma would place the Gordonia Formation almost entirely within the Pleistocene Epoch.

According to Moen (2007) **older river terrace gravels** of possible Late Tertiary to Pleistocene age occur "all along the [Orange] river" within 2 km of the present banks and at elevations of up to 45 m (rarely as high as 85m) above the present flood plain. These older river gravels are frequently calcretised. Small patches of older terrace gravels are mapped along the eastern banks of the River Orange some 25 km north of Groblershoop but they are not indicated within the present study area. They may either be completely absent here or too small to map at 1: 250 000 scale. Field photos of the river bank where this is intersected by the existing pipeline show the presence here of disturbed, fine-grained younger alluvium.

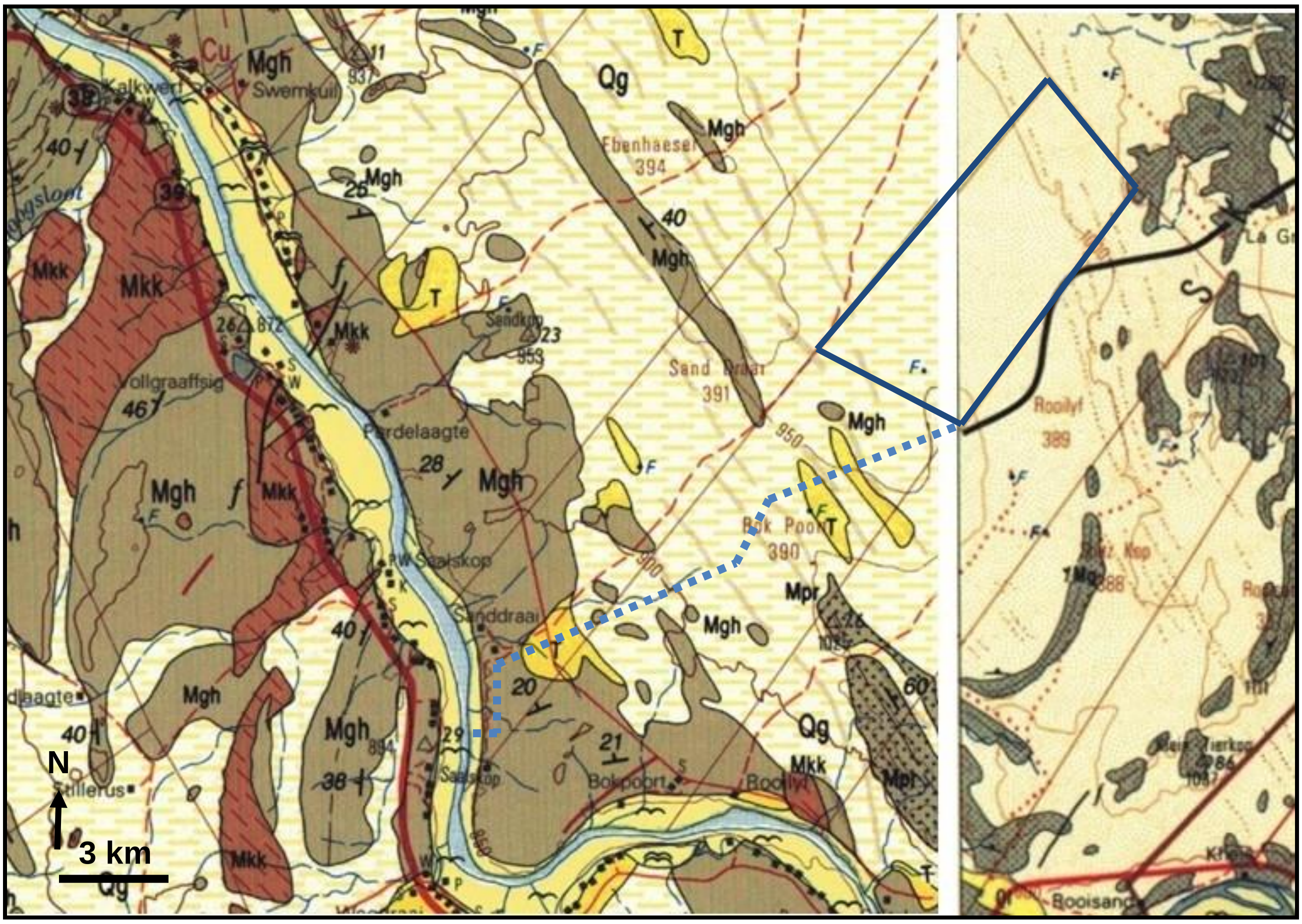

Figure 4: Extract from the adjoining 1: 250 000 geological maps 2820 Upington and 2822 Postmasburg (Council for Geoscience, Pretoria) showing the approximate location of the study area for the Bokpoort II Solar Power Facility on Farm Bokpoort 390 (dark blue polygon). The paler blue dotted line indicates the *approximate* course of the water pipeline to the Orange River.

The study area is underlain at depth by unfossiliferous Precambrian (Middle Proterozoic / Mokolian) basement rocks of the Namaqua-Natal Metamorphic Province (Mgh, Mg, Mpr *etc*, grey or grey-brown) that are assigned to the Brulpan Group and are intruded outside the study area by granite gneisses (Mkk, orange = Kalkwerf Gneiss). Superficial sediments of Late Caenozoic age include calcretes (T, bright yellow), reddish aeolian sands of the Gordonia Formation, Kalahari Group (Qg, pale yellow, with or without dashes), and alluvium of the Orange River (pale yellow with "flying bird" symbol). Small patches of older (Tertiary) terrace gravels are mapped on the eastern bank of the Orange River *c*. 25 km NW of Groblershoop, but *not* within the present study area.

4. PALAEONTOLOGICAL HERITAGE

The Precambrian metamorphic and igneous basement rocks of **the Namaqua-Natal Metamorphic Province** in the study area are entirely unfossiliferous (Almond & Pether 2008) and will therefore not be treated further here.

Late Caenozoic calcretes of the **Kalahari Group** may contain trace fossils such as rhizoliths, termite and other insect burrows, or even mammalian trackways. Mammalian bones, teeth and horn cores (also tortoise remains, and fish, amphibian or even crocodiles in wetter depositional settings) may be occasionally expected within Kalahari Group sediments and calcretes, notably those associated with ancient alluvial gravels and pans (*cf* Almond 2008a). However, these fossil assemblages are generally sparse, low in diversity, and occur over a wide geographic area, so the palaeontological sensitivity of the calcretes within the study region is rated as low. This applies equally to the thin veneer of other surface deposits (rocky scree, stream alluvium *etc*) within this highly-arid region.

Alluvial gravels of the Orange River of Miocene and younger age are locally highly fossiliferous (*e.g.* Hendy 1984, Schneider & Marias 2004, Almond 2008a, 2009 and extensive references therein) but, as argued above, these are *not* mapped within the study area. Younger silty alluvial deposits may contain a range of terrestrial and freshwater fossils and subfossils. Freshwater snails are mentioned in particular by Moen (2007, p. 150). Stream gravels close to the west bank of the Orange River in the Groblershoop area were examined without success for palaeontological remains by Almond (2012).

5. PALAEONTOLOGICAL HERITAGE IMPACT ASSESSMENT

The Precambrian metamorphic bedrocks underling the study area at depth are unfossiliferous while the overlying Late Caenozoic superficial sediments are generally fossil-poor. As a consequence of the paucity of irreplaceable, unique or rare fossil remains within the development footprint the overall impact significance of the construction phase of the proposed solar energy project is assessed as LOW (negative) without mitigation, and VERY LOW (negative) after mitigation (See summary presented in Table 1). This assessment applies to all the planned infrastructure within the project area – *including* the water pipeline to the Orange River as well as the 132 kV overhead line connection to the Eskom Garona Substation - and applies equally to all PV plants under consideration for the Bokpoort II Solar Power Facility. There are no preferences on palaeontological heritage grounds for any particular infrastructure layout or technology alternative among the various options under consideration.

No significant further impacts on fossil heritage are anticipated during the planning, operational and decommissioning phases of the solar power facility. The no-go alternative (*i.e.* no development) would have a neutral impact on palaeontological heritage.

There are no fatal flaws in the present development proposal as far as fossil heritage is concerned. Providing that the proposed recommendations for palaeontological monitoring and mitigation outlined below are followed through, there are no objections on palaeontological heritage grounds to authorisation of this alternative energy project.

Confidence levels for this palaeontological heritage assessment are high. These conclusions are supported by previous palaeontological field assessments undertaken in the broader Kalahari study region (*e.g.* Almond 2012).

- **Cumulative impacts**

Given the low impact significance assessed for all solar energy developments concerned which are all underlain by very similar geology, it is likely that cumulative impacts associated with the Bokpoort II solar power facility are LOW. Very few palaeontological impact assessments for other developments in the wider project area near Groblershoop have been undertaken (SAHRIS website); one exception - for solar projects on the farm Sand Draai by Bamford (2016) - also concluded that the palaeontological sensitivity of the region is low.

Table 1: Assessment of impacts of the proposed Bokpoort II Solar Power Facility on fossil heritage resources within the development footprint during the construction phase of the development (*N.B.* Significant impacts are not anticipated during the operational and decommissioning phases).

Nature of impact: Disturbance, damage, destruction or sealing-in of *scientifically important* fossil remains preserved at or beneath the ground surface within the development area, most notably by surface clearance and bedrock excavations during the construction phase of the solar power facility.		
	Without mitigation	**With mitigation**
Scale	Site only (1)	Site only (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Minor (2)	Minor (2)
Probability	Low (2)	Improbable (1)
Significance	**Negative Low (16)**	**Negative Very Low (8)**
Status	Negative	Negative (loss of fossils) & positive (improved fossil database following mitigation)
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources	No, since the limited fossil resources concerned are also represented outside the development area (*i.e.* not unique)	No, since the limited fossil resources concerned are also represented outside the development area (*i.e.* not unique)
Can impacts be mitigated?	Yes	Yes.
Mitigation: Monitoring of all substantial bedrock excavations for fossil remains by ECO on an ongoing basis during construction phase, with reporting of any substantial new palaeontological finds (notably fossil vertebrate bones & teeth) to SAHRA for possible specialist mitigation.		
Cumulative impacts: Low, given the very similar geology of the entire Bokpoort II study region.		
Residual impacts: Negative impacts due to loss of local fossil heritage will be partially offset by *positive* impacts resulting from mitigation (*i.e.* improved palaeontological database).		

6. SUMMARY & RECOMMENDATIONS

The project areas for the proposed Bokpoort II alternative energy developments on the Remaining Extent (RE) of the Farm Bokpoort 390 near Groblershoop are underlain, at or below the surface, by highly metamorphosed Precambrian basement rocks (schists, quartzites, gneisses) of the Namaqua-Natal Province that are entirely unfossiliferous. These are largely mantled by Late Caenozoic superficial sediments including Quaternary aeolian sands of the Gordonia Formation (Kalahari Group), calcrete pedocretes and alluvium of the Orange River and its tributaries. These younger superficial sediments are generally of low palaeontological sensitivity. Potentially fossiliferous older alluvial gravels are not mapped along the banks of the Orange River close to Groblershoop where these are intersected by the proposed water pipeline.

No significant fossil heritage resources have been recorded within the Bokpoort II solar power facility study area. The area is inferred to be of low sensitivity in terms of palaeontological heritage and no sensitive or no-go areas have been identified within it during the present desktop assessment. The proposed solar power facility is of LOW (negative) impact significance before mitigation with respect to palaeontological heritage resources. This assessment applies to all the planned infrastructure within the project area – *including* the water pipeline to the Orange River (already authorised) as well as the 132 kV overhead line connection to the Eskom Garona Substation - and applies equally to all PV plants under consideration for the Bokpoort II Solar Power Facility. Cumulative impacts associated with the ten PV solar energy developments are probably low, given the similar regional geology, and there are no fatal flaws in the development proposal as far as fossil heritage is concerned. The no-go alternative is of neutral significance for palaeontology. Providing that the recommendations outlined below for palaeontological monitoring and mitigation are followed through, there are no objections on palaeontological heritage grounds to authorisation of this alternative energy project.

Pending the potential discovery of significant new fossil remains during development - notably fossil vertebrate bones & teeth - no further specialist palaeontological studies or mitigation are considered necessary for this project.

6.1. Recommended monitoring and mitigation

In the case of any significant chance fossil finds during construction (*e.g.* vertebrate teeth, bones, burrows, petrified wood, shells), these should be safeguarded - preferably *in situ* - and reported by the ECO as soon as possible to the South African Heritage Resources Agency, SAHRA (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Phone: +27 (0)21 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za). This is so that appropriate mitigation by a professional palaeontologist can be considered. Such mitigation usually involves the judicious sampling, collection and recording of fossils as well as of relevant contextual data concerning the surrounding sedimentary matrix. The palaeontologist concerned would need to apply beforehand for a collection permit from SAHRA. A tabulated Chance Fossil Finds Procedure is provided in Appendix 1 to this report.

These recommendations should be incorporated into the Environmental Management Plan (EMP) for each alternative energy development.

7. ACKNOWLEDGEMENTS

I am grateful to Ms Seshni Govender of Royal HaskoningDHV, Woodmead, for commissioning this study as well as for providing the necessary background information. The original cultural heritage assessment for this project by Dreyer (2015) provided a very useful resource for evaluating surface geology in the study area.

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9. QUALIFICATIONS & EXPERIENCE OF THE AUTHOR

Dr John Almond has an Honours Degree in Natural Sciences (Zoology) as well as a PhD in Palaeontology from the University of Cambridge, UK. He has been awarded post-doctoral research fellowships at Cambridge University and in Germany, and has carried out palaeontological research in Europe, North America, the Middle East as well as North and South Africa. For eight years he was a scientific officer (palaeontologist) for the Geological Survey / Council for Geoscience in the RSA. His current palaeontological research focuses on fossil record of the Precambrian - Cambrian boundary and the Cape Supergroup of South Africa. He has recently written palaeontological reviews for several 1: 250 000 geological maps published by the Council for Geoscience and has contributed educational material on fossils and evolution for new school textbooks in the RSA.

Since 2002 Dr Almond has also carried out palaeontological impact assessments for developments and conservation areas in the Western, Eastern and Northern Cape, Limpopo, Northwest, KwaZulu-Natal, Mpumalanga and the Free State under the aegis of his Cape Town-based company *Natura Viva* cc. He has served as a long-standing member of the Archaeology, Palaeontology and Meteorites Committee for Heritage Western Cape (HWC) and an advisor on palaeontological conservation and management issues for the Palaeontological Society of South Africa (PSSA), HWC and SAHRA. He is currently compiling technical reports on the provincial palaeontological heritage of Western, Northern and Eastern Cape for SAHRA and HWC. Dr Almond is an accredited member of PSSA and APHP (Association of Professional Heritage Practitioners – Western Cape).

Declaration of Independence

I, John E. Almond, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed project, application or appeal in respect of which I was appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of my performing such work.

John E. Almond

Dr John E. Almond
(Palaeontologist)
***Natura Viva* cc**

<table>
<tr><td colspan="3">Appendix 1: CHANCE FOSSIL FINDS PROCEDURE: BOKPOORT II SOLAR POWER FACILITY ON THE REMAINING EXTENT OF FARM BOKPOORT 390 NEAR GROBLERSHOOP</td></tr>
<tr><td>Province & region:</td><td colspan="2">Northern Cape, ZF Mgcawu District Municipality.</td></tr>
<tr><td>Responsible Heritage Management Agency</td><td colspan="2">SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa.
Phone: +27 (0)21 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za</td></tr>
<tr><td>Rock unit(s)</td><td colspan="2">Precambrian Namaqua-Natal basement rocks. Kalahari Group aeolian sands, calcretes, Late Caenozoic alluvium.</td></tr>
<tr><td>Potential fossils</td><td colspan="2">Mammalian bones, teeth and horn cores, freshwater molluscs, trace fossils in older alluvial deposits, calcrete hardpans.</td></tr>
<tr><td rowspan="5">ECO protocol</td><td colspan="2">1. Once alerted to fossil occurrence(s): alert site foreman, stop work in area immediately (N.B. safety first!), safeguard site with security tape / fence / sand bags if necessary.</td></tr>
<tr><td colspan="2">2. Record key data while fossil remains are still in situ:
• Accurate geographic location – describe and mark on site map / 1: 50 000 map / satellite image / aerial photo
• Context – describe position of fossils within stratigraphy (rock layering), depth below surface
• Photograph fossil(s) in situ with scale, from different angles, including images showing context (e.g. rock layering)</td></tr>
<tr><td>3. If feasible to leave fossils in situ:
• Alert Heritage Resources Agency and project palaeontologist (if any) who will advise on any necessary mitigation
• Ensure fossil site remains safeguarded until clearance is given by the Heritage Resources Agency for work to resume</td><td>3. If not feasible to leave fossils in situ (emergency procedure only):
• Carefully remove fossils, as far as possible still enclosed within the original sedimentary matrix (e.g. entire block of fossiliferous rock)
• Photograph fossils against a plain, level background, with scale
• Carefully wrap fossils in several layers of newspaper / tissue paper / plastic bags
• Safeguard fossils together with locality and collection data (including collector and date) in a box in a safe place for examination by a palaeontologist
• Alert Heritage Resources Agency and project palaeontologist (if any) who will advise on any necessary mitigation</td></tr>
<tr><td colspan="2">4. If required by Heritage Resources Agency, ensure that a suitably-qualified specialist palaeontologist is appointed as soon as possible by the developer.</td></tr>
<tr><td colspan="2">5. Implement any further mitigation measures proposed by the palaeontologist and Heritage Resources Agency</td></tr>
<tr><td>Specialist palaeontologist</td><td colspan="2">Record, describe and judiciously sample fossil remains together with relevant contextual data (stratigraphy / sedimentology / taphonomy). Ensure that fossils are curated in an approved repository (e.g. museum / university / Council for Geoscience collection) together with full collection data. Submit Palaeontological Mitigation report to Heritage Resources Agency. Adhere to best international practice for palaeontological fieldwork and Heritage Resources Agency minimum standards.</td></tr>
</table>

Appendix B11: Traffic

REPORT

Addendum to Bokpoort II PV Solar Farm: Concentrated Solar Power Tower Facility, Site Traffic Assessment

Site Traffic Assessment

Client: ACWA Power (LTD) PTY

Reference: MD4195-RHD-ZZ-XX-RP-Z-0001

Status: S0/P01.01

Date: 24 January 2020

Royal HaskoningDHV
Enhancing Society Together

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Document title:	Addendum to Bokpoort II PV Solar Farm: Concentrated Solar Power Tower Facility, Site Traffic Assessment
Document short title:	
Reference:	MD4195-RHD-ZZ-XX-RP-Z-0001
Status:	P01.01/S0
Date:	24 January 2020
Project name:	Bokpoort II
Project number:	MD4195
Author(s):	Tanita Bhayroo

Drafted by:	Tanita Bhayroo
Checked by:	Leonie van Wyk
Date / initials:	
Approved by:	
Date / initials:	

Classification
Internal use only

MANAGEMENT SYSTEM CERTIFICATION
DNV·GL
ISO 9001 = ISO 14001
ISO 45001

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1 INTRODUCTION

1.1 Purpose of Report

This report is an addendum to previously completed reports for the Bokpoort II Solar Farm Concentrated Solar Power Tower Facility, Bokpoort II Photovoltaic Facility 1 and Bokpoort II Photovoltaic Facility 2 (Site Traffic Assessment, May 2016). The previous reports detail the impact of the construction and operations of two 75 Mega Watt (MW) photovoltaic (PV) facilities and one 150MW Concentrated Solar Power (CSP) Tower facility. The project scope has been amended to ten 200MW PV solar facilities and no CSP tower facilities included in the development.
The proposed solar development site is located in the Northern Cape of South Africa. The site is located 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. This report will cover the impact of the 10 proposed PV facilities.

The report will address:

- Description of the Status Quo, including the existing traffic data and analysis at the surrounding road network and accesses to the site;
- Description of the construction process and methodology, including transport of materials and staff to site and site logistics during the construction and operational phases;
- Describe and quantify the traffic impact during construction period using intersection capacity analysis software;
- Address the access / egress at the site.

This traffic study will form part of the Environmental Basic Assessment specialist studies for the development of the proposed PV facilities.

1.2 Overview of Project

The proposed development will consist of ten 200MW PV facilities and the associated infrastructure. Also included in the development is a Battery Energy Storage System (BESS) on each of the 10 PV sites, with a storage capacity of 150MW. The combined power generation capacity of the entire development will be 2000 MW and the combined storage capacity of the BESSs will be 1500MW. Each PV facility will require 150ha of land, the combined area required for the ten proposed PV facilities is 1500 ha. The BESS site footprint is 16ha and the hazardous storage is 4500m^3 for each PV site. 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 BESS for either of the sites as well as the capacity increase from 75 to 200MW.

1.3 Location of the Project

The PV facilities will be located within Farm Bokpoort 390 RE in the !Kheis Local Municipality in the ZF Mgcawu District Municipality, Northern Cape Province. The proposed site location is adjacent to Bokpoort I and in proximity of the Eskom’s Garona Substation The development is also located adjacent to the Sanddraai solar power (CSP) and PV plant on the Farm Sanddraai 391, adjacent to Bokpoort to the north, for which Environmental Authorisation has been granted, however, construction has not yet started.

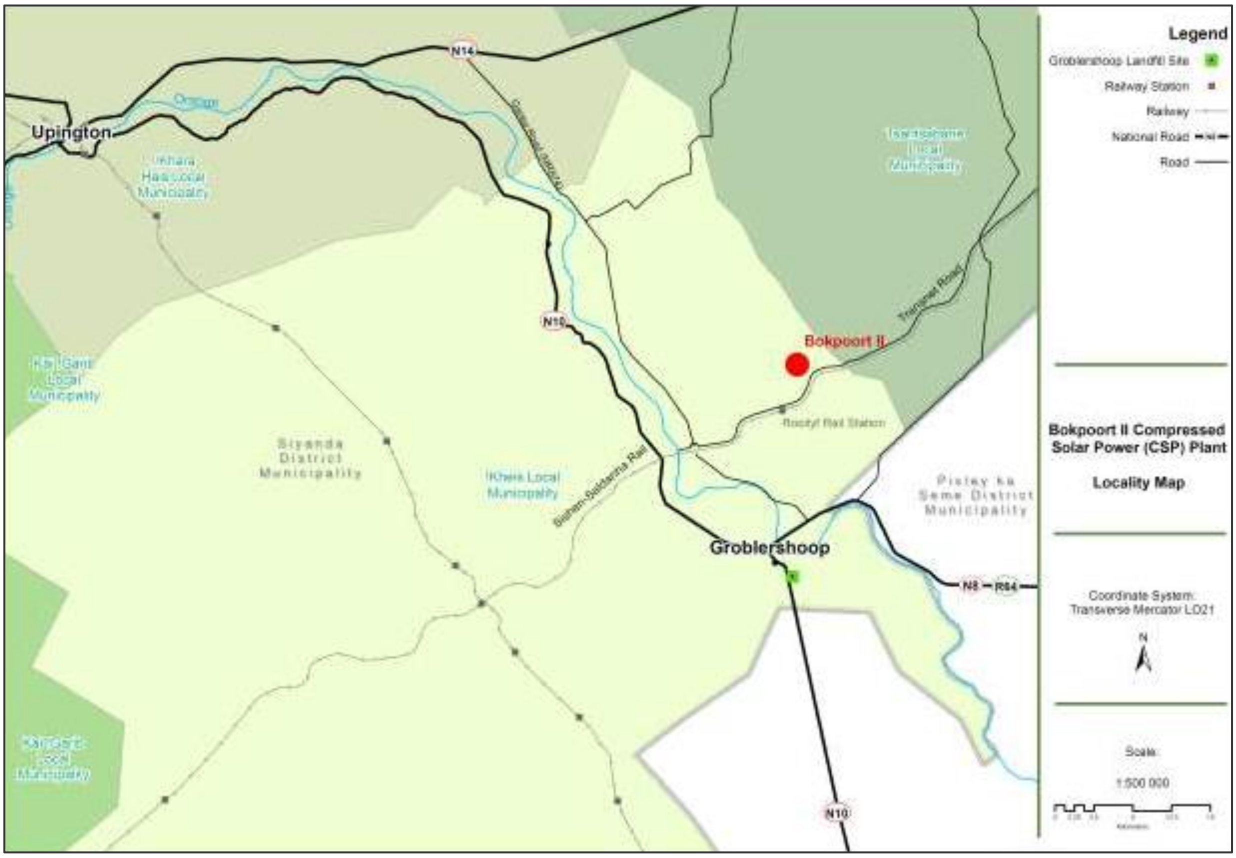

Figure 1.1: Locality Map

1.4 Consultant

Royal HaskoningDHV (RHDHV) was appointed by ACWA Power Energy Africa (Pty) Ltd to update the traffic specialist studies associated with the updated project scope.

1.5 Projects Impacting on this Study

The following projects in the study area should be noted:

- The proposed Sanddraai solar power (CSP) and PV plant on the farm Sanddraai 391, adjacent to Bokpoort I the proposed PV facilities;
- Bokpoort I solar plant for which construction was completed in March 2016 which is located on Farm Bokpoort 390; and
- At the time of completing the original investigation a request by farmers (grape farmers adjacent to the river) to upgrade the Gariep District Road which is currently a gravel road, due to dust generated by construction traffic which affects their grape production.

The expected programme for the construction period abovementioned projects as well as the 10 facilities being investigated are included in Table 1-1 below.

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Table 1-1: Expected simultaneous construction program

	2020				2021												2022											
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Bokpoort I																												
Proposed PV solar facilities																												
PV 1																												
PV 2																												
PV 3																												
PV 4																												
PV 5																												
PV 6																												
PV 7																												
PV 8																												
PV 9																												
PV 10																												
Sanddraai																												

Note: This program is to be confirmed by ACWA Power Energy Africa (Pty) Ltd as details pertaining to the construction program are not yet finalized, and the program above is based on assumptions that were made regarding the construction activities. The construction program is dependent on the awarding of projects by the Department of Mineral Resources and Energy.

Planning and design phase	
Construction phase	
Operation phase	

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2 STATUS QUO

2.1 Land Use

The proposed site is on the north-eastern portion of the Remaining Extent (RE) of the Farm Bokpoort 390, which has previously been used for animal grazing. It is currently zoned as a Special Zone and forms part of Renewable Energy Development Zone (REDZ) 7 Upington. 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 impacts, economic and infrastructural factors. The main farming activity in the area is vineyards with sultana farms on both sides of the Orange River close to (up to 500 to 1000m) the river bank and further away from the river is livestock farming and eco-tourism.

2.2 Access to Site

Access to the proposed site is via a private Transnet Service Road (gravel), running adjacent to the Sishen-Saldanha railway line. The Transnet Service Road is accessed via the Gariep Road, currently a gravel road, from either the N8 or N14. The road also provides access to farms located further north. This road was upgraded (widened to 8m and gravelled) during the construction of Bokpoort I and meet the requirements for the proposed PV facilities. Permission for use of the road was obtained during the application for construction for Bokpoort I, however, permission will have to obtained once again for the construction of the PV solar facilities.

2.3 Road Network and Intersections

The N14, N10 and N8 are the National roads in the region and are the main link between the economic centers of Gauteng and Namibia. Access to the site is via the Gariep Road the Transnet Service Road. Details of the road network are given in Table 1.

The intersections are currently all unsignalized intersections and operating at a good Level of Service (LOS) of LOS A with sufficient spare capacity (Bokpoort II Solar Farm Concentrated Solar Power Tower Facility, Site Traffic Assessment, May 2016).

Details of the LOS classifications are provided in Table 2-2

Table 2-1: LOS Classifications

LOS A	free flow
LOS B	reasonably free flow
LOS C	stable flow, at or near free flow
LOS D	approaching unstable flow.
LOS E	unstable flow, operating at capacity
LOS F	forced or breakdown flow

Details of the Gariep Road and Transnet Service Road are provided in Table 2-2.

Table 2-2: Overview of road network

Road	Ownership	Geometry	Discussion	Layout
Gariep Road (MR874)	Northern Cape Department of Transport	Gravel road 2 lanes (one per direction) 10m wide Speed 60km/hr Longitudinal profile: Flat	The road runs parallel and to the east of the Orange River serving as access to the farms along the Orange River. The road links the N14 with the N8. Major dust issues have been noted by farmers due to construction vehicles during the construction of Bokpoort I. The road is aligned through the southern sections of the farm Bokpoort. Condition: Fair	
Transnet Service Road (Loop 16 Access Road)	Transnet	Gravel road 2 lanes (one per direction) 10m wide Speed 60km/hr Longitudinal profile: Flat	Private Transnet Service Road to serve the Sishen-Saldanha Railway line. The road is the main access to the Bokpoort Farm Condition: Fair Road was regravelled during the construction of Bokpoort I	

Details of the LOS expected at the Gariep Road and Transnet Service Road intersection are provided in Table 2-3. Sidra Intersection analysis was done for the Gariep/Transnet Service Road intersection before construction, during construction and during operation (see **Appendix A: Traffic Data**).

Table 2-3: Overview of Gariep Road/Transnet Service Road intersection

Intersection	LOS	Discussion	Layout
Gariep Road/Transnet Service Road	Existing A During Construction (Phased Construction): A Southern approach: A During Construction (Simultaneous Construction): A Southern approach: D During Operation: A	Sight distance: Fair, after bridge over rail Dedicated right turning lanes: None Safety: Poor Very little traffic currently on road The approach to the intersection is poor, with poor visibility and geometry	

2.4 Non-Motorized Transport

No pedestrians or cyclists were noted on any of these roads (Gariep Road, N14, N10, N8) during the site visit (19 November 2019). No cyclists or pedestrians are allowed on the National roads (N14, N10, N8). Workers and staff working on the farms along the Gariep Road, mostly live on the farms. This is similarly the case with the Transnet Service Road. There are no towns or settlements along these two roads, apart from the farms along the Gariep Road. No dedicated non-motorized transport facilities are provided or required.

2.5 Accident Hotspots

As per the original 2016 investigation, the Gariep Road is an accident hotspot and has seen a number of fatal accidents due to speeding, overtaking and poor visibility caused by dust generated by the vehicles using the road.

2.6 Railway Lines

The Sishen-Saldanha railway line runs adjacent to the farm Bokpoort 390 RE. The railway line could potentially be used for transport of materials to site, but it is highly doubtful if a special train will be scheduled to this site due to lack of rolling stock from Transnet's side. Rail was not used during the construction of Bokpoort I, and therefore it is assumed that it is highly unlikely that the Sishen-Saldanha railway line will be used during the construction of the proposed PV facilities.

2.7 Proposed Refuse Sites

The proposed refuse sites and haul distance include:

- Holfontein (hazardous waste) (814km via N8); and
- Local municipality (general waste) at Groblershoop (35km).

The haul routes to the refuse sites are shown in Figure 2.1 below.

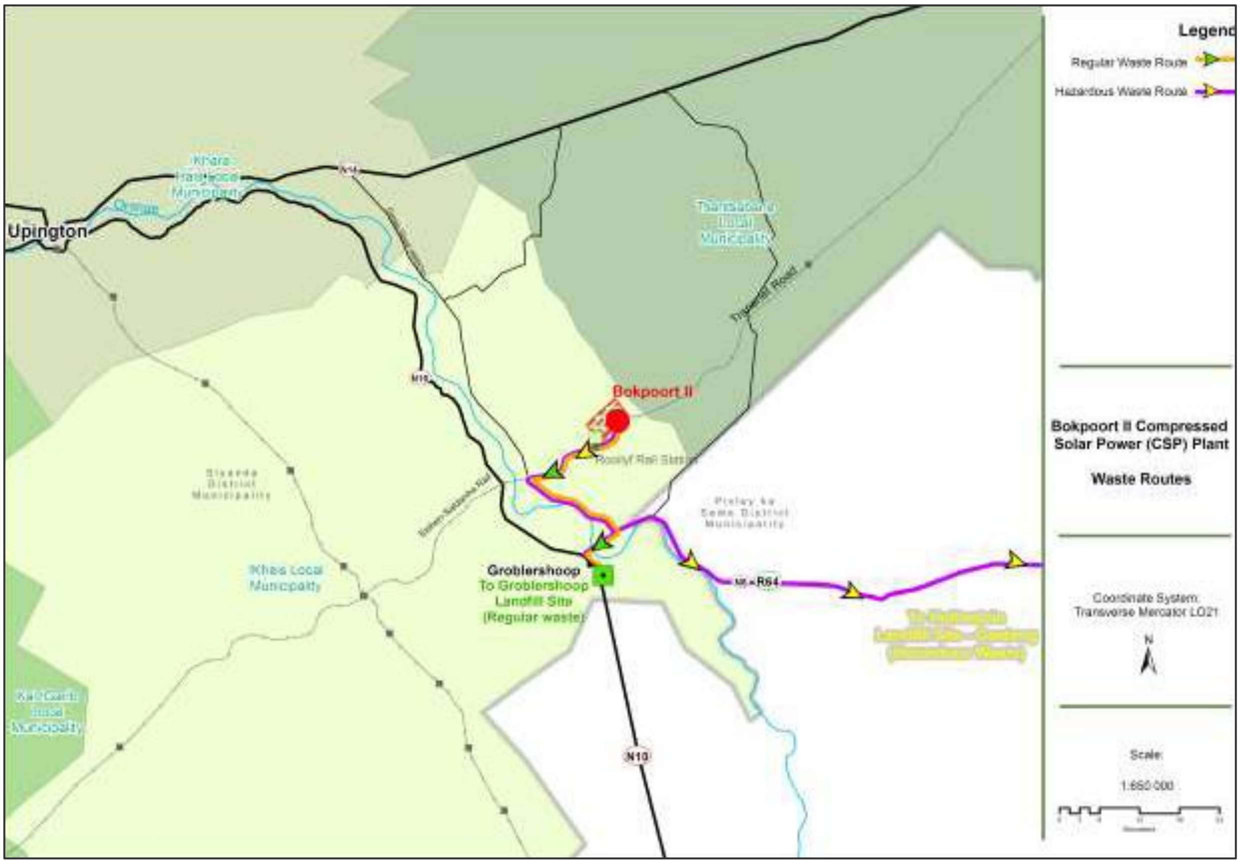

Figure 2.1: Waste Haul Routes

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2.8 Haul Routes

The shortest haul route from Gauteng is via the N8 as shown in Table 2-4.

Table 2-4: Haul distance from Gauteng

Road Distances from Gauteng	Length (km)
Johannesburg CBD to Bokpoort via N8 and R59	794
Johannesburg CBD to Bokpoort via N8 and N12	795
Johannesburg CBD to Bokpoort via N14 via Upington and then N10	908
Johannesburg CBD to Bokpoort N14 (Gariep Road) – not allowed	811

The Gariep Road from the N14 is not recommended as a haul route due to the road safety and dust issues. This route is however 97km shorter than the alternative via the N10 when travelling from Upington. This should be noted in the construction tender.

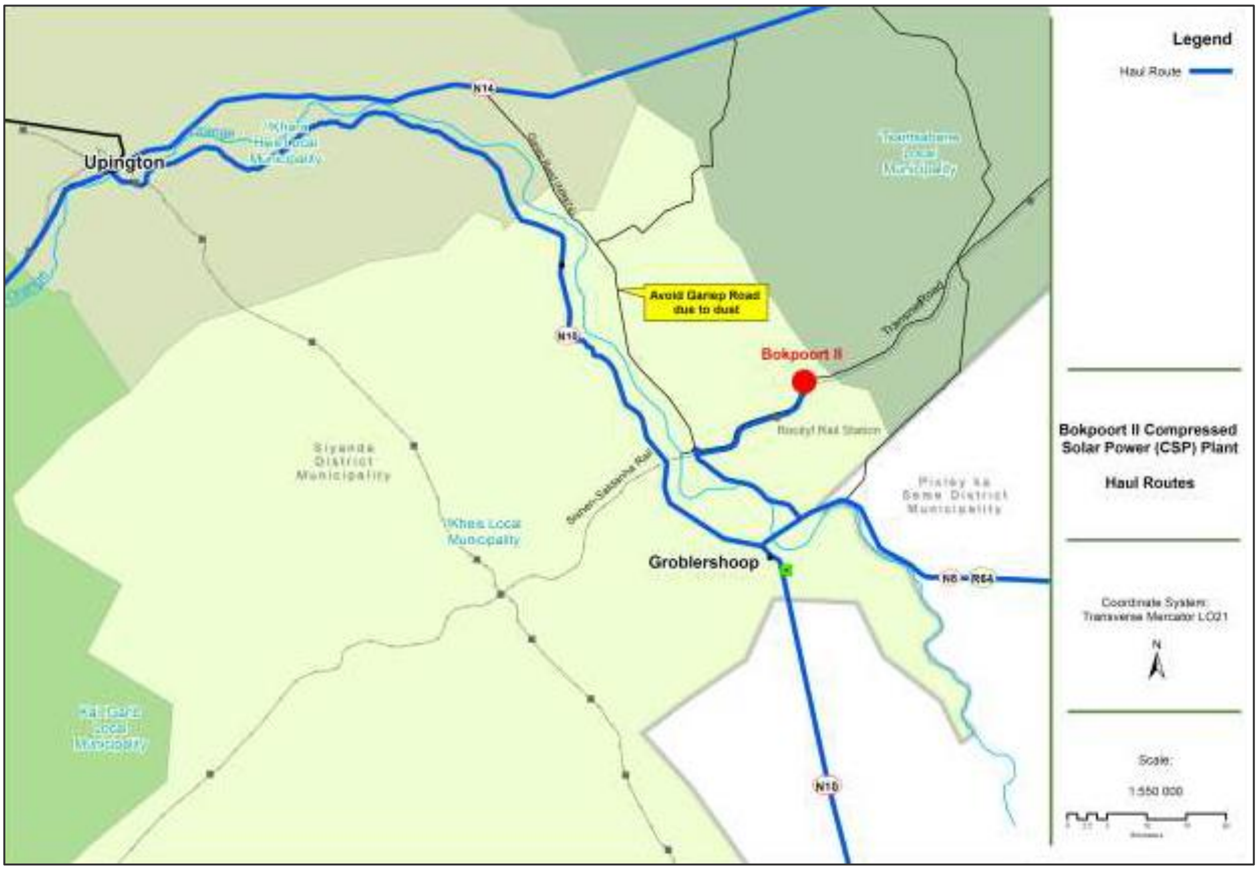

Figure 2.2: Haul Routes

2.9 Traffic Counts

The major intersections were counted on 9-10 March 2016 as well as on 19 November 2019. The traffic volumes are summarized in Table 2-5 and Table 2-6 below.

Table 2-5: Traffic volumes 2016 (peak hour)

Intersection	Morning peak hour Volumes	Afternoon peak hour volumes	Daily volumes
N14/Gariep	168	157	16800
Gariep/Transnet	36	46	265
N8/Gariep	257	274	1340

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Table 2-6: Traffic volumes 2019 (peak hour)

Intersection	Morning peak hour Volumes
Gariep/Transnet	13

2.10 Road Hierarchy

The road hierarchy is shown in Table 2-7 below. Traffic calming and parking is typically not allowed along the Mobility Corridors (Class 1, 2, 3), but is allowed along the Access Routes (Class 4, 5).

Table 2-7: Road Hierarchy

Road	Class	Speed
N14, N10, N8	Class 1, National Road	120 km/hr
Gariep Road	Class 3, Minor arterial	80 km/hr
Transnet Service Road	Class 5, Local access road	60 km/hr

2.11 Public Transport Infrastructure

There are no dedicated public transport loading/pick-up bays along the Gariep Road and the Transnet Service Road. There are no scheduled public transport routes along these two roads. Minibus-taxis transported construction staff to Bokpoort I from the adjacent residential areas. The developer will have to provide transport to site for the construction staff.

2.12 Dust

Due to the nature of the Gariep Road (calcrete) and the speed at which vehicles travel, a large amount of dust is generated by vehicles travelling on the road. The dust generated has an impact on the farming production rates. This is especially evident for farms where the Gariep Road is close to vineyards (within 1km). Various complaints were received during the construction of Bokpoort I from farmers regarding dust generated by construction vehicles. The dust generation is a factor at the Gariep/Transnet Service Road intersection as it affects the decision time for vehicles turning toward the proposed PV facilities.

3 CONSTRUCTION OF THE PROPOSED PV FACILITIES

3.1 Facility Specifications

Each 200MW PV solar facility will consist of the following infrastructure:

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

Associated infrastructure includes:

- Mounting structures for the solar panels;
- Cabling between the structures, to be lain underground where practical;
- A new 132kV overhead power line which will connect the facility to the national grid via Eskom's existing Garona Substation;
- The powerline will be approximately 5km in length and will be located within a servitude spanning 15.5m on both sides. The powerline towers will be 35 m high;
- Internal access roads (4 - 6m wide roads will be constructed but existing roads will be used as far as possible) and fencing.
- 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).

Each PV facility will require 150ha of land, the combined area required for the ten proposed PV facilities is 1500 ha.
The proposed layout of the ten 200MW PV facilities is shown in Figure 3.1 below.

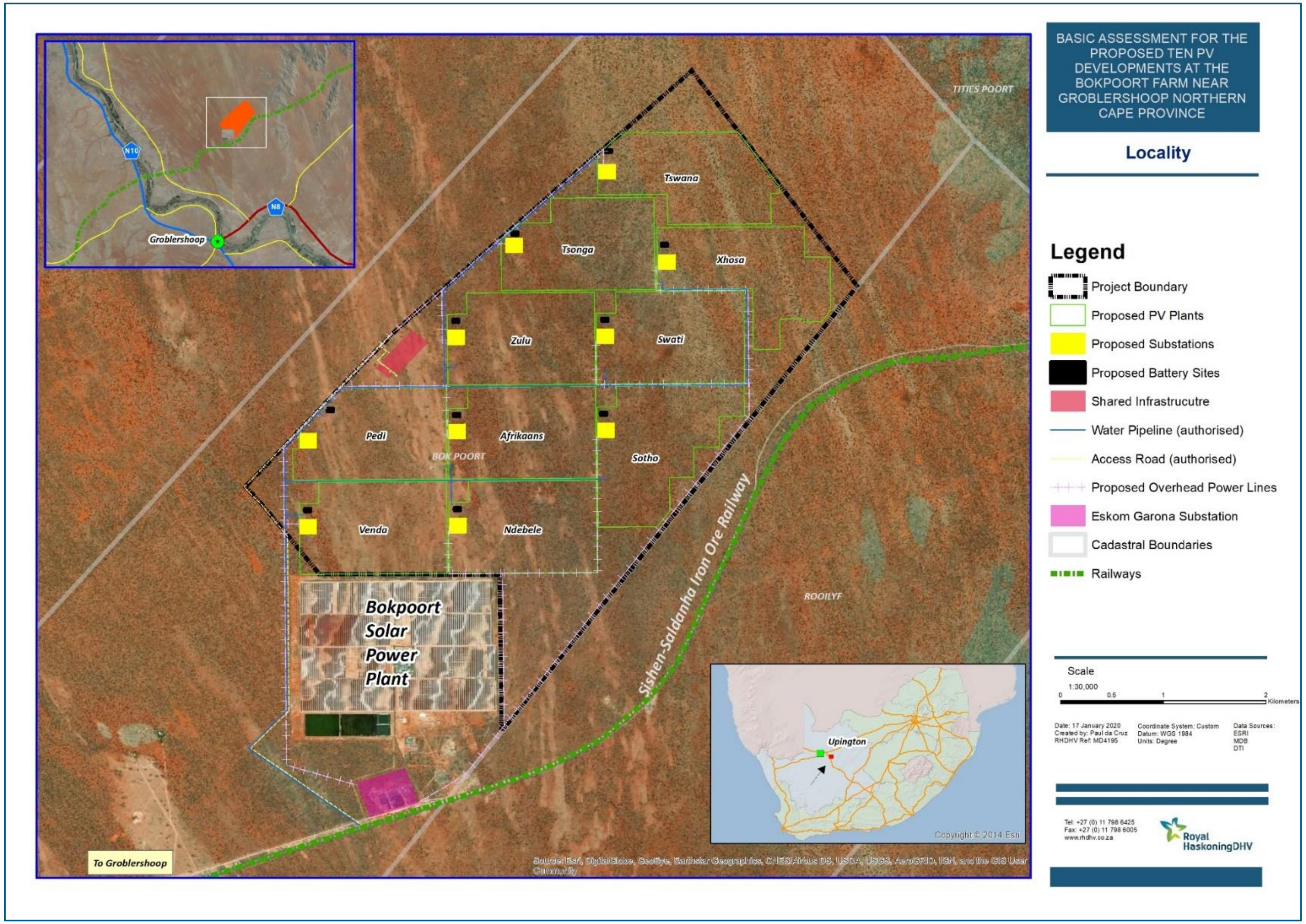

Figure 3.1: Layout of the proposed PV facilities

3.2 Phasing of Construction and Construction Period

It has been assumed that the construction of the proposed PV facilities will be occur simultaneously over a 36-month construction period and that each PV facility will have a 6-12 month construction period with a two month lag between the start of construction each facility i.e. a maximum of 3 PV facilities being constructed at one time (see Table 1-1). However, this is to be confirmed by ACWA Power Energy Africa (Pty) Ltd at a time when details pertaining to the construction program are finalized. The construction program is dependent on the awarding of projects by the Department of Mineral Resources and Energy.

It is anticipated that construction of the PV facilities will commence in January 2021 and be completed by the end of December 2022. It Is anticipated that construction will be carried out during the daytime only (07h00 to 18h00) from Monday to Saturday.

Note: For purposes of the transport analysis, 4 situations were analyzed:

1. Current traffic conditions (as per traffic count done on the 19 November 2019).
2. Successive Construction of the proposed PV facilities i.e. construction of one PV facility at a time, with the construction of the next PV facility commencing once the previous PV facility is fully constructed).
3. Simultaneous construction of the proposed PV facilities with a two month lag between the start of construction each facility, i.e. maximum of 3 PV facilities being constructed at one time (see Table 1-1).
4. Cumulative Impact - Simultaneous construction of the proposed PV development (see 3. Above) and the Sanddraai Solar Plant to determine the combined impact.

3.3 Construction Staff

The anticipated construction staff on site during the construction peak period includes:

Per PV Facility:

- Local resident staff: 40 employees;
- Core construction staff provided by the contractor: 10 staff; and
- Total 50 people.

The combined construction staff on site during the peak period for the phased simultaneous construction (max 3 PV facilities being constructed at one time) of PV facilities is 150 people.

3.4 Accommodation and Transport for Staff

Accommodation (construction camp) was provided on site for 200 staff during the construction of Bokpoort I. It is anticipated that accommodation will be provided on site for 100 staff during the construction of the proposed PV facilities. Local residents and core staff staying in the area (mostly Groblershoop, Upington and on farms) will be transported to site by staff shuttle or minibus-taxis. Other staff will travel by private vehicle to the site.

3.5 Construction Activities

The following construction activities will occur during the construction of the proposed PV facilities:

- Access roads (temporary and permanent, and external and internal roads);
- Construction of access road from the Transnet Service Road;
- Establishing of loading/offloading and storage areas, parking and truck movement areas within the site;
- A crane will be established to assist with the vertical transport of material;

- Material (steel, concrete, gravel, solar panels, cabling etc.) will be delivered to the site, mostly via the road;
- Maintenance, medical, administrative, services, control buildings;
- Water supply pipeline for construction and operation phase;
- Transmission line to Eskom substation;
- Power supply for the construction phase;
- Communications mast/ telecommunications facilities;
- General and hazardous waste storage and handling facilities (temporary and permanent);
- Batching plant (Including concrete and asphalt);
- Construction staff and office accommodation;
- Canteen;
- Firefighting water storage tanks;
- Covered and uncovered parking;
- Rain water buffer basin;
- Rain water storage;
- Compressed air unit;
- Truck washing station for cleaning of vehicles;
- Backup diesel generator for safe shut down.

3.5.1 Road Upgrades and New Roads

New Access Road

A new access road will have to be constructed to connect the Transnet Service Road with the site as shown in Figure *3.2* below. The new access begins at the south of the existing Bokpoort I plant, travelling in a northerly direction, past the Bokpoort I plant, thereafter travelling in a north-easterly direction, terminating between the proposed Pedi and Zulu Facilitates. The proposed access road should be at 4-6m wide, paved road to reduce dust on the PV panels. The geometry of the road to meet the requirements of large abnormal loads.

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Figure 3.2: Access road to the proposed PV facilities

3.6 Construction Vehicles

The construction vehicles will consist of;

- a crane,
- articulated flatbed to deliver the crane and the shuttering (abnormal loads),
- concrete trucks,
- concrete pump,
- tipper trucks to remove the rubble from the site and to deliver raw material (sand, gravel, salt etc.) for the concrete batch plant,
- delivery vehicles, and
- staff vehicles.

3.7 Construction Traffic Generated

The construction traffic generated consists of:

- The materials to be delivered, includes mostly the solar panels/mirror, BESS materials and raw construction materials for the concrete bases, structures and other ad-hoc deliveries;
- Staff entering and exiting the site and
- Ad-hoc deliveries and support vehicles.

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Table 3-1: Construction Generated Traffic for one PV facility

	Morning (AM) Peak hour		Afternoon (PM) Peak hour		Daily	
Item	In	Out	In	Out	In	Out
Staff	16	4	6	16	31	31
Ad-hoc delivery and service support vehicles (small)	1	1	1	1	10	10
Construction and delivery vehicles (large)	4	4	4	4	40	40
Total vehicles	21	9	11	21	81	81

It is expected that during the peak hour the following traffic will be generated for each 200 MW PV facility:

- AM peak hour 30 trips; and
- PM peak hour 32 trips.

The combined peak hour traffic that will be generated for the simultaneous construction of the PV facilities is anticipated to be (max 3 PV facilities being constructed at a time);

- AM peak hour 90 trips; and
- PM peak hour 96 trips.

Sufficient space should be provided on the site to hold all staff vehicles and shuttles, visitors, construction vehicles and delivery vehicles. The delivery of materials/equipment by abnormal (wide) vehicles, such as the materials and equipment for the 10 BESSs, should be scheduled during off-peak periods in order to have the least impact on traffic conditions. The waste material from the site will be loaded directly into the tipper trucks to be moved to the waste sites.

Details of the generated traffic are included in **Appendix A: Traffic Data.**

3.8 Stakeholder Coordination

3.8.1 Eskom and Telkom

Coordination with Eskom and Telkom to be done before construction of the proposed PV facilities to ensure their infrastructure does not cause a safety risk during the transport of loads exceeding 5.8m (Eskom) and 5.5m (Telkom) in height respectively. The haul routes (Figure 2.2) are along National roads which meets the requirements for the transport of heavy and abnormal (wide) loads. The Gariep Road and Transnet Service Road were also used to transport heavy and abnormal (wide) loads during the construction of Bokpoort I and will not posed a constraint. Should any haul routes (Figure 2.2) for the transport of heavy and abnormal (wide) loads change, Eskom and Telkom should be notified and coordinated with to lift overhead lines if and when necessary.

3.8.2 Road Authorities

All heavy load and wide load movements need to be coordinated and scheduled with SANRAL and the Northern Cape Provincial Authorities. The routes and details (Date and time) of such movements to be publicized in advance. The developer to confirm if the road-over-rail bridge of the Gariep Road over the Sishen- Saldanha railway line (Bridge # 5185) has sufficient capacity when transporting abnormal loads for the projects. It has sufficient capacity for standard loads and was used to transport materials and equipment to the existing Garona Substation adjacent to Bokpoort and for Bokpoort I. Whilst the aim will be at all times to avoid any damage to the road, the Principle Contractor shall be responsible for any damage to roads, signs etc. caused by the works. Any such damage shall be rectified as soon as practically possible, and in a manner approved by the relevant road authority.

3.8.3 Transnet

Access to the proposed PV facilities via a private Transnet Service Road, running adjacent to the Sishen-Saldanha railway line. The proposed access to the farm will be via the Transnet Service Road as shown in Figure *3.2*. The developer must meet with Transnet (Head of the Sishen-Saldanha Operations, 083 275 5900) to confirm the continued usage of the Transnet Service Road for the construction of the proposed PV facilities. This road was upgraded (widened to 8m and gravelled) during the construction of Bokpoort I and meet the requirements for the proposed PV facilities. Items to address will include: continued usage of the road, dust suppression, maintenance plan (blading and regraveling during and after construction), access control, etc.

4 OPERATIONAL PHASE

4.1 Staff

The anticipated staff employed during the operational phase for is 10 employees per PV facility (100 employees for 10 facilities). Once all ten facilities (PV1-PV10) are fully operational, the site will operate with more or less 100 employees which might turn out to be less as PV plants do not require a lot of operational staff.

It is anticipated that:

- No staff will stay on site during the operational phase; and
- 24-hour operations, including 3 shifts of the of approximately 34 people per shift:

4.2 Traffic

Traffic generated by the proposed PV facilities during the operational phase peak hour is less than 15 vehicles an hour, which includes staff transport, visitors and deliveries. Transport and traffic will therefore have a very small to negligible impact during the operational phase.

5 DECOMMISIONING PHASE

The design life for the site is 25 years. At completion of the 25-year period, the site might continue to operate, or all the constructed facilities will be demolished and removed to the licensed waste sites, including:

- Holfontein (hazardous waste) (814 km via N8); and
- Local municipality (general waste) at Groblershoop (35km).

The decommissioning phase is not addressed in this report and needs to be addressed before the decommissioning occurs and an appropriate mitigation plan put in place at that time. It is anticipated that traffic generated during the decommissioning phase will be about 60% of the traffic generated during the construction phase over a 6-month period.

6 RISK/IMPACT ASSESSMENT

6.1 Impact Assessment Methodology

The significance of the identified impacts was determined using the approach outlined by 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:

- Probability of occurrence; and
- Duration of occurrence.

Severity:

- Scale/ extent of impact; and
- Magnitude (severity) of impact.

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

Table 6-1: Risk Assessment Ranking Scales

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

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:

Table 6-2: Significance Points

Significance Points	Rating	Discussion
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

6.2 Overview of Impact Significance

The envisioned impact of the PV facilities during the construction phase and operational phase on the surrounding road network includes:

- Deterioration of road network condition;
- Increase in dust;
- Increase in traffic volumes impacting on LOS of the infrastructure; and

- Deterioration of road safety conditions.

Table 6-3: Overview of significance points before implementation of the mitigation measures

Factor	Deterioration of road network condition		Increase in dust, impacting on farms production		Increase in traffic volumes		Deterioration of road safety conditions	
	Con. Phase	Op. Phase	Con. Phase	Op. Phase	Con. Phase	Op. Phase	Con. Phase	Op. Phase
Probability of occurrence	5	2	5	2	5	2	4	2
Duration of occurrence	2	4	2	4	2	4	2	4
Scale / extent of impact	2	2	2	2	2	2	2	2
Magnitude (severity) of impact	6	2	6	2	8	2	4	2
Significance points	**50**	**16**	**50**	**16**	**60**	**16**	**32**	**16**

Deterioration of Road Network Condition:

The increase in traffic, and especially of vehicles carrying heavy loads will cause an increase in deterioration of the road network. The heavy vehicles are unlikely to have a significant impact on the National roads (N10, N14 and N8) as these roads have been built to high standard to carry heavy loads over a long design period. The surrounding gravel road network (Gariep and Transnet Service Roads) have not been designed to carry many repetitions of heavy loads as they cater specifically for local farmers and for the maintenance access to the Sishen-Saldanha railway line. There is a high possibility that the gravel roads will sustain damage during the construction period. The operational phase will not generate heavy vehicle volumes and the impact will be of a low significance.

Increase in Dust:

Increase in dust is only applicable to the gravel roads. Dust is generated due to heavy vehicles and high speeds; therefore, the impact is more significant during the construction phase than during the operational phase. Farmers in the area are concerned about potential dust generated due to the increase in vehicles on the nearby roads. Transnet is also concerned regarding dust on their railway lines.

Increase in Traffic Volumes Impacting on Level of Service of the Infrastructure:

The increase of traffic during the peak hour of 90 vehicles for simultaneous construction i.e. a maximum of 3 PV facilities being constructed at one time, will have a significant impact on the LOS of the roads or intersections during the construction period, with the LOS being maintained at a LOS D for the southern approach (Gariep Road) for the Gariep/Transnet Service Road intersection. The entire intersection, however, will maintain a LOS A for the simultaneous construction of the PV facilities (see **Appendix A: Traffic Data**).

The site will have less impact during the operational phase with a reduced number of trips per hour when compared to the construction phase. The intersection was analyzed for different scenarios for the construction period (see **Section 3.2: Phasing of Construction and Construction Period**), with the worst case being the simultaneous construction of the PV facilities as well as the Sanddraai Solar Plant. Regarding the worst-case scenario, the southern approach of the intersection will operate at a LOS E for the duration of the construction period due to high volume of vehicles as well as the dust generated.

Deterioration of Road Safety Conditions:

Road safety deterioration is due to dust and speeding, causing drivers to lose control on the gravel roads. As a result of the upgrade of the Gariep Road for the construction of Bokpoort I, drivers are able to reach high speeds exceeding the recommended 80km/hr speed limit. High speed accidents and fatalities has occurred, including some of the construction staff. The speeds should be controlled by local traffic police.

6.3 Mitigation and Monitoring Measures

From Table 6-3 above, it can be concluded that all four of the identified environmental impacts have a moderate environmental significance (30-75 Significance Points) before mitigation. These impacts are therefore sufficiently significant to require management, and which could have an influence on the decision unless it is mitigated.

The key mitigation and monitoring measures to implement includes:

1. The re-gravelling of the Transnet Service Road (150mm thick over width) before construction commences of the PV facilities. The prevention of dust, maintenance of the gravel road and re-gravelling of the road to be coordinated with Transnet;
2. Once re-gravelled, the road should be regraded on a monthly basis to prevent the deterioration of the road condition.
3. In order to reduce the impact of dust production the road section adjacent to the Bokpoort I and proposed PV facilities should be watered down on a regular basis (at least daily, depending on the wind intensity and direction as well as rain conditions) to reduce the dust and impact on the panels as well as crop production.
4. The intersection of the Gariep Road and Transnet Service Road can be upgraded in order to reduce the traffic congestion that is expected as well as minimize the dust generation at the intersection.
5. The delivery of materials and equipment by trucks can be phased through the day to the reduce the impact the trucks have on traffic congestion and dust generation. The delivery of materials/ equipment by abnormal vehicles, such as the materials and equipment for the 10 BESSs, should be scheduled during off-peak periods in order to have the least impact on traffic conditions.
6. The section of the Gariep Road between the N8/Gariep Road intersection and the Gariep/Transnet intersection to be upgraded before construction of the proposed PV facilities commences. The upgrading of this road to be coordinated with developers of other solar plants in the area (specifically the Sanddraai plant which is located adjacent to the Bokpoort I & II facilities), farmers, Northern Cape Province Roads Department. This will increase the road safety and minimize the dust impact on the farms along this section of the road as well as manage the deterioration of the road condition.
7. The speed limit to be managed by Traffic Police on the Gariep Road, this will increase the road safety and minimize the dust impact on the farms along this section of the road.
8. As far as possible, construction traffic should follow the route via Upington and Gariep road northbound thereafter, and avoid using the northern section of the Gariep Road between the N14 and the Transnet Service Road.
9. On site accommodation may be provided, and transport arranged for the labourers on site, to reduce the traffic volumes using the gravel roads (Gariep Road and Transnet Service Road).

Table 6-4: Overview of significance points after implementation of the mitigation measures

Factor	Deterioration of road network condition		Increase in dust, impacting on farms production		Increase in traffic volumes		Deterioration of road safety conditions	
	Con. Phase	Op. Phase	Con. Phase	Op. Phase	Con. Phase	Op. Phase	Con. Phase	Op. Phase
Probability of occurrence	3	2	3	2	4	2	3	2
Duration of occurrence	2	4	2	4	2	4	2	4
Scale / extent of impact	2	2	2	2	2	2	2	2
Magnitude (severity) of impact	4	2	2	2	2	2	2	2
Significance points	**24**	**16**	**18**	**16**	**24**	**16**	**18**	**16**

6.3.1 Additional Mitigation Measures

General

- Construction should be planned and implemented timeously and effectively to optimize work efficiency and safety and to minimize traffic and road user congestion, delay and inconvenience.
- On-site speed restrictions to be imposed for 15km/h once through the security gate and 40km/hr on the access road to the site (turn-off from the Transnet Service Road).

Construction traffic management

- Provision of clear and early warning of construction vehicles at intersection Gariep/Transnet Service Roads.
- Access, entry and exit of all construction and material delivery vehicles should be strictly controlled.
- Holding of all construction vehicles to be done on site and sufficient parking to be provided for all staff, visitors, shuttles, public transport, construction and delivery vehicles.
- Vehicles and equipment shall be serviced regularly to avoid the contamination of area from oil and hydraulic fluid leaks etc.
- Servicing must be done off-site or adhere to environmental requirements.
- The use of roads by heavy load and abnormal (wide load) vehicles need to be coordinated and scheduled with SANRAL and the Northern Cape Provincial Authorities. The routes effected and details (Date and time) of such movements to be publicized in advance.
- The delivery of materials and equipment as well as arrival of construction vehicles should be planned and coordinated in order to spread the arrival of the vehicles and minimize the occurrence of high traffic volumes in a short time period and reduce the potential for road blockages

Access:

- Access of all construction and material delivery vehicles should be strictly controlled and vehicles (type e.g. private, heavy, number plates, owner etc.) recorded.
- Security gates to entrance of site.
- Strategic positioning of entry and exit points to ensure as little impact/ effect as possible on the traffic flow.

- The main routes to the site must be clearly defined and signposted.

General Housekeeping

- Material deliveries to form part of the contractor's overall delivery program for the site.
- Generally, all contractors associated with the development will be expected to follow a "good housekeeping" policy at all times. This will extend to the responsible use of the road network by contractor vehicles and their staff. The Principle Contractor will ensure this is enforced.
- Vehicle registration forms to be completed before arrival to ensure that site staff are accounted for and vehicles have been checked and been given a site pass.
- Throughout the period of construction, the Province, District and Local Municipalities to be made aware of the name and contact details of the Contractor's Site Foreman that they can communicate with should any matters arise in connection with any aspects of the construction that are affecting the road.
- Trucks carrying debris or excavated and fill materials to be covered with a tarpaulin as necessary.

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Appendix A: Traffic Data

A1.1 Traffic Generated by Successive Construction (One PV Facility at a time)

Total Typical Daily Traffic Generated (Staff and Construction vehicles)

	Morning (AM) Peak hour		Afternoon (PM) Peak hour		Daily	
Item	In	Out	In	Out	In	Out
Staff	16	4	6	16	31	31
Ad-hoc delivery and service support vehicles (small)	1	1	1	1	10	10
Construction and delivery vehicles (large)	4	4	4	4	40	40
Total vehicles	**21**	**9**	**11**	**21**	**81**	**81**

Note: The split of incoming/outgoing construction traffic generated is assumed to be the following:

- 40% to/from Upington (northern approach of the intersection)
- 40% to/from Groblershoop (southern approach of the intersection)
- 20% to/from the farms (eastern approach of the intersection)

A 75:25 split for light:heavy vehicles was utilized during the analysis.

A1.2 Traffic Generated by Simultaneous Construction (3 PV Facilities at a time)

Total Typical Daily Traffic Generated (Staff and Construction vehicles)

	Morning (AM) Peak hour		Afternoon (PM) Peak hour		Daily	
Item	In	Out	In	Out	In	Out
Staff	48	12	18	48	93	93
Ad-hoc delivery and service support vehicles (small)	3	3	3	3	30	30
Construction and delivery vehicles (large)	12	12	12	12	120	120
Total vehicles	**63**	**27**	**33**	**63**	**243**	**243**

Note: The split of incoming/outgoing construction traffic generated is assumed to be the following:

- 40% to/from Upington (northern approach of the intersection)
- 40% to/from Groblershoop (southern approach of the intersection)
- 20% to/from the farms (eastern approach of the intersection)

A 75:25 split for light:heavy vehicles was utilized during the analysis.

A1.3 Cumulative Impact-Traffic Generated by Simultaneous Construction (3 PV Facilities) and Sanddraai Solar Power Facility

Total Typical Daily Traffic Generated (Staff and Construction vehicles)

	Morning (AM) Peak hour		Afternoon (PM) Peak hour		Daily	
Proposed PV facilities						
Vehicles	63	27	33	63	243	243
Sanddraai SP						
Vehicles	44	1	1	44	115	115
Total vehicles	**107**	**28**	**34**	**107**	**349**	**349**

Note: The split of incoming/outgoing construction traffic generated is assumed to be the following:

- 40% to/from Upington (northern approach of the intersection)
- 40% to/from Groblershoop (southern approach of the intersection)
- 20% to/from the farms (eastern approach of the intersection)

A 75:25 split for light:heavy vehicles was utilized during the analysis.

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A1.4 Sidra Intersection Analysis: Pre-Construction, Existing Traffic Conditions

MOVEMENT SUMMARY

Site: [Site1 - Pre Construction]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Gariep Road South Aproach (from Groblershoop)												
1	L2	0	0.0	0.004	5.6	LOS A	0.0	0.1	0.02	0.45	0.02	54.2
2	T1	1	100.0	0.004	0.0	LOS A	0.0	0.1	0.02	0.45	0.02	55.6
3	R2	6	0.0	0.004	5.5	LOS A	0.0	0.1	0.02	0.45	0.02	53.7
Approach		7	14.1	0.004	4.1	NA	0.0	0.1	0.02	0.45	0.02	53.9
East: Trasnet Road East Aproach (From Bokpoort)												
4	L2	1	0.0	0.002	5.5	LOS A	0.0	0.0	0.02	0.55	0.02	54.1
5	T1	1	0.0	0.002	4.2	LOS A	0.0	0.0	0.02	0.55	0.02	54.3
6	R2	0	0.0	0.002	5.5	LOS A	0.0	0.0	0.02	0.55	0.02	53.6
Approach		2	0.0	0.002	4.9	LOS A	0.0	0.0	0.02	0.55	0.02	54.1
North: Griep Road North Aproach (from Upington)												
7	L2	1	0.0	0.004	5.5	LOS A	0.0	0.0	0.00	0.30	0.00	55.9
8	T1	2	0.0	0.004	0.0	LOS A	0.0	0.0	0.00	0.30	0.00	57.4
9	R2	1	0.0	0.004	5.4	LOS A	0.0	0.0	0.00	0.30	0.00	55.3
Approach		4	0.0	0.004	2.7	NA	0.0	0.0	0.00	0.30	0.00	56.5
West: Trnsnt road West Aproach (from farms)												
10	L2	0	0.0	0.000	5.5	LOS A	0.0	0.0	0.01	0.57	0.01	54.0
11	T1	0	0.0	0.000	4.2	LOS A	0.0	0.0	0.01	0.57	0.01	54.1
12	R2	0	0.0	0.000	5.5	LOS A	0.0	0.0	0.01	0.57	0.01	53.4
Approach		0	0.0	0.000	5.1	LOS A	0.0	0.0	0.01	0.57	0.01	53.8
All Vehicles		14	7.4	0.004	4.2	NA	0.0	0.1	0.02	0.42	0.02	54.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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Project: C:\Users\za00071\Documents\Work\ACWA-TIA\SIDRA intersection analysis\ACWA TIA.sip8

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A1.5 Sidra Intersection Analysis: Successive Construction (1 PV Facility at a time) + Existing Traffic Conditions

MOVEMENT SUMMARY

Site: [Site1 - Exisiting + Construction Traffic (Phased Construction)]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Gariep Road South Aproach (from Groblershoop)												
1	L2	0	25.0	0.040	5.9	LOS A	0.0	0.0	0.00	0.57	0.00	52.8
2	T1	1	25.0	0.040	0.0	LOS A	0.0	0.0	0.00	0.57	0.00	55.3
3	R2	16	25.0	0.040	5.8	LOS A	0.0	0.0	0.00	0.57	0.00	52.2
Approach		17	25.0	0.040	5.4	NA	0.0	0.0	0.00	0.57	0.00	52.4
East: Trasnet Road East Aproach (From Bokpoort)												
4	L2	5	25.0	0.018	5.8	LOS A	0.0	0.2	0.01	0.57	0.01	52.7
5	T1	2	25.0	0.018	4.5	LOS A	0.0	0.2	0.01	0.57	0.01	53.0
6	R2	4	25.0	0.018	5.9	LOS A	0.0	0.2	0.01	0.57	0.01	52.1
Approach		12	25.0	0.018	5.6	LOS A	0.0	0.2	0.01	0.57	0.01	52.5
North: Griep Road North Aproach (from Upington)												
7	L2	11	25.0	0.011	5.8	LOS A	0.0	0.0	0.00	0.49	0.00	53.2
8	T1	2	25.0	0.011	0.0	LOS A	0.0	0.0	0.00	0.49	0.00	55.7
9	R2	1	25.0	0.011	5.7	LOS A	0.0	0.0	0.00	0.49	0.00	52.6
Approach		14	25.0	0.011	4.9	NA	0.0	0.0	0.00	0.49	0.00	53.5
West: Trnsnt road West Aproach (from farms)												
10	L2	0	25.0	0.003	5.8	LOS A	0.0	0.1	0.06	0.52	0.06	53.4
11	T1	3	25.0	0.003	4.5	LOS A	0.0	0.1	0.06	0.52	0.06	53.7
12	R2	0	25.0	0.003	5.9	LOS A	0.0	0.1	0.06	0.52	0.06	52.8
Approach		3	25.0	0.003	4.6	LOS A	0.0	0.1	0.06	0.52	0.06	53.7
All Vehicles		46	25.0	0.040	5.3	NA	0.0	0.2	0.01	0.54	0.01	52.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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A1.6 Sidra Intersection Analysis: Simultaneous Construction (3 PV Facilities at one time) + Existing Traffic Conditions

MOVEMENT SUMMARY

Site: [Site1 -Exisiting + Construction Traffic (Simultaneous Construction-3PV)]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Gariep Road South Aproach (from Groblershoop)												
1	L2	0	25.0	0.090	5.8	LOS A	2.2	18.8	1.00	0.48	1.00	39.1
2	T1	1	25.0	0.090	0.0	LOS A	2.2	18.8	1.00	0.48	1.00	40.4
3	R2	35	25.0	0.090	30.7	LOS D	2.2	18.8	1.00	0.48	1.00	38.7
Approach		36	25.0	0.090	29.7	NA	2.2	18.8	1.00	0.48	1.00	38.8
East: Trasnet Road East Aproach (From Bokpoort)												
4	L2	14	25.0	0.050	5.8	LOS A	0.1	0.5	0.01	0.58	0.01	52.6
5	T1	4	25.0	0.050	4.7	LOS A	0.1	0.5	0.01	0.58	0.01	52.9
6	R2	13	25.0	0.050	6.2	LOS A	0.1	0.5	0.01	0.58	0.01	52.0
Approach		31	25.0	0.050	5.8	LOS A	0.1	0.5	0.01	0.58	0.01	52.4
North: Griep Road North Aproach (from Upington)												
7	L2	29	25.0	0.022	5.8	LOS A	0.0	0.0	0.00	0.54	0.00	52.8
8	T1	2	25.0	0.022	0.0	LOS A	0.0	0.0	0.00	0.54	0.00	55.3
9	R2	1	25.0	0.022	5.8	LOS A	0.0	0.0	0.00	0.54	0.00	52.2
Approach		33	25.0	0.022	5.5	NA	0.0	0.0	0.00	0.54	0.00	53.0
West: Trnsnt road West Aproach (from farms)												
10	L2	0	25.0	0.009	5.8	LOS A	0.0	0.3	0.10	0.51	0.10	53.3
11	T1	9	25.0	0.009	4.7	LOS A	0.0	0.3	0.10	0.51	0.10	53.6
12	R2	0	25.0	0.009	6.1	LOS A	0.0	0.3	0.10	0.51	0.10	52.7
Approach		10	25.0	0.009	4.7	LOS A	0.0	0.3	0.10	0.51	0.10	53.6
All Vehicles		109	25.0	0.090	13.5	NA	2.2	18.8	0.34	0.53	0.34	47.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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A1.7 Sidra Intersection Analysis-Cumulative Impact: Simultaneous Construction (3 PV Facilities) + Existing Traffic Conditions + Sanddraai SP Facility

MOVEMENT SUMMARY

Site: [Site1 -Exisintg + Construction Traffic (Simultaneous Consruction 3PV) + Sandrai]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Gariep Road South Aproach (from Groblershoop)												
1	L2	0	25.0	0.140	3.6	LOS A	3.3	28.2	1.00	0.61	1.00	31.2
2	T1	1	25.0	0.140	6.4	LOS A	3.3	28.2	1.00	0.61	1.00	32.0
3	R2	54	25.0	0.140	39.2	LOS E	3.3	28.2	1.00	0.61	1.00	31.0
Approach		55	25.0	0.140	38.5	NA	3.3	28.2	1.00	0.61	1.00	31.0
East: Trasnet Road East Aproach (From Bokpoort)												
4	L2	14	25.0	0.054	5.8	LOS A	0.1	0.6	0.01	0.58	0.01	52.5
5	T1	4	25.0	0.054	4.8	LOS A	0.1	0.6	0.01	0.58	0.01	52.8
6	R2	14	25.0	0.054	6.4	LOS A	0.1	0.6	0.01	0.58	0.01	51.9
Approach		32	25.0	0.054	6.0	LOS A	0.1	0.6	0.01	0.58	0.01	52.2
North: Griep Road North Aproach (from Upington)												
7	L2	48	25.0	0.034	5.8	LOS A	0.0	0.0	0.00	0.55	0.00	52.7
8	T1	2	25.0	0.034	0.0	LOS A	0.0	0.0	0.00	0.55	0.00	55.2
9	R2	1	25.0	0.034	5.8	LOS A	0.0	0.0	0.00	0.55	0.00	52.2
Approach		52	25.0	0.034	5.6	NA	0.0	0.0	0.00	0.55	0.00	52.8
West: Transnet road West Aproach (from farms)												
10	L2	0	25.0	0.017	5.8	LOS A	0.1	0.5	0.15	0.52	0.15	53.2
11	T1	18	25.0	0.017	4.9	LOS A	0.1	0.5	0.15	0.52	0.15	53.5
12	R2	0	25.0	0.017	6.2	LOS A	0.1	0.5	0.15	0.52	0.15	52.6
Approach		18	25.0	0.017	4.9	LOS A	0.1	0.5	0.15	0.52	0.15	53.5
All Vehicles		156	25.0	0.140	17.1	NA	3.3	28.2	0.37	0.57	0.37	42.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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Appendix B12: Visual

REPORT

Visual Impact Addendum Report for the Development of 8 New PV Plants and Amendment of 2 PV Developments on the Farm Bokpoort in the Northern Cape Province

Client: ACWA Power

Reference: MD4195TPRP2001201147

Status: S0/01

Date: 1/20/2020

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Document title:	Visual Impact Addendum Report for the Development of 8 New PV Plants and Amendment of 2 PV Developments on the Farm Bokpoort in the Northern Cape Province
Document short title:	Bokpoort 2 Visual Addendum
Reference:	MD4195TPRP2001201147
Status:	01/S0
Date:	1/20/2020
Project name:	Basic Assessment for the Proposed 8 New PV Developments and Amendment of 2 PV Developments on the Farm Bokpoort, Northern Cape
Project number:	MD4195
Author(s):	Paul da Cruz

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

Classification
Project related

MANAGEMENT SYSTEM CERTIFICATION
DNV·GL
ISO 9001 = ISO 14001
ISO 45001

Disclaimer

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Executive Summary

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

As part of the original basic assessment study completed in 2016, visual impact assessment studies were undertaken by Golder Associates for the three separate components of the development – the CSP component and the two (2) PV components. As the project scope and components have changed to only include PV, an addendum report for the visual assessment aspect of the environmental studies for the proposed development is required to be undertaken. A single addendum report has been prepared based on the original two PV reports, and has been updated to include:

- a consideration of the revised visual baseline of the study area;
- a revised assessment of the visual impacts associated with the proposed solar development, considering the change in the development components;

Project Description

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

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

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

Associated infrastructure includes:

- Mounting structures for the solar panels will be either rammed steel piles (preferred solution in terms of piles with pre-manufactured concrete footings to support the PV panels;
- Cabling between the structures, to be lain underground where practical;
- A new 132kV overhead powerline which will connect the facility to the National Grid via Eskom's existing Garona Substation. The powerlines vary in length and will be located within a servitude spanning 15.5m meters on both sides. The powerline towers will be 35m high;

- Battery Energy Storage System (BESS) - battery Power at Point of Connection: 150MW, area required: 16ha; the BESS will store approximately 4500m^3 of hazardous substance.;
- One water pipeline connection from the river (previously authorised) and different metering points at individual PV plants;
- Internal access roads (4 – 6 m wide roads will be constructed but existing roads will be used as far as possible) and fencing (approximately 3 m in height); and
- Shared infrastructure consisting of buildings, including a workshop area for maintenance, storage (i.e. fuel tanks, etc.), laydown area, parking, warehouse, and offices (previously approved).

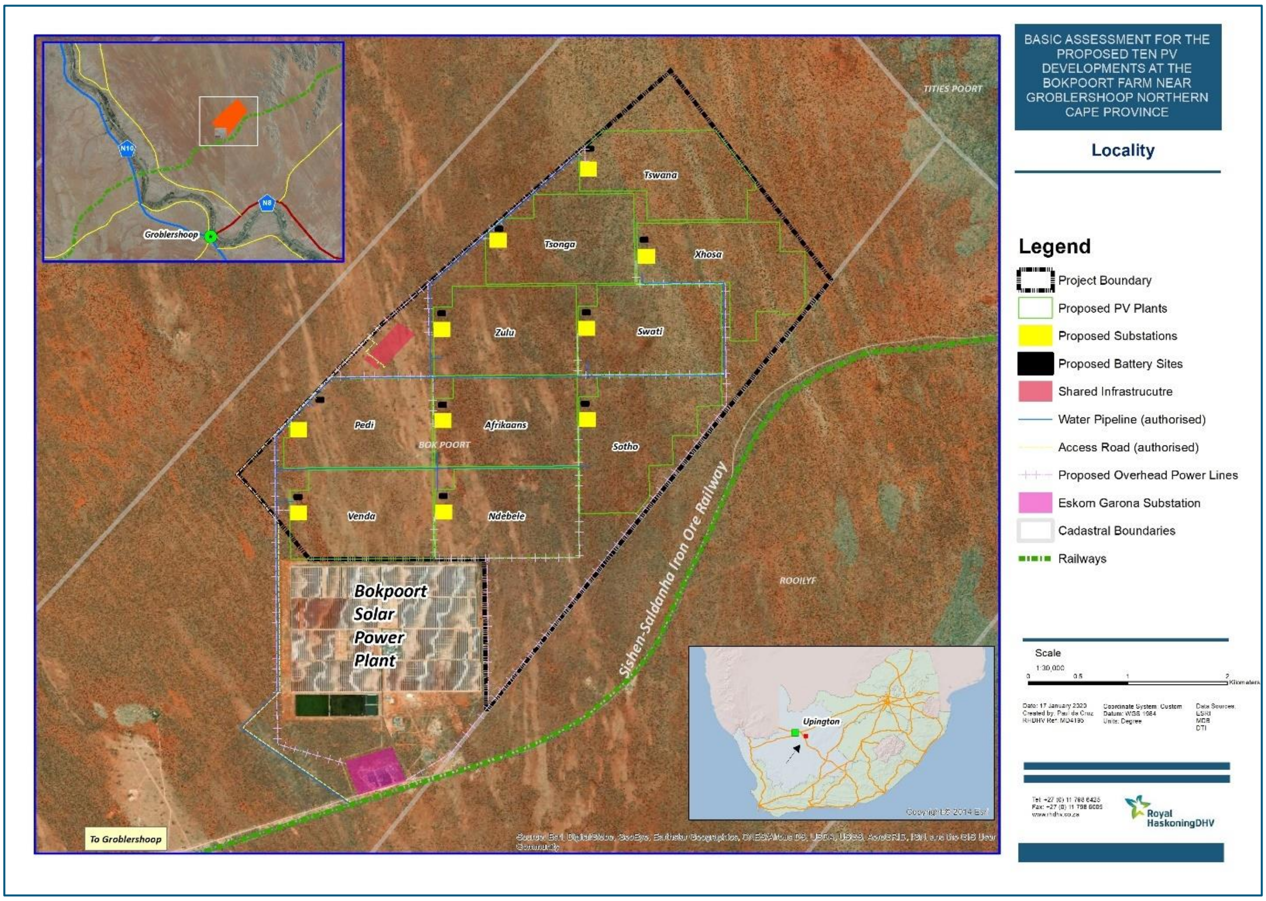

Figure i – Locality

Changes to Visual Baseline and Visual Receptor Locations

The physical aspects of the study area investigated as part of the original visual reports (i.e. topography, hydrology and rainfall, and vegetation cover) remain as described. The land use in the study area has changed little in the four year-period since the original visual reports were compiled.

Seven sensitive receptor locations are situated within a 10km radial area of the proposed development.

Table i -Static Sensitive Receptor Locations located within a 10km radius of the proposed development

Distance (radius around infrastructure)	Receptor Type	Receptor Name	Closest Distance to Proposed Development	Receptor located Within Viewshed?
0 - 5 km	Farmstead (main homestead and smaller household)	Bokpoort Farmstead	1,97km	Yes
5 - 10 km	Two Farmsteads	Eben Haeser Farmstead	7.71km	No
	Farmstead (main homestead and smaller household)	La Gratitude Farmstead	6.25km	No
	Farmstead (main homestead and 3 smaller households)	Tities Poort Farmstead	7.9km	No
	Farmstead (main homestead and 2 smaller households)	Dinas Rus Farmstead	9.34km	No
	Farmstead (2 households)	Bloubos Farmstead	10.38km	No
	Farmstead (3 households)	Hoekvalkte Farmstead	10.58km	No

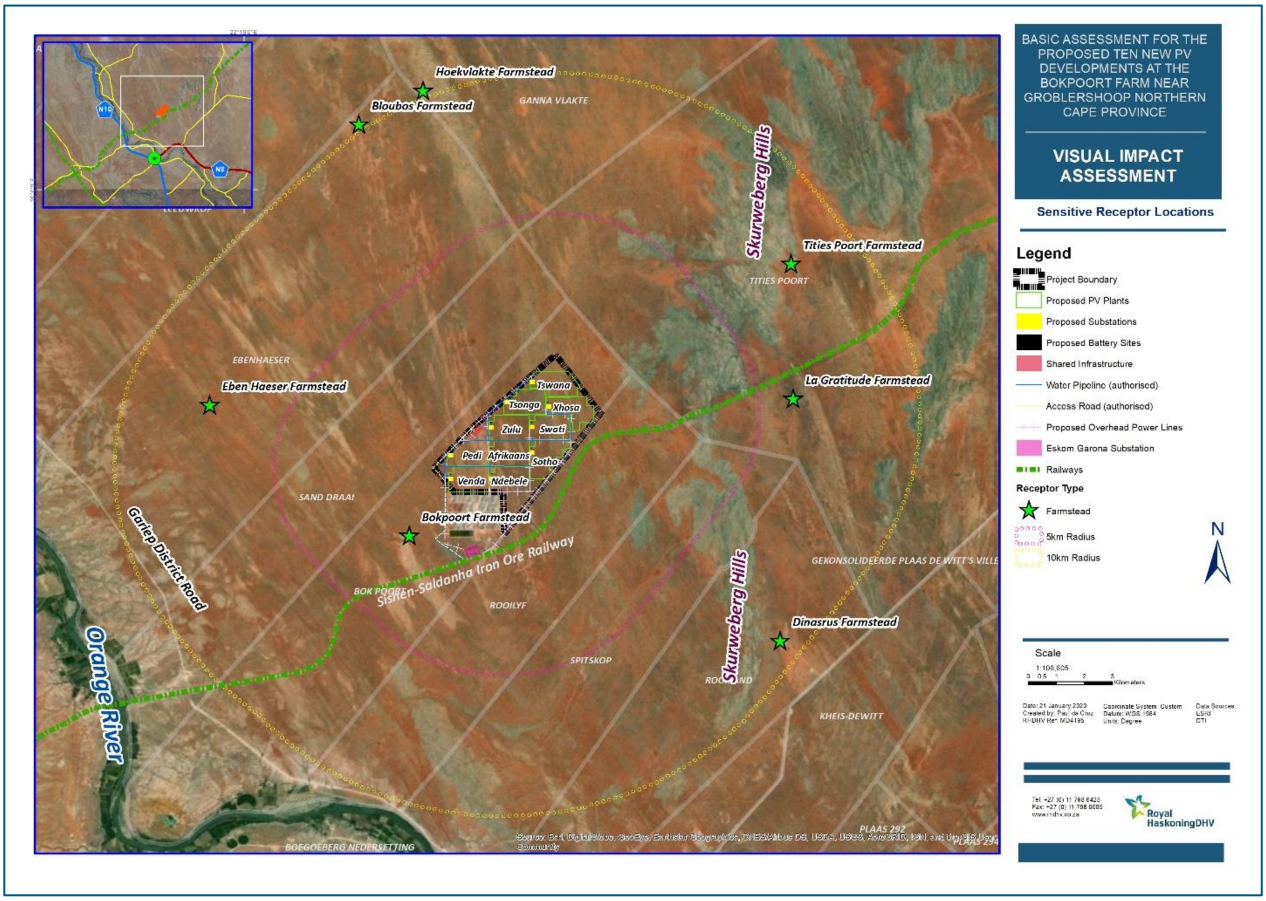

Figure ii – Sensitive Receptor locations situated within 10km of the proposed development

There are no public access transient receptor locations (i.e. roads or rail) located within the 0-5km of the development site. A very short stretch of the Gariep District Road is located within the 10km radial area of the site, but apart from this stretch of road no other transient receptor locations are situated within 10km of the development site.

Assessment of Visual Impacts

As distance is a significant factor in the experiencing of visual impacts, the site context is important in how impacts associated with the proposed development on the development site are likely to be experienced. The vast majority of receptor locations are located greater than 10km distant from the facility and are predominantly located along the Orange River (within the Orange River corridor). Accordingly, a potentially significant distance between the solar facility components and the majority of the receptor locations is present.

All but one of the (sensitive) receptor locations located within a distance of 10km of the proposed development fall into a zone of low potential visual exposure. The Bokpoort Farmstead is the only receptor location that is situated within the zone of moderate to high visual exposure. This receptor location is located within the viewsheds of the development; it is located on an isolated hillside with an aspect that faces in a northwards arc towards the development site. The raised position of the farmstead in relation to the surrounding plains entails that it is exposed to a clear view of much of the terrain. The receptor location will thus be subject to a high degree of visual exposure and thus a high level of visual intrusion. The visual intrusion factor associated with the new development would be ameliorated however by a number of factors, in particular the screening effect of vegetation around the homestead and the existing presence of the Bokpoort 1 CSP Facility as viewed from the receptor location.

Of the six other sensitive receptor locations located within a distance of 10km of the development site, ***none*** are located within the viewshed of either the northern or southern part of the development, thus meaning that none of these six receptor locations will be exposed to any views of the proposed development. Parts of the 5-10km radial area around the proposed development are located within the viewsheds of the development, in particular the viewshed of the northern part of the development which covers a greater area as the northern part of the development is located on higher-lying ground than the southern part of the development footprint. However significant parts of the radial area fall outside of the viewshed of the development. This is largely due to the presence of hilly / mountainous terrain located within the north-eastern and eastern parts of the 10km radial area that screens much of the surrounds, preventing views towards the development site.

Beyond the 10km radial area the visual exposure factor associated with the proposed plant would be minimal and twinned with the absence of visibility of the plant in large areas where receptor locations are clustered, in particular along the Orange River corridor, the potential for visual impacts to be generated is low to minimal. Most of the Orange River corridor lies outside of the viewshed of the development, and accordingly will not be affected by the proposed development.

When non-static receptor locations are considered, the visual intrusion factor of the development will be very low to minimal. Most of the Gariep District Road is located outside of the viewshed of the development, and thus will be exposed to no visual exposure to the proposed development.

The proposed development could also be associated with other visual-related potential impacts:

- **Glint and glare**: Glint and glare can become a problematic issue associated with solar power facilities. However, as the proposed development will not be visible to the vast majority of receptor locations in the study area it will not create any glint or glare impacts. In addition, PV arrays are not typically associated with glint or glare as the PV surfaces are non-reflective, and only the metal supports could potentially cause glare, thus greatly reducing the potential for glint or glare-related impacts.

- **Lighting impacts in the context of the night-time environment**: the night-time environment of the wider area is characterised by limited sources of lighting, especially in the area to the east of the Orange River. The Bokpoort 1 CSP Plant has introduced a set of lights into this dark environment and is the only really visible source of light on the eastern side of the Orange River (when viewed from afar). If similar lighting was developed at the proposed facility, the relative proximity of the proposed facility to the Bokpoort CSP Plant when viewed from the area to the west would effectively add to the cluster of lighting that is already visible in this part of the study area. The number of lights as visible could more than double and the development would result in the introduction of further light spill into a generally unlit night-time environment.
- **Dust plume-related visual impacts**: The generation of dust plumes could constitute a visual impact, although it would only be transient in nature. Dust plumes associated with the proposed development that could become problematic in a visual context could be generated by the clearing of vegetation on the development site during construction and by construction traffic along the access roads to the development site, which would likely be the Gariep District Road and the Transnet Access road, both of which are not tarred and from which dust would be generated. If it were to occur excessively, dust plume creation could be construed as a visual impact. The distance factor and limited viewshed ameliorate the potential impact of dust plumes generated on the site, but generation of dust plumes by a large increased volume of heavy vehicle traffic may be perceived as a negative visual intrusion in addition to negative perceptions regarding dust-related grazing impacts, as well as road safety.

Overall, the degree of visual intrusion associated with the proposed development is likely to be low at worst, with the distance between most of the receptor locations and the development site being the greatest contributing factor, twinned with the non-visibility of the development in large parts of the study area. The proposed development is thus very unlikely to result in the creation of a visual impact, or perceptions of visual impact by people inhabiting the sensitive receptor locations in the 10km radial area or moving transiently within the area. Twinned with the presence of the Bokpoort 1 CSP Plant and the Eskom Garona Substation the proposed solar development will add to the presence of large-scale power generation infrastructure in the study area, but which due to its remote location and the low density of human settlement will not generate any degree of visual exposure beyond that which is very low, thus being unlikely to generate any visual impacts.

Mitigation

A number of mitigation measures have been recommended to be implemented:

- It is strongly recommended that clearing of vegetation on the construction site only be undertaken in a phased manner, so as to prevent the large-scale exposure of soils and substrate that could result in atmospheric conditions (wind) creating large dust plumes on the site.
- Regular dust abatement measures must be applied on the construction site, as detailed in the development's EMPr.
- Lighting of the plant at night should be limited to security lighting (where this is necessary). It is acknowledged that emergency operational lighting may be required, but this should not be permanently lit, only being lit when such emergency operational lighting is required.
- The height of any lights should be limited; more lights of lower height should be installed rather than fewer floodlights that would be visible from a wider area.
- All lighting should be downward, and inward facing (towards the plant), to avoid light spill into surrounding areas.

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- Speed limits for construction vehicles, in particular heavy trucks travelling along the site access roads (including the Gariep District Road and the Transnet Railway Road), must be set, and must be rigorously enforced. It is recommended that speed limits of <50km/hr be set, especially in the vicinity of (i.e. within 500m) of households / farmsteads located close to the Gariep District Road.

Impact Rating Matrix Assessment

Aspect / Impact	Construction - Significance Rating before Mitigation	Construction - Significance Rating after Mitigation	Operation- Significance Rating before Mitigation	Operation - Significance Rating after Mitigation	Decommissioning- Significance Rating before Mitigation	Decommissioning - Significance Rating after Mitigation
Visual Impacts Associated with the Development Components	Low	Low	Low	Low	Low	Low
Lighting-related Impacts	N/A	N/A	Low	Low	N/A	N/A
Generation of Dust Plumes from the construction footprint	Low	Low	N/A	N/A	Low	Low
Generation of Dust Plumes from construction traffic on access routes	Low	Low	N/A	N/A	Low	Low

Acronyms

Acronym	Acronym description
CSP	Concentrated Solar Power
PV	Photovoltaic
RHDHV	Royal HaskoningDHV

Glossary

Glossary Term	Glossary Text
Aeolian	Wind-borne – i.e. referring to wind-borne and deposited materials, and erosion caused by wind
Glare	The sensation produced by luminance within the visual field that is sufficiently greater than the luminance to which the eyes are adapted, which causes annoyance, discomfort, or loss in visual performance and visibility
Glint	Glint is a brief flash of light.
Micro-topography	Small scale variations in the height and roughness of the ground surface; in the context of this report the definition includes structures such as buildings and larger-sized vegetation that can restrict views
Viewshed	A viewshed is an area of land, water, or other environmental element that is visible to the human eye from a fixed vantage point

Specialist Declaration

I, **Paul da Cruz**, declare that I –

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

PAUL DA CRUZ

1 Introduction

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

As part of the original basic assessment study completed in 2016, visual impact assessment studies were undertaken by Golder Associates for the three separate components of the development – the CSP component and the two PV components. As the project scope and components have changed to only include PV, an addendum report for the visual assessment aspect of the environmental studies for the proposed development is required to be undertaken. A single addendum report has been prepared based on the original two PV reports.

1.1 Aims of the Study

The aims of the study are to undertake:

- a consideration of the revised visual baseline of the study area;
- a revised assessment of the visual impacts associated with the proposed solar development, considering the change in the development components;

1.1.1 Project (Study Area) Location and Description

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

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

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

Associated infrastructure includes:

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

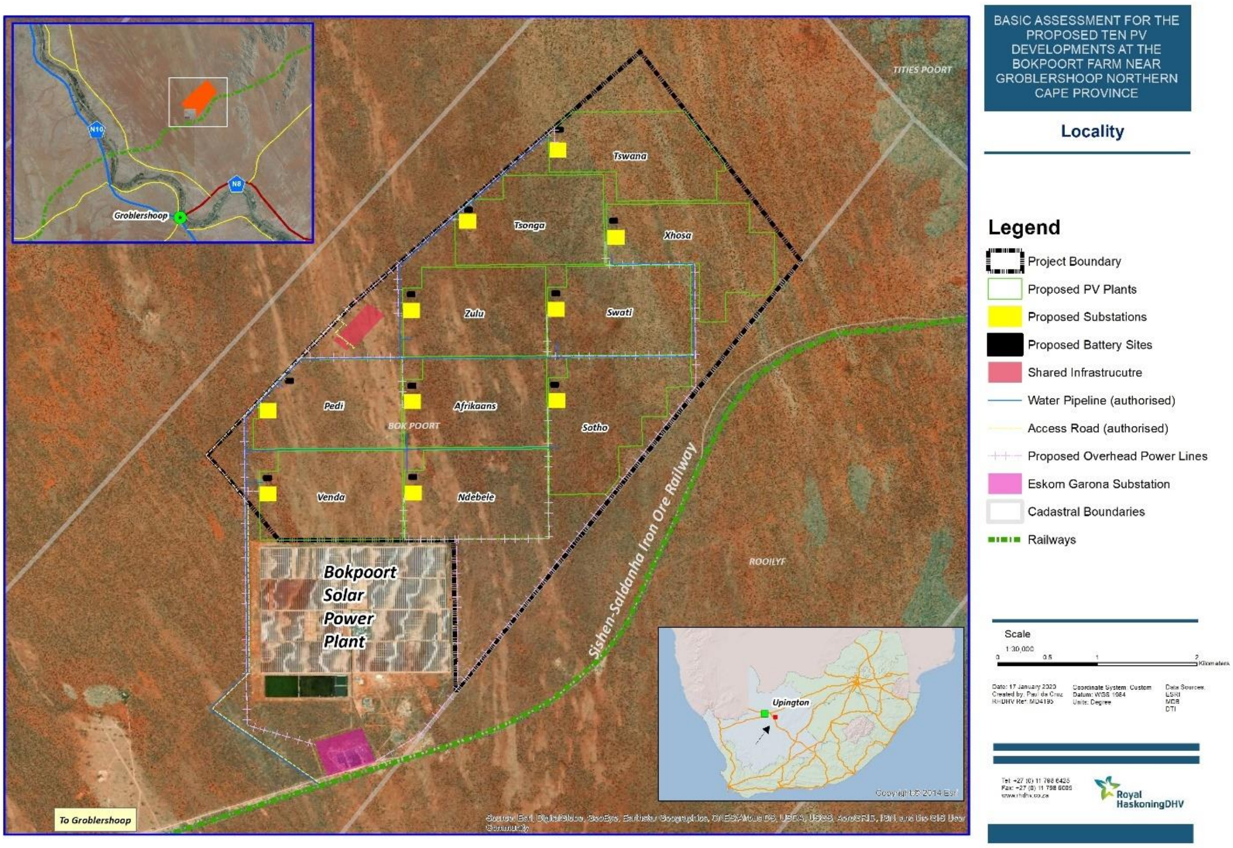

Figure 1 – Locality Map

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1.2 Assumptions and Limitations

This is addendum report is not a stand-alone visual impact report and has been prepared to update the two (2) visual impact reports prepared by Golder Associates for the original basic assessment process completed in 2016. As such this report assumes that the original two visual impact assessment reports adequately and accurately described the baseline visual environment of the study area and accurately undertook the assessment of viewsheds associated with the proposed development.

This addendum report has utilised the original reports' assessment of viewsheds associated with the original northern and southern PV plants. These viewsheds were generated for the northern and southern PV plants respectively. As the overall footprint of the development has not changed, and as the design (height) of the PV components has not changed markedly these viewsheds represent the northern and southern extents of the current development. Accordingly, the viewsheds are an accurate representation of the southern and northern extents of the ten proposed PV facilities.

It should be noted that the 'experiencing' of visual impacts is subjective and largely based on the perception of the viewer or receptor. The presence of a receptor in an area potentially affected by the proposed solar power development does not thus necessarily mean that a visual impact would be experienced.

It has been assumed that households and farmsteads located within the study area are sensitive receptors – i.e. receptor locations at which a perception of visual impact could be generated. Existing Power Generation / power transmission infrastructure and the people that work at such locations in the study area have not been classified as being sensitive receptors in a visual impact context.

2 Changes to Visual Baseline and Visual Receptor Locations

2.1 Landscape Physical Characteristics and Landuse

This part of the report investigates any changes to the visual baseline in the area that may have occurred since the undertaking of the original visual studies (in 2016), which if affected, could affect the experiencing of visual impacts associated with the proposed development.

The physical aspects of the study area investigated as part of the report (i.e. topography, hydrology and rainfall, and vegetation cover) remain the same as described in the original reports. Land-use change can often occur more rapidly than changes to a landscape's physical attributes, although vegetation cover change often occurs in conjunction with land-use change. The land-use in the study area has changed little in the four year-period since the original visual reports were compiled. Away from the Orange River corridor the predominant land-use in the wider study area and including the majority of the Bokpoort Farm remains livestock rearing, predominately sheep. The Orange River valley / corridor is predominated by the presence of irrigated agriculture, with the establishment of grape (sultana) vineyards evidently becoming more common. Game farming and hunting still occur in the Kalahari Oryx Game Farm located to the north and north-west of the Bokpoort Farm. The Bokpoort (1) CSP plant remains the only energy generation-industrial facility in the wider area with no other solar or wind power generation facilities having been constructed to date. There appears to have been little to no growth in settlements in the study area, with Groblershoop remaining a small rural town along with a handful of smaller settlements located close to the Orange River corridor.

2.2 Visual Receptors

The original visual reports listed the number of structures within a 10km radius of the site. As the area beyond 10km of the development site would be very unlikely to be subject to any form of visual exposure to the development (refer to Figure 5), this addendum report focusses on a 10km radius of the development site. This addendum report has identified all *sensitive* receptor locations in the 10km radial area (Table 1).

Table 1 -Static Sensitive Receptor Locations located within a 10km radius of the proposed development site

Distance (radius around infrastructure)	Receptor Type	Receptor Name	Closest Distance to Proposed Development	Receptor located Within Viewshed?
0 - 5 km	Farmstead (main homestead and smaller household)	Bokpoort Farmstead	1,97km	Yes
5 - 10 km	Two Farmsteads	Eben Haeser Farmstead	7.71km	No
	Farmstead (main homestead and smaller household)	La Gratitude Farmstead	6.25km	No
	Farmstead (main homestead and 3 smaller households)	Tities Poort Farmstead	7.9km	No
	Farmstead (main homestead and 2 smaller households)	Dinas Rus Farmstead	9.34km	No
	Farmstead (2 households)	Bloubos Farmstead	10.38km	No
	Farmstead (3 households)	Hoekvalkte Farmstead	10.58km	No

In the context of visual impact assessment, it is important to note that not all structures can be considered to be sensitive receptors to the development, especially where the structures are associated with the undertaking of a similar activity or process to the proposed development that would not be associated with any degree of visual sensitivity. The original reports listed seven (7) structures as being located within a 5km radius around the site, all of which were listed as households. However only two are non-industrial or non-power generation-related, being the Bokpoort Farmstead and an associated farmworker's dwelling. The remainder are located either at the Bokpoort CSP Plant or at the Eskom Garona Substation. As such these other structures and the people working within them are unlikely to display any degree of visual sensitivity and accordingly only one sensitive receptor location exists within a 5km radius of the development footprint.

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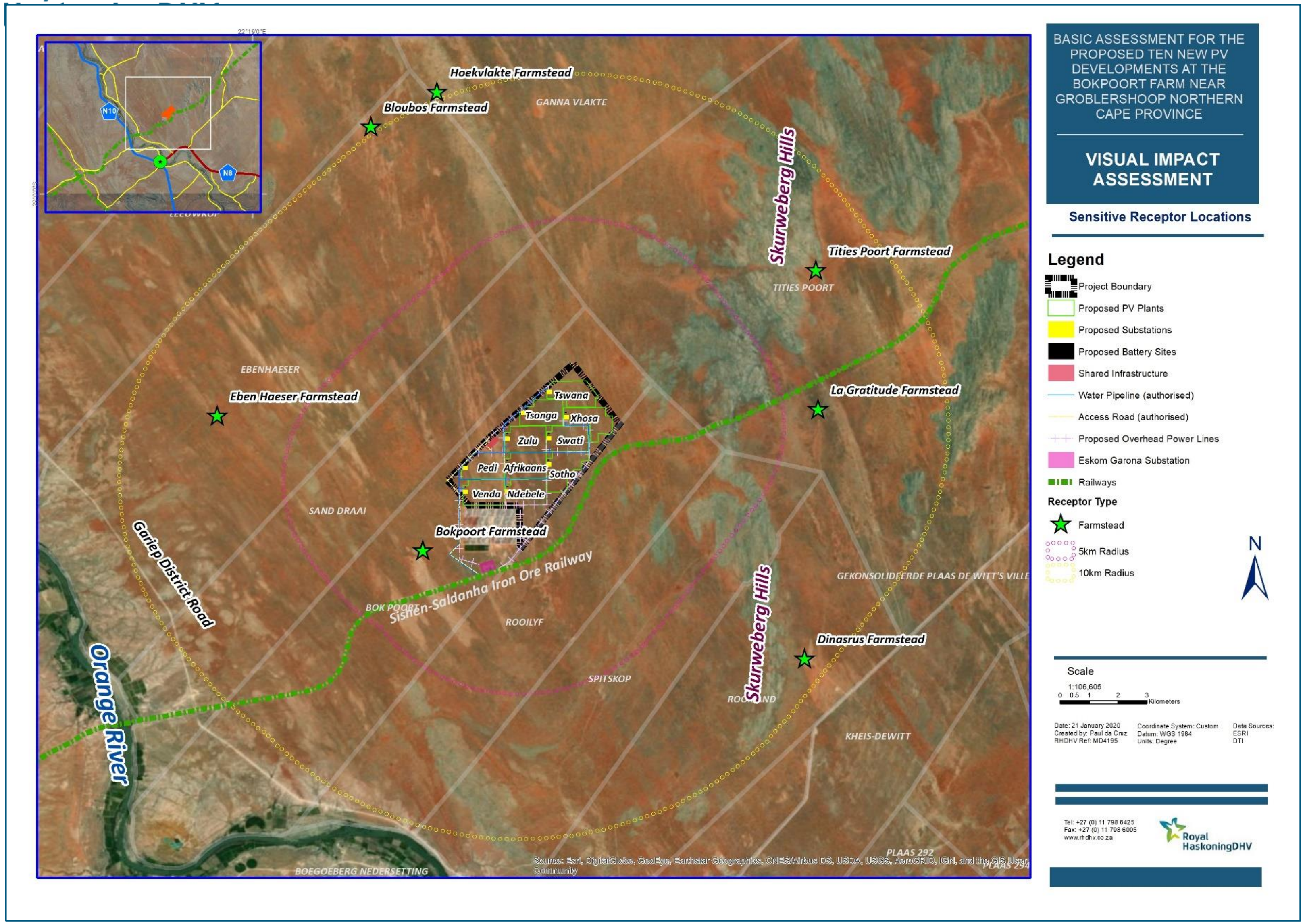

Figure 2 – Location of Sensitive Receptor Locations within a 10km radius of the proposed development

Within a 5-10km radius, the original report identified a further fifteen (15) structures. The assessment completed for this addendum report identified six (6) *sensitive* receptor locations within the 5-10km radius[1]. All of these are farmsteads, with each farmstead typically consisting of a number of households.

There are no public access transient receptor locations (i.e. roads or rail) located within the 0-5km radial area of the development site. The Transnet Rail road is located within the radial area however this is a non-public access road and access is limited to employees of Transnet, and for the stretch of the road from the Gariep Road to the Bokpoort CSP Plant, to people working at the Solar Power Plant. This road is thus not considered as a route on which potential sensitive receptors could travel. The Transnet Railway is not a passenger railway, only transporting iron ore (raw materials) from Sishen to Saldanha. As such the railway can also not be considered to be a transient receptor location.

Only a short stretch of the Gariep District Road enters the 10km radial area. This is the primary and only public access road located on the eastern side of the Orange River corridor in the area and which is located within the area surrounding the proposed development. The road runs from the N8 National Road east of Groblershoop north-westwards, running largely parallel to the course of the river, in the direction of the small settlement of Gariep and eventually linking to the N14 National Road and Olifantshoek to the north. The road also provides access to the only other road bridge across the Orange River between Groblershoop and Upington. As such the Gariep Road is an important public route that carries local traffic in the area to the north-east of Groblershoop.

3 Impact Assessment

3.1 Generic aspects of visual impacts associated with developments and structures

Before exploring the site-specific impacts associated with the proposed development, it is necessary to explore some generic aspects of visual impact as associated with new developments such as the proposed solar power development.

- Size and footprint of an object/ development

Size of a new object / series of objects placed into a landscape is an important determinant in terms of visibility. The larger a structural feature, the more it is likely to be visible. Spatial footprint is also an important factor, as the larger the spatial footprint of a development, the more it will be likely to occupy a large portion of a landscape, thus having a greater potential to alter the visual character of the landscape.

- Viewing distance

The distance of the viewer / receptor location away from an object is the most important factor in the context of the experiencing of visual impacts. Beyond a certain distance, even large structural features tend to be much less visible and are difficult to differentiate from the surrounding landscape. The visibility of an object is likely to decrease exponentially with increasing distance away from the object, with maximum impact being exerted on receptors at a distance of 500m or less. The impact decreases exponentially as one moves away from the source of impact, with the impact at 1000m being a quarter of the impact at 500m away (see Figure 3 below). At 5000m away or more, the impact would be negligible.

[1] *The Hoekvalkte and Bloubos Farmsteads are located just outside of the 10km radial area but have been included in this assessment*

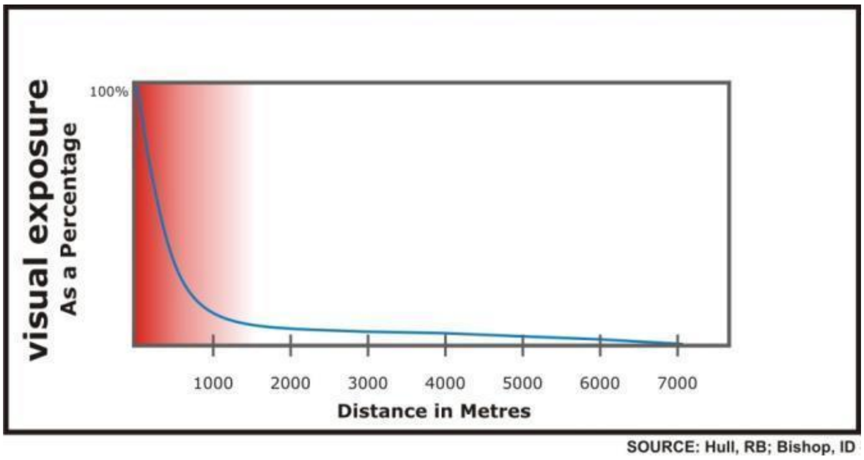

Figure 3 - Diagram Illustrating Diminishing Visual Exposure over Distance

- Presence of receptors

It is important to note that visual impacts are only experienced when there are receptors present to experience the impact; thus, in a context where there are no human receptors or viewers present there are not likely to be any visual impacts experienced.

- Viewer perception

As described above, value can be placed in a landscape in terms of its aesthetic quality, or in terms of its sense of identity or sense of place with which it is associated. If no such values are held with respect to a landscape, there is less likely to a perception of visual impact if the landscape is visually altered. Development within a landscape may not be perceived negatively at all if the development is associated with progress or upliftment of the human condition. The perception of visual impacts is thus highly subjective and thus involves 'value judgements' on behalf of the receptor. The context of the landscape character, the scenic / aesthetic value of an area, and the types of land use practiced tend to affect the perception of whether new developments are considered to be an unwelcome intrusion. Sensitivity to visual impacts is typically most pronounced in areas set aside for the conservation of the natural environment (such as protected natural areas or conservancies), or in areas in which the natural character or scenic beauty of the area acts as a draw card for visitors (tourists) to visit an area, and accordingly where amenity and utilitarian ecological values are associated with the landscape.

When landscapes have a highly natural or scenic character, amenity values are typically associated with such a landscape. Structural features such as industrial / power generation developments and related infrastructure are not a feature of the natural environment but are rather representative of human (anthropogenic) change to a landscape. Thus, when placed in a largely natural landscape, such structural features can be perceived to be highly incongruous in the context of the setting, especially if they affect or change the visual quality of a landscape. It is in this context of incongruity with a natural setting that new developments are often perceived to be a source of visual impact.

- Landform (topographical) and micro-topographical context

The landform context of the environment in which the object is placed is an important factor. The location of the feature within the landform setting – i.e. in a valley bottom or on a ridge top is important in determining the relative visibility of the feature. In the latter case, the feature would be much more visible and would 'break' the horizon, if a viewer was located 'inferior' (lower than) to the object in the topographical context. Similarly, the landform context in which the viewer is located is important in that topography can inherently block views towards an object if the viewer is located in a setting such as a steep-sided valley or on an aspect facing away from the object.

The micro-topography within the landscape setting in which the viewer and object are located is also important; the presence of micro-topographical features and objects such as buildings or vegetation that would screen views from a receptor position to an object can remove any visual impact factor associated with it.

- Landscape development context

The presence / existence of other anthropogenic objects associated with the built environment may influence the perception of whether a new development is associated with a visual impact. Where buildings and other infrastructure exists, the visual environment could be considered to be already altered from a natural context and thus the introduction of a new structural feature into this setting may be considered to be less of a visual impact than if there was no existing built infrastructure visible.

- Receptor type and nature of the view

Visual impacts can be experienced by different types of receptors, such as people driving along roads, or people living / working in the area in which the structural feature is visible. The receptor type in turn affects the nature of the typical ‘view’ of a potential source of visual impact, with views being permanent in the case of a residence or other place of human habitation, or transient in the case of vehicles moving along a road. The nature of the view experienced affects the intensity of the visual impact experienced.

- Weather and visibility

Meteorological factors, such as weather conditions (presence of haze, or heavy mist) which would affect visibility can impact the nature and intensity of a potential visual impact associated with a structural feature.

3.2 Generic Visual Impact Issues related to Solar Power Plants

3.2.1 Impacts associated with large-scale solar power facilities

It is important to note that the development and associated environmental assessment of solar power plants in South Africa is relatively new, and thus it is valuable to draw on international experience. Thus, this section of the report draws on international literature and web material to describe the generic impacts associated with solar power.

In general, solar power generating facilities need to occupy a very large area in comparison to other types of power generation facilities relative to the level of power output generated (Sullivan *et al*, 2012). This is an important component of the visual aspect of solar power plants as they can occupy large parts of a landscape, especially when viewed from an elevated position.

The large size, strong regular geometry of solar facilities, and the use of mirrors or glass panels with metal supporting structures, may result in high visual contrast being created that is visible for long distances in many instances (Sullivan *et al*, 2012). In favourable viewing conditions, large facilities can be visible from a distance of 16km or greater; it should be noted however that viewed from such long distances, the facilities may not be recognisable as solar facilities (Sullivan, *et al*, 2012). Built structures associated with solar power facilities would introduce complex, rectilinear geometric forms and lines and artificial looking textures and colours into the landscape; these would typically contrast markedly with natural appearing landscapes (US Department of Interior, 2013).

Previous studies have indicated that the ancillary infrastructure such as power blocks, substations, or cooling towers are also important in contributing towards observed visual contrasts and visual intrusion, particularly in the case of concentrating solar facilities (Sullivan *et al*, 2012). The visual impacts associated with this ancillary infrastructure is most pronounced in the case of views towards facilities from a low angle or low elevation, where the viewer is on the same, or lower horizontal plane as the facility. From low viewing angles, taller structures such as cooling towers extend far above the much lower collector arrays, creating a vertical contrast, and being particularly prominent if they extend above the horizon. If metallic (or containing metallic components), these can also be associated with glinting or glare.

A commonly expressed concern is whether glint or glare would negatively affect aircraft flying above the facility. It should be noted that in recent times several large-scale solar projects have been completed and constructed at or near certain major airports in the USA (such as Denver International Airport or the Oakland FedEx International Airport Hub) without any reports of such problems (Power Engineers, 2010). It should be noted however that the solar power facilities at these airports are solar panel facilities that are typically low in reflectivity.

As most solar power plants tend to be located in vacant or uninhabited areas due to space availability, the landscape context is often natural; in this context the solar field could be considered to be a visual intrusion that possibly acts to alter the visual environment, especially if the pre-development visual context is natural. The level of visual exposure to the power plant (and potential visual intrusion of the facility) is dependent on the location of the solar fields in relation to receptor locations.

The proposed PV structures will rotate on an axis and are proposed to be a maximum of 4m in height above the ground (approximate in height to a 1-1.5 storey building). The low profiles of these solar collector arrays of PV facilities entail that these are typically able to be fully or partially screened by desert vegetation in flat landscapes where viewpoints are not elevated (U.S Department of the Interior, 2013). These typically however require very flat terrain and the solar field for these facilities is typically completely cleared and levelled (US Department of Interior, 2013); this relates to the clearing of vegetation as discussed below in section 3.2.2.

3.2.2 Vegetation clearing

One of the important potential indirect impacts of a solar power development relates to the clearing of natural vegetation. Clearing of vegetation could result in the potential loss of vegetative screening, which would result in the opening of views. Importantly in a visual contrast context the clearing of vegetation could result in the exposure of soils which could contrast with the colour of surrounding natural vegetation as well as potentially creating significant changes in form, line, colour, and texture for viewers close to the solar field. Lastly (especially in arid settings in which solar power plants are often developed) vegetation removal could result in windblown dust which could constitute an indirect visual impact (US Department of the Interior, 2013).

The proposed development will require the clearing of vegetation over most of the development footprint. The plant footprints will need to be graded and terraced where necessary, in order to provide a level surface for foundations. This practice of clearing vegetation will intensify the visibility of the solar energy facility, particularly in locations where natural woody vegetation would exist, but to a lesser degree when the proposed facility is located on land where woody vegetation does not occur.

3.2.3 Lighting

Due to the nature of solar power plants which would primarily be operational during sunlit (daylight) hours, lighting (at night) is not a major operational component of such facilities. However solar power generation facilities would include exterior lighting around buildings, parking areas, and other work areas, as well as security and other lighting around and on support structures (e.g., the control building) (US department of the Interior, 2013). In the context of a natural setting in which there would be little to no lighting, visible lighting at solar power generation facilities could constitute light pollution, especially in settings where land-uses and activities (e.g. ecotourism establishments) which value the absence of lighting in a natural setting. Maintenance activities conducted at night, such as mirror or panel washing might require vehicle-mounted lights, which could also contribute to light pollution (US department of the Interior, 2013). Light pollution impacts associated with utility-scale solar facilities include sky glow, light trespass, and glare (US department of the Interior, 2013).

3.3 Analysis of degree of visual intrusion caused by the proposed PV Facility at receptor locations in the study area

As distance is a significant factor in the experiencing of visual impacts (refer to section 3.1 above), the site context is important in how impacts associated with the proposed development on the development site are likely to be experienced. As detailed in the original PV visual impact reports for the proposed development, the vast majority of receptor locations are located greater than 10km distant from the facility and are predominantly located along the Orange River (within the Orange River corridor). Accordingly, a potentially significant distance between the solar facility components and the majority of the receptor locations is present. In this addendum report distance banding from the proposed facility footprint has been used to determine the zone of likely visual exposure to the facilities into which the respective receptor locations would fall. Increasing distance from the proposed facility footprint has been used to give an indication of the likely visibility or potential degree of visual exposure to the solar plant developments from different parts of the study area. The following zones (distance bandings) have been utilised:

- <2km – zone of high potential visual exposure
- 2km-5km – zone of moderate potential visual exposure
- 5km-10km – zone of low potential visual exposure
- >10km – zone of marginal / negligible visual exposure

It is very important to note that all but one of the (sensitive) receptor locations located within a distance of 10km of the proposed development fall into the zone of **low potential visual exposure**. The Bokpoort Farmstead is the only receptor location that is situated within the zone of moderate to high visual exposure. This receptor location is located within the viewshed of the development (Figures 4&5); it is located on an isolated hillside (Figure 6) with an aspect that faces in a northwards arc towards the development site. The raised position of the farmstead in relation to the surrounding plains entails that it is exposed to a clear view of much of the terrain (refer to Figure 6).

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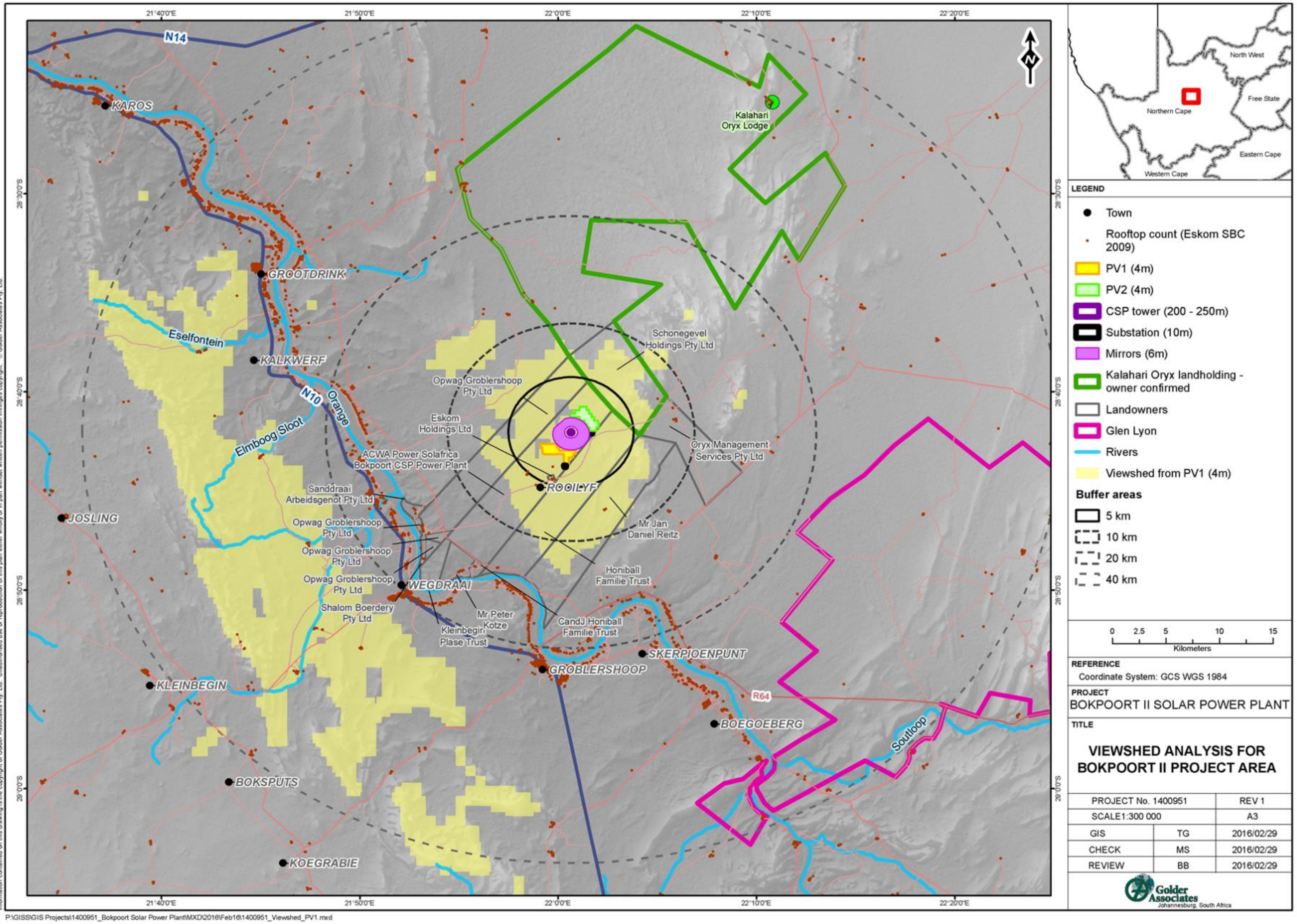

Figure 4 - Viewshed Analysis undertaken as part of the original Visual Impact Assessment for the original PV1 component – representative of the southern part of the development site

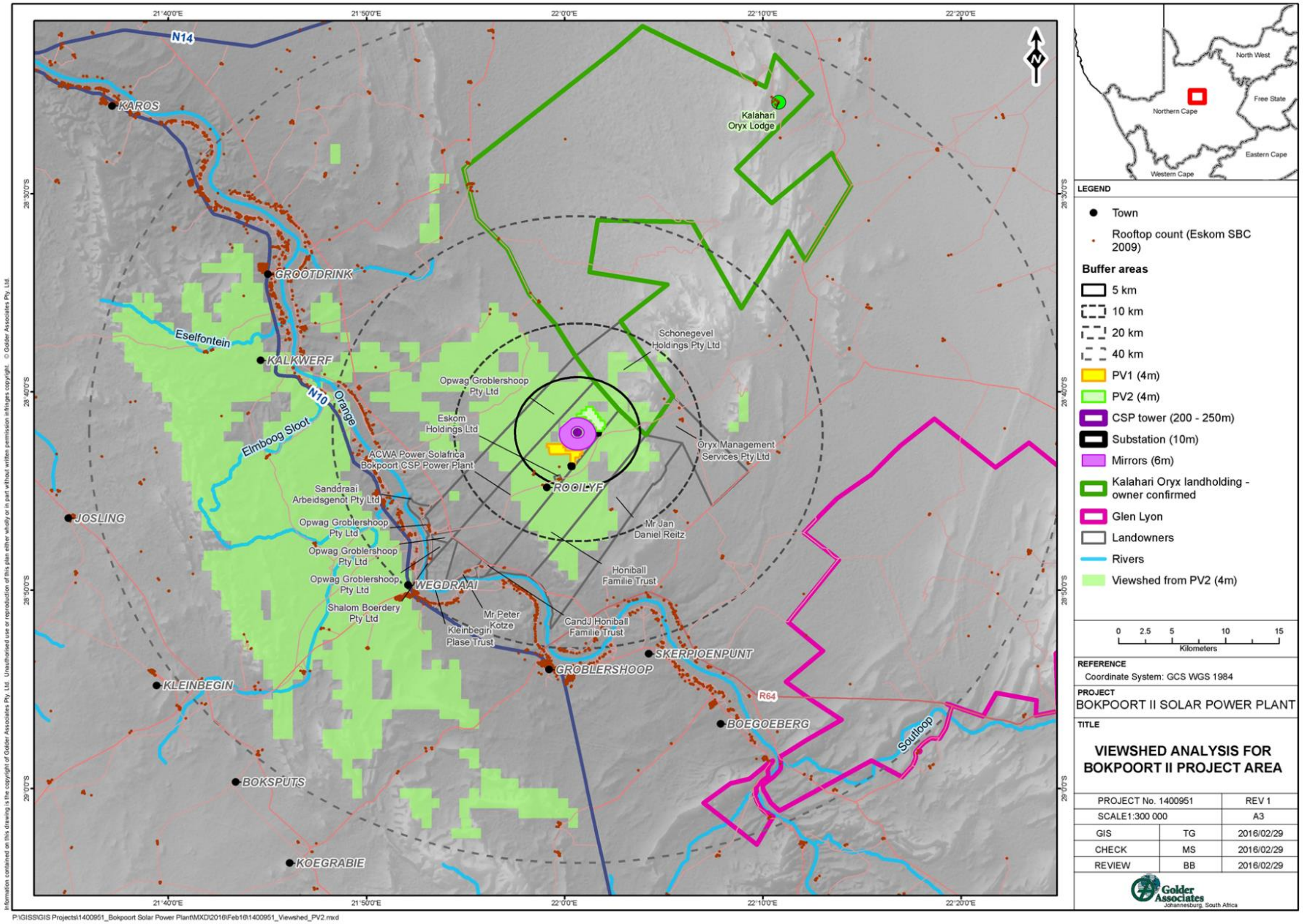

Figure 5 – Viewshed Analysis undertaken as part of the original Visual Impact Assessment for the original PV2 component – representative of the northern part of the development site

The receptor location will thus be subject to a high degree of visual exposure and thus a high level of visual intrusion. The visual intrusion factor associated with the new development would however be ameliorated by a number of factors; firstly, the new development would be viewed in the context of existing views of the Bokpoort 1 CSP Plant. As the 10 proposed PV plants would be located directly adjacent to the existing solar power plant, these would be viewed as an extension of the existing solar plant in the context of a view of the landscape that has already been transformed from a completely natural context. In addition, the vegetation (large mature trees) located around the farmstead would be effective in screening the receptor from views to the surrounding areas.

Figure 6 – The Bokpoort Farmstead viewed from the Sanddraai Property to the west. Note the elevated position of the farmstead in relation to the surrounding terrain.

Of the six other sensitive receptor locations located within a distance of 10km of the development site, ***none*** are located within the viewshed of either the northern or southern part of the development (Figures 4&5), thus meaning that **none of these 6 receptor locations will be exposed to any views of the proposed development**. Parts of the 5-10km radial area around the proposed development are located within the viewsheds of the development, in particular the viewshed of the northern part of the development which covers a greater area as the northern part of the development is located on higher-lying ground than the southern part of the development footprint. However significant parts of the radial area fall outside of the viewshed of the proposed development (Figures 4&5). This is largely due to the presence of hilly / mountainous terrain located within the north-eastern and eastern parts of the 10km radial area. This higher-lying terrain screens much of the 10km radial area in which the receptors are located, blocking views towards the site footprint.

Beyond the 10km radial area the visual exposure factor associated with the proposed plant would be minimal and twinned with the absence of visibility of the plant in large areas where receptor locations are clustered, in particular along the Orange River corridor would result in a negligible visual impact. Most of the Orange River corridor lies outside of the viewshed of the development, and accordingly will not be visually affected by the proposed development.

When non-static receptor locations are considered, the visual intrusion factor of the development will be very low to negligible. The only public access located in the 10km radial area is a short section of the Gariep District Road. This, and the other stretches of the road are located outside of the viewsheds of the development (Figures 4&5), and thus will be exposed to no visual exposure to the proposed development.

Figure 7 View in the direction of the development site from the raised portion of the Gariep District Road that crosses the Transnet Railway; neither the Bokpoort 1 Solar Plant or the proposed development are o/ would be visible.

Overall, the degree of visual intrusion associated with the proposed development components is likely to be low at worst, with the distance between most of the receptor locations and the development site being the greatest contributing factor, twinned with the non-visibility of the development in large parts of the study area. The proposed development is thus very unlikely to result in the creation of a visual impact, or perceptions of visual impact by people inhabiting the sensitive receptor locations in the 10km radial area or moving transiently within the area. Twinned with the presence of the Bokpoort 1 CSP Plant and the Eskom Garona Substation the proposed solar development will add to the presence of large-scale power generation infrastructure in the study area, but which due to its remote location and the low density of human settlement will not generate any degree of visual exposure beyond that which is very low, thus being unlikely to generate any visual impacts.

3.3.1 Glint and Glare analysis

As described in section 3,3,1 above, glint and glare can become problematic aspects of a solar power plant. As described above the proposed development will not be visible to the vast majority of sensitive receptor locations in the study area and thus will not create any glint or glare impacts at these locations. Where it is visible, the proposed development would be located at a significant distance from much of the study area from which it potentially could be viewed. In addition, PV arrays are not typically associated with glint or glare as the PV surfaces are non-reflective, and only the metal supports could potentially cause glare, thus greatly reducing the potential for glint or glare-related impacts. Thus, glint and glare associated with the proposed development is unlikely to be a visual impact-related issue.

3.3.2 Assessment of lighting impacts associated with the Proposed Development

In order to assess the impact of lighting at the proposed solar power station facility, it is necessary to explore the nature of the night-time environment in the study area.

Most parts of the study area are highly rural in nature with a very low density of human settlement. Accordingly, the night-time environment within the wider area is thus characterised by few sources of artificial lighting. Where these occur, these are highly localised. The location of the viewer is important as viewers located in low-lying terrain settings (such as in the Orange River valley) would not be able to view the lights in the surrounding area. However viewers in higher lying settings, such as certain of the receptor locations on higher-lying ground closer to the N10 national road west of the Orange River valley would be able to view a greater area, and thus see the light sources in this wider area (including the ground to the east of the river).

The primary sources of lighting are floodlights that illuminate on a permanent (nightly) basis in a number of the small settlements located along the N10 including Wegdraai, Saalskop and Grootdrink to the north as well as in certain parts of Groblershoop and the settlement of Boegoeberg to the south. A number of these very tall floodlights provide general illumination for these respective settlements in the absence of (lower) street lighting. The height of these lights makes them highly visible in an otherwise dark night-time context. When viewed from a high point the effect is of ‘islands of light’ in an otherwise very dark, unlit night-time context.

The Bokpoort 1 CSP Plant has introduced a further set of lights into this dark environment and is the only really visible source of light on the eastern side of the Orange River (when viewed from afar). The Bokpoort 1 CSP Plant is located relatively far from the Orange River and cannot be discerned from the higher points on the western side of the Orange River during the day. However, a set of lights at the power plant is visible from higher-lying terrain to the west of the river. A collection of lights is visible at the plant’s location. These lights are likely to be tall, floodlight-type lights in order to be viewed from the higher lying areas to the west of the river. This set of lights adds to the few sources of lighting visible in the wider area.

It should be noted that it is not known what type of lighting is planned at the proposed facility. However if similar type of lighting was developed at the proposed facility, the relative proximity of the proposed facility to the Bokpoort 1 CSP Plant when viewed from the area to the west would effectively add to the cluster of lighting that is already visible in this part of the study area. The number of lights as visible could more than double. The degree of visibility of lighting would depend on the height of the lights, the degree of illumination (strength) and their orientation. It is important to note that lighting at the proposed plant may not become a permanent feature of the light time environment if it is not operated on a permanent (nightly) basis, and only used in case of emergency maintenance requirements.

3.3.3 Dust Plume-related Visual Impacts

The generation of dust plumes could constitute a visual impact, although it would only be a transient impact that is dependent on atmospheric factors such as wind. Dust plumes associated with the proposed development that could become problematic in a visual context could be generated in two ways:

- By the clearing of vegetation on the development site during construction, leaving the underlying soils exposed, and through the subsequent movement of construction vehicles or through bulk earth moving activities.
- By construction traffic along the access roads to the development site, which would likely be the Gariep District Road and the Transnet Access road, both of which are not tarred and from which dust would be generated.

The study area is located in an arid environment, and thus the generation of dust is not necessarily incongruent in this setting. Dry, hot conditions can create dust plumes or whirlwinds. However, if it were to occur excessively, dust plume creation could be perceived as a visual impact. The risk of excessive dust creation relates to the potential vegetation clearing across the entire development footprint, rather than the phased clearing of vegetation. It is accepted that vegetation across most of the development footprint will need to be cleared but should the entire development footprint be cleared of vegetation at the start of the construction period, this will leave the underlying soils exposed over a very large area for a relatively long period of time. In particular in the northern parts of the site where sandier soils as opposed to gravelly substrate is encountered, the risk of mobilisation of this substrate by wind would be high.

The visual impacts associated with such increased dust plume creation would be ameliorated by the same factors that will ameliorate the degree of visual impact associated with the proposed PV plant infrastructure – i.e. the remote location of the site twinned with the topographical characteristics of the area that entail that the development site would not be visible from large parts of its surrounds and the distance of sensitive receptors from the site. In this regard dust plumes generated on the development site are unlikely to be perceived as a source of visual impact, nonetheless mitigation needs to be applied to prevent this impact from occurring.

The Gariep District Road is an unsurfaced (untarred) road and accordingly dust is typically generated by vehicles travelling along it. The road surface is comprised of material that originates from calcrete and thus fine white dust is mobilised by vehicles moving along the road. Dust generation on the road, however has in the past proved to be a contentious issue in the context of the construction of the Bokpoort Solar Power Plant and the large number of construction vehicles that travelled along the road and which generated large volumes of dust. The objections from local farmers and land owners were centred on the adverse impacts of the depositing of large volumes of fine dust on the vegetation surrounding the road that allegedly greatly reduced the palatability of the vegetation and the overall grazing capacity of the veld. The transport of components of the proposed PV plant developments by road would result in a highly significant daily increase in the volume of heavy vehicle traffic along the road, which would last for much of the duration of the construction period. In this context the generation of dust plumes by a large increased volume of heavy vehicle traffic may be perceived as a negative visual intrusion in conjunction with negative perceptions regarding dust-related grazing impacts, as well as road safety concerns.

A different set of receptors to those potentially affected by the development footprint would potentially be exposed to the dust plumes generated by construction traffic along the Gariep District Road. If construction traffic approached the development site from the south-east – i.e. from the N8 National Road – a number of farmsteads, including three farmsteads located close to the road, and a greater number along the opposite side of the Orange River – would be exposed to the regular dust plumes generated by construction vehicles. Though not necessarily significant as an impact on its own, the visual intrusion of the dust plumes could be perceived to have significant nuisance value in combination with negative perceptions of adverse effects on vegetation and concerns relating to road safety. It is important that mitigation be implemented to reduce the impact and extent of dust generated by the large numbers of construction vehicles that will need to use this road to access the site.

Dust plumes generated along the Transnet Rail access road could have a similar visual effect, but apart from a short stretch of the road located close to the Gariep District Road. This road is remote from any areas of public access and dust plume-related impacts will be mitigated by the distance factor in a similar manner to dust plumes generated on the development site.

3.4 Mitigation Measures

Due to the remote location of the proposed development and the low degree of visual intrusion anticipated with the plant, detailed design-related mitigation measures are not required. However, for a number of other aspects of the proposed development, in particular for dust creation, lighting and construction access which could potentially be associated with potential visual impacts, mitigation measures are specified, as detailed below.

3.4.1 Vegetation Clearing

- It is strongly recommended that clearing of vegetation only be undertaken in a phased manner, so as to prevent the large-scale exposure of soils and substrate that could result in atmospheric conditions (wind) creating large dust plumes on the site.
- Regular dust abatement measures must be applied on the construction site, as detailed in the development's EMPr.
- If high wind conditions are forecast for the area, bulk earthworks, in particular in the sandy, northern parts of the site characterised by parallel-running dunes should ideally not be undertaken in order to reduce the mobilisation of large volumes of dust.

3.4.2 Lighting-related mitigation measures

Lighting at the plant could potentially exert a visual impact, especially if floodlight-type lighting was to be developed at the plant. Accordingly, the following mitigation measures should be implemented with regards to lighting:

- Lighting of the plant at night should be limited to security lighting (where this is necessary). It is acknowledged that emergency operational lighting may be required, but this should not be permanently lit, only being lit when such emergency operational lighting is required.
- The height of any lights should be limited; more lights of lower height should be installed rather than fewer floodlights that would be visible from a wider area.

- All lighting should be downward, and inward facing (towards the plant), to avoid light spill into surrounding areas.

3.4.3 Mitigation measures for dust creation on access roads

- Speed limits for construction vehicles, in particular heavy trucks, must be set, and must be rigorously enforced. It is recommended that speed limits of <50km/hr be set, especially in the vicinity of (i.e. within 500m) of households / farmsteads located close to the Gariep District Road. Lower speeds will limit dust plume creation.
- Speed limits and dust abatement measures must be applied along both the Gariep District Road and along the Transnet Rail access road.
- Dust abatement measures must be applied along all non-tarred access routes (e.g. dust suppression with water). These must be focussed on stretches of the access routes located within 500m of households and farmsteads located close to the access road.
- Consideration must be given to timing the movement of construction traffic to and from the site during cooler periods of the day during which dust suppression with water would be more effective due to lower temperatures and lower evaporation rates.

3.4.4 Other visual mitigation measures

- Within linear servitudes and on the development site, all cleared areas during the construction phase that will not form part of the plant footprint, including power line and pipeline servitudes should be rehabilitated and replanted with grass or low shrubs with non-invasive root systems, in order to avoid the creation of areas devoid of vegetation that may be visible from receptor locations.
- Where applicable and depending on Eskom's requirements, it is recommended that the monopole power line tower be used (as opposed to the steel lattice tower) in order to reduce the visibility of power line towers. Wooden power line tower poles are also preferable to steel lattice tower types.

3.5 Impact Rating Matrix

3.5.1 Visual Impacts associated with the proposed development components (proposed PV Plant)

Phase	Potential Aspect and or Impact	Significance rating of impacts before mitigation	Mitigation	Significance rating of impacts after mitigation
Construction	• The construction site would not be visible to the vast majority of the receptor locations in the study area, and thus would not cause any visual impact for the majority of the study area	**Intensity:** Low (-1) **Extent:** Local (-2) **Duration:** Medium Short (-2) **Probability: Possible** (0.5) **Significance: Low (-2.5)**	• It is strongly recommended that clearing of vegetation only be undertaken in a phased manner, so as to prevent the large-scale exposure of soils and substrate that could result in a large visual contrast compared to the surrounding vegetation.	**Intensity:** Low (-1) **Extent:** Local (-2) **Duration:** Short term (-1) **Probability: Possible** (0.5) **Significance: Low (-2)**
Operations	• The PV arrays would not be visible to the vast majority of the receptor locations in the study area, and thus would not cause any visual impact for the majority of the study area.	**Intensity:** Moderately Low (-2) **Extent:** Local (-2) **Duration:** Long term (-4) **Probability: Possible** (0.5) **Significance: Low (-4)**	• Within linear servitudes and on the development site, all cleared areas during the construction phase that will not form part of the plant footprint, including power line and pipeline servitudes should be rehabilitated and replanted with grass or low shrubs with non-invasive root systems, in order to avoid the creation of areas devoid of vegetation that may be visible from receptor locations.	**Intensity:** Moderately Low (-2) **Extent:** Local (-2) **Duration:** Long term (-4) **Probability: Possible** (0.5) **Significance: Low (-4)**
Decom-missioning		**Intensity:** Low (-1) **Extent:** Local (-2) **Duration:** Medium Short (-2) **Probability: Possible** (0.5) **Significance: Low (-2.5)**		**Intensity:** Low (-1) **Extent:** Local (-2) **Duration:** Medium Short (-2) **Probability: Possible** (0.5) **Significance: Low (-2.5)**
Cumulative	• The proposed development will be located immediately adjacent to the Bokpoort Solar Power Facility, so when	**N/A**	N/A	**N/A**

Phase	Potential Aspect and or Impact	Significance rating of impacts before mitigation	Mitigation	Significance rating of impacts after mitigation
	viewed from the surrounds it will form part of a visual environment that is already transformed from a natural context. The proposed development will add to the transformation of the landscape in the local area, thus increasing the cumulative visual effect on the landscape. However the remoteness of the location lowers the overall cumulative visual impact in a wider study area context.			

3.5.2 Lighting-related Impacts

Phase	Potential Aspect and or Impact	Significance rating of impacts before mitigation	Mitigation	Significance rating of impacts after mitigation
Construction	• No lighting impacts are anticipated in the construction phase as all construction is expected to occur during daylight hours.	N/A	N/A	N/A
Operations	• Lighting at the Solar Power Plant could create a visual impact on the night-time environment by introducing new sources of lighting to a relatively unlit night-time environment. This impact would be more pronounced if lighting sources were permanently lit at night and if floodlight-type lighting was used.	**Intensity:** Moderately Low (-2) **Extent:** Local (-2) **Duration:** Long term (-4) **Probability: Possible** (0.5) **Significance: Low (-4)**	• Lighting of the plant at night should be limited to security lighting (where this is necessary), and emergency operational lighting must only be lit when required. • The height of any lights should be limited; more lights of lower height should be installed rather than fewer floodlights that would be visible from a wider area. • All lighting should be downward, and inward facing (towards the plant), to avoid light spill into surrounding areas.	**Intensity:** Low (-1) **Extent:** Local (-2) **Duration:** Long term (-4) **Probability: Possible** (0.5) **Significance: Low (-3.5)**
Decom-missioning		N/A	N/A	N/A

Phase	Potential Aspect and or Impact	Significance rating of impacts before mitigation	Mitigation	Significance rating of impacts after mitigation
Cumulative	• The proposed development will be located immediately adjacent to the Bokpoort Solar Power Facility and lighting at the new plant would increase the number of lighting sources able to be viewed from this area. Permanent lighting at the new plant would thus increase the number of light sources, albeit in a cluster rather than adding diffuse lighting sources to the landscape, further altering the overall dark night time environment to a more lit one.	**N/A**	As above for operation	N/A

3.5.3 Generation of Dust Plumes from Construction at the plant footprint

Phase	Potential Aspect and or Impact	Significance rating of impacts before mitigation	Mitigation	Significance rating of impacts after mitigation
Construction	• The construction site would not be visible to the vast majority of the receptor locations in the study area, and thus dust plumes generated at the construction site would be unlikely to cause any visual impact for the majority of the study area	**Intensity:** Low (-1) **Extent:** Local (-2) **Duration:** Medium Short (-2) **Probability: Possible** (0.5) **Significance: Low (-2.5)**	• It is strongly recommended that clearing of vegetation only be undertaken in a phased manner, so as to prevent the large-scale exposure of soils and substrate that could result in large-scale mobilisation of unconsolidated substrate by wind. • Dust suppression measures must be implemented on the construction site. • Bulk earthworks must not occur on (forecast) very windy days.	**Intensity:** Low (-1) **Extent:** Local (-2) **Duration:** Short term (-1) **Probability: Possible** (0.5) **Significance: Low (-2)**
Operations	N/A			
Decom-missioning	As above, for Construction	**Intensity:** Low (-1) **Extent:** Local (-2) **Duration:** Medium Short (-2)	As above for construction	**Intensity:** Low (-1) **Extent:** Local (-2) **Duration:** Medium Short (-2)

Phase	Potential Aspect and or Impact	Significance rating of impacts before mitigation	Mitigation	Significance rating of impacts after mitigation
		Probability: Possible (0.5) **Significance: Low (-2.5)**		**Probability: Possible** (0.5) **Significance: Low (-2.5)**
Cumulative	• Generation of dust plumes is not incongruous to this hot arid environment, but the area surrounding the development site is not characterised by the large-scale generation of large dust plumes on a regular basis. Such an impact would not further an existing impact.	**N/A**	N/A	**N/A**

3.5.4 Generation of Dust Plumes from Construction Traffic on the access roads

Phase	Potential Aspect and or Impact	Significance rating of impacts before mitigation	Mitigation	Significance rating of impacts after mitigation
Construction	• Large numbers of heavy construction vehicles will need to access the site along public access routes to transport infrastructure components to the site. Such a large number of vehicles will greatly increase the volumes of traffic compared to the ambient traffic volumes on the Gariep District Road. Each vehicle could create a dust plume that could constitute visual intrusion or nuisance factor that could be negatively perceived by adjacent landowners in addition to concerns regarding vegetation impacts and road safety.	**Intensity:** Moderately-Low (-2) **Extent:** Local (-2) **Duration:** Medium Short (-2) **Probability: Highly Probably** (0.75) **Significance: Low (-4.5)**	• Dust suppression measures must be implemented, especially on road stretches located within 500m of households / farmsteads located close to the access route. • Speed limits must be kept as low as possible and strictly enforced.	**Intensity:** Low (-1) **Extent:** Local (-2) **Duration:** Medium Short (-1) **Probability: Possible** (0.5) **Significance: Low (-2)**
Operations	N/A		•	

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Phase	Potential Aspect and or Impact	Significance rating of impacts before mitigation	Mitigation	Significance rating of impacts after mitigation
Decom-missioning	As above, for Construction	**Intensity:** Moderately-Low (-2) **Extent:** Local (-2) **Duration:** Medium Short (-2) **Probability: Highly Probably** (0.75) **Significance: Low (-4.5)**	As above for construction	**Intensity:** Low (-1) **Extent:** Local (-2) **Duration:** Medium Short (-2) **Probability: Possible** (0.5) **Significance: Low (-2.5)**
Cumulative	• Generation of dust plumes by vehicles travelling along the Gariep District Road is typical of the study area visual environment due to the unsurfaced nature of the road. However there is currently a very low volume of traffic along this road and vehicle-generated dust plumes are accordingly highly intermittent. The increase in dust plume generation would thus not constitute a cumulative impact.	**N/A**	N/A	**N/A**

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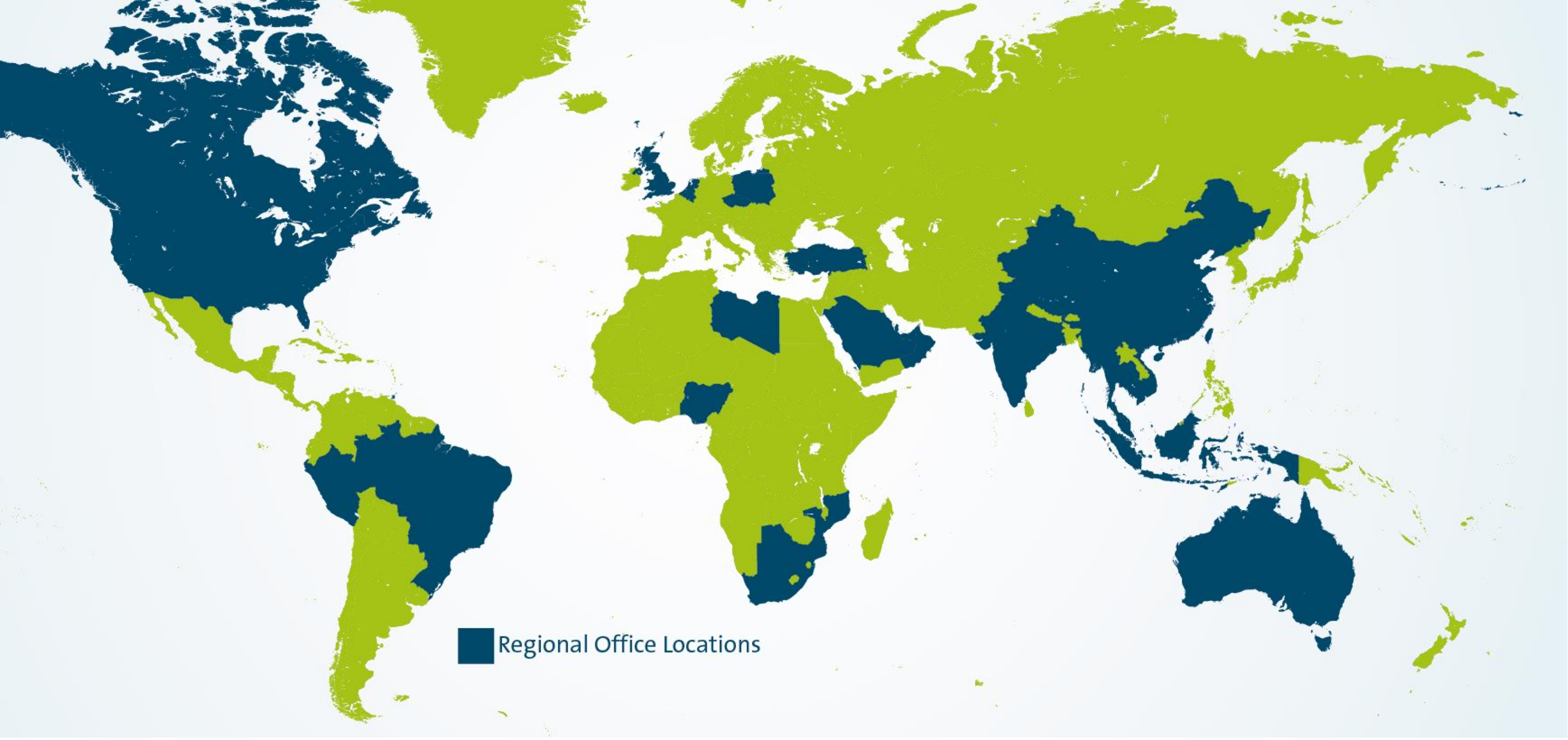
4 References

- Powergen Engineers, 2010, Panoche Valley Solar Farm Project - Glint and Glare Study; Report prepared for Solargen Energy
- Sullivan, R.G., Kirchler, L.B., McCoy, C., McCarty, J., Beckman, K., and Richmond, P, 2012, Visual Impacts of Utility-scale Solar Energy Facilities on Southwestern Desert Landscapes. National Association of Environmental Professionals 37th Annual Conference, Portland OR, May 21–24, 2012.
- United States Department of the Interior. 2013. Best Management Practices for Reducing Visual Impacts of Renewable Energy Facilities on BLM-Administered Lands. Bureau of Land Management. Cheyenne, Wyoming. 342 pp, April.



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Appendix B13: Socio-Economic

Note / Memo

HaskoningDHV Nederland B.V.
Industry & Buildings

To: Environmental Team, RHDHV
From: Kim Moonsamy
Date: 2020/02/21
Copy:
Our reference: 1-RHD-ZZ-XX-NT-Z-0001
Classification: Internal use only

Subject: Social Screening for Bokpoort 11

The table below outlines the general (known) characteristics of the site and surrounding areas. The data contained herein is relative to the data received for assessment.

General Social Characteristics	Description
Development location	- Site area : 150 ha (10 developments), - Construction lay down : 5ha - Road : internal, 4-6 meter width - Battery Energy Storage System (BESS) on each site (10 developments) – 16ha each
District demarcation	!Kheis Local Municipality and the ZF Mgcawu District Municipality
Private land owner/s (neighbouring)	There is evidence of agricultural farming south west of the site, closer to the Orange River. This would be representative of private landowners.
Land use at Location (communal/State)	Acwa Power ownership.[1] Land is currently not in use.
Servitude registration	Eskom is currently exempt from agricultural consent for power line servitudes if the servitude width is within 15 metres; and if Eskom is the applicant for the servitude.
Existing infrastructure	The road currently used to the Bokpoort (operational) CSP site, will be utilised during the proposed development. Further internal gravel access roads will be established (on the property) and will be 4-6 meters in width. The water pipelines that are currently in place to feed the operational Bokpoort farm, will be extended to cater for the new development area. A powerline with a range of 5 kms will be connected to the Garona substation. It will have a 31.5 meter width servitude, and will be at a height of 35 meters.
Labour camp	▪ The assumption is that there will be 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) constructed for the duration of the construction, within the property of ACWA Power Energy Africa (Pty) Ltd[2]. The labour facility will be required to provide the necessary medical, catering and accommodation facilities necessary.

[1] No leasing, communal land, state land information has been evidenced, so assumed to be a title deed held by Acwa Power.
[2] No confirmed labour figures for the construction and operations phases are known.

General Social Characteristics	Description
Areas of direct impact (within the development footprint)	There are no identified residences or areas of agricultural cultivation within the development footprint.
Areas of impact (within a 5 km radius)	The area found within the 5 km buffer (likely to be areas of direct impact) includes one homestead (at 1.97 kms). Homesteads found between 5 – 10 kms from the site, amount to 6.
Areas of impact (within a 10 km radius)	The small communities of Saalskop (with a population of 1398, Census 2011) and Wegdraai (with a population of 1398, Census 2011), are both on the west bank of the Orange River) and fall within the 10 km buffer, along with seven (7) identified schools, two (2) identified hospitals/ clinics, two (2) businesses and four (4) places of worship[3].
Tourist attractions	None known of.
Educational facilities	A total of nine (9) schools are recorded in the 10 km radius, with seven (7) of those being within the 5 km radius.
Health facilities	!Kheis Municipality has health facilities[4] available in: • Groblershoop • Wegdraai • Topline (Mobile) • Grootdrink • Boegoeberg • Gariep (Mobile once a week) • Opwag (Mobile once a week)
Transport	Inhabitants / workers in the 5 km and 10 km buffer area would utilise two major routes, that is a dirt/ farm road from the north (N14) or the N10 from the south (west bank of the Orange River). In the case of the use of the N10, direct access to farm properties would be via the N8 from the N10. A dirt/farm road stretches from the north west (N14) to the south east (N8), along the southern end of the project development area, along the east bank of the Orange River. A functional rail line traverses the land adjacent to the development site, in Bokpoort farm. The rail line is constructed in a north east to south westerly direction. The current use of the rail line has not been established.
Business (formal)	There is limited commercial activity taking place within 5 kms from the site. Large scale agricultural activity is noticeable slightly over 10 kms from the site, towards the banks of the Orange River.
Livestock farming	The agricultural land value of livestock farms in the area is relatively low, at on average R3 000 per hectare, while irrigated land with cash crops next to the Orange River is typically up to R100 000 per hectare. These prices per hectare range from farm to farm (Economic and Agricultural Specialist Study, November 2015).

[3] The type of 'place of worship' has not been identified
[4] Assessed in 2016.

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General Social Characteristics	Description
Specialist Studies in support of Understanding Potential Social Impacts	
Cultural / ancestral heritage specialist study for the current Project	There is one identified ruin 10 kms from the development area. However, no cultural heritage finds were made within the development footprint.
Paleontological specialist study for the current Project	Low significance of a find in the development footprint, however a tabulated fossil chance find procedure is identified for the Project.
Visual specialist study for the current Project	Low visual significance in both the construction and operations phases.
Air Quality Specialist study for the current Project	Overcharging of lead-acid batteries can result in the emissions of hydrogen (H_2) and hydrogen sulphide (H_2S). H_2 does not have health implications, but has explosion risks. H_2S has a rotten egg smell and health implications at high concentrations. Such concentrations will not be reached in the offsite ambient environment. Containment breaches can result in gaseous emissions from BESS, with implications for occupational health and ambient air quality.
Agricultural and Soil Specialist study for the current Project	Land in the project footprint shows low agricultural potential.

The table below reflects the potential impacts affiliated to a project of this nature . Since the scope of this study was to render a 'Screening assessment,' each potential impact is accompanied by an 'applicability' rating.

Potential Impacts during the Preconstruction and Construction phases of a Project	**Applicability**
• Potential loss of cultivated areas on proposed development site	N/A
• Potential loss of land due to the transmission line	N/A
• Tenure arrangement for the proposed development site	N/A
• Restricted access (to people) over the development site	N/A
• Possible cultural heritage finds in the powerline routing impact area	N/A
• No access to cattle shepherding and natural resources through the site	N/A
• Sourcing of equipment and machinery locally	Low applicability
• Inconvenience and danger to proximate residents through increased road traffic, dust and noise	Low-medium applicability
• Local job creation opportunities (specifically for the vulnerable and women)	Low applicability
• Perceived preferential access to a finite number of jobs	Low applicability
• Increased social ills in villages in close proximity – due to presence of labour camp facility	Low applicability
• Potential increase in criminal activity in nearby communities	Low applicability
• Additional pressure on basic services provision (education, housing and healthcare)	Low applicability
• Increase in HIV/AIDS cases and associated vulnerabilities	Low applicability
Potential Impacts during the Operations phase of a Project	
• Restricted access (to people) over the development site	N/A
• No access to cattle shepherding and natural resources through the site	N/A
• Potential noise pollution from the plant operating on a 24 hour basis	Low applicability
• Potential visual impact of the plant on nearby communities	Low applicability
• Implementation of specific power supply CSI activity	Low applicability
• Local job creation opportunities (specifically for the vulnerable and women)	Low applicability
• H&S concerns during operation of BESS	Low applicability
Potential Impacts during the Decommissioning phase of a Project	
• Inconvenience and danger to proximate residents through increased road traffic, dust and noise	Low-medium applicability
• Decreased agricultural value of land	Low applicability

Appendix C: EAPs CV

Appendix D: Environmental Management Programme

Curriculum Vitae

Seshni Govender

Roads and Rail
Environmental Consultant

E: **seshni.govender@rhdhv.com**

Seshni is a Environmental Consultant working on strategic environmental planning and water related projects. Seshni has been involved in numerous Water Use Licence projects, including complex integrated licencing that requires understanding cumulative environmental impacts. She also has been involved in the development of the Gauteng Environment Outlook, the N11-13X Mokpane Ring Road Environmental Authorisation Processes and Open Space plans for the City of Joburg.

Seshni has drafted applications for complex integrated licences that include components of National Environmental Management Act and National Water Act on behalf of Eskom and private companies. This has exposed me to complex matters of trying to integrate environmental impacts with mitigations measures that will be in line with the sustainable development principles.

As an Environmental Scientist Seshni contributes to projects through; report writing, data management and analysis, environmental impact analysis, policy review and public engagement/consultation.

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Degree
BSc Environmental Science (Hons)
Nationality
South African
Years of experience
8
Years with Royal HaskoningDHV
8

Professional experience

Basic Assessment and Environmental Management Programme for the Borrow Pit 5.5L associated with the N11 Section 13X (N11-13X), Mokopane Ring Road, Mogalakwena Local Municipality, Limpopo province

> South African National Roads Agency Ltd

> Limpopo Province, 2019

The South African National Roads Agency Ltd (SANRAL) has commissioned the Detail Design and the Construction Monitoring of the N11-13X Mokopane Ring Road to divert the heavy vehicle traffic that travels to and from the mines on the western side of Mokopane and to Botswana, from the already congested existing N11 section which passes through the existing villages and the Mahwelereng Township.

The N11-13X Mokopane Ring Road is a "greenfields" project where a new road will be constructed. The class of the new road will be Class 1. The new road to be constructed will typically have an overall width of 13.4 m where the initial carriageway will comprise a minimum 2.5 m outer shoulder, 2 x 3.7 m lanes, and 2.5 m inner shoulder. In general, the road reserve varies between 71 – 75 m but there are wider sections where there is a deep cutting or because of allowance for future interchanges.

A limited amount of gravel (G5 – G7 quality) will be available from cut widenings within the road reserve. The remainder of the gravel required for the proposed road construction (gravel layer works) will need to be sourced from borrow pits.

Application for Postponement of Compliance Timeframes to achieve New Plant Standards at ArcelorMittal South Africa, Vanderbijlpark Works, Emfuleni Local Municipality

> ArcelorMittal South Africa

> Gauteng Province, 2019

In response to Section 21 of the National Environmental Management: Air Quality Act, 2004 (Act No.39 of 2004) (as amended in 2018), ArcelorMittal applied for a postponement of the compliance timeframes to achieve the new plant minimum emission standards, as well as alternative emission standards for certain plants at the Vanderbijlpark Works (AMSAVW), Emfuleni Local Municipality, Gauteng.

Application for an Alternative Plant Standard and Suspension Application for activities associated with the ArcelorMittal Pretoria Works, City of Tshwane, Gauteng.

> ArcelorMittal South Africa

> Gauteng Province, 2019

In response to Section 21 of the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) (as amended in 2018), ArcelorMittal intends to apply for an alternative plant standard and submit a suspension application of the compliance timeframes to achieve the new plant minimum emission standards for the Pretoria Works, City of Tshwane, Gauteng.

Water Use Licence for the Proposed Deviation of the 88kV Firnham-Platrand Powerline near Standerton, Mpumalanga Province

> Eskom Holdings SOC Limited

> Mpumalanga Province, 2018

Eskom Holdings Limited, a State-Owned Company (SoC) proposed a deviation of a portion of the existing 88kV Firham-Platrand Powerline from pole 157 to pole 180 within a servitude of 31m and a length of approximately 2km. The purpose of the deviation is to avoid a wetland in which these poles are currently located which poses a network stability risk as it is located within a wetland area.

Firham Platrand is an interconnector between Standerton and Volksrust for network stability, the line supplies Transnet Traction Stations, should the line fail, the trains in the nearby tractions will not be able to move.

Water Use Licence Application for the Proposed Site Clearance for Planning and Design of a Border Barrier, Patrol Roads and Fencing between the Republic of South Africa (RSA), Swaziland and Mozambique, Phase 1 (KM 0.0 0 KM 54.0)

> The National Department of Public Works (DPW) and KwaZulu-Natal Department of Transport (KZN DoT)

> KwaZulu-Natal Province, 2018

Proposed the upgrade of existing border control infrastructure, and development of new border control infrastructure along a portion of the South Africa (KwaZulu-Natal) - Mozambique Border in the north-eastern part of the KwaZulu-Natal (KZN) Province. This application is termed the 'Phase 1' application and forms a component of a wider project being undertaken by the DPW for the upgrading of border control infrastructure along the South Africa - Swaziland border and the southern part of the South Africa - Mozambique border (the Phase 2 Project). The Phase 1 alignment is comprised of the section of the international border with Mozambique from the high-water mark of the Indian Ocean (KM0.0) to the eastern boundary of the Ndumo Game Reserve (KM54.0).

Environmental Screening Investigation: Route Determination for the K178 between the Gauteng Provincial Border and PWV1, Gauteng Province

> Gauteng Department of Roads and Transport (GDRT)

> Gauteng, 2018

The purpose of the Gauteng Strategic Road Network (GSRN) conceived by the Gauteng Department of Roads and Transport (GDRT) some 40 years ago was to plan a robust road system, with the objective of preserving transportation corridors and serving as a guideline for the rapid development and urbanisation of Gauteng.

The route for the K178 is the section between the Gauteng Provincial Border (in the east) and the future PWV1 (in the west) with an approximate length of 18.8km. The alignment generally follows the previous planned GDRT route along the alignment of the existing R54.

In the context of integrated environmental management, screening determines whether a development proposal requires environmental assessment, and if so, what level of assessment is appropriate. Screening is thus a decision-making process that is initiated during the early stages of the development of a project.

The main purpose of the ESI was to determine at this stage of the road design whether there are aspects of the development proposal that have the potential to give rise to significant or unacceptable environmental consequences i.e. fatal flaws.

Water Use Licence Application for the Proposed Site Clearance for Planning and Design of a Border Barrier, Patrol Roads and Fencing between the Republic of South Africa (RSA), Swaziland and Mozambique, Phase 2 (KM 54.0 0 KM 524.0)

> The National Department of Public Works (DPW)

> KwaZulu-Natal and Mpumalanga Provinces, 2018

The National Department of Public Works (DPW) as the applicant, (in conjunction with the KwaZulu-Natal Department of Transport (KZN DoT) as an implementing agent) is proposing the upgrade of existing border control infrastructure, and development of new border control infrastructure along a portion of the South Africa–Mozambique-Swaziland Border in KwaZulu-Natal and Mpumalanga. This application was termed the 'Phase 2' application and forms a component of a wider project being undertaken by the DPW for the upgrading of border control infrastructure along the South Africa - Swaziland border and the southern part of the South Africa - Mozambique border. The Phase 1 alignment is comprised of the section of the international border with Mozambique from the high-water mark of the Indian Ocean (KM0.0) to the eastern boundary of the Ndumo Game Reserve (KM54.0), whilst this Application (Phase 2) is from KM54.0 to KM524.0.

The project is being undertaken by the DPW in conjunction with the Department of Agriculture Forestry and Fisheries (DAFF) and the South African National Defence Force (SANDF), and Ezemvelo KZN Wildlife (EKZNW) and the iSimangaliso Wetland Park Authority (IWPA) as partner organs of state. The KZN DoT is an implementing agent for one of the infrastructure components (the border barrier structure).

The aim of the project is to stop the illegal trafficking of stolen vehicles and contraband across this section of the international border, as well as to prevent the illegal movement of people as well as livestock that could transmit disease. South Africa has approximately 4 800 km of land border and 2 800 km of coastline border which is required to be secured. South Africa is greatly affected and financial impacted by illegal imports, smuggling and other similar illegal activities which transpire over borders. In order to effectively respond to the range of security and control challenges that are being experienced by responsible organs of the State, it is important to assess the situation and to be able to incorporate a viable solution.

Basic Assessment for the Proposed Construction of a Bridge over the Rooisloot River, Various Culverts and Borrow Pits Associated With the National Route N11 Section 13x (N11-13x) (Mokopane Ring Road) in the Mokopane Area

> South African National Roads Agency Ltd

> Limpopo Province, 2018

The South African National Roads Agency Ltd (SANRAL) has commissioned the Detail Design and the Construction Monitoring of the N11-13X Mokopane Ring Road. An Environmental Impact Assessment (EIA) study was previously conducted for the proposed re-routing of the N11-13X road. The Environmental Authorisation and subsequent approval of the Environmental Management Plan (EMP) was obtained in 2009. The subject of this Basic Assessment Process was therefore to address the infilling activities within the watercourses which pertain to the Rooisloot Bridge and the associated culverts**.** There were 5 Borrow Pits associated with this project that were also subject to Basic Assessment Processes.

NW Environment Outlook, South Africa

> North West Department of Rural, Environment and Agricultural Development

> Mahikeng, 2018

Compilation of the water chapter as part of the publication of the North West Environment Outlook

Water Use Licence Application for the Proposed Upgrade of Dango Bridge (B1372) and Bedlane Bridge (B1336) situated along P393 (R34) Road Between Nkwalini Pass (Km0,0) and Empangeni (Km24,0)

> KwaZulu-Natal Department of Transport

> Empangeni**,** KwaZulu-Natal, 2017

The KwaZulu-Natal Department of Transport (DoT) proposed to improve the Provincial road P393 (R34) from P47-4 at Nkwalini Pass (km 0.0) to P230 at Empangeni (km 24.0) within the King Cetshwayo District Municipality in KwaZulu-Natal Province. The project starts at the intersection of P47-4 (R66) with P393 (R34) at Nkwalini Pass (km 0.0) and ends at P230 (km 24.0) towards Empangeni. The Bedlane river bridge (B1334) is situated at km 2.6 from Nkwalini Pass and the Dango river bridge (B1372) is situated at km 3.9 from Nkwalini Pass. The existing P393 road is 8.8m wide and the proposed road geometry for the rehabilitation is 10.0m wide including shoulders.

Integrated Water Use Licence Application for the Rehabilitation of the Existing P236 and Culvert from km 6.235 to km 14.0

> KwaZulu-Natal Department of Transport

> Ubombo**,**, KwaZulu-Natal, 2017

The P236 is located north of Mkhuze and starts at km 0.0 at the intersection with P2-9 and ends at km 32.0, intersecting P449. The application, however, was only for the rehabilitation of km 6.235 to km 14.0 of the P236 as well as the replacement of a culvert at Km 6.240.

Water Use Licence Application for the Proposed Culvert Rehabilitation along Provincial Road P230 from Km37.0 to Km47.0

> KwaZulu-Natal Department of Transport

> Umhlathuze Local Municipality, KwaZulu-Natal, 2017

This project formed part of the Empangeni Road Rehabilitation Programme and covers the rehabilitation of the provincial road P230 between km 37,0 and km 47,0 within the uMhlathuze Local Municipality which forms part of the King Cetshwayo District Municipality (DC28), KwaZulu-Natal. Provincial Road P230 from the intersection with P393 at km 37,0 to km 47,0 near Empangeni is defined as an undivided two lane road, and has been classified as a Class R1 Rural Arterial Road (in terms of the TRH26). The P230 forms part of the R34 long distance heavy haul freight route, which connects the harbour of Richards Bay and the surrounding industrial and commercial areas, with inland provinces.

Royal HaskoningDHV

Integrated Water Use Licence Application for the Canelands Extension Development, KwaZulu-Natal

> Tongaat Hulett Developments
> Kwadukuza Municipality, KwaZulu-Natal, 2017

Tongaat Hulett Development wishes to develop the site for industrial purposes. The site lies adjacent to the existing Canelands Industrial estate. Potential land uses may include general / industrial, logistics, warehousing and distribution. These land uses will complement those of the existing Canelands Industrial Estate, and will ensure that this land parcel reads as an extension to the existing development. It is proposed, due to the proximity of the floodplain and numerous other constraints located on-site, that a single platform covering an area of approximately 1.67 hectares (1.67 ha) is created. Both a servicing and traffic report has been completed, which details how this development will be accommodated by the existing bulk infrastructure within the region.

Gauteng Province Environment Outlook Report

> Gauteng Department of Agriculture and Rural Development
> Gauteng, 2017

State of the Environment Report (SoER) is a report card on the condition or quality of the environment. It provides information on how we affect the environment, how the environment affects us, and how this condition has changed over time. Environmental conditions are analysed through the use of environmental indicators which are proxies of environmental status, and which can be monitored over time and space. Reporting on the State of Environment (SoE) is therefore an important tool in identifying, assessing and setting priorities for environmental issues, as well as in determining whether environmental policies and actions are effective. Furthermore, the 'environment outlook' component attempts to describe or predict how environmental challenges will evolve in the near future, and what needs to be done to achieve a more sustainable state of living for all people in the province. The ultimate value of environmental outlook reporting lies in the degree to which that assessment can be used for adaptive environmental management to address anticipated future environmental conditions and pressures.

North West Envrionmental Outlook/State of the Environment Trend Analysis

> North West Department of Rural, Environment and Agricultural Development
> Mahikeng, 2017

The *Environmental Trend Analysis Report* focused on the publications of the North West Province State of Environment and Environment Outlook Reports dated 1995, 2002, 2008 and 2013, in an effort to expand this trend reporting to fully cover the period 1995 to 2013. This exercise followed on from the 2013 Environment Outlook Report which reported on environmental trends and made related recommendations to guide the province towards a more sustainable future. As such, the following objectives were achieved:

- The indicators for each chapter were tracked through the reporting period
- Data Gaps Identified
- the value of the indicator set determined

Integrated Open Space for the Greater Khayalami and Ruimsig/Honeydew Sub Regions

> City of Joburg, 2017

Development of two integrated open space plans for the Greater Khayalami and Ruimsig-Honeydew Sub-regions which aim to ensure that ecological goods and services are maintained and enhanced so as to contribute to spatial planning in the City of Johannesburg, and both economic and social development.

Environmental Impact Assessment and Integrated Water Use Licence Application for the Tinley Manor Southbanks Coastal Development, KwaZulu-Natal

> Tongaat Hulett Developments
> Kwadukuza Municipality, KwaZulu-Natal, 2017

Tongaat Hulett Developments proposes to develop the Tinley Manor Southbanks Coastal Development into a mixed-use coastal development including a large residential component. Tinley Manor Southbanks Coastal Development is an approximately 485 ha site, located between the coastal towns of Tinley Manor and Sheffield Beach within the KwaDukuza Municipality, KwaZulu-Natal.

The proposed Tinley Manor Southbanks Coastal Development is set to be the first phase of the development of Tongaat Hulett Developments' land holdings in Tinley Manor, which is situated to the south and north of the Umhlali River.

Integrated Open Space Plan – Greater Khayalami and Ruimsig-Honeydew Sub-Regions, Johannesburg, South Africa

> >Client: City of Johannesburg, 2016

Development of two integrated open space plans for the Greater Khayalami and Ruimsig-Honeydew Sub-regions which aim to ensure that ecological goods and services are maintained and enhanced so as to contribute to spatial planning in the City of Johannesburg, and both economic and social development.

Update of the Dube Tradeport State of the Environment Report

> Dube Tradeport Corporation

> KwaZulu-Natal, 2016

Compilation of the Dube Tradeport State of the Environment Report 2016/2017

Integrated Open Space Plan - Linbro Park & Greater Bassonia, Johannesburg, South Africa

> City of Johannesburg,2016

Development of two integrated open space plans for the Linbro Park and Greater Bassonia which aim to ensure that ecological goods and services are maintained and enhanced so as to contribute to spatial planning in the City of Johannesburg, and both economic and social development.

Final Consultation Basic Assessment Report for the Dismantling of a portion of the existing double-circuit power line and the construction of two (2) 7 km long 88 kV power lines within a 2 km corridor between the Grootpan and Brakfontein Substations

> >Eskom Holdings SOC Ltd

> Ogies, Mpumalanga, 2015

Eskom Holdings (SoC) Pty Ltd (Eskom Distribution – Mpumalanga Operating Unit) proposes to construct two (2) 7 km 88 kV overhead power lines within a 2 km corridor between Grootpan and Brakfontein Substations near Ogies. The existing power lines are located on GlencoreXstrata mining property. The mine has requested that Eskom relocate the lines as they are within the operational footprint of the mine. The project also involves the dismantling of a portion of the existing 88 kV double-circuit mink power line approximately 5.2 km in length. The new power lines will ensure continuity of supply and access to electricity for the surrounding communities.

Conduct Pre-Feasibility (FEL-2) Waterberg Heavy Haul Line, South Africa

> Transnet SOC Ltd

> Waterberg, 2015

High-level environmental screening investigation for the proposed +- 600km rail corridor running from Lephalale to Ermelo as part of the national Strategic Infrastructure Project (SIP) suite.

Tembisa Hub Plan, South Africa

> >Intersite Property Management Services

> Ekurhuleni Metropolitan Mucipality, 2015

Preparation of a Precinct plan for the Tembisa Urban Hub in Ekurhuleni.

Review and Update of the City of Windhoek's Environmental Policy

> Consulting Services Africa (CSA)

> Windhoek, Namibia, 2014

Review the existing City of Windhoek Environmental Management Policy, 2004 and revise and improve the existing policy so that it may be approved, launched, and implemented by the Windhoek City Council.

Green existing by-laws and develop a set of new environmental by-laws or amend the existing by-laws,

> Ekurhuleni Metropolitan Municipality

> Ekurhuleni, South Africa 2014

Review the existing Ekurhuleni by-laws by introducing environmental considerations and develop a set of new environmental by-laws if required.

Route Determination and EIA for K86, K118, K181 K208, K217 and K219,

> Gauteng Department of Roads and Transport

> Gauteng Province, 2014

Route Determination and Environmental Scan of K-routes in the Gauteng Province.

Dube Tradeport State of the Environment Report

> Dube Tradeport Corporation

> KwaZulu-Natal, 2014

Compilation of the Dube Tradeport State of the Environment Report 2013/2014

State of Environment Report (SOER) for City of Johannesburg, South Africa
> >South African Cities Network
> City of Joburg, 2014
Compilation of the State of the Environment Report for the City of Johannesburg 2014
Position: Environmentalist

Cornubia Human Settlement - Integrated Water Use Licence Application, South Africa
> Tongaat Hulett Developments (Pty) Ltd
> Cornubia, KwaZulu-Natal, 2013
Water Use Licence Application for the Cornubia Industrial and Business Estate, Phase 1-Retail Park, Cornubia Phase and Cornubia Bridge

NW Environment Outlook, South Africa
> North West Department of Economic Development, Environment, Conservation and Tourism
> Mahikeng, 2013
Compilation and Publication of the North West Provincial

Qualifications

2010 BSc (Hons) Environmental Science, University of KwaZulu Natal, South Africa

2009 BSc Environmental Science, University of KwaZulu Natal, South Africa

Royal HaskoningDHV
Enhancing Society Together

Curriculum Vitae

Malcolm Roods

Environmental Knowledge Group Leader – South Africa
Infrastructure Business Unit

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Malcolm Roods is a Principal with RHDHV specialising in Environmental Impact Assessments (EIA) for electricity supply (generation, transmission and distribution), road infrastructure, residential developments as well as water management projects. This builds on a broad government background, which has made him particularly flexible. His past experience includes 6 years public service which included policy development, environmental law reform and EIA reviews. His experience also includes more than 12 years of environmental consulting in the field of Impact Assessment and Authorisation Applications, with a focus on legislative requirements and business management.

Since joining the company he has been involved with major EIA projects such as the Transnet New Multi Product Pipeline (NMPP), various Rand Water Pipeline projects, numerous Eskom Research, Generation, Transmission and Distribution projects, SANRAL road developments, Waste Water Treatment & Re-use projects as well as undertook Independent Reviews of the EIA process for the National Department of Environmental Affairs, etc to name but a few.

Nationality
South African

Years of Experience
18 year(s)

Years with Royal HaskoningDHV
12 year(s)

Professional memberships
Environmental Assessment Practitioners Association of SA

Qualifications

2016 Bachelor of Laws (LLB) - University of South Africa
2000 BA (Honours)* Geography and Environmental Management, Potchefstroom University, South Africa
1999 BA Public and Private Sector, Potchefstroom University, South Africa
1997 Higher Education Diploma Intermediate Phase, Potchefstroom University, South Africa

* *Cum laude*

Professional experience

Environmental and Social Impact Assessment (ESIA) for the Proposed NEO I 20MWac PV Solar Power Plant and associated infrastructure in Mafeteng District, Lesotho

> Start Date: 2019

> Client: One Power Consortium

Undertake the ESIA processes in support of obtaining an Environmental License for the proposed PV solar power plant and power line.

Position: Environmental Specialist

- Assigned Tasks: Environmental specialist, quality controller and reviewer

Environmental & Social Scoping Study for the Proposed Glen Valley Waste Water Treatment and Re-use Scheme Project, Gaborone, Botswana

> Start Date: 2019

> Client: IFC / World Bank

Undertake an Environmental & Social Scoping Study to identify issues that need further investigation during the ESIA phase. The Scoping Report included a Terms of Reference (ToR) for the preparation of an ESIA so as to ensure that all issues are fully investigated and assessed.

Position: Environmental Specialist

- Assigned Tasks: Environmental Specialist, quality controller and final reviewer

Basic Assessment (BA) processes for the proposed Bokpoort II ten (10) x 200MW PV developments in Groblershoop, Northern Cape Province

> Start Date: 2019

> Client: ACWA Power Energy Africa (Pty) Ltd

Undertake the BA processes in support of obtaining Environmental Authorisation for the conversion from CSP to PV, capacity increase and Battery Energy Storage Systems

Position: Project Principal

- Assigned Tasks: Lead EAP, quality controller and final reviewer

Environmental Impact Assessment for the Proposed Health Care Risk Waste Incinerator and Converter in the Coega IDZ, Eastern Cape

> Start Date: 2018

> Client: Uloyiso Group Medical Waste

Undertake the EIA processes in support of obtaining a Waste Management License for the HCRW project

Position: Project Principal

- Assigned Tasks: EAP, quality controller and reviewer

Basic Assessment (BA) processes for the proposed Bez Valley & Naledi Clinics, Gauteng Province

> Start Date: 2017

> Client: Johannesburg Development Agency (JDA)

Undertake the BA processes in support of obtaining Environmental Authorisation for the respective clinics

Position: Project Principal

- Assigned Tasks: Lead EAP, quality controller and final reviewer

Environmental services in support of site clearance for planning and design of patrol roads and fencing between RSA, Swaziland and Mozambique – Phases 1 and 2

> Start Date: 2017

> Client: Department of Public Works

Undertook two (2) Basic Assessment processes in support of obtaining an EA and Water Use Authorisation for the construction of border control infrastructure

Position: Project Principal

- Assigned Tasks: Overall project inputs and quality control

Environmental and Social Impact Assessment (ESIA) for the proposed Red Line Rail project in Lagos, Nigeria

> Start Date: 2017

> Client: Marina Express Train Services Limited

ESIA study for the proposed Lagos Metro Rail Transit – Red Line Project, Agbado to Marina, Lagos- Nigeria

Position: Project Specialist

- Assigned Tasks: Quality controller and technical inputs

Royal HaskoningDHV

Environmental Impact Assessment (EIA) for the Nexant CSP developments in the Northern Cape Province

> Start Date: 2015

> Client: Nexant Inc

Undertake the EIA processes in support of obtaining integrated Environmental Authorisations and Waste Management Licenses for the construction of a 150MW Parabolic Through and 150MW Central Receiver development

Position: Project Principal

- Assigned Tasks: Lead EAP, quality controller and final reviewer

Environmental Impact Assessment (EIA) and Waste Management License (WML) for the Southern Waste Water Treatment Works (WWTW) Upgrades, South Africa

> Start Date: 2014

> Client: AECOM SA (Pty) Ltd

Assist eThekwini Municipality in applying for a Coastal Waters Discharge Permit and an Integrated Environmental Authorisation for the Southern Wastewater Treatment Works sea outfall pipeline and upgrades

Position: Project Principal

- Assigned Tasks: Undertaking the EIA for the Waste Water Treatment Works upgrades

Environmental Control Officer (ECO) & Auditing services for the 75MW CSP project in Bokpoort, South Africa

> Start Date: 2013

> Client: ACWA Power Solafrica Bokpoort CSP Power Plant (Pty) Ltd

Undertake the necessary Environmental Control Officer (ECO) and auditing services for the monitoring of the implementation of the Environmental Authorisations (EA), Environmental Management Plans/Programmes (EMP/EMPr), Waste License (WL) and Water Use License (WUL) during the construction phase

Position: Project Principal

- Assigned Tasks: Internal review of all project documentation prior to this being submitted to the Environmental Authorities

Environmental Impact Assessment (EIA) for the P166/1-2 New Route in Nelspruit, South Africa

> Start Date: 2012

> Client: Ubuntu (Pty) Ltd on behalf of Sanral

Environmental Impact Assessment (EIA) for the Proposed New Route P166-1/2 in Mbombela /Nelspruit

Position: Project Principal

- Assigned Tasks: Lead EAP and final reviewer

Rendering of Various Environmental services on various quarries and borrow pits for the Roads and Stormwater Division, South Africa

> Start Date: 2012

> Client: City of Tshwane Metropolitan Municipality

Rendering environmental (Basic Assessment, Section 24G, AEL) and mine health/safety services: various quarries/borrow pits,

Position: Project Principal

- Assigned Tasks: Quality controller and final reviewer for the mining right, rectification and WULA processes.

Technical Inputs and Management Tasks relating to the Eskom TTLIP transmission line project, South Africa

> Start Date: 2012

> Client: SiVest SA

Technical Project Support is provided to SiVest in the completion of the Eskom proposed Thyspunt Transmission Line Environmental Impact Assessment (EIA). This includes completing sections of the final EIA, review of the final EIA as well as providing environmental advice to the project proponent, Eskom. Tasks also included the revision and addendum to the Visual Impact Assessment report.

Position: Project Principal

- Assigned Tasks: Final reviewer and Technical Input on the EIA.

Environmental Impact Assessment (EIA) for the Valleyview Residential Development, South Africa

> Start Date: 2012

> Client: Before the Wind Investments 113 (Pty) Ltd

An Environmental Impact Assessment and Traffic Assessment for the Proposed Valleyview Residential Development on Portion 22 of the Farm Naauwpoort 355-JS, in Witbank, Mpumalanga Province.

Position: Project Principal

- Assigned Tasks: Client Liaison, quality controller and final reviewer of reports.

Environmental Impact Assessment (EIA) for the Cornubia Phase 2 Development, South Africa

> Start Date: 2012

> Client: Tongaat Hulett Developments (Pty) Ltd

Conduct a full Environmental Impact Assessment (EIA) for the proposed Cornubia Mixed Use Phased development - Phase 2 in Mount Edgecombe, KwaZulu-Natal.

Position: Project Principal

- Assigned Tasks: Final reviewer and quality controller on the EMPR and EIA reports compiled.

Environmental Assessment Services for the proposed BRT Line 1, South Africa

> Start Date: 2012

> Client: A-M Consulting Engineers (Pty) Ltd

Conducting all General Environmental Assessment Services and Public Participation Process work related to managing the process in obtaining the required environmental authorisation from the relevant authorities for the proposed BRT Line.

Position: Project Principal, Project Manager

- Assigned Tasks: Reviewer and overall quality controlling of the project deliverables.
- Responsible for the Project Management, which will include regular liaison with the Client and the environmental authorities, and an on-going review of progress of all aspects of the project. Overall Project Management and quality control during PPP.

Environmental Impact Assessment (EIA) for the Cornubia Retail Park, South Africa

> Start Date: 2012

> Client: Tongaat Hulett Developments (Pty) Ltd

Undertaking the Environmental Impact Assessment (EIA), Public Participation Process (PPP), attending client progress meetings and providing environmental input into the planning of the proposed Phase 2 Retail Development. The aim was to obtain environmental authorisation from KZN DAEA &RD.

Position: Project Principal

- Assigned Tasks: Review Reports and supply Technical Input.

Technical Support to GDID: Enhancement of current Technical & Administrative Capacity, South Africa

> Start Date: 2012

> Client: Gauteng Department of Infrastructure Development

RHDHV (in association with Messrs Ernest & Young and Nokuthula Dube & Associates cc) were appointed to provide technical support to enhance current capacity within the GDID to deliver on infrastructure projects.

Position: Specialist

- Assigned Tasks: Providing environmental legislative inputs

Environmental and Social Impact (ESIA) for Envalor Lda in Mozambique, Mozambique

> Start Date: 2011

> Client: Envalor Lda

Appointed to obtain an environmental license to develop plantations, generate electricity and produce Ethanol from sugarcane and sweet sorghum, as well as the production of food crops.

Position: Project Principal

- Assigned Tasks: Environmental Management Licence Application and management of ESIA process

Environmental Impact Assessment (EIA) for the SOLAFRICA 75MW CSP, South Africa

> Start Date: 2010

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

Royal HaskoningDHV

Environmental Impact Assessment (EIA) for the proposed concentrating solar power plant in Groblershoop, Northern Cape

Position: Project Principal

- Assigned Tasks: Client consultation and overall management of the project team.

Environmental Impact Assessment (EIA) for the proposed township development in Glen Erasmia Ext within the Ekurhuleni Metropolitan Municipality, South Africa

> Start Date: 2009

> Client: Witfontein Ext. 28 (Pty) Ltd

Environmental Impact Assessment and Environmental Management Plan for the proposed township development in Glen Erasmia Ext in the Ekurhuleni Metropolitan Municipality

Position: Project Principal

- Assigned Tasks: Quality controller and final reviewer

Environmental Impact Assessment (EIA) for the Rehabilitation of National Route 8 Section 12 between Tweespruit and Ladybrand, Free State

Start Date: 2008

Client: PD Naidoo and Associates

Compile Environmental Scoping, Impact Assessment and Management Programme Reports required in support of obtaining an environmental authorisation for the Road Rehabilitation

Position: Project Manager

- Assigned Tasks: Responsible for Project Management, which included regular liaison with the Client and the environmental authorities, and an on-going review of progress of all aspects of the project. Overall quality control.

Environmental Impact Assessment (EIA) and Waste Management License (WML) for the Underground Coal Gasification Project and associated infrastructure in support of co-firing of gas at the Majuba Power Station, Mpumalanga, South Africa, South Africa

> Start Date: 2008

> Client: Eskom Holdings SOC Ltd

Undertaking the Environmental Impact Assessment process for (EIA, Waste Management License, Water Use License, Rectification process), for the Underground Coal Gasification (UCG) project for Eskom Holdings

Position: Project Principal

- Assigned Tasks: Strategic input into the project, quality control and peer review.

Environmental Impact Assessment (EIA) for the Tarlton to Magalies 132 kv line, South Africa

> Start Date: 2008

> Client: Eskom Holdings SOC Ltd

Construction of a new 132KV distribution line from Tarlton Substation to Magalies Substation and new double circuit 132KV line from Magalies to Springfarms Substation

Position: Project Manager, Project Principal

- Assigned Tasks: Responsible for Project Management, which included regular liaison with the Client and the environmental authorities, and an on-going review of progress of all aspects of the project. Overall Project quality control.
- Lead EAP and final reviewer

Environmental Impact Assessment (EIA) for the Transnet New Multi Products Pipeline (NMPP) Inland lines in Gauteng & Mpumalanga provinces, South Africa

> Start Date: 2008

> Client: Transnet Pipelines

Construction of a new 165km pipeline as part of the Northern Routes (Inland Lines) components of the NMPP project.

Position: Project Manager

- Assigned Tasks: Overall project management and quality control.

Capacity Building Sessions to Bridge the gap between the Environmental Management, Development Planning & Urban Management Departments, South Africa

> Start Date: 2008

> Client: City of Johannesburg

Capacity Building Sessions to bridge the gap between the Environmental Management, and Development Planning & Urban Management

Position: Specialist

- Assigned Tasks: Specialist Studies undertaken required for Environmental Impact Assessment (EIA) processes

Environmental Impact Assessment (EIA) for the Jupiter to Sebenza 400kV line, South Africa

> Start Date: 2008

> Client: Eskom Holdings SOC Ltd

Construction of a new 400KV transmission line from Jupiter to Sebenza Substations and associated 400kV link lines, Gauteng

Position: Project Principal

- Assigned Tasks: Lead EAP, quality controller and final reviewer

Appendix E: Public Participation Report

REPORT

BASIC ASSESSMENT PROCESSES FOR EIGHT NEW PHOTOVOLTAIC (PV) PLANTS AS WELL AS INCREASE IN CAPACITY AND ADDITION OF BATTERY ENERGY STORAGE SYSTEMS (BESS) FOR TWO PREVIOUSLY AUTHORISED PV PLANTS ON THE NORTH-EASTERN PORTION OF THE REMAINING EXTENT (RE) OF THE FARM BOKPOORT 390, GROBLERSHOOP WITHIN THE !KHEIS LOCAL MUNICIPALITY

Public Participation Summary Report

Client: ACWA Power Energy Africa Pty (Ltd)

Reference: MD4195-RHD-ZZ-XX-RP-YE-0001
Status: P0.01/S0
Date: 27 February 2020

Royal HaskoningDHV
Enhancing Society Together

ROYAL HASKONINGDHV (PTY) LTD

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Document title:	BASIC ASSESSMENT PROCESSES FOR EIGHT NEW PHOTOVOLTAIC (PV) PLANTS AS WELL AS INCREASE IN CAPACITY AND ADDITION OF BATTERY ENERGY STORAGE SYSTEMS (BESS) FOR TWO PREVIOUSLY AU FARM BOKPOORT 390, GROBLERSHOOP WITHIN THE !KHEIS LOCAL MUNICIPALITY THORISED PV PLANTS ON THE NORTH-EASTERN PORTION OF THE REMAINING EXTENT (RE) OF THE
Document short title:	
Reference:	MD4195-RHD-ZZ-XX-RP-YE-0001
Status:	P0.01/S0
Date:	27 February 2020
Project name:	PV Plant Developments
Project number:	MD4195
Author(s):	Seshni Govender

Drafted by:	Seshni Govender
Checked by:	Prashika Reddy
Date / initials:	02.03.2020 P.R
Approved by:	Prashika Reddy
Date / initials:	02.03.2020 P.R

Classification
Project related

MANAGEMENT SYSTEM CERTIFICATION DNV·GL ISO 9001 = ISO 14001 ISO 45001

Disclaimer

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Appendices

1 Introduction

1.1 Background

ACWA Power Energy Africa (Pty) Ltd (hereafter referred to as ACWA Power) is proposing to construct a solar energy facility consisting of ten (10) photovoltaic (PV) plants on the north-eastern portion of the Remaining Extent (RE) of the Farm Bokpoort 390, located 20 km north-west of the town of Groblershoop within the !Kheis Local Municipality in the ZF Mgcawu District Municipality, Northern Cape Province.

On 21 October 2016, a 150 MW Concentrating Solar Power (CSP) plant on 900 ha, was authorised by the Department of Environmental Affairs (DEA) – *Ref 14/12/16/3/3/2/879*. Due to the changes in the Integrated Resource Plan (IRP) published in October 2019, ACWA Power intend replacing the authorised CSP site with eight (8) new PV plants. The updated layout has been revised to incorporate the 8 new PV plants of 200 MW each, covering a total of 1200 ha (i.e. 150 ha for each plant).

Individual applications for Environmental Authorisation will be lodged per plant (8 applications), however, one Basic Assessment (BA) study is applicable to the entire development footprint for the 8 individual plants.

Two (2) 75 MW PV plants including ancillary infrastructure (*Ref 14/12/16/3/3/2/880* and *14/12/16/3/3/2/881*), were also authorised by the DEA on 24 October 2016. The intention to replace the CSP with 8 PV plants will result in development footprint changes of the overall project. As such PV 1 (Ndebele) and PV 2 (Xhosa) plants will undergo a non-substantive amendment to better cater for the overall project development and ancillary infrastructure. The substantive amendment will include:

- Name changes – PV 1 and PV 2 to *Ndebele* and *Xhosa* respectively;
- Updated co-ordinates of each PV plant; and
- Updated technical description.

A second Basic Assessment study is being undertaken to accommodate the following on the already authorised Xhosa and Ndebele PV Plants:

1. The Battery Energy Storage System (BESS) that will be associated with the Ndebele PV Plant (formerly PV 1) and the Xhosa PV Plant (formerly PV2). This activity was applied for in the original environmental process but was not approved due to lack of information with regards to the type of technology to be used. The BESS footprint is approximately 16ha and will store 4500m^3 of hazardous substances with a battery power capacity of 150MW.
2. The electricity generation capacity of the PV 1 & 2 Plants will be 200 MW [75 MW was originally approved in the EAs dated 24/10/2016 (Ref: 14/12/16/3/3/2/881 & Ref 14/12/16/3/3/2/880). It was confirmed in the IQ/20/0004 correspondence from the Department of Environment, Forestry and Fisheries (DEFF) that the electricity generation of more than 20MW from a Renewable Resource listed activity is now triggered and must be applied for due to the increase in capacity].

In order to avoid stakeholder fatigue, the public participation process will be combined for both processes.

1.2 Public Participation Process

Public Participation (PP) is a process that is designed to enable all interested and affected parties (I&APs) to voice their opinion and/or concerns which enables the practitioner to evaluate all aspects of the proposed development, with the objective of improving the project by maximising its benefits while minimising its adverse effects.

The PP Process must adhere to the requirements of Regulations 41 and 42 (GNR 982) as amended in 2017. Further, a PP guideline in terms of NEMA was issued by the Department of Environment, Forestry and Fisheries (DEFF) in 2017, of which provisions will also be implemented.

The PP Process for proposed project will be undertaken according to the stages outlined below as well as the requirements for the stakeholders.

cBAR PHASE

- Raise issues of concern
- Make suggestions for project development
- Contribute relevant local and indigenous knowledge to the environmental assessment
- Comment on the findings of the study and the rating of the impacts

DECISION MAKING PHASE

- Provide any comments on the final BAR directly to DEFF
- May appeal the decision

Figure 1-1: Responsibilities of I&APs

1.3 Purpose of the Report

The key purpose of this PP Summary Report is to:

- Summarise the PP Process undertaken for the BA study;
- Highlight what has been done to date;
- Synthesise the issues and concerns identified by I&APs and various stakeholders during the PP Process; and
- Synthesise comments on the proposed development.

1.4 Terms of Reference for Public Participation

The terms of reference for the implementation of a successful and robust PP Process, were as follows:

- Identification of I&APs in the vicinity of the study area;
- Provision to all I&APs of an opportunity to comment or raise concerns regarding the project;
- Maintenance of procedures for communication with I&APs and receiving, documenting and responding to relevant communication from I&APs;
- Identification and elimination of any sources of misunderstandings between the Applicant, EAP and the I&APs;
- Always aim to improve the communication between the Applicant, EAP and I&APs;
- Present the project in an objective way by supplying all appropriate, relevant and accurate information and facts in an unbiased manner to ensure a better understanding of the proposed project; and
- Ensure that the PP Process is an independent and transparent process.

1.5 Public Participation Summary

The PP Process commenced in November 2019 where comment forms and Background Information Documents (BID) were distributed to the I&APs and Councillors as well as commenting authorities. I&APs were introduced to the project and encouraged to register on the database.

Site notices were erected at strategic locations around the study area, which was also erected in November 2019.

An advertisement will be placed in the Volksblad Newspaper on the 04 – 06 March 2020 followed by a commenting period which will provide an opportunity for the I&APs to raise their issues and concerns regarding the proposed activity.

A draft Consultation Basic Assessment Report (cBAR) was compiled and has been distributed to the relevant authorities and to the public for review, for a 30-day comment period (06 March 2020 to 06 April 2020) in which I&APs are afforded the opportunity to raise any further issues and concerns, until the finalisation of the document for submission to the DEFF.

2 Identification of I&APs

The first step in the PP Process entailed the identification of key I&APs and Stakeholders, including:

- Local and provincial government;
- Affected and neighbouring landowners; and
- General I&APs.

An I&AP database (**Appendix A**) and Proof of notification (**Appendix B**) has been compiled which has been maintained and updated throughout the duration of the BA study thus far.

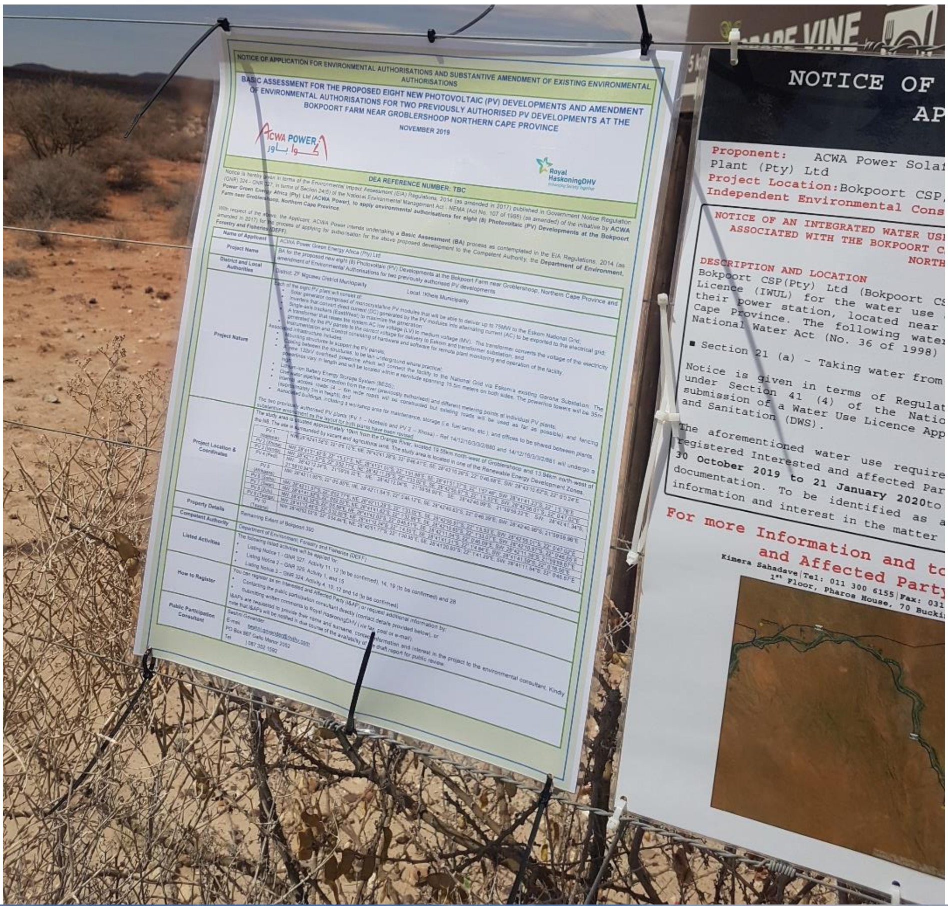
3 Site Notices

The NEMA EIA Regulations (2014 as amended in 2017) require that a site notice be fixed at a place conspicuous to the public at the boundary or on the fence of the site where the activity to which the application relates is to be undertaken and on any alternative sites. The purpose of this is to notify the public of the project and to invite the public to register as stakeholders and inform them of the PP Process. Royal HaskoningDHV erected site notices at various noticeable locations around the perimeter of the site and at strategic locations on or near the site (entrance to the Bokpoort 1 Solar Facility, !Kheis Municipality, intersection of the N8 and Gariep Road, intersection of Gariep Road and N10 link Road and Intersection of Gariep Road and Transnet Road).

3.1 Proof of Placement of Site Notices

Figure 3-1: Site notices placed along the Bokpoort 1 Solar Facility entrance

Figure 3-2: Site notice placed at the !Kheis Local Municipality


NOTICE OF APPLICATION FOR ENVIRONMENTAL AUTHORISATIONS AND SUBSTANTIVE AMENDMENT OF EXISTING ENVIRONMENTAL AUTHORISATIONS
BASIC ASSESSMENT FOR THE PROPOSED EIGHT NEW PHOTOVOLTAIC (PV) DEVELOPMENTS AND AMENDMENT OF ENVIRONMENTAL AUTHORISATIONS FOR TWO PREVIOUSLY AUTHORISED PV DEVELOPMENTS AT THE BOKPOORT FARM NEAR GROBLERSHOOP NORTHERN CAPE PROVINCE
NOVEMBER 2019
ACWA POWER
Royal HaskoningDHV
DEA REFERENCE NUMBER: TBC
NOTICE OF
Proponent: ACWA Power Solar
Plant (Pty) Ltd
Project Location: Bokpoort CSP
Independent Environmental Cons
NOTICE OF AN INTEGRATED WATER USE
ASSOCIATED WITH THE BOKPOORT C
DESCRIPTION AND LOCATION
Bokpoort CSP(Pty) Ltd (Bokpoort CS
Licence (IWUL) for the water use
their power station, located near
Cape Province. The following water
National Water Act (No. 36 of 1998)
Section 21 (a) - Taking water from
Notice is given in terms of Regulat
under Section 41 (4) of the Natio
submission of a Water Use Licence App
and Sanitation (DWS).
The aforementioned water use require
registered Interested and affected Par
30 October 2019 to 21 January 2020 to
documentation. To be identified as a
information and interest in the matter
For more Information and to
and Affected Party


K·H·E·I·S
Tel: 082 490 1321
GRAPE VINE
NOTICE OF WATER USE LICENCE APPLICATION

Figure 3-3: Site notice at the intersection of the N8 and Gariep Road

Figure 3-4: Site notice placed at the intersection between the Gariep Road and the N10 Link Road

Figure 3-5: Site notice placed at the intersection between the Gariep Road and the Transnet Road

4 Background Information Document

A briefing paper or BID (**Appendix C**) for the project was compiled in English and Afrikaans. The aim of this document is to provide a brief outline of the application and the nature of the development. It is also aimed at providing preliminary details regarding the BA study and explains how I&APs could become involved in the project. The briefing paper was distributed to all identified I&APs and stakeholders, together with a registration/comment sheet inviting I&APs to submit details of any issues, concerns or inputs they might have with regards to the project.

5 Public Meeting

A Public Meeting will be held on 26 March 2020. Minutes of the meeting will form part of the final cBAR.

6 Advertisement

In compliance with the EIA Regulations (2014 as amended in 2017), notification of the commencement of the BA study for the project will be advertised in a one local newspaper, the Volksblad Newspaper on 04 March 2020 in English (**Appendix D**). I&APs are requested to register their interest in the project and become involved in the BA study. The primary aim of this advertisement is to ensure that the widest group of I&APs possible was informed and invited to provide input and questions and comments on the project. I&APs were also notified of the availability of the draft cBAR for public review.

7 Public Review of the Draft Consultation BAR

The draft cBAR is being made available for authority and public review for 30 days from 06 March to 06 April 2020. The report will be made available at the following public locations within the study area, which are all readily accessible to I&APs:

- !Kheis Municipality Public Library;
- !Kheis Municipal Offices; and
- Royal HaskoningDHV Website: https://www.royalhaskoningdhv.com/en/south-africa/projects/environmental-reports

8 Issues Trail

Issues and concerns raised to date on the project has been compiled into an Issues Trail (**Appendix E**).

9 Environmental Authorisation

On receipt of environmental authorisation (positive or negative) for the project, I&APs registered on the project database will be informed of this authorisation and its associated terms and conditions by correspondence and advertisement.

Appendix A: I&AP Database

Title	Salutation	Surname	Organisation
Mr	Jakobus	Blom	!Kheis Local Municipality
Mr	Angelo	Daniels	!Kheis Local Municipality
Mr	Edward	de Klerk	!Kheis Local Municipality
Mr	Andries	Diergaardt	!Kheis Local Municipality
Mr	D	Dolopi	!Kheis Local Municipality
Ms	Sarina	Jansen	!Kheis Local Municipality
Ms	Lizzy	Job	!Kheis Local Municipality
Mr	J	Joseph	!Kheis Local Municipality
Ms	Matilda	Mathupi	!Kheis Local Municipality
Ms	Teresa	Scheepers	!Kheis Local Municipality
Mr	Stephanus	van Eck	!Kheis Local Municipality
Cllr	Paul	Vries	!Kheis Local Municipality
Mr	Ockert	Bouwer	!Kheis Riverside Lodge
Mr	Nandu	Bhula	ACWA Power
Mr	Lusani	Rathanya	ACWA Power Africa Holdings
Mr	Mike	Nlengana	African Farmers Association of South Africa (AFASA)
Mr	Henning	Myburgh	Agri Northern Cape
Mr	Nicol	Jansen	Agri SA-Northern Cape
Mr	Johan	Mouton	Agrimark
Mr	Peter	Marais	Air Traffic and Navigation Services (ATNS)
Mr	Hennie	Marais	Air Traffic and Navigation Services (ATNS)
Mr	J	Stander	Airports Company of South Africa
Ms	Nongo	Dibede	Airports Company of South Africa - Upington Airport
Ms	Helena	Buys	Alstop Supermarket
Mr	Michael	Cheesian	AngloAmerican
Ms	Ansie	Nel	Arrie se Put Guest House
Ms	Simphiwe	Masilela	ATNS
Ms	Samantha	Ralston-Paton	Birdlife South Africa
Mr	Andre	Kruger	Boegoeberg Water Association
Mr	Jean	Lombard	Boegoeberg Water Use Association
Mr	Fanie	Marais	Boegoeberg Water Use Association
Mr	Peter	Kotze	Boegoeberg Water Users Association
Mr	Hanno	Blom	Boegoebergdam Resort
Ms	**Vered**	**Karty**	**BrightSource Energy**
Mr	Francois	Slabber	Crescendo Trust
Mr	Jacques	Slabber	Crescendo Trust
Mr	O	Gaorelwe	Department Environment and Nature Conservation
Ms	Erna	Groeners	Department Environment and Nature Conservation
Mr	Norman	Shushu	Department of Agriculture, Land Reform and Rural Development
Mr	Norman	Shushu	Department of Agriculture, Land Reform and Rural Development
Mr	Christo	Smit	Department of Agriculture, Land Reform and Rural Development
Ms	Tshidi	Nchabeleng	Department of Communications
Mr	Andre	Phete	Department of Cooperative Governance Human Settlement and Traditional Affairs
Ms	I	Mogodi	Department of Co-operative Governance, Human Settlement and Traditional Affairs
Ms	Cynthia	Ferrys	Department of Education
Ms	Ndumie	Madlongilwana	Department of Education
Mr		Madlongolwana	Department of Education
Mr	Johannes	Nowalaza	Department of Education
Ms	Lerato	April	Department of Energy
Ms	Vania	Mahotas	Department of Energy
Ms	Martha	Molokwane	Department of Environment and Nature Conservation
Mr	Herman	Alberts	Department of Environmental Affairs
Mr	Muhammed	Essop	Department of Environmental Affairs
Ms	Senisha	Murugan	Department of Environmental Affairs
Ms	Mmatlala	Rabothata	Department of Environmental Affairs
Mr	Coenrad	Agenbach	Department of Environmental Affairs (DEA)
Ms	Dineo	Moleko	Department of Environmental Affairs (DEA)
Ms	Millicent	Solomons	Department of Environmental Affairs (DEA)
Mr	Seoka	Lekota	Department of Environmental Affairs:
Mr	**Simphiwe**	**Makhatini**	**Department of Public Enterprises**
Ms	Ruth	Palm	Department of Roads and Public Works
Mrs	Alet	Pienaar	Department of Social Development
Mr	Julian	WilliaMs	Department of Social Development
Mr	Mervin	October	Department of Social Services and Population Development
Mr	Luke	Solomon	Department of Social Services and Population Development

Mr	Melvyn	Smith	Department of Sport, Arts and Culture
Ms	Norma	Sali	Department of Trade and Industry (DTI)
Mr	J	Jonkens	Department of Transport, Safety and Liaison
	MC	Cebekhulu	Department of Water and Sanitation
Mr	Steven	Shibambu	Department of Water and Sanitation
Mr	Sean	Cloete	Department of Water and Sanitation (DWS)
Mr	L	Snyders	Department of Water and Sanitation (DWS)
Ms	Joline	Towell	Department of Water and Sanitation (DWS)
Mrs	Kgaphola	Mashudu	Department of Water and Sanitation (DWS): Area Office
Mr	Emmanuel	Thebe	Department of Water and Sanitation Area Office
Mr	Nico	Fourie	Department Roads and Public Works
Ms	Thoko	Buthelezi	Dept of Agricultur, Forrestry and Fisheries
Mr	Dirk	Nortje	DJN Boerdery Pty Ltd
Mr	A	Abrahams	DWS
Ms	Bridget	Mohlala	Economic Development Department
Dr	K	Sikhitha	Economic Development Department
Mr	Pieter	Struwig	Eskom
Ms	Adila	Marengo	Eskom - Renewable Energy Independent Power
Mr	Ronnie	Snyman	Eskom Holdings Ltd
Ms	Justine	Wyngaardt	Eskom Holdings SOC Limited - Land Development
Mr	John	Geeringh	Eskom Transmission
Mr	Raymond	Brown	Farmer
Mr	Pieter	de Witt	Farmer
Mr	Pieter	du Plessis	Farmer
Mr	Marthinus	Du Preez	Farmer
Mr	Stephanus	Els	Farmer
Mr	Wilco	Fourie	Farmer
Mr	Gary	Gerber	Farmer
Mr	Frank	Groenewald	Farmer
Mrs	Elizabeth	Jordaan	Farmer
Mr	Peter	Kotze	Farmer
Mr	Barend	Louw	Farmer
Mr	Jan	Reitz	Farmer
Mr	Theunis	Strauss	Farmer
Mrs	Susan	Van der Merwe	Farmer
Mr	Johannes	van Jaarsveldt	Farmer
Mr	Cornelius	Van Niekerk	Farmer
Mr	Piet	van Schalkwyk	Farmer
Mr	Pieter	van Zyl	Farmer
Mr	Stephan	van Zyl	Farmer
Mr	Willem	Strauss	Game Farm
Mr	Louis	Kotze	Gariep Farmers Union
Mr	Lucias	Moolman	General Manager: Northern Cape Parks
Mr	Hendrik	Maritz	Glen Lyon Farms
Dr	D	de Waal	Golder
Mrs	Mariette	Weiderman	Golder Associates Africa
Ms	Catrin	de Beer	Green Kalahari Tourism Office
Mr	H	Koopman	Groblershoop Community Health Centre
Mr	Chris	Honiball	Honiball Familie Trust
Mr	Mehmood	Ahmed	Industrial Development Corporation (IDC) - Northern Cape
Mr	Jannie	van Zyl	Jakkalsdans Farm
Mr	A	Goussard	JCG Water Treatment
Mr	J	Esterhuysen	JH Esterhuysen Familie Trust
Mr	Dirk	Malan	Kalahari Water
Mr	Charl	April	Khara Hais Local Municipality
Mr	Hennie	Auret	Khara Hais Local Municipality
Mr	Thomas	Basson	Khara Hais Local Municipality
Mr	Gundlani	Bovu	Khara Hais Local Municipality
Cllr	Elizabeth	Cloete	Khara Hais Local Municipality
Mr	Conrad	Geldenhuys	Khara Hais Local Municipality
Mr	Ivan	Juries	Khara Hais Local Municipality
Ms	Dimakatso	Koloi	Khara Hais Local Municipality
Mr	Klassie	Makatong	Khara Hais Local Municipality
Mr	Vernon	Mfusi	Khara Hais Local Municipality
Mr	Daloxolo	Ngxinga	Khara Hais Local Municipality
Mr	Jeremy	Plessis	Khara Hais Local Municipality
Mr	Ferdie	van Wyk	Khara Hais Local Municipality
Ms	Vanessa	van Wyk	Khara Hais Local Municipality

Mr	Johannes	Kotze	Kleinbegin Plase Trust
Mr	Johannes	Kotze	Kleinbegin Plase Trust
Mr	Albert	van Niekerk	Klipkoppies Farm
Mr	Kobus	Buys	LAW Abattoir
Mr	Abraham	Morkel	Louwvale-Weg Opkomende Boere Vereniging
Mr	Deon	van Zyl	Lutz & Van Zyl Land Surveyors
Mr	Jan	van Zyl	Lutz & Van Zyl Land Surveyors
Mr	Jason	Schaffer	Nano Energy
Mr	Lazarus	Mahlangu	National Department of Energy
Ms	**Vania**	**Mohotas**	**National Department of Energy**
Mr	Maduna	Ngobeni	National Department of Energy
Dr	Andile	Gxasheka	National Energy Regulator of South Africa (NERSA)
Ms	Omkarabetfe	Mothelefi	Northern Cape Department of Arts and Culture
Mr	Hendrik	Louw	Northern Cape Department of Development and Tourism
Mr	Itumeleng	Bulani	Northern Cape Department Roads & Public Works
Mr	Tiny	Chotelo	Northern Cape Provincial Government
Ms	Mora	Maraaia-Martin	Northern Cape Provincial Government
Ms	Maryke	van der Merwe	Opwag Groblershoop Pty Ltd
Mr	Gawie	Brand	Orange River Farmers Association
Mr	Willem	Fourie	Orange River Farmers Association
Ms	Melanie	Theron	Orange River Farmers Association
Mr	Japie	Engelbrecht	Orange River Farmers Union: Agri SA
Mr	Herman	Craywagen	Orange River Wine Cellars
Mr	Hoffie	Joubert	Oranje Cooperative Limited
Ms	Lizelle	Beukes	Oranje Vaal Water Use Association
Mr	Willie	Bruwer	Oranje Vaal Water Use Association
Mr	Johan	Maritz	Oryx Management Services Pty Ltd
Mrs	Poppie	Howell	Private
Ms	Gloria	Klaas	Private
Mr	Jannie	Kuhn	Private
Mr	W	van Eck	Private
Mr	Ampie	Vlok	Private
Mr	Sampie	de Beer	Sampie de Beer Familie Trust
Mr.	Wilco	Fourie	Sanddraai Arbeidsgenot Pty Ltd
Ms	Nicolle	Abrahams	Sanral
Mr	Johan	Maritz	Schonegevel Holdings Pty Ltd
Mr	Naas	Breytenbach	Sentech Limited
Mr.	Johannes	Fourie	Shalom Boerdery Pty Ltd
Dr	Adrian	Tiplady	SKA South Africa
Ms	Annetjie	Plessis	SKA South Africa - Carnavon Office Northern Cape
Mr	Pieter	Snyman	SKA South Africa Northern Cape
Mr	Dieter	Holm	Solar Energy Society of SA (SESSA)
Mr	Zola	Ndimande	Solarzone (Pty) Ltd
Mr	Andre	Smith	Sotrou Vervaardigers CC
Mr	Koos	Pretorius	South African Civil Aviation Authority (SACAA)
Mrs	Lizell	Stroh	South African Civil Aviation Authority (SACAA)
Mr	Maloeiemang	Manong	South African Heritage Resource Agency (SAHRA)
Mr	Andrew	Timothy	South African Heritage Resource Agency (SAHRA)
Mr	Steven	Smith	South African National Parks (SANPARKS)
Ms	Rene	de Kock	South African National Roads Agency (SANRAL)
Ms	Christa	Mouton	South African National Roads Agency Limited
Dr	Adrian	Tiplady	Square Kilometre Array (SKA)
Mr	Andy	Louw	Standard Bank
Mr	Shaun	Johnson	Sustainable Futures ZA
Ms	Marina	Lourens	Transnet Freight Rail
Mr	Gilbert	Nortier	Transnet Freight Rail
Mr	Norman	Papenfus	Transnet Ltd - Landowner
Ms	Melissa	September	Trausere
Mr	Martin	Compion	Tripple T Consulting Of South Africa Pty Ltd
Ms	Suzanne	Erasmus	Wildlife and Environment Society of South Africa
Mr	Robert	Hasty	Wildlife and Environment Society of South Africa
Mr	Andre	Smith	Willie Smith & Seuns Boerdery CC
Mr	David	Khakhane	Witsand Nature Reserve
Mr	Hannes	Combrinck	ZF Mcgawu Disctrict Municipality
Mr	Frikkie	Rupping	ZF Mcgawu District Municipality
Mr	G	Cloete	ZF Mgcawu District Municipality
Mr	Zelna	Mjila	ZF Mgcawu District Municipality
Mr	Elias	Ntoba	ZF Mgcawu District Municipality
Ms	Denise	Rapatsa	ZF Mgcawu District Municipality

Mr	Alfred	Tieties	ZF Mgcawu District Municipality
Mr	Gift	van Staden	ZF Mgcawu District Municipality
Mr	Kobus	van Zyl	ZF Mgcawu District Municipality
Mr	Frikkie	Rupping	ZF MGCAWU Distrik Municipality
Mr	P	Kotze	ZF Mgcawu Local Municipality
Miss	Mashudu	Marubini	
Ms	Anga	Yaphi	
Mrs	Marie	Schlechter	Golder Associates

Appendix B: Proof of Notification

Seshni Govender

From:	Seshni Govender
Sent:	Tuesday, November 26, 2019 10:51 AM
Cc:	Malcolm Roods; Prashika Reddy
Subject:	Public Participation for the Proposed 8 new PV developments and amendments of 2 EAs for previously authorised PV developments, Bokpoort near Groblershoop, Northern Cape Province
Attachments:	MD4195-RHD-ZZ-XX-SE-YE_BID_F02 Afr.pdf; MD4195-RHD-ZZ-XX-SE-YE_BID_F02 Eng.pdf
Importance:	High

Tracking:

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Royal HaskoningDHV
Enhancing Society Together

Dear Interested and Affected Party

Notice is hereby given in terms of the Environmental Impact Assessment (EIA) Regulations, 2014 (as amended in 2017) published in Government Notice Regulation (GNR) 324 - GNR 327, in terms of Section 24(5) of the National Environmental Management Act - NEMA (Act No. 107 of 1998) (as amended) of the initiative by ACWA Power Green Energy Africa (Pty) Ltd (ACWA Power) for the Proposed Eight new

Photovoltaic (PV) developments and amendment of Environmental Authorisations (EA) for two previously authorised PV developments at the Bokpoort farm near Groblershoop, Northern Cape Province.

With respect of the above, the Applicant, ACWA Power intends undertaking a Basic Assessment (BA) process as contemplated in the EIA Regulations, 2014 (as amended in 2017) as well as a Substantive Amendment process for the purposes of applying for authorisations for the above proposed development to the Competent Authority, the Department of Environment, Forestry and Fisheries (DEFF, then Department of Environmental Affairs).

Royal HaskoningDHV Pty Ltd (Royal HaskoningDHV) has been appointed by ACWA Power as an Independent EAP to undertake the BA, WUA and Public Participation Process (PPP) for the proposed project. The PPP entails informing the local authorities, Interested and Affected Parties (I&APs), key stakeholders and landowners about the proposed project. A Background Information Document (BID), including a comment and registration form and a locality map is attached for your information.

Royal HaskoningDHV would like to thank you in advance, for taking part in the PPP and is looking forward to receiving your valuable comments relating to the proposed project.

Regards

Seshni Govender
Environmental Consultant

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Classification:	Project related		

Dear Interested and Affected Party

BASIC ASSESSMENT PROCESSES FOR EIGHT NEW PHOTOVOLTAIC (PV) PLANTS AS WELL AS INCREASE IN CAPACITY AND ADDITION OF BATTERY ENERGY STORAGE SYSTEMS (BESS) FOR TWO PREVIOUSLY AUTHORISED PV PLANTS ON THE NORTH-EASTERN PORTION OF THE REMAINING EXTENT (RE) OF THE FARM BOKPOORT 390, GROBLERSHOOP WITHIN THE !KHEIS LOCAL MUNICIPALITY

ACWA Power Energy Africa (Pty) Ltd (hereafter referred to as ACWA Power) is proposing to construct a solar energy facility consisting of ten (10) photovoltaic (PV) plants on the north-eastern portion of the Remaining Extent (RE) of the Farm Bokpoort 390, located 20 km north-west of the town of Groblershoop within the !Kheis Local Municipality in the ZF Mgcawu District Municipality, Northern Cape Province.

On 21 October 2016, a 150MW Concentrated Solar Power (CSP) plant on 900ha was authorised by the Department of Environment, Forestry and Fisheries – DEFF (then Department of Environmental Affairs) – Ref 14/12/16/3/3/2/879. Due to the changes in the Integrated Resource Plan published in October 2019, ACWA Power intend replacing the authorised CSP site with 8 new PV plants. The updated layout has been revised to incorporate the 8 new PV plants of 200MW each, covering a total of 1200ha (i.e. 150ha for each plant) on Remaining Extent of the Farm Bokpoort 390. As the PV 1 and PV 2 plants are also approved on the Farm Bokpoort 390, the footprints of these approved PV plants will undergo an amendment to accommodate the 8 new PV plants and ancillary infrastructure (see below for more detail).

Each of the PV plants will consist of the following infrastructure:

- Solar PV panel 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 to medium voltage. The transformer converts the voltage of the electricity generated by the PV panels to the correct voltage for delivery to Eskom;
- Transformer substation; and
- Instrumentation and Control consisting of hardware and software for remote plant monitoring and operation of the facility.

Associated infrastructure includes:

- Mounting structures for the solar panels;
- Cabling between the structures, to be lain underground where practical;
- A new 132 kV overhead powerline (servitude spanning 15.5 m on both sides with towers that will be 35 m high) which will connect the facility to the National Grid via Eskom's existing Garona Substation;
- Battery Energy Storage System (BESS);
- Internal access roads (4 – 6 m wide roads will be constructed but existing roads will be used as far as possible) and fencing (approximately 3 m in height); and
- Shared infrastructure consisting of buildings, including a workshop area for maintenance, storage (i.e. fuel tanks, etc.), laydown area, parking, warehouse, and offices (previously approved).

Individual applications for Environmental Authorisation will be lodged per plant (8 applications), however, one Basic Assessment (BA) study is applicable to the entire development footprint for the 8 individual plants.

Two (2) 75MW PV plants including ancillary infrastructure [Ref 14/12/16/3/3/2/880 (PV2) and 14/12/16/3/3/2/881 (PV1)], were also authorised by the DEFF on 24 October 2016. The two aforementioned PV plants will undergo a Non-substantive Amendment process with the following key amendments:

- Name changes – PV 1 and PV 2 to *Ndebele* and *Xhosa* respectively;
- Updated co-ordinates of each PV plant;
- Reduction in development footprint from 250ha to 150ha; and
- Updated technical description.

A second Basic Assessment study is being undertaken to accommodate the following on the already authorised Xhosa and Ndebele PV Plants:

1. The BESS that will be associated with the Ndebele PV Plant (formerly PV 1) and the Xhosa PV Plant (formerly PV2). This activity was applied for in the original environmental process but was not approved due to lack of information with regards to the type of technology to be used. Each BESS footprint is approximately 16ha and will store 4500m^3 of hazardous substances with a battery power capacity of 150MW.
2. The electricity generation capacity of the PV 1 & 2 Plants will be 200 MW [75 MW was originally approved in the EAs dated 24/10/2016 (Ref: 14/12/16/3/3/2/881 & Ref 14/12/16/3/3/2/880). It was confirmed in the IQ/20/0004 correspondence from DEFF that the electricity generation of more than 20MW from a renewable resource listed activity is now triggered and must be applied for due to the increase in capacity].

With respect of the above, the applicant, ACWA Power is therefore undertaking two Basic Assessment studies and a non-substantive amendment process as contemplated in the EIA Regulations 2014 (as amended in 2017) for the process of applying for authorisations for the above proposed developments to the Competent Authority i.e. DEFF.

The draft cBAR is now available for review and comment from 06 March – 06 April 2020. Please can we have comments on or before 06th April 2020.

The report is available electronically on the following link:
https://www.royalhaskoningdhv.com/en/south-africa/projects/environmental-reports

Regards
Seshni Govender
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Appendix C: BID Document

BASIC ASSESSMENT FOR THE PROPOSED EIGHT NEW PHOTOVOLTAIC (PV) DEVELOPMENTS AND AMENDMENT OF ENVIRONMENTAL AUTHORISATIONS FOR TWO PREVIOUSLY AUTHORISED PV DEVELOPMENTS AT THE BOKPOORT FARM NEAR GROBLERSHOOP, NORTHERN CAPE PROVINCE

BACKGROUND INFORMATION DOCUMENT

(NOVEMBER 2019)

DEFF REF (8 NEW PVs): ***TBC***

DEFF REF (2 PV EA AMENDMENTS): 14/12/16/3/3/2/880 & 14/12/16/3/3/2/881

WHAT DOES THIS DOCUMENT TELL YOU?

This document aims to inform you as an Interested and Affected Party (I&AP), with background information regarding the development of eight (8) Photovoltaic (PV) plants at the Bokpoort Farm near Groblershoop, Northern Cape Province. being undertaken by ACWA Power Green Energy Africa (Pty) Ltd (ACWA Power).

The document also provides information regarding the Basic Assessment (BA) and Substantive Amendment processes to be undertaken. The document advises you on how you can become involved in the project – by reviewing information, and making inputs thereon, including raising any possible issues and concerns. This sharing of information forms the basis of the Public Participation Process (PPP) and offers you the opportunity to become actively involved in the project from the outset.

PROPERTY DESCRIPTON

The proposed project area is located on the north-eastern portion of the Farm Bokpoort 390 Remaining Extent (Landowner: ACWA Power Solafrica Bokpoort CSP Power Plant Pty Ltd) 20km north-west of the town of Groblershoop within the !Kheis Local Municipality in the ZF Mgcawu District Municipality, Northern Cape Province. Refer to the Locality Map - Figure 2.

PROJECT DESCRIPTION

Eight New PV Plants:

On 21 October 2016, a 900ha, 150MW Concentrated Solar Power (CSP) plant was authorised by DEFF (then Department of Environmental Affairs) – Ref 14/12/16/3/3/2/879. Due to the changes in the Integrated Resource Plan published in October 2019, ACWA Power intend replacing the authorised CSP site with 8 new PV plants. The updated layout has been revised to incorporate the 8 new PV plants of 75MW each, covering a total of 1200ha (i.e. 150ha for each plant) on Remaining Extent of the Farm Bokpoort 390. As the PV 1 and PV 2 plants are also approved on the Farm Bokpoort 390, the footprints of these approved PV plants will undergo an amendment to accommodate the 8 new PV plants and ancillary infrastructure (see below for more detail).

Each of the PV plants will consist of the following infrastructure:

- Solar generator comprised of monocrystalline PV modules that will be able to deliver up to 75MW to the Eskom National Grid;
- Inverters that convert direct current generated by the PV modules into alternating current (AC) to be exported to the electrical grid;
- Single-axis trackers (East/West) to maximize the generation;
- 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 and transformer substation; and
- Instrumentation and Control consisting of hardware and software for remote plant monitoring and operation of the facility.

Associated infrastructure includes: mounting structures to support the PV panels; cabling between the structures, to be lain underground where practical; a new 132kV overhead powerline (servitude spanning 15.5m meters on both sides with towers that will be 35m high) which will connect the facility to the National Grid via Eskom's existing Garona Substation; lithium-ion battery energy storage system (BESS); One water pipeline connection from the river (*previously authorised*) and different metering points at individual PV plants; internal access roads (4 – 6m wide roads will be constructed but existing roads will be used as far as possible) and fencing (approximately 3m in height); associated buildings including a workshop area for maintenance, storage (i.e. fuel tanks, etc.) and offices to be shared between the plants.

The new PV plants will be identified by the following names: PV 3 - *Venda*, PV 4 - *Pedi*, PV 5 - *Afrikaans*, PV 6 - *Sotho*, PV 7 - *Swati*, PV 8 - *Zulu*, PV 9 - *Tsonga* and PV 10 – *Tswana*. Each new PV plant development will undergo its own application for authorisation and have its own reference number.

Figure 1: Lesedi Solar Park near Postmasburg in the Northern Cape. This solar park is an example of a PV Solar Power Plant[1]

Substantive Amendment of 2 previously authorised PV Plants:

Two 250ha 75MW PV plants including ancillary infrastructure (Ref 14/12/16/3/3/2/880 and 14/12/16/3/3/2/881), were also authorised by the DEFF on 24 October 2016. One of the conditions for the respective Environmental Authorisations was that a copy of the final development layout map must be made available for comments by registered I&APs and approved by the Department prior to the commencement of the activity. In addition to the final layout map, the two PV plants will undergo a Substantive Amendment process with the following key amendments:

- Name changes – PV 1 and PV 2 to *Ndebele* and *Xhosa* respectively;
- Updated co-ordinates of each PV plant;
- Assessment of the impacts related to the lithium-ion BESS – activity applied for but not authorised;
- Reduction in development footprint from 250ha to 150ha; and
- Updated technical description.

WHAT THE POTENTIAL ENVIRONMENTAL IMPACTS ASSOCIATED WITH THE PROPOSED PROJECT?

A number of potential environmental impacts associated with the project have been identified. Various specialist assessments have been conducted for the previous applications for EAs (CSP and PVs) including the Bokpoort I development and will be revised and updated based on the new layouts and technology i.e. PV instead of CSP.

Specialist Study (including update and review of previous assessments)	Organisation
Ecology	Bathusi Environmental Consultants
Freshwater	Scientific Aquatic Services
Surface- and Groundwater	GCS
Avifauna & Bats	Arcus Consulting Services
Wetlands	Royal HaskoningDHV
Soils and Agricultural Potential	Johann Lanz (private)
Heritage	Johnny van Schalkwyk (private)
Palaeontology	Natura Viva
Air Quality	WSP
Social	Royal HaskoningDHV
Traffic	Royal HaskoningDHV
Visual	Royal HaskoningDHV

[1] https://mybroadband.co.za/news/wp-content/uploads/2015/02/Lesedi.jpg

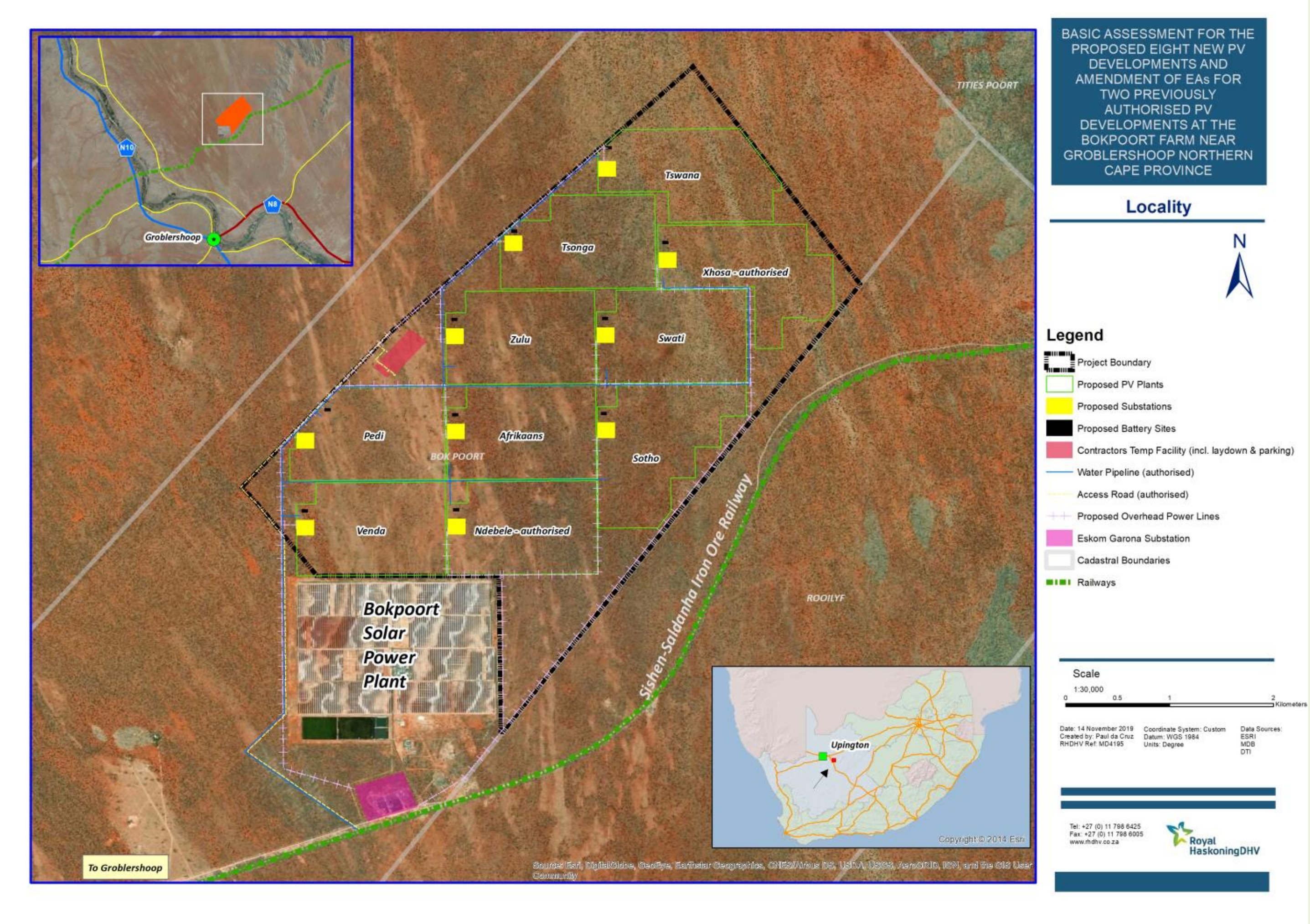


Figure 2: Locality map

WHY ARE ENVIRONMENTAL STUDIES NEEDED?

In terms of the Environmental Impact Assessment (EIA) Regulations Government Notice Regulation (GNR) 324 – 327, published in terms of Section 24(5), and read with Section 44, of the National Environmental Management Act (NEMA) (Act No. 107 of 1998), ACWA Power requires an Environmental Authorisation per PV plant from the DEFF for undertaking the proposed project as it includes activities listed under Listing Notices 1 - 3 of the EIA Regulations 2014 (as amended in 2017).

The following activities of Listing Notice 1, 2 and 3 are triggered:

Listing Notice	Activity Number	Description and Applicability
1 (GNR 327)	11	The development of facilities or infrastructure for the transmission and distribution of electricity outside urban areas or industrial complexes with a capacity of more than 33 but less than 275kV. *Applicable to the construction of the overhead 132kV powerline that will connect each of the PV plants to the National Grid via Eskom's existing Garona Substation.*
	12	The development of infrastructure or structures with a physical footprint of $100m^2$ or more; where such development occurs – within a watercourse or if no development setback exists, within 32m of a watercourse, measured from the edge of a watercourse. *To be confirmed by the wetland specialist assessment.*
	14	The development and related operation of facilities or infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of $80m^3$ or more but not exceeding $500m^3$. *Each PV plant will have its own lithium-ion BESS with a combined capacity not exceeding $500m^3$.*
	19	The infilling or depositing of any material of more than $10m^3$ into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than $10m^3$ from a watercourse. *To be confirmed by the wetland specialist assessment.*
	28	Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture on or after 01 April 1998 and where such development will occur outside an urban area, where the total land to be developed is bigger than 1ha. *The development of the solar facility will involve the development of 1200ha of agricultural land. The*

Listing Notice	Activity Number	Description and Applicability
		project site is located outside an urban area.
2 (GNR 325)	1	The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20MW or more. *The electricity generation capacity of each of the PV plants will be 75MW.*
	4	The development and related operation of facilities or infrastructure, for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of more than 500m^3. *Each PV plant will have its own lithium-ion BESS with a combined capacity exceeding 500m^3.*
	15	The clearance of an area of 20ha or more of indigenous vegetation. *The construction of the proposed PV plant will require the clearance of 150ha of indigenous vegetation per plant.*
3 (GNR 324)	4	The development of a road wider than 4m with a reserve less than 13.5m. In the Northern Cape – Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans. *Internal access roads (4 – 6m wide roads will be constructed but existing roads will be used as far as possible). To be confirmed by the ecological assessment.*
	10	The development and related operation of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80m^3. In the Northern Cape – Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans. *To be confirmed by the ecological assessment.*
	12	The clearance of an area of 300m^2 or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan. *To be confirmed by the ecological and wetland assessments.*
	14	The development of infrastructure or structures with a physical footprint of 10m^2 or more; where such development occurs within a watercourse or within 32m of a watercourse, measured from the edge of a watercourse. In the Northern Cape – Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans. *To be confirmed by the ecological assessment.*

Since the project will take place in a Renewable Energy Development Zone (GNR113 of 16 February 2018) and Activity 1 (Listing Notice 2) of the EIA Regulations 2014 (as amended in 2017) is triggered, a BA procedure as contemplated in Regulation 19 and 20 of the EIA Regulations 2014 (as amended in 2017), must be followed in order to obtain environmental authorisation.

A BA is an effective planning and decision-making tool, which allows for the identification of potential environmental consequences of a proposed project, and its management through the planning process.

ACWA Power on behalf has appointed Royal HaskoningDHV to provide independent Environmental Assessment Practitioner (EAP) services for the proposed project. As part of these environmental studies, all I&APs will be actively involved through a public participation process (PPP).

PUBLIC PARTICIPATION PROCESS

It is important that relevant I&APs are identified and involved in the PPP from the outset of the project. To ensure effective public participation, the process includes the following steps:

- **Step 1** Create awareness & notification – adverts, BIDs, site notices
- **Step 2** Register I&APs & stakeholders on the database (on-going)
- **Step 3** Consultation with & transfer of information through consultation and stakeholder engagement
- **Step 4** Invite I&AP to review & comment on the consultation BA report (30 day comment period)
- **Step 5** Record all comments, issues & concerns raised by I&APs within an issues trail, which will form an integral part of the BAR

HOW CAN YOU GET INVOLVED?

If you consider yourself an I&AP for this proposed project, we urge you to become involved.

- By responding (by phone or e-mail) to our invitation for your involvement in the process;
- By completing the attached comment form and mailing or faxing it to Seshni Govender at Royal HaskoningDHV;
- In writing, contacting the EAP if you have a query, comment or require further project information; and
- By reviewing and commenting on the consultation Basic Assessment Report (BAR) within the allowed 30-day review period.

Your input into this process forms a key part of the environmental study and we would like to hear from you to obtain your views on the proposed project.

By completing and submitting the accompanying response form, you automatically register yourself as an I&AP for this project, and ensure that your comments, concerns and/ or queries raised regarding the project will be noted.

COMMENTS AND QUERIES ON THE PROJECT CAN BE DIRECTED TO

Seshni Govender	Royal HaskoningDHV PO Box 867, Gallo Manor, 2052	
	Tel	087 352 1592
	Email	Seshni.govender@rhdhv.com

BASIC ASSESSMENT FOR THE PROPOSED EIGHT NEW PHOTOVOLTAIC (PV) DEVELOPMENTS AND AMENDMENT OF ENVIRONMENTAL AUTHORISATIONS FOR TWO PREVIOUSLY AUTHORISED PV DEVELOPMENTS AT THE BOKPOORT FARM NEAR GROBLERSHOOP, NORTHERN CAPE PROVINCE COMMENTS AND REGISTRATION FORM

(NOVEMBER 2019)

DEFF REF (8 NEW PVs): TBC

DEFF REF (2 PV EA AMENDMENTS): 14/12/16/3/3/2/880 & 14/12/16/3/3/2/881

YOUR COMMENTS AND QUERIES ARE WELCOME

Please **complete** this Comment Form **in full** and return to:

Seshni Govender	Royal HaskoningDHV PO Box 867, Gallo Manor, 2052, Johannesburg		Royal HaskoningDHV Enhancing Society Together
	Tel	087 352 1592	
Royal HaskoningDHV	Fax	011 798 6005	
	Email	seshni.govender@rhdhv.com	

Title (Prof/Mr/Mrs)		**First name**	
Surname			
Capacity (e.g. Secretary / Director)			
Organisation			
Postal address		**Postal code**	
Tel No. ( )		**Cell No.**	
Fax No. ( )		**Email address**	

What comments / concerns would you like to raise regarding this proposed project? (Please use additional pages, if required)

PLEASE REGISTER THE FOLLOWING PERSON(S) ON THE PROJECT DATABASE:

Title (Prof/Mr/Mrs)		**First name**	
Surname			
Capacity (e.g. Secretary / Director)			
Organisation			
Postal address		**Postal code**	
Tel No. ( )		**Cell No.**	
Fax No. ( )		**Email address**	
Signature			

IF YOU PREFER NOT TO RECEIVE ANY FURTHER INFORMATION REGARDING THIS PROPOSED PROJECT, AND, WOULD PREFER TO BE REMOVED FROM THE PROJECT DATABASE, PLEASE TICK THE BOX BELOW AND RETURN THE FORM TO THE PUBLIC PARTICIPATION CONSULTANTS (CONTACT DETAILS AS PROVIDED ABOVE).

Yes, remove my name

BASIESE OMGEWINGS ASSESSERINGS (BOA) PROSES VIR DIE VOORGESTELDE ONTWIKKELING VAN AGT (8) FOTOVOLTAIESE (FV) PROJEKTE EN WYSIGING VAN DIE OMGEWINGS GOEDKEURINGS VAN TWEE (2) FV ONTWIKKELINGE OP DIE BOKPOORT PLAAS NABY GROBLERSHOOP IN DIE NOORD KAAP PROVINSIE

AGTERGROND INLIGTINGS DOKUMENT

(NOVEMBER 2019)

DEFF VERWYSING (8 NUWE FVs): SAL NOG DEUR DEPARTEMENT VERSKAF WORD

DEFF VERWYSING (2 FV OMGEWINGS GOEDKEURINGS VERANDERINGE): 14/12/16/3/3/2/880 & 14/12/16/3/3/2/881

WAT BEOOG DIE DOKUMENT OM U TE VERTEL?

Die dokument poog om u as Geinteresseerde en Geaffekteerde Individu of Groep (G&GI) met agtergrond inligting te verskaf aangaande die voorgestelde ontwikkeling van agt (8) Fotovoltaiese (FV) projekte en wysiging van die omgewings goedkeurings van twee (2) FV ontwikkelinge deur ACWA Power Green Energy Africa (Pty) Ltd ("ACWA Power") op die Bokpoort plaas naby Groblershoop in die Noord Kaap Provinsie.

Die dokument verskaf inligting oor die Basiese Omgewings Assesserings proses (BOA) en substantiewe wysigings proses wat onderneem gaan word. Die dokument verskaf ook advies oor hoe u betrokke kan raak by die projek deur die inligting deur te lees en om kommentaar te lewer. Die basis van die Publieke Deelname proses is om inligting beskikbaar te stel, en daardeur word vir u 'n geleentheid gebied om enige bekommernisse uit te lig of om ander insette te maak. Dit is dus van kardinale belang dat u aktief betrokke raak by die projek en sodoende word plaaslike kennis ook geintegreer in die BOA.

EIENDOM BESKRYWING

Die voorgestelde projek gebied is gelee op die noord-oostelike gedeelte van die Bokpoort 390 plaas waarvan ACWA Power die eienaar is. Die plaas is gelee 20km noord-wes van die dorp Groblershoop binne die !Kheis plaaslike Munisipaliteit in die ZF Mgcawu Distrik Munisipaliteit, Noord Kaap provinsie. Verwys asseblief na die kaart in Figuur 2.

PROJEK BESKRYWING

8 Nuwe FV ontwikkelinge:

Op 21 Oktober 2016 het die Departement van Omgewingsake, Bosbou en Visserye (DEFF) 'n 900 hektaar 150MW Gekonsentreerde Son Krag (GSK) Ontwikkeling goedgekeur – verwysing Ref 14/12/16/3/3/2/879. As gevolg van die veranderinge aan die Geintegreerde Hulpbron Plan wat gepubliseer is in Oktober 2019, beoog ACWA Power om nou die goedgekeurde GSK te vervang met 8 nuwe FV ontwikkelinge. Die opgedateerde uitleg was gewysig om vir die agt (8) nuwe FV ontwikkelinge van 75MW elk voorsiening te maak wat n totale gebied van 1200 hektaar beslaan (dus 150 hektaar elk) op die restant van die Bokpoort 390 plaas. Aangesien die FV 1 en FV 2 ontwikkelinge ook op die Bokpoort plaas goedgekeur is, sal die gebiede van die twee goedgekeurde FV ontwikkelinge n wysiging ondergaan om voorsiening te maak vir die agt nuwe FV ontwikkelinge asook gepaardgaande infrastruktuur (verwys asb na onderstaande paragraaf vir meer inligting in die verband).

Elkeen van die FV ontwikkelinge sal oor die volgende infrastruktuuur beskik:

- Son opwekker wat uit monokristalien FV modules bestaan en wat elk 75MW se elektrisiteit kan lewer aan die Eskom nasionale netwerk;
- Omskakeler wat direkte stroom vanaf die FV modules omskakel na wissel stroom;
- Enkel direksionele-as (oos/wes) wat die son volg om opwekking te optimaliseer;
- n Transformator wat die stelsel se alternatiewe lae stroom tot medium stroom verhoog; en
- Instrumentasie en Kontroles wat uit hardeware en sagteware bestaan om sodoende die FV stasie vanaf 'n afgelee posisie te beheer.

Gepaardgaande infrastruktuur sluit die volgende in: stukture waarop die FV panele gemonteer word, ondergrondse kabels tussen die modules, n nuwe 132kV oorhoofse kraglyn (met 'n servituut van 15.5m aan beide kante van die lyn met torings wat 35m hoog is) wat die FV krag stasie met die Garona Substasie en Eskom nasionale netwerk verbind en verskeie lithium-ion battery stoor sisteme. Die hoof water pyplyn konneksie met die Oranje Rivier was voorheen goedgekeur, maar daar sal binne die Bokpoort plaas verskeie kleiner water pyplyne na elke FV ontwikkeling toe wees. Daar is ook interne toegangspaaie (4 - 6m wyd) maar bestaande paaie sal so veel as moontlik gebruik word. Die plaas sal met ‘n heining (3m hoog) omhein word en gepaardgaande geboue sal ‘n werkswinkel vir hestelwerk, die stoor van brandstof en kantore insluit.

Die agt nuwe FV ontwikkelinge sal die volgende name hê: FV 3 - *Venda*, FV 4 - *Pedi*, FV 5 - *Afrikaans*, FV 6 - *Sotho*, FV 7 - *Swati*, FV 8 - *Zulu*, FV 9 - *Tsonga* and FV 10 – *Tswana*. Elke nuwe FV ontwikkleing sal sy eie omgewings goedkeurings ondergaan en elkeen sy eie verwysings nommer hê.

Figuur 1: Lesedi Son Park naby Postmasburg in die Noord Kaap Provinsie. Hierdie Son Park Ontwikkeling is ‘n voorbeeld van ‘n FV Son Krag Stasie[1]

<u>Substantiewe Wysiging van twee (2) voorheen goedgekeurde FV ontwikkelinge:</u>

Twee (2) x 250 hektaar 75MW FV stasies wat gepaardgaande infrastruktuur insluit (Verwysing 14/12/16/3/3/2/880 en 14/12/16/3/3/2/881), was ook deur die DEFF op 24 Oktober 2016 goedgekeur. Een van die Omgewings Goedkeurings kondisies was dat ‘n kopie van die finale ontwikkelings uitleg plan vir kommentaar aan G&GI partye beskikbaar gestel moet word en daarna aan die Departement ingehandig word vir goedkeuring voordat konstruksie begin. Gesamentlik met die finale uitleg plan, sal die twee FV stasies n substantiewe wysigings proses ondergaan waar die volgende veranderinge gemaak gaan word:

- Naam Verandering – FV 1 en FV 2 na ondeskeidelik *Ndebele en Xhosa*;
- Opgedateerde koordinate vir elke FV stasie;
- ‘n Assessering van die Lithuim-Ion Battery impakte – aansoek was voorheen vir die aktiwiteit gedoen maar dit was nie goedgekeur nie;
- ‘n Vermindering van die ontwikkelingsgebied van 250 hektaar na 150 hektaar; en
- Opgedateerde tegniese beskrywing.

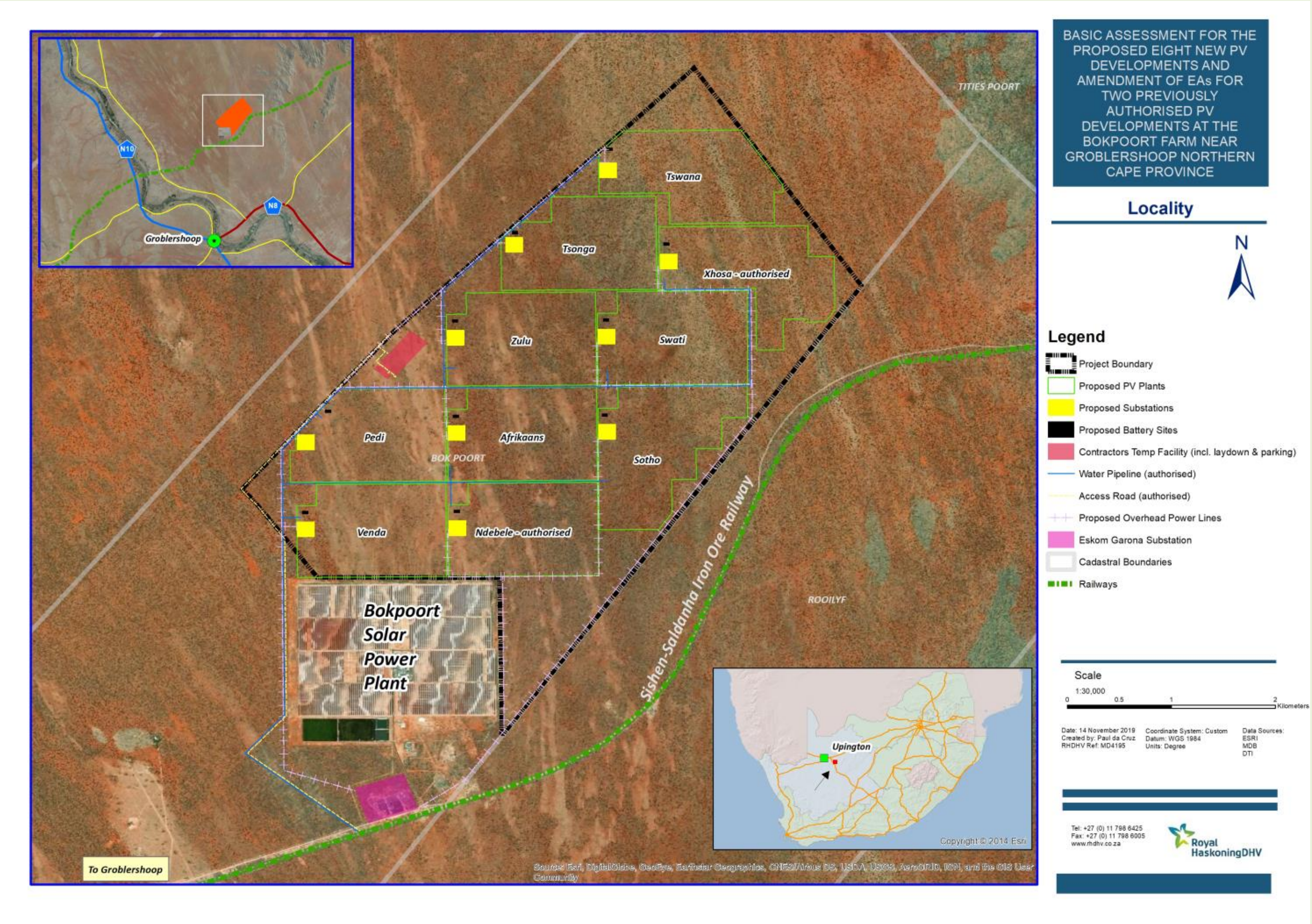
WAT IS DIE POTENSIELE OMGEWINGS-IMPAKTE WAT MET DIE VOORGESTELDE PROJEK VEREENSELWIG WORD?

‘n Paar potensiele omgewings-impakte word vereenselwig met die projek. Verskeie spesialis studies was onderneem gedurende die vorige Omgewings-Impak Assesserings-Proses vir die GSK en twee FV ontwikkelinge, insluitende die Bokpoort 1 ontwikkeling. Die studies sal opgedateer word gebasseer op die nuwe uitleg en tegnologie (FV in plaas van GSK).

SPESIALIS STUDIE (INSLUITENDE DIE OPDATERING EN RESENSIE VAN DIE VORIGE SPESIALIS STUDIES)	ORGANISASIE
Ekologie	Bathusi Omgewings Konsultante
Vars Water	Scientific Aquatic Services
Oppervlak en Grond Water	GCS
Vöel lewe en Vlermuise	Arcus Consulting Services
Vleilande	Royal HaskoningDHV
Grond en Landbou Potensiaal	Johann Lanz (privaat)
Erfenis	Johnny van Schalkwyk (privaat)

[1] https://mybroadband.co.za/news/wp-content/uploads/2015/02/Lesedi.jpg

SPESIALIS STUDIE (INSLUITENDE DIE OPDATERING EN RESENSIE VAN DIE VORIGE SPESIALIS STUDIES)	ORGANISASIE
Palaeontologie	Natura Viva
Lug Kwaliteit	WSP
Sosiaal	Royal HaskoningDHV
Verkeer	Royal HaskoningDHV
Visueel	Royal HaskoningDHV



Figuur 2: Liggings Kaart

HOEKOM IS ‘n OMGEWINGS STUDIE NODIG?

In terme van die Omgewings Impak Assesserings (OIA) Regulasies [Staats Kennisgewing Regulasie (SKR) 324 – 327, wat gepubliseer is in terme van Artikel 24(5), lees gesamentlik met Artikel 44 van die Nasionale Omgewings Bestuur Wet (Wet 107 van 1998)], moet ACWA Power aansoek by die DEFF doen vir ‘n Omgewings Goedkeuring vir elke FV stasie aangesien dit gelyste aktiwiteite onder Kennisgewing van Notering 1-3 van die OIA Regulasies 2014 (soos gewysig in 2017) bevat.

Die volgende aktiwiteite van Kennisgewing van Notering 1, 2 en 3 is ter sake:

Kennisgewing van Notering	Aktiwiteit nommer	Beskrywing en Toepaslikheid
1 (SKR 327)	11	Die ontwikkeling van fasiliteite of infrastruktuur vir die transmissie en verspreiding van elektrisiteit buite n stedelike gebied of industriële kompleks met ‘n kapasiteit van meer as 33kV maar minder as 275kV. *Die aktiwiteit is toepaslik vir die 132 kraglyn vanaf elke FV ontwikkeling.*
	12	Die ontwikkeling van infrastruktuur of strukture met ‘n gebied van 100m^2 of meer binne ‘n waterloop of as geen ontwikkeling terugslag bestaan, binne 32m vanaf ‘n waterloop, soos gemeet van die buitekant van die waterloop *Die aktiwiteit sal deur die spesialis bevestig word.*

Kennisgewing van Notering	Aktiwiteit nommer	Beskrywing en Toepaslikheid
	14	Die ontwikkeling en gepaardgaande operasie van fasiliteite of infrastruktuur vir die berging of storing en hantering van gevaarlike bestandele, waar die berging en storing binne ‘n houer met ‘n gekombineerde kapasiteit van $80m^3$ of meer maar nie $500m^3$ oorskrei nie. *Elke FV ontwikkeling sal sy eie lithium-ion battery stoor gebied hê met ‘n volume kapasiteit van 80 tot* $500m^3$.
	19	Die vulling of deponering van enige material van meer as $10m^3$ in, of baggerwerk, uitgrawing, verwydering or verskuiwing van grond, sand, skulpe of rots van meer as $10m^3$ van ‘n waterloop. *Konstruksie van infrastruktuur binne in ‘n waterloop wat die vulling, deponering of verweidering van materiaal van meer as* 10^3 *vanuit ‘n waterloop/stroom behels.* *Die aktiwiteit sal nog bepaal word deur ‘n spesialis.*
	28	Residensiële, gemengde, kleinhandel, kommersiële en industriële of institusioniële ontwikkelinge op grond wat voorheen as landbou op of voor 1 April 1998 gebruik was en waar so ‘n ontwikkeling buite die stedelike gebied plaasvind, en waar die gebied wat ontwikkel word groter as 1 hekaar is. *Die ontwikkleing van die sonkrag fasiliteit sal die transformasie van 1200 hektaar landbou grond behels. Die Bokpoort plaas is ook buite die stedelike gebied geleë.*
2 (SKR 325)	1	Die ontwikkeling van fasiliteite of infrastruktuur vir die opwekking van elektrisiteit van ‘n hernubare hulpbron waar die kraglewering 20MW of meer is. *Die elektrisiteit opwekkings kapasiteit is 75MW vir elke FV ontwikkeling.*
	4	Die ontwikkeling en gepaardgaande operasie van fasiliteite of infrastruktuur vir die berging of storing en hantering van gevaarlike bestandele, waar die berging en storing binne ‘n houer met ‘n gekombineerde kapasiteit van $500m^3$ of meer is. *Elke FV stasie sal sy eie lithium-ion battery stoor gebied hê met ‘n volume kapasiteit van* $500m^3$ *of meer. Die presiese kapasiteit sal nog met die tegniese span bevestig word.*
	15	Die verwydering van ‘n gebied van 20 hektaar se inheemse plantegroei. *Die konstruksie van die voorgestelde FV stasie sal die verwydering van 150 hektaar per FV ontwikkeling behels.*
3 (SKR 324)	4	Die ontwikkeling van ‘n pad wyer as 4m met ‘n reserwe minder as 13.5m in die Noord Kaap – binne kritiese biodiversiteit gebiede soos bepaal deur die biodiversiteit planne wat deur die bevoegde owerheid of bioregionale planne aangeneem is. *Interne toegangspaaie (4-6m wyd). Sal bepaal word deur die biodiversiteit spesialis.*
	10	Die ontwikkeling en gepaardgaande operasie van fasiliteite of infrastruktuur vir die berging of storing en hantering van gevaarlike bestandele, waar die berging en storing binne ‘n houer met ‘n gekombineerde kapasiteit van $30m^3$ of meer maar nie $80m^3$ oorskrei nie in die Noord Kaap binne kritiese biodiversiteit gebiede soos bepaal deur die biodiversiteit planne wat deur die bevoegde owerheid of bioregionale planne aangeneem is. *Sal nog deur die biodiversiteit en vleiland spesialis studies bepaal word.*
	12	Die verwydering van $300m^2$ van inheemse plantegroei, uitsluitend waar die verwydering van inheemse plantegroei nodig is vir instandhoudings doeleindes volgens ‘n goedgekeurde instandhouding bestuursplan. *Sal nog deur die biodiversiteit en vleiland spesialis studies bepaal word.*
	14	Die ontwikkeling van infrastruktuur of strukture met ‘n fisiese gebied van $10m^2$ of meer, waar so ‘n ontwikkeling binne ‘n waterloop/stroom plaasvind, of binne 32m van so ‘n waterloop/stroom soos gemeet van die grens van die waterloop - in die Noord Kaap binne-kern gedeeltes in biosfeer reservate. *Sal nog deur die biodiversiteit spesialis studie bepaal word.*

Aangesien die projek in ‘n Hernubare Energie Ontwikkelings Sone (SKR113 gedateer 16 Februarie 2018) gaan plaasvind, en in lig van die feit dat Aktiwiteit 1 (SKR 2) van die OIA Regulasies 2014 (soos gewysig in 2017) van toepassing is, sal ‘n Basiese Omgewings Asseserings proses soos vereis deur Regulasie 19 en 20 van die OIA Regulasies 2014 (soos gewysig in 2017) gevolg word, om sodoende ‘n omgewings goedkeuring van DEFF te verkry.

‘n Basiese Omgewings Assessering is ‘n effektiewe beplanning en besluitnemings hulpmiddel, wat die potensiele omgewings impakte van ‘n voorgestelde ontwikkeling bepaal, en dit word bestuur die beplannings proses.

ACWA Power het Royal HaskoningDHV aangestel as ‘n onafhanklike Omgewings Assesserings Praktisyn (OAP) om konsultasie dienste in die verband te verskaf. As deel van die omgewings studies, sal alle Geinteresseerde en Geaffekteerde Individue of Groepe (G&GI) aktief betrek word gedurende die publieke deelname proses.

PUBLIEKE DEELNAME PROSES

Dit is belangrik dat alle relevante G&GI geidentifiseer word en betrokke raak vanaf die begin van die projek. Om effektiewe publieke deelname te verseker, sluit die proses die volgende stappe in:

- **Stap 1:** Skep bewustheid & kennisgewing oor die projek deur sirkulasie van 'n Agtergrond Inligtings Dokument, advertensie, en terrein kennisgewing.
- **Stap 2:** Registreer G&GI en belanghebbende partye op die databasis gedurende die proses.
- **Stap 3:** Raadpleeg met en versprei inligting deur konsultasie met belanghebbende partye.
- **Stap 4:** Nooi G&GI uit om op die konsultasie Basiese Assesserings Verslag kommentaar te lewer (binne 30 dae).
- **Stap 5:** Noteer alle kommentaar en bekommernisse wat deur G&GI uitgelig word wat dan 'n integrale deel van die Basiese Assesserings Verslag sal vorm.

HOE KAN U BETROKKE RAAK?

As u 'n Geinteresseerde en Geaffekteerde individue is op die projek, raai ons u vriendelik aan om betrokke te raak deur die volgende te doen:

- Die publieke vergadering (wat op 'n toekomstige datum wat nog vasgestel gaan word) by te woon;
- Deur te reageer op ons uitnodiging om deel te neem aan die publieke deelname proses (deur middel van e-pos, telefoon of pos);
- Om die aangehegte kommentaar vorm te voltooi en om dit terug te pos aan **Seshni Govender** (kontak besonderhede verskaf hieronder);
- Om skriftelik die konsultant te kontak indien u enige navraag, kommentaar of verder projek inligting nodig het; of
- Deur die konsultasie Basiese Asseserings Verslag binne die 30 dae kommentaar periode en die Water Goedkeurings Aansoek binne die gereguleerde 60 dae kommentaar periode deur te lees.

U deelname in die OIA proses vorm 'n baie belangrike deel van die proses en ons sal graag soos bo genoem, u insette wil ontvang. Deur die onderstaande kommentaar vorm in te vul, sal u outomaties geregistreer word as 'n G&GI vir die projek, en sal u sodoende verseker dat u kommentaar, bekommernisse en/of navrae oor die projek gedokumenteer word.

KOMMENTAAR EN NAVRAE OOR DIE PROJEK KAN GERIG WORD AAN:

Seshni Govender	Royal HaskoningDHV Posbus 867, Gallo Manor, 2052		Royal HaskoningDHV Enhancing Society Together
	Tel	087 352 1592	
	Epos	Seshni.govender@rhdhv.com	

BASIESE OMGEWINGS ASSESSERINGS (BOA) PROSES VIR DIE VOORGESTELDE ONTWIKKELING VAN AGT (8) FOTOVOLTAIESE PROJEKTE EN WYSIGING VAN DIE OMGEWINGS GOEDKEURINGS VAN TWEE (2) FOTOVOLTAIESE (FV) ONTWIKKELINGE OP DIE BOKPOORT PLAAS NABY GROBLERSHOOP IN DIE NOORD KAAP PROVINSIE

KOMMENTAAR VORM

(NOVEMBER 2019)

DEFF VERWYSING (8 NUWE FVs): SAL DEUR DEPARTEMENT VERSKAF WORD

DEFF VERWYSING (2 FV OMGEWINGS GOEDKEURINGS VERANDERINGE): 14/12/16/3/3/2/880 & 14/12/16/3/3/2/881

U KOMMENTAAR EN NAVRAE WORD BAIE WAARDEER

Vul asb die Kommentaar Vorm **volledig** in en stuur terug aan:

Seshni Govender	Royal HaskoningDHV Posbus 867, Gallo Manor, 2052, Johannesburg		Royal HaskoningDHV Enhancing Society Together
	Tel	087 352 1592	
Royal HaskoningDHV	Fax	011 798 6005	
	Email	seshni.govender@rhdhv.com	

Titel (Prof/Mnr/Mev)		**Naam**	
Van			
Kapasiteit (e.g. Sekretaresse / Direkteur)			
Organisasie		**Poskode**	
Posadres		**Sel No.**	
Tel No. ( )		**Epos adres**	
Faks No. ( )			

Kommentaar / bekommernisse wat u wil uitlig aangaande die voorgestelde ontwikkeling (gebruik asseblief ekstra bladsye indien nodig):

REGISTREER ASSEBLIEF DIE VOLGENDE PERSONE OP DIE PROJEK DATABASIS:

Titel (Prof/Mnr/Mev)		**Naam**	
Van			
Kapasiteit (e.g. Sekretaresse / Direkteur)			
Organisasie		**Poskode**	
Posadres		**Sel No.**	
Tel No. ( )		**Epos Adres**	
Faks No. ( )			
Hantekening			

AS U NIE VERDERE INLIGTING OOR DIE PROJEK WIL ONTVANG NIE, EN GRAAG VAN DIE DATABASIS VERWYDER WIL WORD, MERK ASB. DIE ONDERSTAANDE SPASIE MET N "X" EN STUUR DIE VORM TERUG AAN DIE PUBLIEKE DEELNAME KONSULTANT (KONTAK BESONDERHEDE VERSKAF HIERBO)

JA, VERWYDER MY NAAM

Appendix D: Proof of Advert (to be provided in the final cBAR)

Appendix E: Issues Trail

Issue	Raised by	Comment
The proposed project changes have to be registered on the IDP of the municipality by way of a written submission addressed to the office of the Municipal Manager.	Mr Floyd Leeuw Municipal Manager-!Kheis Local Municipality Written submission via the BID document comment sheet 02/12/2019	The Municipality has been requested to provide further details regarding the registration process.
Secondly, there must be a commitment that at least 4MW (negotiable) will be for the direct benefit of the municipality for current and future developments.		ACWA Power intends submitting a bid for the projects in the Department of Energy's Renewable Energy Independent Power Producer Procurement Programme (REIPPP) Purchase Agreement (PPA) with Eskom Holdings SOC Ltd. In terms of this agreement, the buyer being ACWA Power needs to warrant the Seller being Eskom, that: 1. It has sole purpose, object and business of undertaking the project and selling energy in terms of this agreement; and 2. The Seller is not subject to any obligation or non-compliance which is likely to have a material adverse effect on its ability to conduct the project. Based on the above, ACWA Power is unable to make a commitment toward the provision of the requested 4MW (negotiable) for the direct benefit of the Municipality for its current and future developments. It should be noted that these projects will connect to the National grid and increase the national supply in the country which will indirectly benefit the Municipality. Also note that as part of the REIPPP, projects are required to commit towards social-economic development initiatives, and the project will endeavour to include the development of social infrastructure including (electrification) as part of this initiatives.
Furthermore, requisite Heads of Agreement will have to be reviewed.		The project is currently undergoing early stage of project development such as obtaining project approvals and permits. Post this stage, the Municipality will be engaged to further discuss the project as well as Heads of Agreement.

Issue	Raised by	Comment
Possible glare from PV cells.	Mr Gilbert Nortier IOM Rail Network Transnet Freight Rail Email submission 26/11/2019	The Bokpoort CSP is adjacent to the railway line and has been operating for many years now without any incidents impacting train drivers. The CSP technologies use mirrors that has high reflectivity and correspondingly high glare indication relative to PV panels that are not designed to reflect sunlight but rather to absorb sunlight. To date the Bokpoort CSP has had no negative impact on the train drivers in terms of glare and it can be inferred that the panels which are less reflective than CSP mirrors will not have a glare risk on train drivers.
Contractors may not use the TFR Service Road.		Access to the Bokpoort CSP site has been through the Transnet Service Road throughout construction and current operational phases. The construction was well managed from a health. safety and environmental, (HSE). perspective, in terms of the road. The Bokpoort CSP plant regularly maintains this section of the road. The CSP project has heavy equipment and was managed without negatively impacting the road, whilst PV plants are very lightweight and corresponding impact on road is expected to be minimal. As the only access road in the area ACWA Power will take the necessary precautions from a HSE perspective in managing our contractors. ACWA Power have successfully managed this prior and foresee no problems doing the same in the future. ACWA Power would welcome a discussion to discuss an acceptable right of use agreement for this road.
No structures to be built on TFR property.		The plan is to only construct on the PV plant land areas. These areas are demarcated on drawings and verified with geospatial co-ordinates. ACWA Power can confirm that none of the structures will be on Transnet land.
No blasting from the track and TFR boundary.		There are no heavy equipment requirements for a PV plant, so there is no need for extensive blasting to cater for light weight PV structures. Previous construction for the Bokpoort CSP in the same vicinity, with similar terrain, did

Issue	Raised by	Comment
		not require significant blasting. In the unlikely event that blasting is required, all necessary safety and other notification protocols will be abided by inclusive of any specific Transnet requirements.
No excavations and other services from the TFR boundary.	Mr Gilbert Nortier IOM Rail Network Transnet Freight Rail Email submission 26/11/2019	No excavations will be required on Transnet land. All construction will be on the Remaining Extent of the farm Bokpoort as described in the EIA process.
No equipment or heavy plant crossing of the tracks.		We would only be travelling on the road to the construction site. We can confirm there is no need to cross any Transnet tracks.
Applications for 50kV OHTE permits.		It is the responsibility of the Project Company and the contractors to ensure that all permits are in place and complied to, ensuring all HSE requirements are met - we do not envisage any shortcomings in this area. In the unlikely event there is a need for OHTE permits, all necessary Transnet protocols will be followed and adhered to.
I'm not satisfied with the timing of your Public Participation process. Sent 26/11/2019 and comment window open for 30 days. This PPP must start in the middle of January 2020. I want to be included in the process, as I'm an affected party.	Mr Peter Kotze Interested and Affected Party Email Submission 02/12/2019	The correspondence which you have received is just part of the initial project notification. The initial stage (which is the provision of the Background Information Document) is to make the stakeholders aware of the project and to provide background on how the process will be handled as well as the steps involved in our public participation process. Please note that the regulated 30-day commenting period has not begun and will only commence next year once we have finalised all specialist studies and prepared the environmental report (it is envisaged that the draft consultation Basic Assessment report will be circulated for public comments during March 2020). You are encouraged to send through any comments from now until the end of the official 30-day commenting period

Issue	Raised by	Comment
		(which has not started) as prescribed by the EIA regulations 2014 (as amended). As the environmental process unfolds, we will notify stakeholders of all relevant information.

Appendix F: EAP Oath

APPENDIX 12
UNDERTAKING UNDER OATH/ AFFIRMATION

I, Malcolm Roods, 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 Environmental Assessment Practitioner

Royal Haskoning DHV

Name of Company

24/02/2020

Date

Signature of the Commissioner of Oaths

24/02/2020

Date

Sworn (Affirmed or Declared) before me at WOODMEAD
this 24 day of FEBRUARY 2020

ADRI WELMAN Bid Officer
Commissioner of Oaths. Ref no: 104/12/2015
17 December 2015